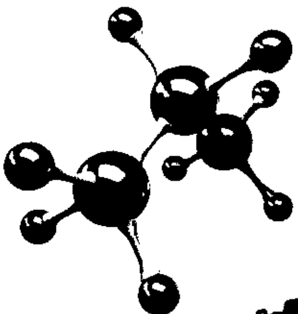
श्री BalaJi

M.S. Chouhan

Advanced Problems in ORGANIC CHEMISTRY for JEE



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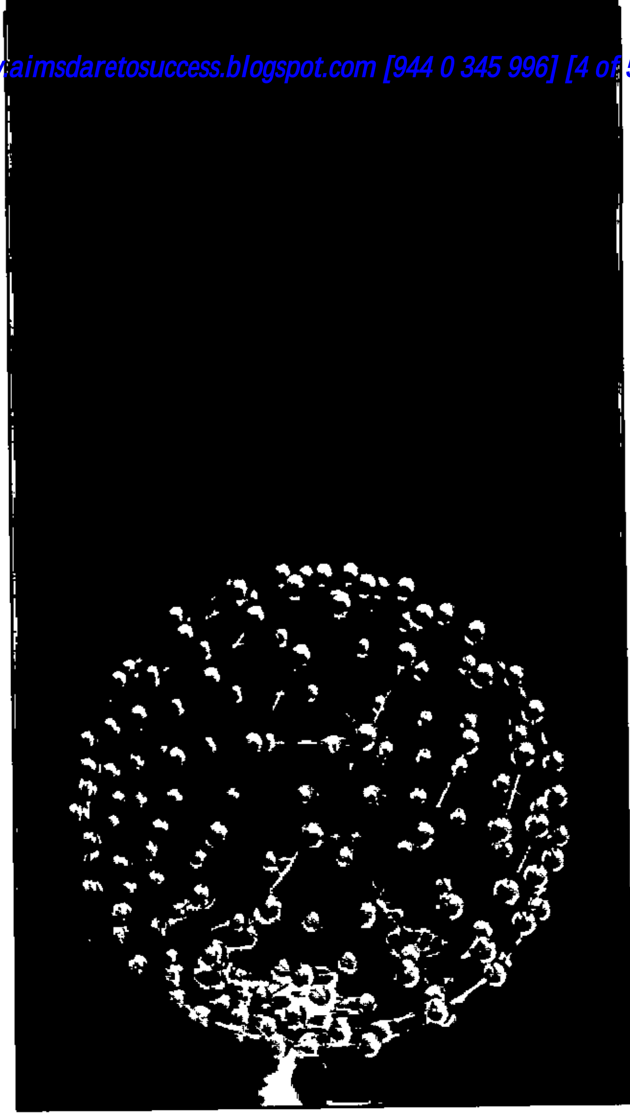
Dedicated to the

Lotus feet of

Revered Guruji

SHRI KESARAM JI MAHARAJ



Advanced Problems in ORGANIC CHEMISTRY

Preface

It is a matter of great pleasure for me to present the eighth edition of **"Advanced Problems in Organic Chemistry for JEE"** before JEE aspirants. During my teaching experience, I felt that the facts may be made more and more clear to the students through problematic approach. Although an ocean of material in Organic Chemistry is available with the students, yet the approach to design the problems has been changed in recent years and if one tries to swim in this ocean, it will be a very difficult task. To make the students more familiar with trends and tricks how to solve problems, the present problem book has been presented. In the current scenario of stiff competition especially for JEE, one must be clear that almost all the sincere applicants are well equipped with the facts of subject, yet the winner is one who knows how to use these equipments with accuracy and efficiency. As an experienced teacher, I would like to suggest students three golden rules to score high in Organic Chemistry:

1. Don't get behind
2. Work out a number of problems of different types
3. Revise through short notes / learning chart.

I hope that the present book will cater to the needs of JEE aspirants & as a matter of fact, they will enjoy the present venture and I would feel rewarded if this book is found helpful to the students and teachers in real terms. All attempts have been made to make the book error free however a few misprints may inadvertently creep.

I acknowledge the blessing and support of my mother Smt. Raj Kanwar, father Shri B.S. Chouhan, brother Dr. V.S. Chouhan, my wife and daughter. They inspired me all the time during the preparation of this book.

The support and valuable suggestions from my colleagues especially Mr. N. Avasthi, Mr. V.K. Jaiswal, Mr. Nitin Jain, Mr. N.K. Sethia, Mr. Vikash Gupta, Mr. Pankaj Joshi, Dr. S. Kothari, Mr. Vineet Khatri, Mr. Ashish Mishra, Mr. Manish Arora, Mr. Govind Khandelwal, Mr. Rahul Pareek, Mr. Rahul Malav, Mr. Akshay Choudhary, Mr. Hanuman Sahay, Mrs. Neha Joshi, Mrs. Neetu Jha, Mr. Kamlesh Gupta, Mr. Kumud Ranjan and Mr. K.D. Tiwari are highly acknowledged. I also pay my sincere thanks to all the esteemed members of **M/s Shri Balaji Publications** in bringing out this book in such a nice form.

In the last, constructive criticism and valuable suggestions from the readers are most welcome to make the book more useful.

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A few words to the JEE Aspirants

Dear JEE aspirants,

I hope that this collection of problems will surely help you during your preparation for JEE. In this book, each chapter consists of two levels :

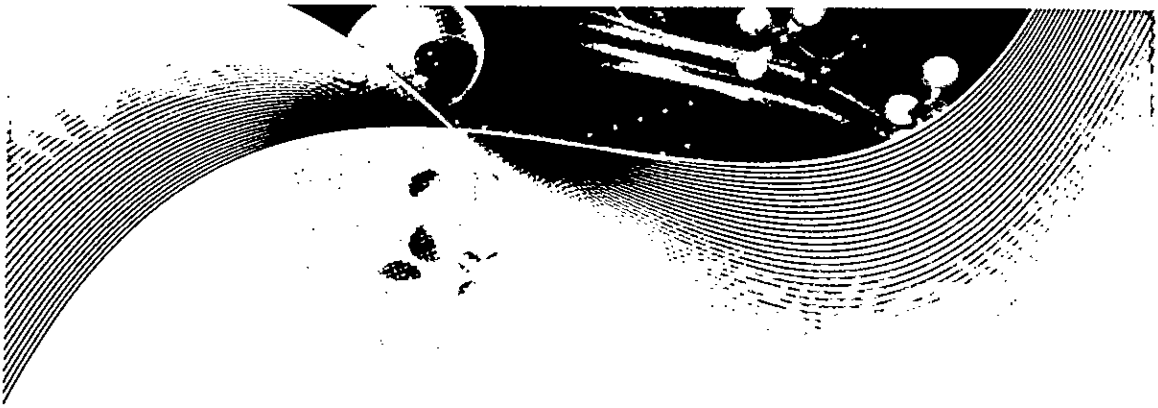
Level 1 - includes the problems having only one option correct. These problems are based on different facts and their twists.

Level 2 - includes unique approach which may be used to solve the problems altogether different from the prevailing trend followed by JEE. These approaches will undoubtedly help you in the quick revision of the key facts and their applications.

I wish all of you a grand success in the ensuing Joint Entrance Examination. Your valuable suggestions and constructive criticism for the betterment of the book are welcome.

M.S. Chouhan
e-mail : mahen_chouhan@yahoo.com

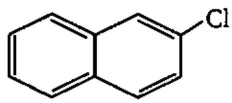
Contents



1 GENERAL ORGANIC CHEMISTRY

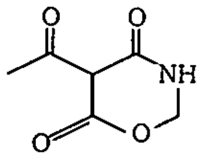
LEVEL-1

1. How many 2° Hydrogen atoms are present in the given following compound ?



(a) 2 (b) 5 (c) 7 (d) 8

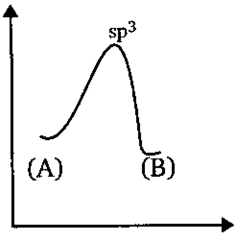
2. Identify which functional group are **Not** present in the given following compound ?

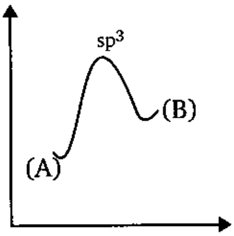


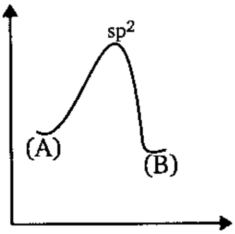
(a) Ketone (b) Ester (c) Amide (d) Ether

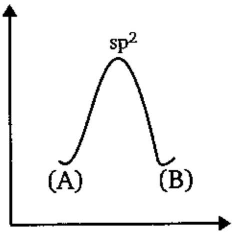
3. Correct energy profile for amine inversion and hybridization of nitrogen in transition state is:

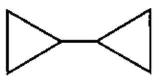
(A) (B)

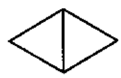
(a) 

(b) 

(c) 

(d) 

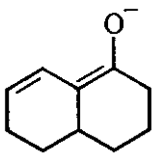
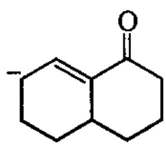
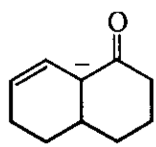
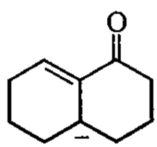
4. 
(i)

(ii)

(iii)

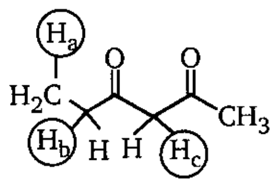
Compare the heats of combustion of above compounds:

(a) (i) > (ii) > (iii) (b) (i) > (iii) > (ii) (c) (ii) > (i) > (iii) (d) (ii) > (iii) > (i)

5. Which of the following is not a resonance structure of the others ?

(a) 
(b) 
(c) 
(d) 

6. Rank the hydrogen atoms (H_a, H_b, H_c) in the following molecule according to their acidic strength.



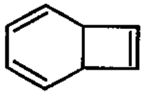
(a) $a > b > c$ (b) $b > a > c$ (c) $b > c > a$ (d) $c > b > a$

7. $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}\underset{a}{-}O\underset{b}{-}CH_3$;

Compare the bond lengths a and b.

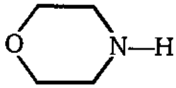
(a) $a = b$
(b) $b > a$
(c) $b < a$
(d) Impossible to predict

8. The number of $sp^2 - sp^2$ sigma bonds in the compound given below is :



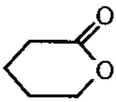
(a) 1 (b) 3 (c) 4 (d) 5

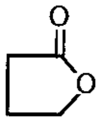
9. The total number of lone pair of electrons in the given molecule is :

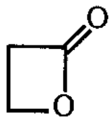


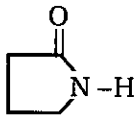
(a) 2 (b) 3 (c) 4 (d) 5

10. Which of the following rings is highly strained ?

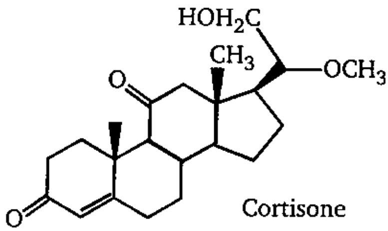
(a) 
δ-lactone

(b) 
γ-lactone

(c) 
β-lactone

(d) 
δ-lactam

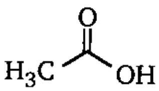
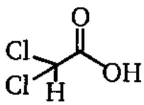
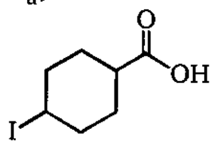
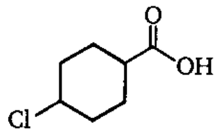
11. The functional groups present in Cortisone are :



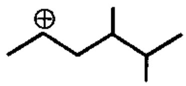
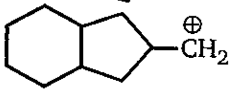
Cortisone

(a) Ether, alkene, alcohol
(b) Alcohol, ketone, alkene, ether
(c) Alcohol, ketone, amine
(d) Ether, amine, ketone

12. Select the acid with the highest K_a (*i.e.*, lowest pK_a).

(a) 
(b) 
(c) 
(d) 

13. Most stable carbocation among the given example is :

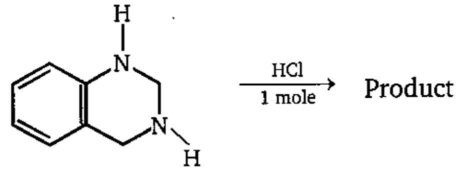
(a) 
(b) 
(c) 
(d) ${}^{\oplus}CH_3$

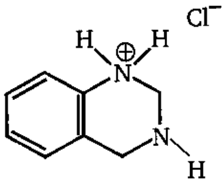
14. Set the following in increasing order of their pK_a values.

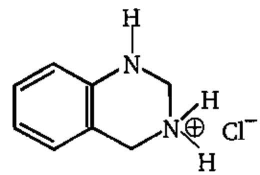
(x) $CH_3-\overset{\overset{O}{||}}{\underset{\underset{O}{||}}{S}}-O-H$ (y) $CH_3-\overset{\overset{O}{||}}{C}-O-H$ (z) CH_3-OH

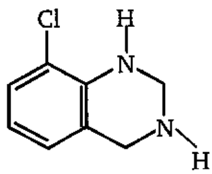
(a) $y < x < z$ (b) $x < y < z$ (c) $y < z < x$ (d) $x < z < y$

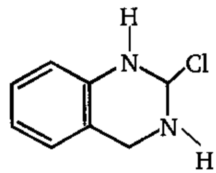
15. Which is the major product of the following reaction ?



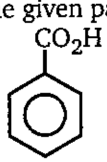
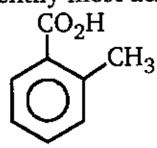
(a) 

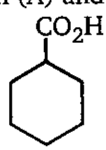
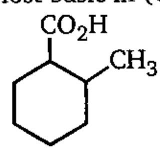
(b) 

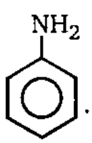
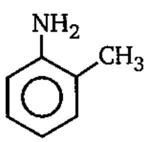
(c) 

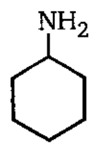
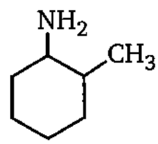
(d) 

16. In the given pair identify most acidic compound in (A) and (B). Most basic in (C) and (D).

(A)  (I)  (II)

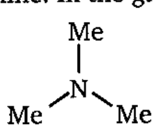
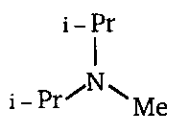
(B)  (I)  (II)

(C)  (I)  (II)

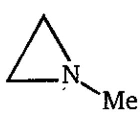
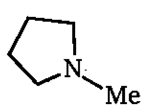
(D)  (I)  (II)

(a) A - I, B - II, C - I, D - II
(b) A - II, B - I, C - I, D - II
(c) A - II, B - II, C - II, D - II
(d) A - I, B - II, C - I, D - I

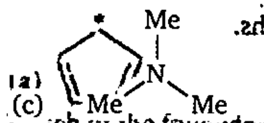
17. Several factors (steric, electronic, orbital interactions etc.) can affect the inversion barrier of an amine. In the given pair which data is correctly placed ?

(a)  *vs* 

$\Delta G^{\ddagger} = 7.9$ kcal/mol $\Delta G^{\ddagger} = 0.2$ kcal/mol

(b)  *vs* 

$\Delta G^{\ddagger} = 20.5$ kcal/mol $\Delta G^{\ddagger} = 7.0$ kcal/mol

(a) 

(c)

26. Which of the following compound is most stable ?

$\Delta G^{\ddagger} = 7.9$ kcal/mol $\Delta G^{\ddagger} = 22.9$ kcal/mol

(d) All of these

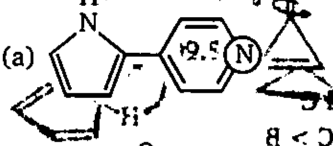
18. Select the response that correctly identifies the number of carbon atoms of each type of hybridization in the compound given below

$H_2C=C=CH-CH=O$

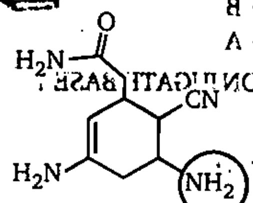
	sp^3	sp^2	sp		sp^3	sp^2	sp
(a)	2	2	0	(b)	1	3	0
(c)	0	3	1	(d)	1	2	1

19. Circle represents most basic atoms in these molecule. Which of the following is correct representation ?

27. Selected bond angles for hydrocarbons are shown below. Arrange ... according to their pK_a ..., from the lowest to the highest

(a) 

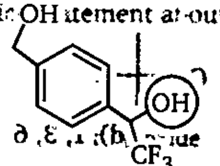
(b) 

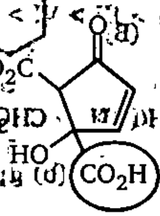
(c) 

(d) All of these

20. Circle represent most acidic hydrogens in these molecules. Which of the following is correct representation ?

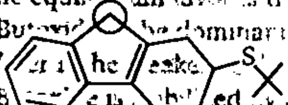
28. Which statement about the following equilibrium ...

(a) 

(b) 

(a) The equilibrium favours the products

(b) t-Butoxide ... dominant anion present in the equilibrium

(c) 

(c) ... resonance (d) All of these

29. Consider the following reaction involving two acids shown below : formic acid and HF

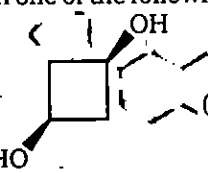
$$K^+F^- + H\text{-}COOH \rightleftharpoons H\text{-}COO^-K^+ + HF$$

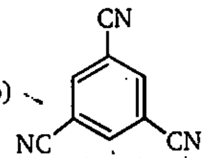
Which of the following statements about this reaction are true ?

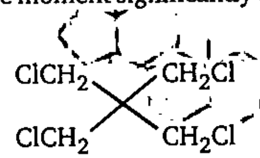
(A) Formic acid is the strongest Bronsted acid in the reaction
(B) HF is the strongest Bronsted acid in the reaction
(C) KF is the strongest Bronsted base in the reaction
(D) KO_2CH is the strongest Bronsted base in the reaction
(E) The equilibrium favours the reactants
(F) The equilibrium favours the products
(G) Formic acid has a weaker conjugate base
(H) HF has a weaker conjugate base

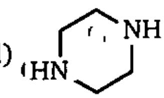
(a) A, D and F (b) B, D, and H (c) A, C, and H (d) B, D, E and H

30. Which one of the following compounds has a dipole moment significantly different from zero?

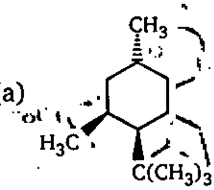
(a) 

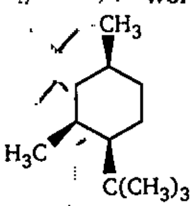
(b) 

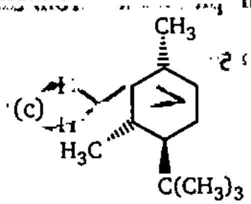
(c) 

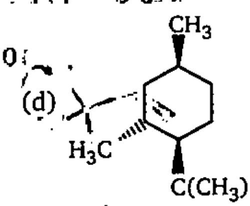
(d) 

31. Which one of the following has the smallest heat of combustion ?

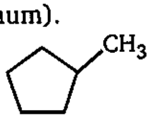
(a) 

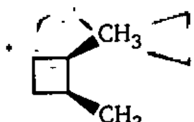
(b) 

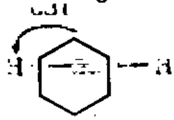
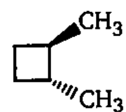
(c) 

(d) 

32. Rank the following substances in order of decreasing heat of combustion (maximum → minimum).

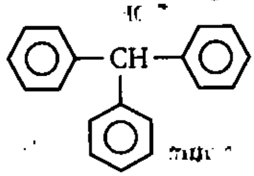


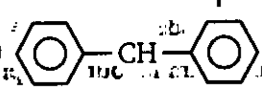


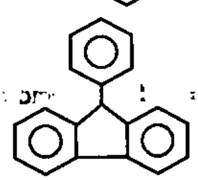
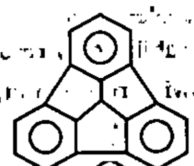



(a) 1 > 2 > 4 > 3 (b) 3 > 4 > 2 > 1
(c) 2 > 4 > 1 > 3 (d) 1 > 3 > 2 > 4

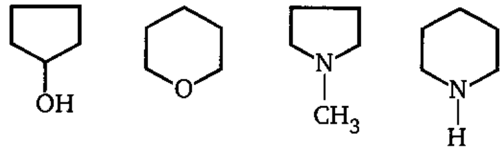
33. Which of the following has lowest pK_a value ?

(a) 

(b) 

(c) 
(d) 

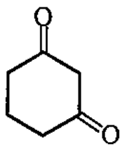
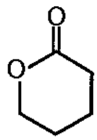
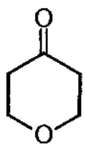
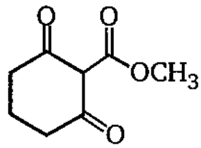
34. Arrange the following (w, x, y, z) in decreasing order of their boiling points:



(w) (x) (y) (z)

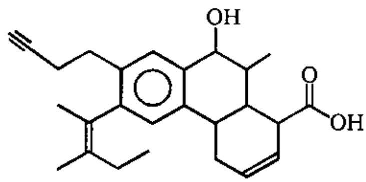
(a) $w > x > z > y$ (b) $w > x > y > z$
(c) $w > z > y > x$ (d) $w > z > x > y$

35. Arrange the following in increasing order of their acidic strength.

(I)  (II)  (III)  (IV) 

(a) III < I < IV < II (b) II < I < IV < III
(c) I < III < IV < II (d) II < III < I < IV

36. How many degrees of unsaturation are there the following compound ?

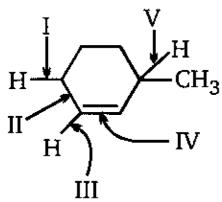


(a) 6 (b) 7 (c) 10 (d) 11

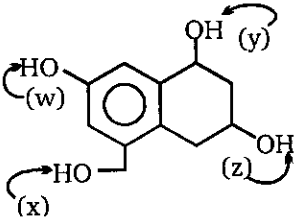
37. The heat of hydrogenation for 3-methylbutene and 2-pentene are –30 kcal/mol and –28 kcal/mol respectively. The heats of combustion of 2-methylbutane and pentane are – 784 kcal/mol and –782 kcal/mol respectively. All the values are given under standard conditions. Taking into account that combustion of both alkanes give the same products, what is ΔH (in kcal/mol) for the following reaction under same conditions ?

(a) 0 (b) – 4 (c) – 2 (d) 2

38. Which of the following σ-bonds participate in hyperconjugation ?



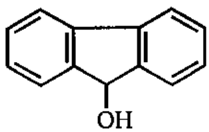
(a) I and II (b) I and V (c) II and V (d) III and IV

39. 

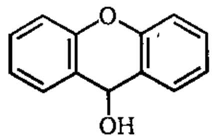
Decreasing order of acidic strength of different (–OH) groups is :

(a) $w > x > y > z$ (b) $w > z > x > y$ (c) $z > w > x > y$ (d) $z > x > w > y$

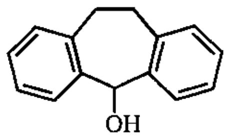
40. Arrange the following alcohols in decreasing order of the ease of ionization under acidic conditions.



(I)



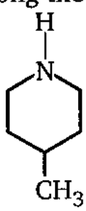
(II)

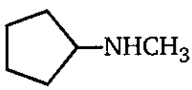


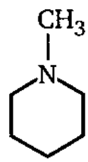
(III)

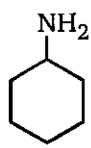
(a) I > III > II (b) I > II > III (c) II > III > I (d) II > I > III

41. Among the isomeric amines select the one with the lowest boiling point.

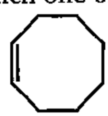
(a) 

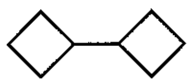
(b) 

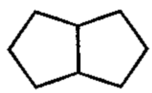
(c) 

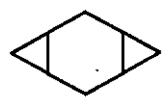
(d) 

42. Which one of the compounds shown below, is not an isomer of the others ?

(a) 

(b) 

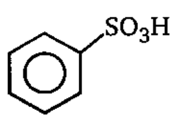
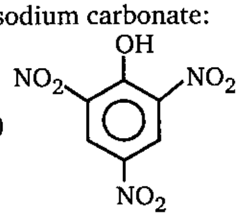
(c) 

(d) 

43. Arrange the anions (p) $\bar{C}H_3$, (q) $\bar{N}H_2$, (r) OH^-, (s) F^-, in decreasing order of their basic strength.

(a) $p > q > r > s$ (b) $q > p > r > s$ (c) $r > q > p > s$ (d) $r > p > q > s$

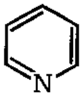
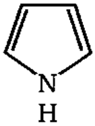
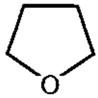
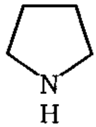
44. One among the following compounds will not give effervescence with sodium carbonate:

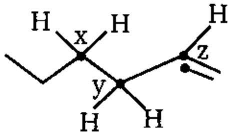
(a) $C_6H_5CO_2H$ (b)  (c) C_6H_5OH (d) 

45. The carboxylic acid which has maximum solubility in water is:

(a) phthalic acid (b) succinic acid
(c) malonic acid (d) salicylic acid

46. Among the following compounds, the most basic compound is :

(a)  (b)  (c)  (d) 

47. 

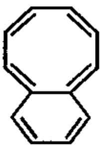
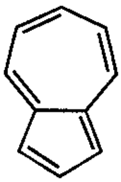
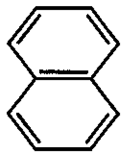
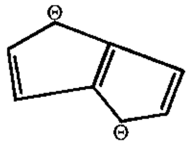
Arrange the (C – H) bonds x, y and z in decreasing order of their bond dissociation energies in homolysis.

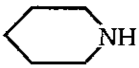
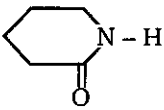
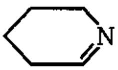
(a) $y > x > z$ (b) $z > x > y$ (c) $z > y > x$ (d) $y > z > x$

48. 23 g of sodium will react with methyl alcohol to give :

(a) one mole of oxygen (b) 22.4 dm^3 of hydrogen gas at NTP
(c) 1 mole of H_2 (d) 11.2 L of hydrogen gas at NTP

49. Which of the following is most polar?

(a)  (b)  (c)  (d) 

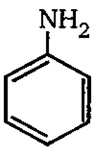
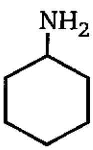
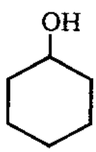
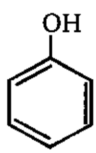
50.  ;  ;  ;

(x) (y) (z)

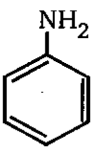
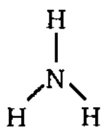
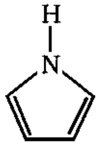
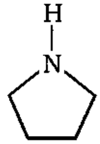
The correct order of decreasing basic strengths of x, y and z is :

(a) $x > y > z$ (b) $x > z > y$ (c) $y > x > z$ (d) $y > z > x$

51. Which of the following is the strongest Bronsted acid ?

(a)  (b)  (c)  (d) 

52. Which of the following is the strongest Bronsted base ?

(a)  (b)  (c)  (d) 

53. Which of the following is polar aprotic solvent ?

(a) DMSO (b) Crown ether (c) DMG (d) All of these

54. Some pairs of acids are given below. Select the pair in which second acid is stronger than first

(a) CH_3CO_2H and CH_2FCO_2H
(b) CH_2FCO_2H and CH_2ClCO_2H
(c) CH_2ClCO_2H and CH_2BrCO_2H
(d) $CH_3CH_2CHFCO_2H$ and $CH_3CHFCH_2CO_2H$

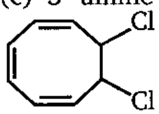
55. $H-C\equiv C\overset{a}{-}C\equiv C\overset{b}{-}CH_3$;

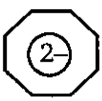
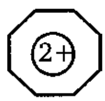
Compare the bond lengths a and b:

(a) $a = b$ (b) $a > b$ (c) $b > a$ (d) $a >>> b$

56. Which (isomeric) amine has lowest boiling point ?

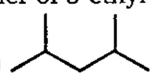
(a) 1° amine (b) 2° amine
(c) 3° amine (d) cannot predict

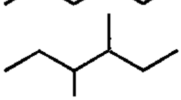
57.  $\xrightarrow{2SbCl_5}$ P ; P will be :

(a)  (b)  $2SbCl_6^{\ominus}$

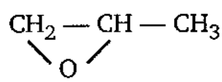
(c)  (d) mixture of (a) and (b)

58. Which of the following substances is not an isomer of 3-ethyl 2-methyl pentane ?

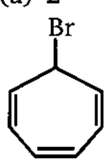
(a)  (b) 

(c)  (d) All are isomers

59. Which of the following is an isomer of compound 1 ?

CH_3CH_2CHO (1) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (2) $CH_3-CH=CH-OH$ (3)  (4)

(a) 2 (b) 4 (c) 2 and 3 (d) all are isomers

60.  $\xrightarrow{AgNO_3}$ (A) ;

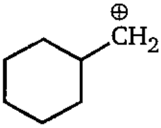
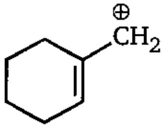
Which statement is incorrect in respect of the above reaction ?

(a) Product is aromatic (b) Product has high dipole moment
(c) Product has less resonance energy (d) Product is soluble in polar solvent

61. Some pairs of ions are given below. In which pair, first ion is more stable than second?

(a) $CH_3-\overset{\oplus}{C}H-CH_3$ and $CH_3-\overset{\oplus}{C}H-OCH_3$

(b) $CH_3-CH_2-\overset{\oplus}{C}H-CH_3$ and $CH_2=CH-CH_2-\overset{\oplus}{C}H_2$

(c)  and 

(d) $\begin{array}{l} CH_3-CH-CH_3 \\ \quad\;\;\, | \\ CH_2-\overset{}{C}^{\oplus}-CH_3 \end{array}$ and $\begin{array}{l} CH_3-N-CH_3 \\ \quad\;\;\;\; | \\ CH_3-C^{\oplus}-CH_3 \end{array}$

62. Among the given pairs in which pair, first compound has higher boiling point than second ?

(a) $CH_3-CH_2OCH_3$ and $CH_3-\underset{\displaystyle OH}{\underset{|}{C}H}-CH_3$

(b) $CH_3-CH_2-CH_2-CH_3$ and $CH_3-CH_2-CH_3$

(c) $CH_3-CH_2-CH_2-CH_2-CH_3$ and $CH_3-\overset{\displaystyle CH_2-CH_3}{\overset{|}{C}H}-CH_2-OH$

(d) $CH_3-CH_2-CH_2-CH_3$ and $CH_3-CH_2-CH_2-Cl$

63. Which of the following alcohols is the least soluble in water ?

(a) Ethanol (b) 1-Propanol

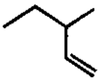
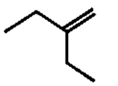
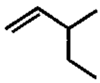
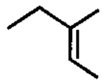
(c) 1-Butanol (d) 1-Pentanol

64. Which of the following alcohols is expected to have a lowest pK_a value ?

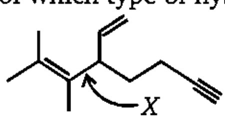
(a) Ethanol (b) 1-propanol

(c) 2, 2, 2-trifluorethanol (d) 2-chloroethanol

65. Which of the following alkenes is the most stable ?

(a)  (b)  (c)  (d) 

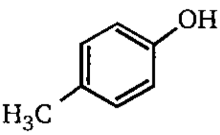
66. Bond X is made by the overlap of which type of hybridized orbitals ?



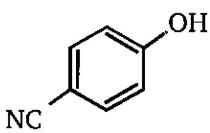
(a) sp and sp^3 (b) sp and sp^2

(c) sp^2 and sp^3 (d) none of these

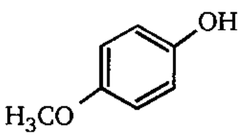
67. Increasing order of acidic strength of given compounds is :



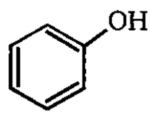
(I)



(II)

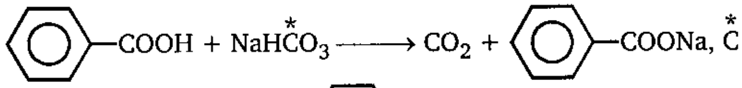


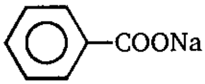
(III)



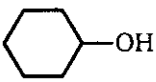
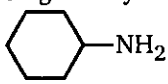
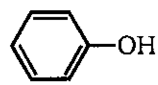
(IV)

(a) III < I < IV < II (b) II < I < IV < III
(c) I < III < IV < II (d) I < III < II < IV

68.  is with the product :

(a) CO_2 (b)  (c) both (d) none of these

69. Rank in the order of increasing acidity.

(I)  (II)  (III) 

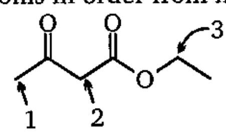
(a) III < I < II (b) I < III < II
(c) III < II < I (d) II < I < III

70. Which compound has the highest value of pK_a?

(a) $Cl-CH_2-CH_2-COOH$ (b) CH_3-CH_2-COOH

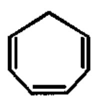
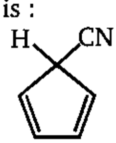
(c) $CH_3-\underset{\displaystyle Cl}{\underset{|}{C}}H-COOH$ (d) $CH_3-\underset{\displaystyle Cl}{\underset{|}{\overset{\displaystyle Cl}{\overset{|}{C}}}}-COOH$

71. Consider the hydrogen atoms attached to three different carbon atoms (labeled 1, 2 & 3). Rank the attached hydrogen atoms in order from most acidic to least acidic.



(a) 2 > 1 > 3 (b) 1 > 2 > 3 (c) 2 > 3 > 1 (d) 3 > 2 > 1

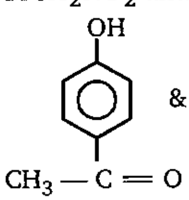
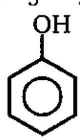
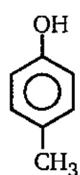
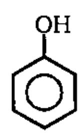
72. Decreasing order of acidic strengths of following compounds is :

(x)  (y)  (z) 

(a) $x > y > z$ (b) $y > x > z$ (c) $z > y > x$ (d) $z > x > y$

73. Among the given pairs, in which pair second compound is more acidic than first ?

(a) $BrCH_2NO_2$ and CH_3CH_3 (b) $CH_3-\overset{\displaystyle O}{\overset{||}{C}}CH_2CN$ and $CH_3-\overset{\displaystyle O}{\overset{||}{C}}-CH_3$

(c)  &  (d)  & 

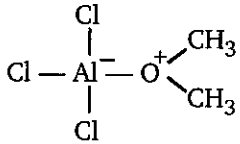
74. Which of the underlined atoms in the molecules shown below have *sp*-hybridization ?

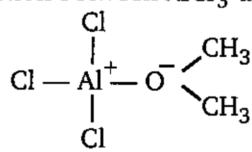
(u) $\underline{C}H_2CHCH_3$ (v) $CH_2\underline{C}CHCl$ (w) $CH_3\underline{C}H_2^+$ (x) $H-C\equiv C-H$

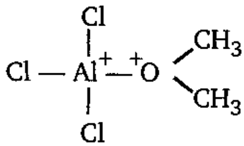
(y) $CH_3\underline{C}N$ (z) $(CH_3)_2C\underline{N}NH_2$

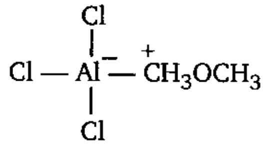
(a) x and z (b) x, y, and z (c) u, w and x (d) v, x and y

75. Which of the following, is the product of the reaction between $AlCl_3$ and CH_3OCH_3 ?

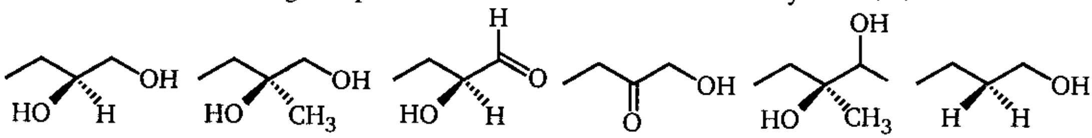
(a) 

(b) 

(c) 

(d) 

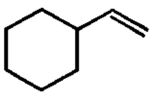
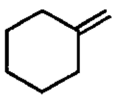
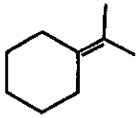
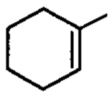
76. Which of the following compounds contain at least one secondary alcohol ?



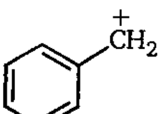
(I) (II) (III) (IV) (V) (VI)

(a) I, II, IV, VI (b) I, III (c) I, II, III, V (d) I, III, V

77. Which of the following has the most negative heat of hydrogenation ?

(a)  (b)  (c)  (d) 

78. Which of the following options is the correct order of relative stabilities of cations I, II and III as written below (most stable first) ?

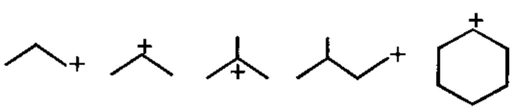
(I) 

(II) $H_2C=CH-CH_2-\overset{+}{C}H-CH_3$

(III) $H_3C-\underset{CH_3}{\overset{CH_3}{C}}-\overset{+}{C}H_2$

(a) I > II > III (b) II > III > I (c) III > I > II (d) I > III > II

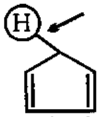
79. What is the decreasing order of stability (most stable → least stable) of the following carbocations ?



1 2 3 4 5

(a) 3 > 2 > 1 > 4 > 5 (b) 3 > 2 > 5 > 4 > 1

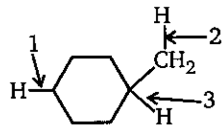
(c) 1 ≈ 4 > 2 ≈ 5 > 3 (d) 3 > 1 ≈ 4 > 2 ≈ 5

80. 

the hydrogen indicated by arrow will be easily removed as :

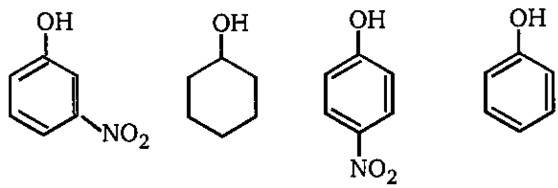
(a) H^+ (b) $H^{\ominus}$ (c) $H^{\bullet}$ (d) H^{-2}

81. Rank the bond dissociation energies of the bonds indicated with the arrows. (from smallest to largest).



(a) $1 < 2 < 3$ (b) $3 < 2 < 1$ (c) $2 < 3 < 1$ (d) $3 < 1 < 2$

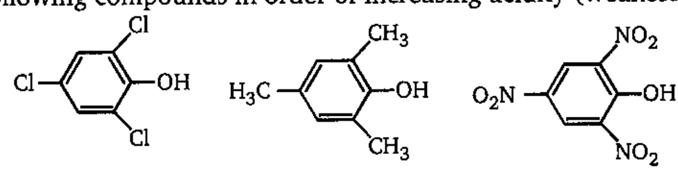
82. Rank the following compounds in order of decreasing acid strength (most acidic → least acidic) .



1 2 3 4

(a) $2 > 4 > 1 > 3$ (b) $1 > 3 > 4 > 2$ (c) $3 > 1 > 2 > 4$ (d) $3 > 1 > 4 > 2$

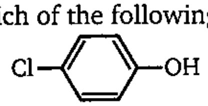
83. Rank the following compounds in order of increasing acidity (weakest acid first).

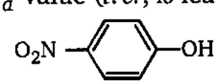


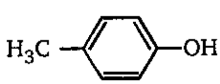
1 2 3

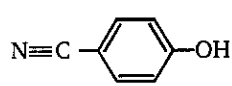
(a) $2 < 3 < 1$ (b) $3 < 1 < 2$ (c) $1 < 2 < 3$ (d) $2 < 1 < 3$

84. Which of the following phenols has the largest pK_a value (*i.e.*, is least acidic) ?

(a) 

(b) 

(c) 

(d) 

85. Among the given sets, which represents the resonating structures ?

(a) $H-C\equiv\overset{+}{N}-\ddot{\underset{\cdot\cdot}{O}}:^{-}$ and $H-\ddot{\underset{\cdot\cdot}{O}}-C\equiv N:$

(b) $H-\overset{+}{\underset{\cdot\cdot}{O}}=C=\ddot{N}:^{-}$ and $H-\ddot{\underset{\cdot\cdot}{O}}-C\equiv N:$

(c) $H-C\equiv\overset{+}{N}-\ddot{\underset{\cdot\cdot}{O}}:^{-}$ and $H-\overset{\overset{:O:}{\|}}{C}-\ddot{N}:$

(d) $H-\ddot{\underset{\cdot\cdot}{O}}-C\equiv N:^{-}$ and $H-\ddot{N}=C=\ddot{O}:$

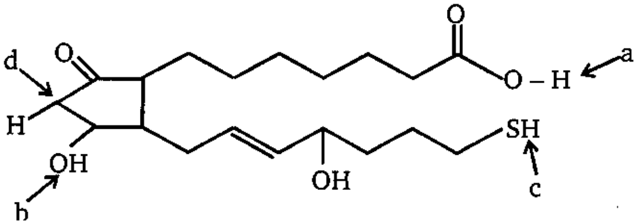
86. Identify each species in the following equilibrium according to the code :
SA = stronger acid ; SB = stronger base ; WA = weaker acid ; WB = weaker base.
The pK_a of $(CH_3)_2NH$ is 36 ; the pK_a of CH_3OH is 15.2.

$$\underset{1}{CH_3OH} + \underset{2}{(CH_3)_2NH} \rightleftharpoons CH_3-O^- + CH_3-\underset{\displaystyle H}{\overset{+}{N}H}-CH_3$$

	1	2
(a)	WA	WB
(b)	WB	WA
(c)	SA	SB
(d)	SB	SA
(e)	WA	WA

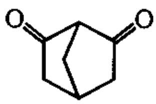
87. The hydrogen bonding is strongest in which one of the following set ?
(a) F — H - - - F (b) O — H - - - S (c) S — H - - - F (d) F — H - - - O

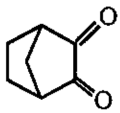
88. Intermolecular hydrogen bonding is strongest in :
(a) methylamine (b) phenol (c) formaldehyde (d) methanol

89. 

Identify most acidic hydrogen in given compound.
(a) *a* (b) *b* (c) *c* (d) *d*

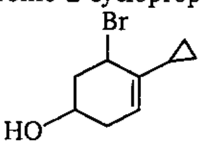
90. Which of the following compounds would you expect to be strongest carbon acid ?

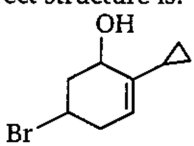
(a) 

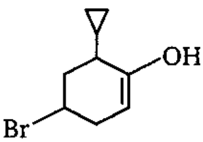
(b) 

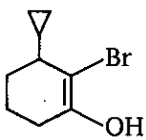
(c) $CH_2(CO_2Et)_2$ (d) $CH_3COCH_2COOC_2H_5$

91. 5-Bromo-2-cyclopropyl cyclohex-2-enol have correct structure is:

(a) 

(b) 

(c) 

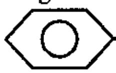
(d) 

92. Rearrange the following in the increasing order of acidic strength.

(i) benzoic acid (ii) *p*-methoxybenzoic acid (iii) *o*-methyoxybenzoic acid

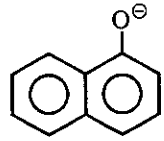
(a) i < ii < iii (b) iii < i < ii (c) ii < i < iii (d) iii < ii < i

93. In the following acid-base reaction, in which can backward reaction if favoured?

(a) $EtO^{\ominus}$ + —OH $\rightleftharpoons$

(b) KH + EtOH $\rightleftharpoons$

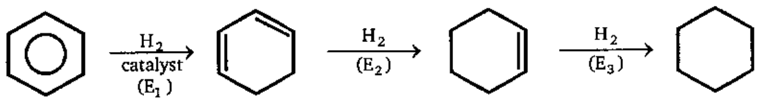
(c) $Me_3CO^{\ominus} + H_2O \rightleftharpoons$

(d)  + $CH_3OH \rightleftharpoons$

94. Which compound posses highest dipole moment ?

(a) naphthalene (b) phenanthrene

(c) anthracene (d) azulene

95. 

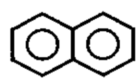
(E = activation energy)

Relation between activation energies of above reactions is :

(a) $E_2 > E_1 > E_3$ (b) $E_3 > E_1 > E_2$ (c) $E_3 > E_2 > E_1$ (d) $E_1 > E_2 > E_3$

96. Rank the following solvents in decreasing order of ability to dissolve given compound.

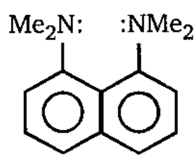
Solvent
Et_2O
H_2O
EtOH

→ 

Solute

(a) $Et_2O > H_2O >$ EtOH (b) $H_2O >$ EtOH $> Et_2O$

(c) $H_2O > Et_2O >$ EtOH (d) $Et_2O >$ EtOH $> H_2O$

97. 

1, 8-Bis (dimethylamino) naphthalene is after referred so as (Proton sponge)

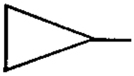
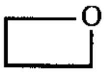
Its basic strength is 10^{10} more than 1-dimethyl amino naphthalene.

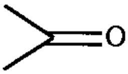
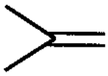
Reason for high basic strength is :

(a) resonance (b) steric inhibitation of resonance

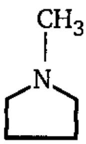
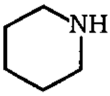
(c) ortho effect (d) hyperconjugation

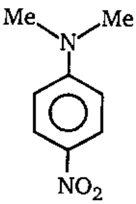
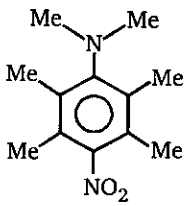
98. In the given pair of compounds, in which pair second compound has higher boiling point than first compound ?

(a)  OH and 

(b)  and 

(c) $HO-CH_2-CH_2-OH$ and $CH_3-CH_2-CH_2-OH$

(d)  and 

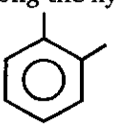
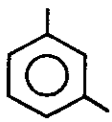
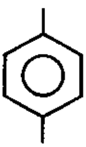
99.  (A) ,  (B) ; Dipole moments of given compound will be :

(a) (A) = 6.87D, (B) = 4.11D
(b) (A) = 4.11 D , (B) = 6.87 D
(c) (A) = 4.11 D , (B) = 4.11 D
(d) (A) = 6.87 D, (B) = 6.87 D

100. Order of decreasing basic strengths of halides is :

(a) $F^- > Cl^- > I^- > Br^-$
(b) $F^- > Cl^- > Br^- > I^-$
(c) $I^- > Br^- > Cl^- > F^-$
(d) $I^- > Cl^- > Br^- > F^-$

101. Among the xylenes, which is thermodynamically most stable ?

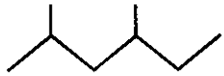
(a) 
(b) 
(c) 
(d) All are equally stable

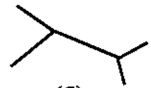
102. Heat of combustion of two isomer x and y are 17 kJ/mol and 12 kJ/mol respectively. From this information it may be concluded that :

(a) isomer x is 5 kJ /mol more stable
(b) isomer y is 5 kJ/mol less stable
(c) isomer y has 5 kJ/mol more potential energy
(d) isomer x is 5 kJ/mol less stable

103. Rank the following substances in decreasing order of heat of combustion (most exothermic $\longrightarrow$ least exothermic)

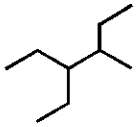

(A)

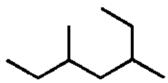

(B)

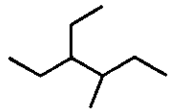

(C)

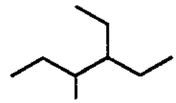
(a) B > A > C (b) A > B > C (c) C > A > B (d) C > B > A

104.


(1)


(2)


(3)


(4)

Choose the statement that best describes given compounds.

(a) 1, 3, 4 represent same compound (b) 1 and 3 are isomer of 2 and 4

(c) 1, 4 are isomer of 2 and 3

(d) All the structure represent the same compound

105. Decreasing order of acid strengths is :

$\underset{(A)}{Ph-OH}$, $\underset{(B)}{Ph-CH_2-OH}$, $\underset{(C)}{Ph-CO_2H}$, $\underset{(D)}{Ph-CH_2-\overset{\oplus}{N}H_3}$

(a) B > A > C > D (b) C > A > B > D (c) C > A > D > B (d) C > B > A > D

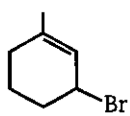
106. Rank the following in decreasing order of basic strength is :

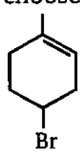
(A) $CH_3-CH_2-C\equiv C^-$ (B) $CH_3-CH_2-S^-$

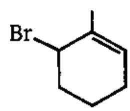
(C) $CH_3-CH_2-CO_2^-$ (D) $CH_3-CH_2-O^-$

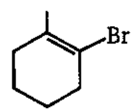
(a) B > A > D > C (b) D > A > B > C (c) A > D > B > C (d) A > D > C > B

107. Among the given compound choose the two that yield same carbocation on ionization.


(A)


(B)


(C)


(D)

(a) A, C (b) B, D (c) A, B (d) B, C

108. Oxalic acid pK_1

Malonic acid pK_2

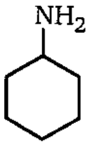
Heptanedioic acid pK_3

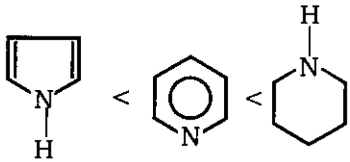
where pK_1, pK_2, pK_3 are first ionization constants. Incorrect order is :

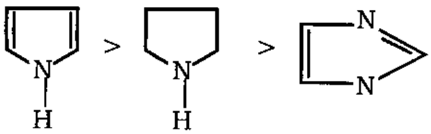
(a) $pK_1 > pK_2 > pK_3$ (b) $pK_1 < pK_2 < pK_3$

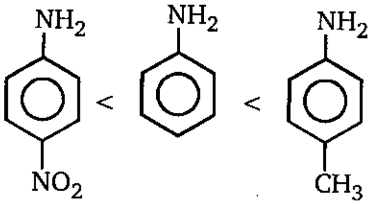
(c) $pK_3 > pK_2 > pK_1$ (d) $pK_3 > pK_1 > pK_2$

109. In sets a – d, only one of the set is incorrect regarding basic strength. Select it :

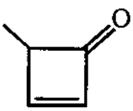
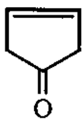
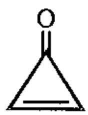
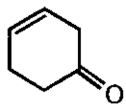
(a) Ph — NH — Ph_1 < Ph — NH_2 <  (strong base)

(b) 

(c) 

(d) 

110. Dipole moment of which ketone is maximum ?

(a)    (b)    (c)    (d) 

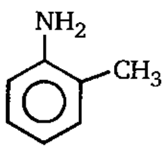
111. Correct order of basic strengths of given amines is :

(a) Me_2NH (2°) > $MeNH_2$ (1°) > Me_3N (3°) > NH_3 (Protic solvent)

(b) Et_2NH (2°) > Et_3H (3°) > $EtNH_2$ (1°) > NH_3 (Protic solvent)

(c) Me_3N > Me_2NH > Me – NH_2 > NH_3 (Gas phase)

(d) All are correct

112. Order of basic strength Ph — NH_2, (A)   Ph — NH — Me, (B)   Ph — N(Me) — Me, (C)    (D)

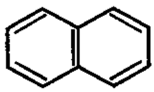
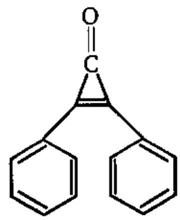
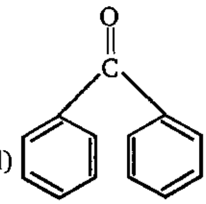
(a) A > B > C > D   (b) B > A > C > D   (c) C > B > A > D   (d) C > B > D > A

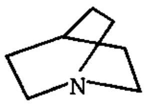
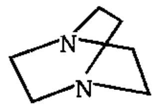
113. Carbon-carbon double bond length will be maximum in which of the following compounds ?

(a) $CH_3-CH=CH_2$ (b) $CH_3-CH=CH-CH_3$

(c) $CH_3-\underset{\underset{CH_3}{|}}{C}=\underset{\underset{CH_3}{|}}{C}-CH_3$ (d) $CH_2=CH_2$

114. Which has maximum dipole moment ?

(a)  (b)  (c)  (d) 

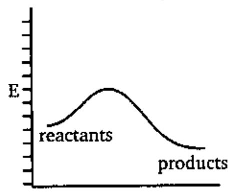
115. (i) Et_3N (ii)  (iii) 

Compare the basic strengths of compounds given:

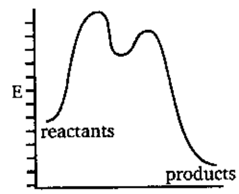
(a) (i) > (ii) > (iii) (b) (ii) > (i) > (iii)

(c) (ii) > (iii) > (i) (d) (iii) > (ii) > (i)

116. For the following two reactions, which statement is true ?



Reaction A



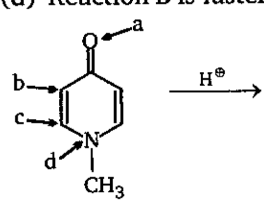
Reaction B

(a) Reaction *A* is faster and less exergonic than *B*

(b) Reaction *B* is faster and more exergonic than *A*

(c) Reaction *A* is faster and less endergonic than *B*

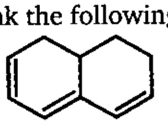
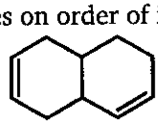
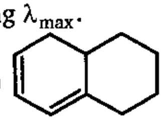
(d) Reaction *B* is faster and more endergonic than *A*

117. 

Identify the site, where attack of H^+ is most favourable.

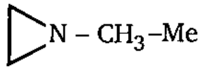
(a) *a* (b) *b* (c) *c* (d) *d*

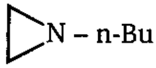
118. Rank the following alkenes on order of increasing λ_{max}.

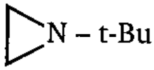
(1)  (2)  (3) 

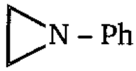
(a) 1 < 2 < 3 (b) 1 < 3 < 2 (c) 2 < 1 < 3 (d) 2 < 3 < 1

119. Which of the following cyclic amine has lowest $\Delta G^{\#}$ for inversion ?

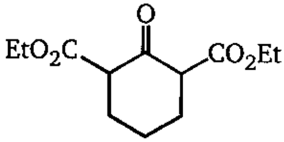
(a) 

(b) 

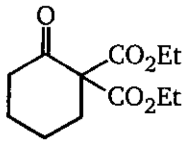
(c) 

(d) 

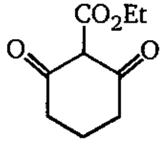
120. Rank in the order of increasing acidic strength:



(A)



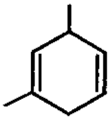
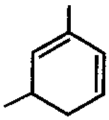
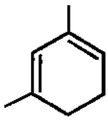
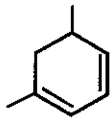
(B)



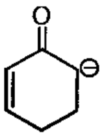
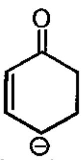
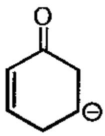
(C)

(a) A < B < C
(b) A < C < B
(c) B < A < C
(d) B < C < A

121. Which one of the following dienes would you expect to be the most stable ?

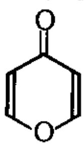
(a)  (b)  (c)  (d) 

122. Which metal catalyzed reaction would release the maximum amount of heat per CH_2 unit ?
(a) cyclopropane + H_2 → propane
(b) cyclobutane + H_2 → butane
(c) cyclopentane + H_2 → pentane
(d) cyclohexane + H_2 → hexane

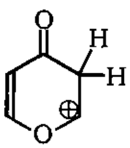
123. (A)  (B)  (C) 

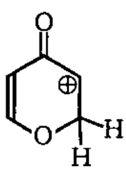
Compare basic strengths of the above compounds:
(a) A > B > C
(b) B > A > C
(c) C > A > B
(d) C > B > A

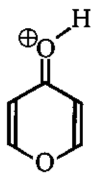
124. On reaction with acid, 4-pyrone gives a very stable cationic product. Which of the following structures shows the protonation site in that product ?

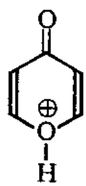


4-Pyrone

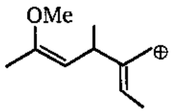
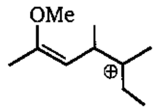
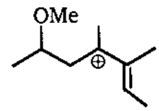
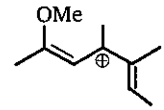
(a) 

(b) 

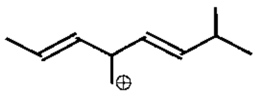
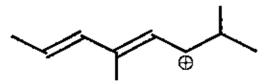
(c) 

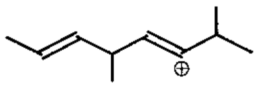
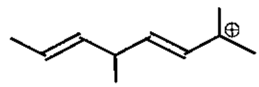
(d) 

125. Which of the following is the most stabilized carbocation ?

(a)  (b)  (c)  (d) 

126. Which carbocation is the most stable ?

(a)  (b) 

(c)  (d) 

127. Consider a positively charged C_2H_3 species in which the positively charged carbon is sp-hybridized, the uncharged carbon is sp^2-hybridized and an empty p-orbital is perpendicular to the π system. What it the best description of this cation ?

(a) vinyl (b) allenyl (c) alkyl (d) allyl

128. Which of the following reactions is not exothermic ?

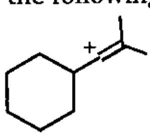
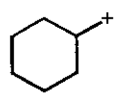
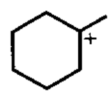
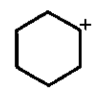
(a) $CH_3-Cl + CH_3-CH_3 \longrightarrow CH_4 + CH_3-CH_2-Cl$

(b) $CH_3-Cl + (CH_3)_3C-H \longrightarrow CH_4 + (CH_3)_3C-Cl$

(c) $CH_3-Cl + CH_2=CH-CH_3 \longrightarrow CH_4 + CH_2=CH-CH_2-Cl$

(d) $CH_3-Cl + CH_2=CH_2 \longrightarrow CH_4 + CH_2=CHCl$

129. List the following carbocations in order of decreasing stabilization energies.

(I)  (II)  (III)  (IV) 

(a) II, III, I, IV (b) III, IV, II, I (c) III, IV, I, II (d) I, II, IV, III

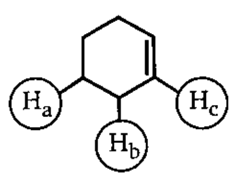
130. For the following two acid-base reactions, which statement is true ?

(I) $CH_3CH_2^- + \underset{pK_a=35}{CH_3NH_2} \rightleftharpoons \underset{pK_a=50}{CH_3CH_3} + CH_3NH^-$

(II) $F^- + \underset{pK_a=15.7}{H_2O} \rightleftharpoons \underset{pK_a=3.2}{HF} + HO^-$

(a) I is favoured to the right, II is favoured to the left
(b) I is favoured to the left, II is favoured to the right
(c) I is favoured to the right, II is favoured to the right
(d) I is favoured to the left, II is favoured to the left

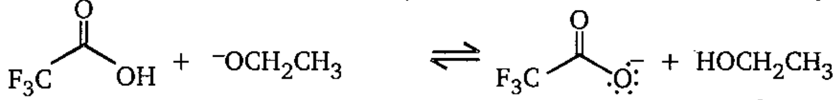
131. Rank the hydrogen atoms (H_a, H_b, H_c) in the following molecules according to their acidic strengths:



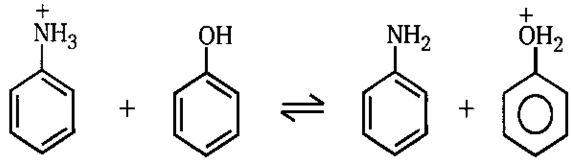
(a) $a > b > c$ (b) $b > a > c$ (c) $b > c > a$ (d) $a > c > b$

132. In which of the following reactions, backward reaction is favoured ?

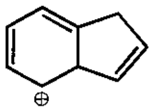
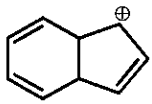
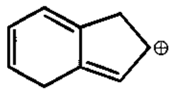
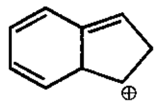
(a) $H-C\equiv C-H + Li^{+}\ {}^{-}CH_2CH_3 \rightleftharpoons H-C\equiv C:^{\ominus}Li^{+} + H_3C-CH_3$

(b) 

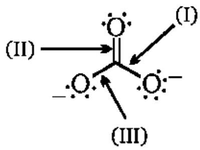
(c) $CH_3CH_2\overset{+}{S}H_2 + CH_3CH_2OH \rightleftharpoons CH_3CH_2SH + CH_3CH_2\overset{\oplus}{\ddot{O}}(H)-H$

(d) 

133. Which carbocation is the most stabilized ?

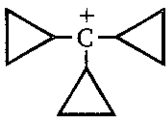
(a)  (b)  (c)  (d) 

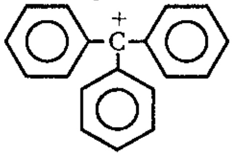
134. Taking into account of hybridization and resonance effects, rank the following bonds in order of decreasing bond length.

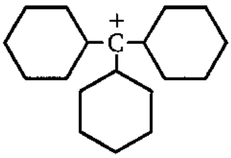


(a) I > II = III (b) II > III > I (c) I > III > II (d) II = III = I

135. Which one among the following carbocations has the longest half-life ?

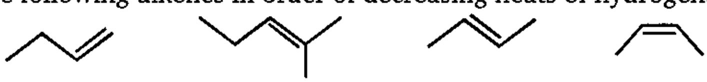
(a) 

(b) 

(c) 

(d) $CH_3-\overset{+}{C}(CH_3)-CH_3$

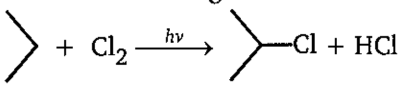
136. Rank the following alkenes in order of decreasing heats of hydrogenation (largest first)

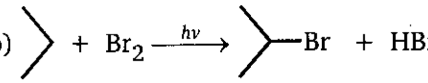


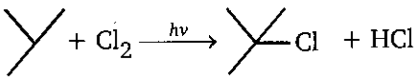
1 2 3 4

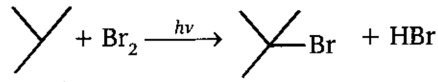
(a) 2 > 3 > 4 > 1
(b) 2 > 4 > 3 > 1
(c) 1 > 3 > 4 > 2
(d) 1 > 4 > 3 > 2

137. Which of the following reactions is most exothermic ?

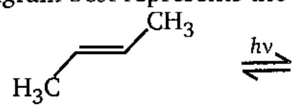
(a) 

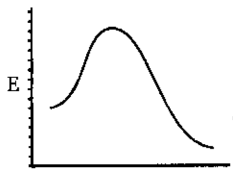
(b) 

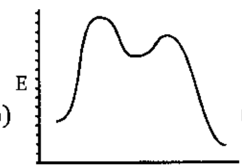
(c) 

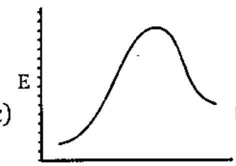
(d) 

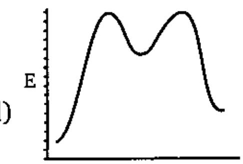
138. Which energy diagram best represents the given reaction ?



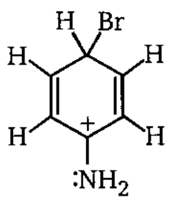
(a) 

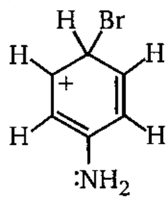
(b) 

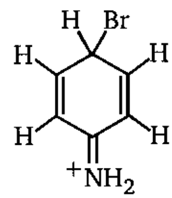
(c) 

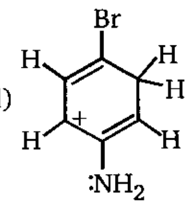
(d) 

139. Which one of the following is most stable ?

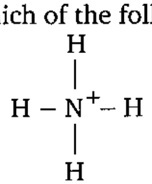
(a) 

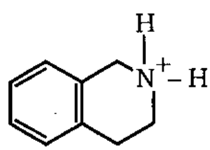
(b) 

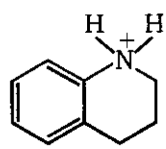
(c) 

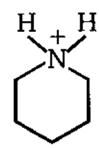
(d) 

140. Which of the following is strongest acid ?

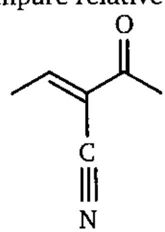
(a) 

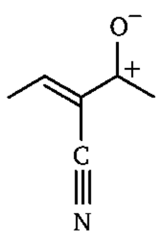
(b) 

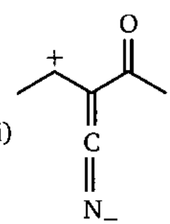
(c) 

(d) 

141. Compare relative stability of the following resonating structure.

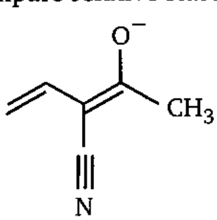
(i) 

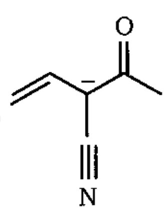
(ii) 

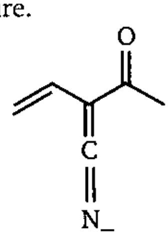
(iii) 

(a) (i) > (ii) > (iii)
(b) (ii) > (i) > (iii)
(c) (i) > (iii) > (ii)
(d) (ii) > (iii) > (i)

142. Compare relative stability of the following resonating structure.

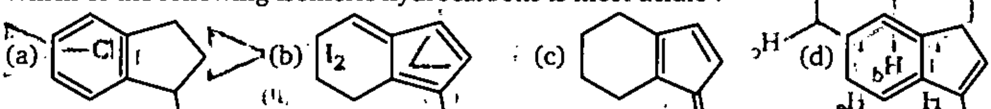
(p) 

(q) 

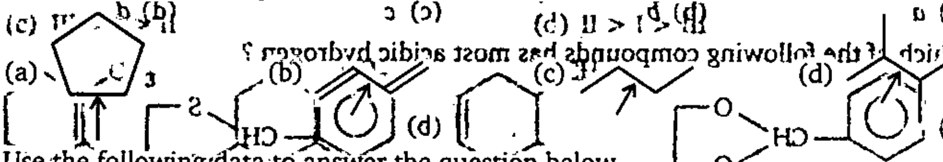
(r) 

(a) $p > q > r$
(b) $q > p > r$
(c) $q > r > p$
(d) $p > r > q$

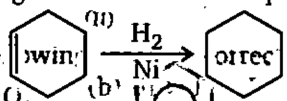
143. Which of the following isomeric hydrocarbons is most acidic ?



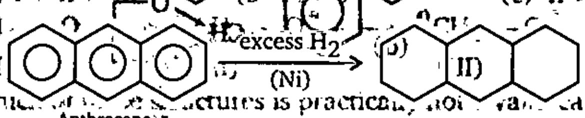
144. Which of the following has the lowest barrier to rotation about the indicated bond ?



145. Use the following data to answer the question below.



$(\Delta H = -28.6\,\text{kcal mol}^{-1})$



$(\Delta H = -116.2\,\text{kcal mol}^{-1})$

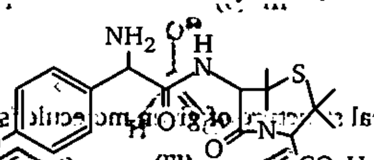
Calculate the resonance energy of anthracene.

(a) 84 kcal/mol
(b) 100 kcal/mol
(c) 110 kcal/mol
(d) 116 kcal/mol

146. How many double bond equivalents does a compound of molecular formula $C_6H_{12}O_6$ possess?

(a) 0
(b) 1
(c) 2
(d) 3

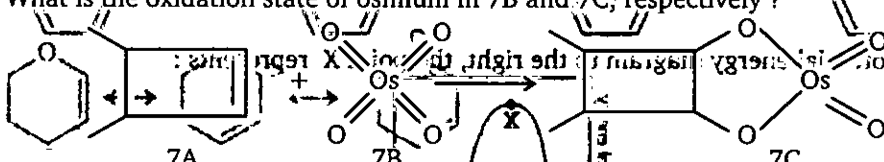
147. How many double bond equivalents does amoxycillin (shown below) possess ?



amoxycillin

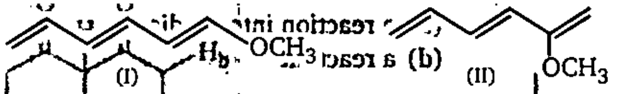
(a) 5
(b) 6
(c) 7
(d) 9

148. What is the oxidation state of osmium in 7B and 7C, respectively ?



7A 7B 7C

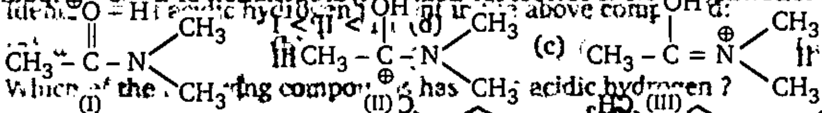
(a) 6, 8
(b) 8, 6
(c) 6, 6
(d) 8, 8

160. 

For the given compounds the correct order of resonance energy is :

(a) III > I > II (b) II > I > III

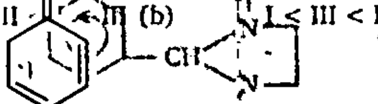
(c) I > II > III (d) III > II > I

161. 

The correct stability order of the given canonical structures is :

(a) I > II > III (b) III > I > II

(c) I > III > II (d) II > III > I

162. 

In the above compound, how many sites are available for the attack of CH_3O^- ?

(a) 1 (b) 2 (c) 3 (d) 4

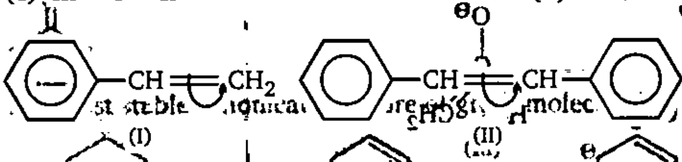
163. $CH_2 = CH_2$ $CH_3O - CH = CH_2$ $CH_3O - CH = CH - C(=O) - OEt$

(I) (II) (III)

Which of the following orders of rotation barrier about the C = C bond, as indicated, is correct ?

(a) I > II > III (b) III > II > I

(c) III > I > II (d) II > I > III

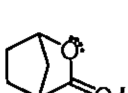
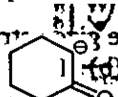
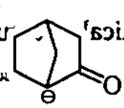
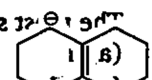
164. 

Which of the following orders of rotation barrier about the C = C bond, as indicated, is correct?

(a) I > II > III (b) III > II > I

(c) III > I > II (d) II > I > III

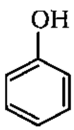
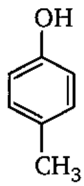
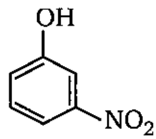
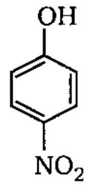
165. Which of the following compound is not resonance stabilized ?

(a)  (b)  (c)  (d) 

166. Homologous compound have same:

(a) General formula
(b) Emperical formula
(c) Structural formula
(d) Molecular formula

167. Most acidic is:

(a) 
(b) 
(c) 
(d) 

168. Which of the following substituents will decrease the acidic strength of phenol?

(a) $—NO_2$
(b) —CN
(c) $—CH_3$
(d) —CHO

169. Which of the following structures possesses a cross-conjugated system?

(a) $CH_2=CH—CH=CH—CH_2$
(b) $CH_2=CH—C(CH_2CH_3)=CH_2$
(c) $CH_2=CH—CH(CH=CH_2)—CH=CH_2$
(d) $CH_2=CH—C(CH=CH_2)=CH_2$

170. Examine the following resonating structures of formic acid for their individual stability and then answer the question given below.

$$\underset{\text{I}}{H—\overset{\overset{O}{\|}}{C}—OH} \longleftrightarrow \underset{\text{II}}{H—\overset{\overset{O^-}{|}}{C}=\overset{+}{O}—H} \longleftrightarrow \underset{\text{III}}{H—\overset{\overset{O^-}{|}}{\overset{+}{C}}—OH} \longleftrightarrow \underset{\text{IV}}{H—\overset{\overset{O^+}{|}}{\overset{-}{C}}—OH}$$

Which of the following arrangements gives the correct order of decreasing stability of the above-mentioned resonance contributors?

(a) II > I > III > IV
(b) I > II > III > IV
(c) IV > III > I > II
(d) IV > III > I > II

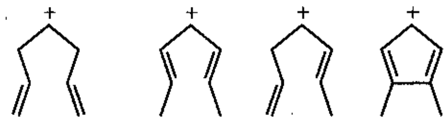
171. Which of the following is not resonating structure of each other?

(a) $CH_3—N=C=S$ and $CH_3—S—C\equiv N$
(b) $CH_3—\overset{+}{C}=O$ and $CH_3—C\equiv\overset{+}{O}$
(c) $CH_3—\overset{\overset{O}{\|}}{C}—OH$ and $CH_3—\overset{\overset{O^-}{|}}{C}=\overset{+}{O}—H$
(d) $CH_2=CH—C\equiv N$ and $\overset{+}{C}H_2—CH=C=N^-$

172. In the molecule $CH_3C\equiv CCH=CH_2$, the maximum number of carbon atoms arranged linearly is:

(a) 2
(b) 3
(c) 4
(d) 5

173. The stability order of the following carbocations is:

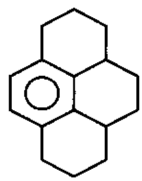


I II III IV

(a) II > IV > III > I (b) IV > II > III > I

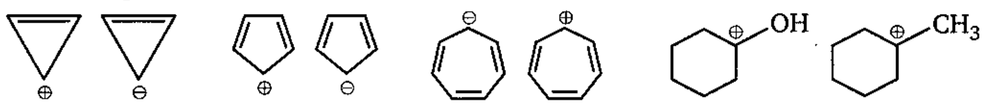
(c) II > III > I > IV (d) I > III > II > IV

174. Total number of α-hydrogen in given compound is:



(a) 4 (b) 5 (c) 6 (d) 7

175. In which pair second ion is more stable than first?



(i) (ii) (iii) (iv)

(a) (i) and (ii) (b) (ii) and (iii)

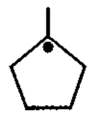
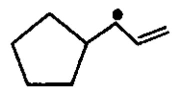
(c) (ii) and (iv) (d) (iii) and (iv)

ANSWERS — LEVEL 1

1.	(c)	**2.**	(d)	**3.**	(d)	**4.**	(a)	**5.**	(d)	**6.**	(d)	**7.**	(b)	**8.**	(c)
9.	(b)	**10.**	(c)	**11.**	(b)	**12.**	(b)	**13.**	(a)	**14.**	(b)	**15.**	(b)	**16.**	(b)
17.	(d)	**18.**	(c)	**19.**	(d)	**20.**	(d)	**21.**	(c)	**22.**	(c)	**23.**	(c)	**24.**	(a)
25.	(d)	**26.**	(d)	**27.**	(d)	**28.**	(a)	**29.**	(d)	**30.**	(a)	**31.**	(c)	**32.**	(c)
33.	(d)	**34.**	(d)	**35.**	(d)	**36.**	(d)	**37.**	(b)	**38.**	(b)	**39.**	(a)	**40.**	(c)
41.	(c)	**42.**	(d)	**43.**	(a)	**44.**	(c)	**45.**	(c)	**46.**	(d)	**47.**	(b)	**48.**	(d)
49.	(b)	**50.**	(b)	**51.**	(d)	**52.**	(d)	**53.**	(d)	**54.**	(a)	**55.**	(c)	**56.**	(c)
57.	(b)	**58.**	(b)	**59.**	(d)	**60.**	(c)	**61.**	(b)	**62.**	(b)	**63.**	(d)	**64.**	(c)
65.	(d)	**66.**	(c)	**67.**	(a)	**68.**	(a)	**69.**	(d)	**70.**	(b)	**71.**	(a)	**72.**	(d)
73.	(d)	**74.**	(d)	**75.**	(a)	**76.**	(d)	**77.**	(a)	**78.**	(a)	**79.**	(b)	**80.**	(a)
81.	(d)	**82.**	(d)	**83.**	(d)	**84.**	(c)	**85.**	(b)	**86.**	(a)	**87.**	(a)	**88.**	(b)
89.	(a)	**90.**	(d)	**91.**	(b)	**92.**	(c)	**93.**	(d)	**94.**	(d)	**95.**	(d)	**96.**	(d)
97.	(b)	**98.**	(d)	**99.**	(a)	**100.**	(b)	**101.**	(b)	**102.**	(d)	**103.**	(a)	**104.**	(a)
105.	(c)	**106.**	(c)	**107.**	(c)	**108.**	(b)	**109.**	(c)	**110.**	(c)	**111.**	(d)	**112.**	(c)
113.	(c)	**114.**	(c)	**115.**	(c)	**116.**	(a)	**117.**	(a)	**118.**	(d)	**119.**	(c)	**120.**	(c)
121.	(c)	**122.**	(a)	**123.**	(c)	**124.**	(c)	**125.**	(d)	**126.**	(b)	**127.**	(a)	**128.**	(d)
129.	(b)	**130.**	(a)	**131.**	(c)	**132.**	(d)	**133.**	(c)	**134.**	(d)	**135.**	(a)	**136.**	(d)
137.	(c)	**138.**	(d)	**139.**	(c)	**140.**	(c)	**141.**	(a)	**142.**	(d)	**143.**	(b)	**144.**	(c)
145.	(a)	**146.**	(b)	**147.**	(d)	**148.**	(b)	**149.**	(a)	**150.**	(b)	**151.**	(d)	**152.**	(b)
153.	(a)	**154.**	(a)	**155.**	(c)	**156.**	(c)	**157.**	(c)	**158.**	(b)	**159.**	(c)	**160.**	(c)
161.	(b)	**162.**	(c)	**163.**	(a)	**164.**	(a)	**165.**	(c)	**166.**	(a)	**167.**	(d)	**168.**	(c)
169.	(d)	**170.**	(b)	**171.**	(a)	**172.**	(d)	**173.**	(c)	**174.**	(c)	**175.**	(b)		

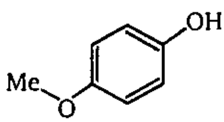
LEVEL-2

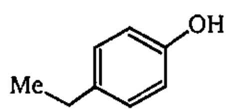
1. Rank in order of radical stability (1 = most stable).

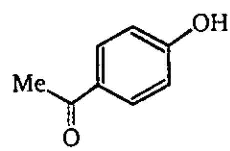
(a)  (b)  (c)  (d) 

☐ ☐ ☐ ☐

2. Predict the acidity order for the three phenols shown below :
Acidity order : 1 (most) to 3 (least)

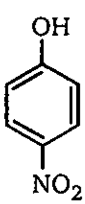
(a) 

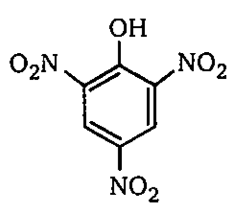
(b) 

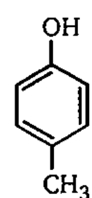
(c) 

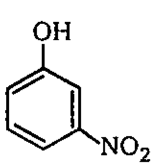
Acidity order : ....

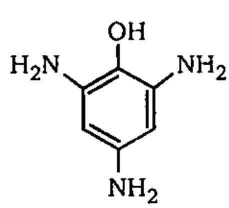
3. Comprehension

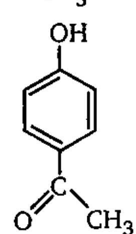












A. Which of the phenol derivatives above is the strongest acid ?

☐ Compound A ☐ Compound B ☐ Compound C
☐ Compound D ☐ Compound E ☐ Compound F

B. Which of the phenol derivatives above is the weakest acid ?

☐ Compound A ☐ Compound B ☐ Compound C
☐ Compound D ☐ Compound E ☐ Compound F

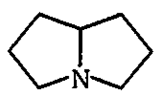
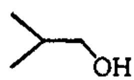
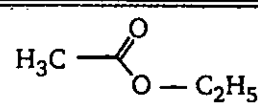
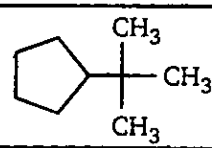
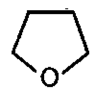
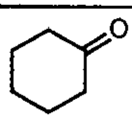
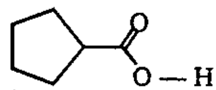
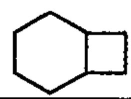
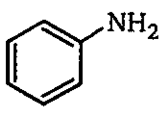
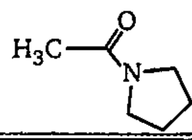
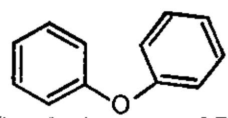
C. Which of the mono-nitrophenol derivatives above is the strongest acid ?

☐ Compound A ☐ Compound D

D. Which of the carbon-substituted phenol derivatives above is the strongest acid ?

☐ Compound C ☐ Compound F

4. The following questions refer to the twelve compounds given below. You may enter as many as six choices in each answer box.

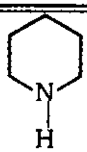
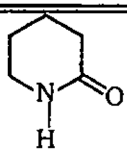
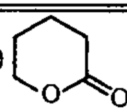
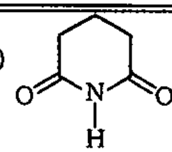
(a)		**(b)**		**(c)**	
(d)	H — F	**(e)**		**(f)**	
(g)		**(h)**		**(i)**	
(j)		**(k)**		**(l)**	

A. Which compound may serve only as H-bond acceptors ? ☐

B. Which may serve both as H-bond donors and acceptors? ☐

C. Which compounds will not participate in H-bonding ? ☐

5. Consider the following compounds and answer A and B.

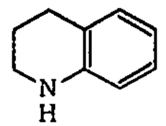
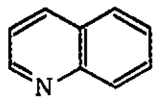
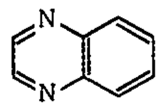
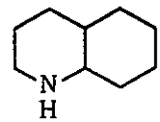
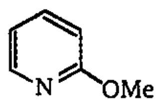
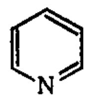
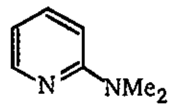
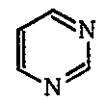
(I)  (II)  (III)  (IV) 

A. Which of the compounds is the strongest Bronsted acid ?

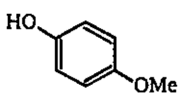
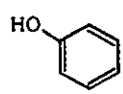
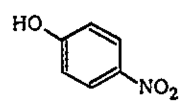
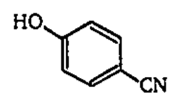
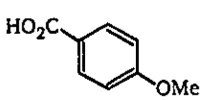
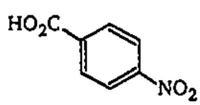
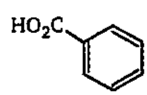
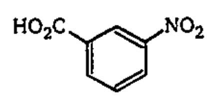
(a) I (b) II (c) III (d) IV

10. In the two questions below, you are asked to rank the relative strengths of illustrated acids and bases. Use your knowledge of resonance and inductive to answer this.

A. For the series of bases shown below, rank the set from strongest to weakest.

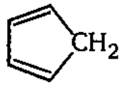
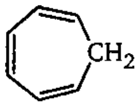
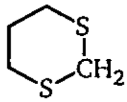
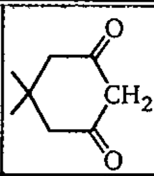
(i)						Strongest
	(a)	(b)	(c)	(d)		Weakest
(ii)						Strongest
	(a)	(b)	(c)	(d)		Weakest

B. For the series of acids shown below, rank the set from strongest to weakest.

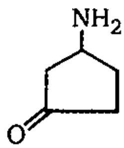
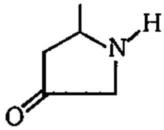
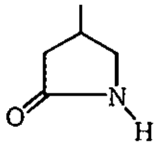
(i)						Strongest
	(a)	(b)	(c)	(d)		Weakest
(ii)						Strongest
	(a)	(b)	(c)	(d)		Weakest

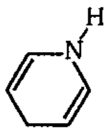
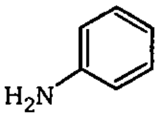
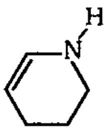
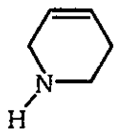
11. In each of the following sections four compounds are listed. (Decreasing order of acidic strength, 1 is strongest & 4 is weakest).

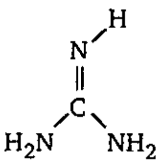
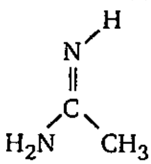
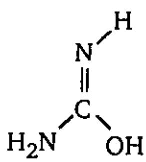
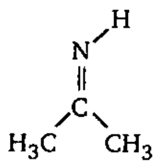
(a)	$CH_2(CO_2C_2H_5)_2$	$CH_3COCH_2CO_2C_2H_5$	$(CH_3CO)_2CH_2$	$RC\equiv CH$
(b)	RCH_2NO_2	RSO_2CH_3	$(C_6H_5)_3CH$	$RCOCH_3$
(c)	$CH_2(C\equiv N)_2$	$CH_2(NO_2)_2$	$HC\equiv N$	$RCH_2CO_2C_2H_5$

(d)		 ;		

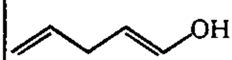
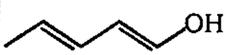
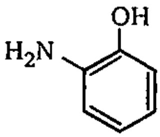
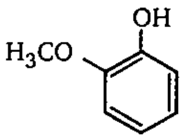
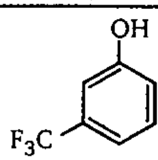
12. Rank in the order of increasing basic strength.

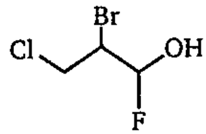
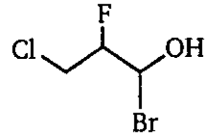
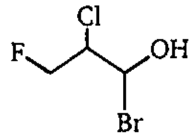
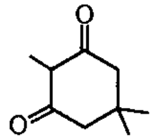
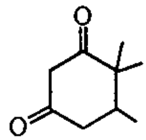
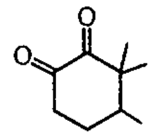
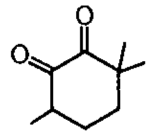
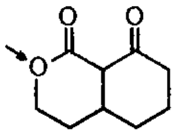
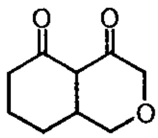
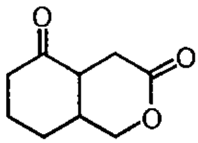
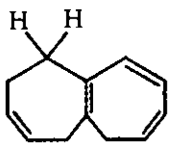
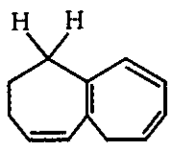
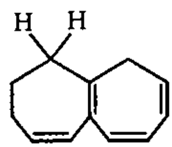
A. (a)  (b)  (c) 

B. (a)  (b)  (c)  (d) 

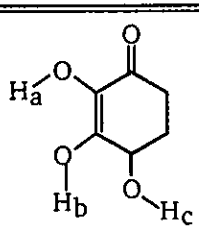
C. (a)  (b)  (c)  (d) 

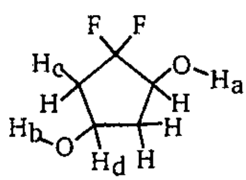
13. Compare acidic strength of the following (Write your answer in box).

A.					
	(a)	(b)	(c)		
B.					
	(a)	(b)	(c)		

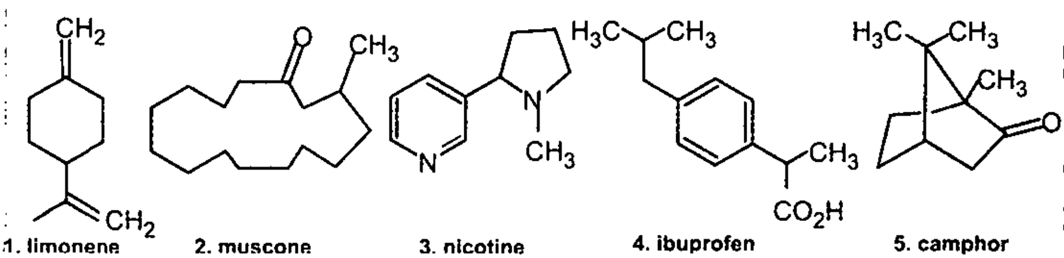
C.					
	(a)	(b)	(c)		
D.					
	(a)	(b)	(c)	(d)	
E.					
	(a)	(b)	(c)		
F.					
	(a)	(b)	(c)		

14. Arrange the hydrogens in increasing order of their acidic strengths.

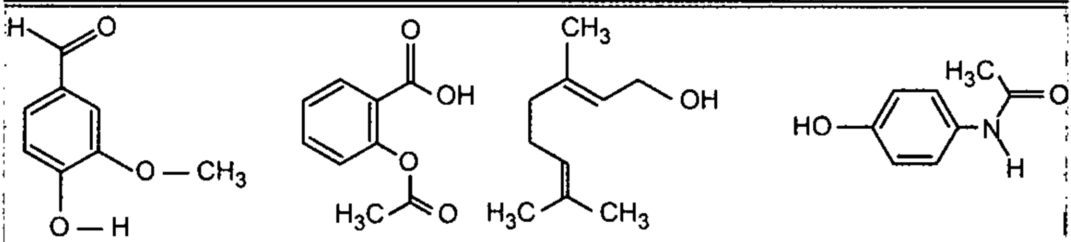
A. 

B. 

15. The compounds whose structures are shown below, incorporate a variety of functional groups. The question on the right ask you to identify which compounds have a specific functional group. For each compound that has the designed group, enter the appropriate number. The aromatic rings should not be counted as double bonds.



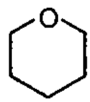
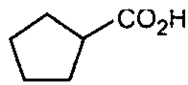
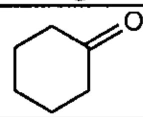
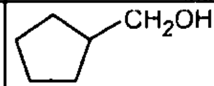
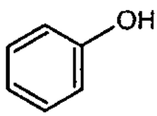
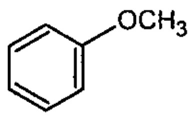
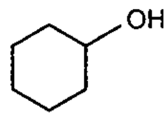
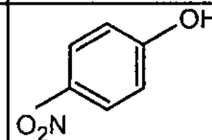
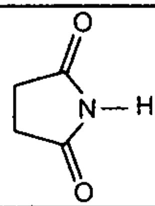
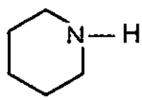
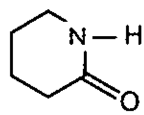
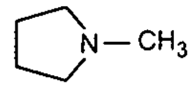
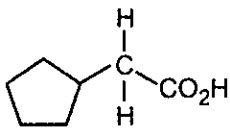
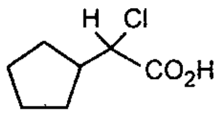
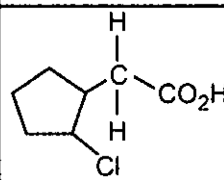
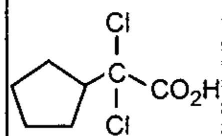
1. limonene 2. muscone 3. nicotine 4. ibuprofen 5. camphor



6. vanillin 7. aspirin 8. geraniol 9. acetaminophenol

A.	Which have carbon-carbon double bonds ?	
B.	Which have a ketone carbonyl group ?	
C.	Which have an aldehyde carbonyl group ?	
D.	Which have aromatic rings ?	
E.	Which have a hydroxy group ?	
F.	Which have ether groups ?	
G.	Which have an ester group ?	
H.	Which have an amide group ?	
I.	Which have a carboxylic acid group ?	

16.

Problem	A	B	C	D
1				
2				
3				
4				

A. Which is the strongest acid in 1?

(a) A (b) B (c) C (d) D

B. Which is weakest acid in 1 ?

(a) A (b) B (c) C (d) D

C. Which is the strongest acid in 2 ?

(a) A (b) B (c) C (d) D

D. Which is weakest acid in 2 ?

(a) A (b) B (c) C (d) D

E. Which is the strongest acid in 3 ?

(a) A (b) B (c) C (d) D

F. Which is weakest acid in 3 ?

(a) A (b) B (c) C (d) D

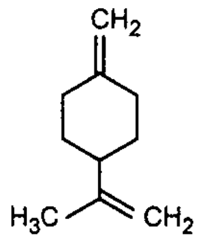
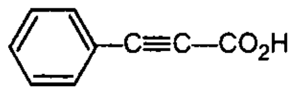
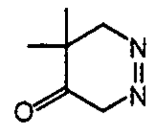
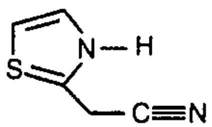
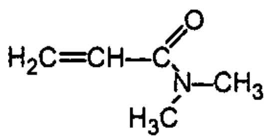
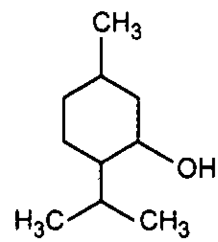
G. Which is the strongest acid in 4 ?

(a) A (b) B (c) C (d) D

H. Which is weakest acid in 4 ?

(a) A (b) B (c) C (d) D

17. For each of the six structural formulae (**A** through **F**), shown below, five questions are posed. The answer to each is a number that should be entered in the appropriate answer box.

		
A	**B**	**C**
		
D	**E**	**F**

A. (i) Number of sp^3 carbons : ....

(ii) Number of sp^2 carbons : ....

(iii) Number of sp carbons : ....

(iv) Number of carbon-carbon σ-bonds : ....

(v) Number of π-bonds to carbon : ....

B. Number of sp^3 carbons : ....

Number of sp^2 carbons : ....

Number of sp carbons : ....

Number of carbon-carbon σ-bonds : ....

Number of π-bonds to carbon : ....

C. Number of sp^3 carbons : ....

Number of sp^2 carbons : ....

Number of sp carbons : ....

Number of carbon-carbon σ-bonds : ....

Number of π-bonds to carbon :......................

D. (i) Number of sp^3 carbons : ....

(ii) Number of sp^2 carbons : ....

(iii) Number of sp carbons : ....

(iv) Number of carbon-carbon σ-bonds : ....

(v) Number of π-bonds to carbon : ....

E. Number of sp^3 carbons : ....

Number of sp^2 carbons : ....

Number of sp carbons : ....

Number of carbon-carbon σ-bonds : ....

Number of π-bonds to carbon :..............

F. Number of sp^3 carbons : ....

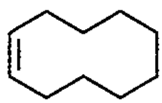
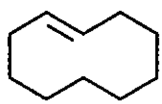
Number of sp^2 carbons : ....

Number of sp carbons : ....

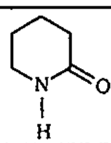
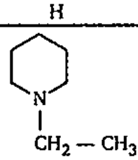
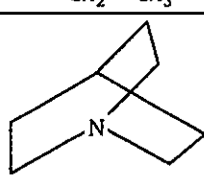
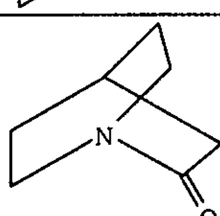
Number of carbon-carbon σ-bonds : ....

Number of π-bonds to carbon :..............

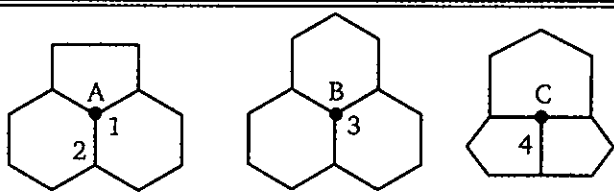
18. Match the column (I) and (II). (Matrix)

Column (I)		Column (II)	
	Molecule		**Property**
(a)		**(p)**	*cis*-compound
(b)		**(q)**	*trans*-compound
(c)		**(r)**	Highest heat of combustion
(d)		**(s)**	lowest heat of combustion

19. Match the column (I) and (II).

Column (I)		Column (II)	
	Molecule		**pK_a of Conjugate acid**
(a)		**(p)**	0.8
(b)		**(q)**	5.33
(c)		**(r)**	10.65
(d)		**(s)**	10.95

20. The junctures centred on atoms A, B and C on the given structure.



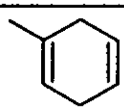
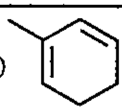
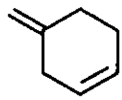
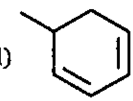
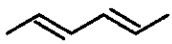
A. Which juncture has the greatest deviation from planarity ?

(a) A (b) B (c) C (d) Cannot be predicted

B. Of the carbon-carbon bonds, (shown above) numbered from 1 to 4, which represent the most favourable site for H_2 addition ?

(a) 1 (b) 2 (c) 3 (d) 4

21. Select the most stable structure in each of the following

Part (A)			
(a) 	(b) 	(c) 	(d) 
Part (B)			
(a) 	(b) 	(c) 	(d) 
Part (C)			
(a) $H_2C=CH-CH=CH-CH_3$		(b) $H_2C=C=CH-CH_2-CH_3$	
(c) $H_3C-CH=C=CH-CH_3$		(d) $H_2C=CH-CH_2-CH=CH_2$	

22. Match the column I and II. (Matrix)

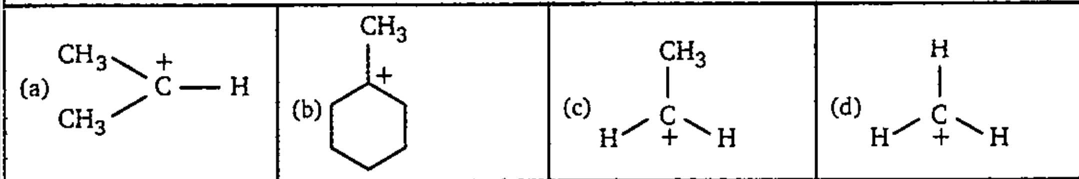
	Column (I)		Column (II)
(a)	$-NO_2$	**(p)**	$-m$ effect
(b)	$-O^-$	**(q)**	$+m$ effect
(c)	$-O-CH_3$	**(r)**	$+I$ effect
(d)	$-C\equiv N$	**(s)**	$-I$ effect

23. Match the column I and II. (Matrix)

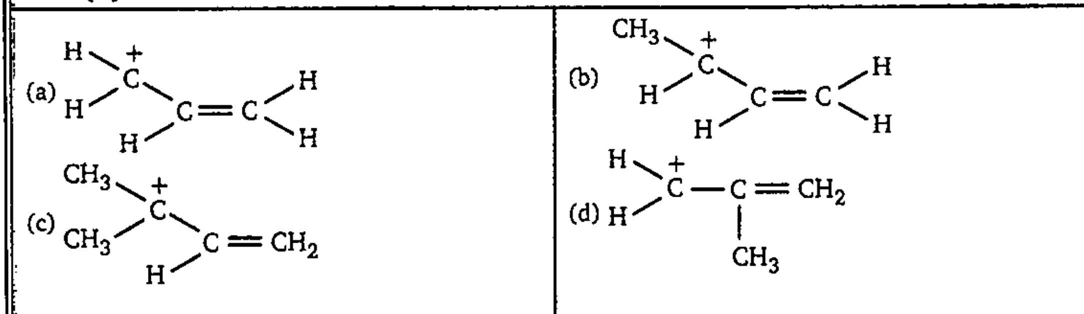
	Column (I)		Column (II)
(a)	$H_3C-CH=CH-CH_3$	**(p)**	Dipole (*cis* > *trans*)
(b)	$H_3C-CH=CH-CN$	**(q)**	Dipole (*trans* > *cis*)
(c)	$H_3C-CH=CH-Cl$	**(r)**	Melting point ((*trans* > *cis*)
(d)	$Cl-CH=CH-Cl$	**(s)**	Boiling point (*cis* > *trans*)

24. Identify the most stable structure in each of the following :

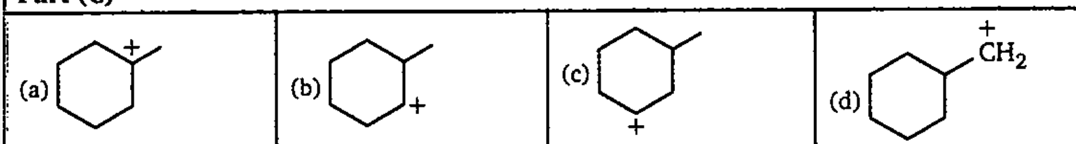
Part (A)



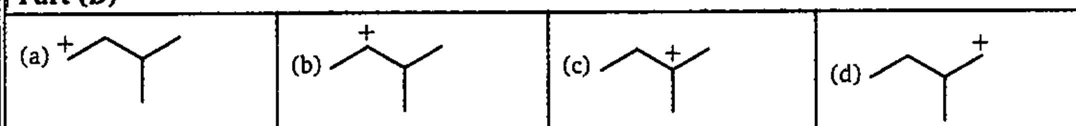
Part (B)



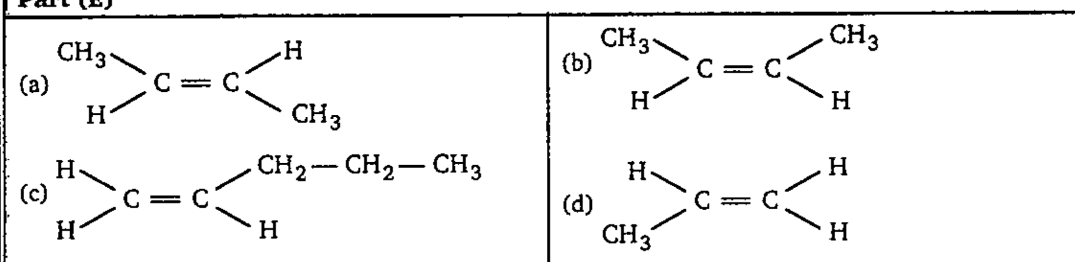
Part (C)



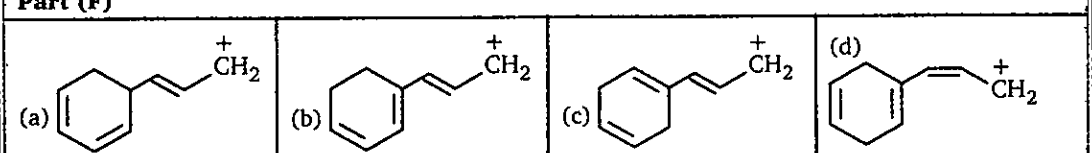
Part (D)

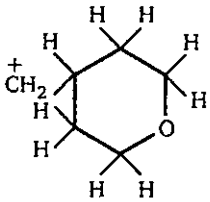
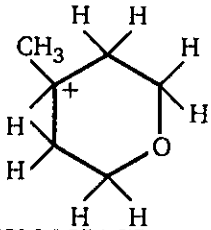
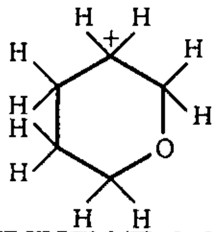
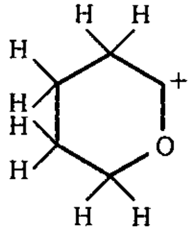


Part (E)

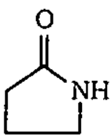
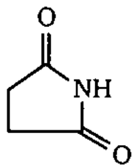
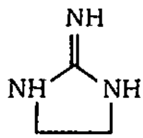
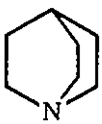
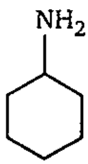
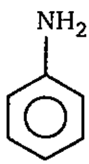
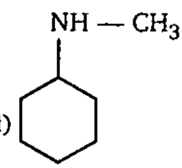
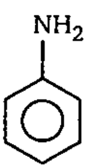
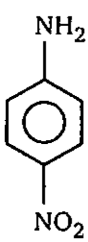
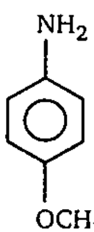
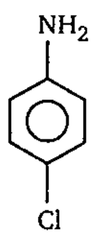


Part (F)

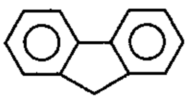
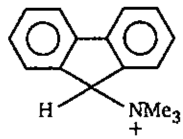
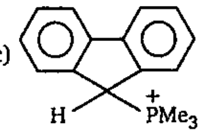
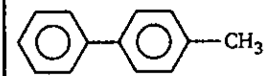
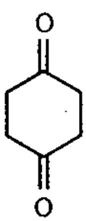
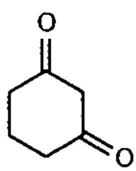
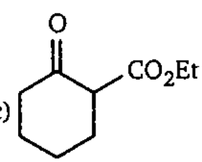
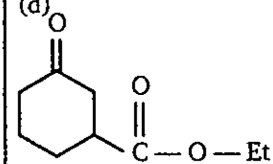
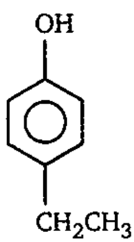
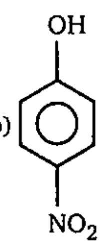
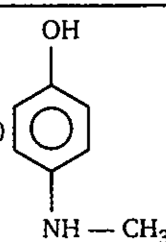
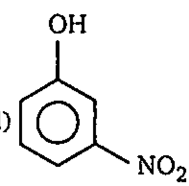
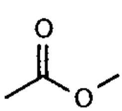
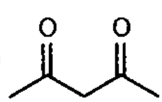
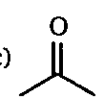
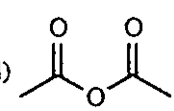
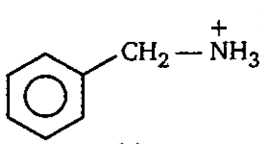
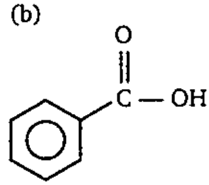
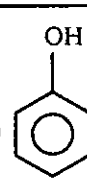
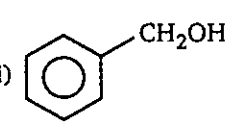


Part (G)			
(a) 	(b) 	(c) 	(d) 

25. Identify the most basic compound in the following.

Part (A)			
(a) 	(b) 	(c) 	(d) 
Part (B)			
(a) 	(b) 	(c) 	(d) 
Part (C)			
(a) NaOH	(b) $NaOOCCH_3$	(c) $NaOCH_3$	(d) $NaNH_2$
Part (D)			
(a) 	(b) 	(c) 	(d) 

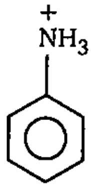
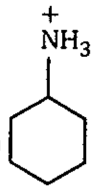
26. Identify the most acidic hydrogen containing compound from the following.

Part (A)			
(a) 	(b) 	(c) 	(d) 
Part (B)			
(a) 	(b) 	(c) 	(d) 
Part (C)			
(a) 	(b) 	(c) 	(d) 
Part (D)			
(a) 	(b) 	(c) 	(d) 
Part (E)			
 (a)	(b) 	(c) 	(d) 

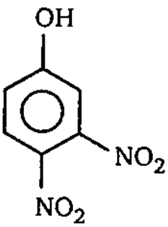
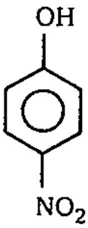
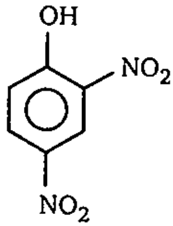
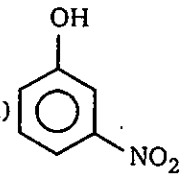
Part (F)

(a) CH_3CH_2OH	(b) $CH_3CH_2NH_2$	(c) $CH_3-C\equiv CH$	(d) $CH_3-CH=CH_2$

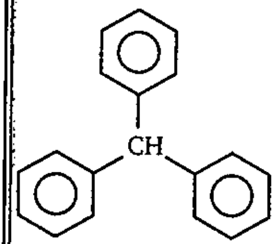
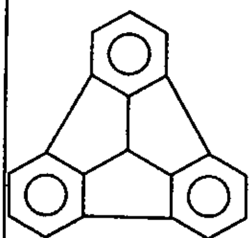
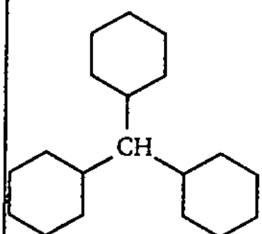
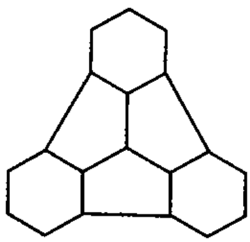
Part (G)

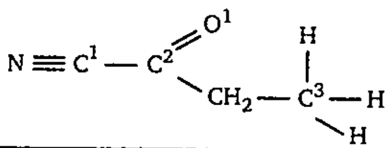
(a) CH_3-CO_2H	(b) $\underset{\substack{\vert \\ NH_3 \\ \oplus}}{CH_2}-CO_2H$	(c) 	(d) 

Part (H)

(a) 	(b) 	(c) 	(d) 

Part (I)

 (a)	 (b)	 (c)	 (d)

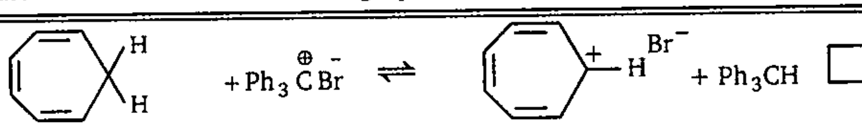
27. 

Give the type of hybridization present at each atom.

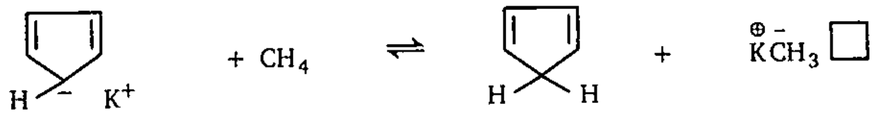
(i) N —.................. (ii) C_1 —.................. (iii) C_2 —..................

(iv) O_1 —.................. (v) CH_2 —.................. (vi) C_3 —..................

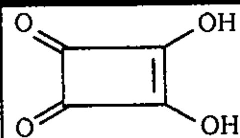
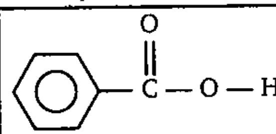
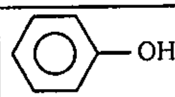
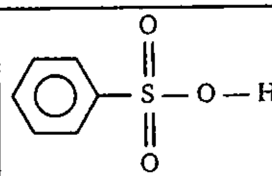
28. Predict the direction of the following equilibrium. Write your answer in the box given below.

(a) 

(A) (B) (C) (D)

(b) 

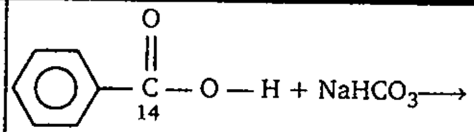
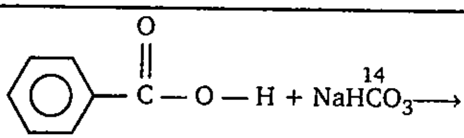
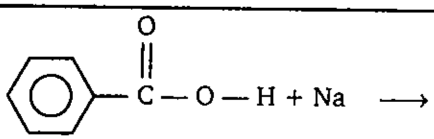
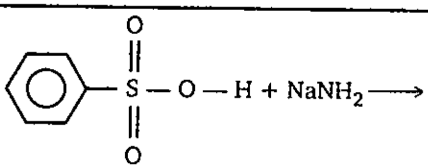
29. Match the column I and II. (Matrix)

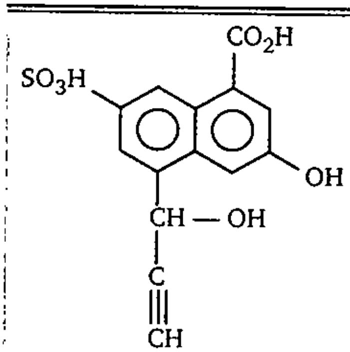
Column (I)		Column (II)	
(a)	$NaHCO_3$ will react with	**(p)**	 Squaric acid
(b)	Na will react with	**(q)**	
(c)	NaOH will react with	**(r)**	
(d)	$NaNH_2$ will react with	**(s)**	

30. Match the column I and II.

Column (I)		Column (II)	
Acid		pK_a	
(a)	CH_3-CO_2H	**(p)**	5.69
(b)	$(CH_3)_3\overset{\oplus}{N}CH_2CO_2H$	**(q)**	4.27
(c)	$(CH_3)_3\overset{\oplus}{N}(CH_2)_4CO_2H$	**(r)**	1.83
(d)	$\bar{O}_2C-CH_2-CO_2H$	**(s)**	4.80

31. Match the column I and II.

	Column (I)		Column (II)
(a)		(p)	NH_3
(b)		(q)	$^{14}CO_2$
(c)		(r)	CO_2
(d)		(s)	H_2

32. 

$$\xrightarrow{NaH\overset{14}{C}O_3} \underset{gas}{(A)} + (B) \xrightarrow{NaHCO_3} \underset{gas}{(C)} + (D)$$

Sum of molecular mass of gas $(A + C)$ is :

(a) 88 (b) 90 (c) 92 (d) 40

33.

$Ph-\overset{\overset{O}{\|}}{C}-O-H \xrightarrow{NaHCO_3} (A)$ gas

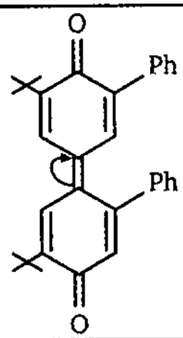
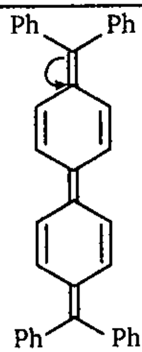
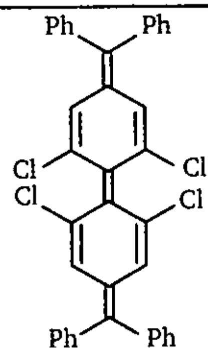
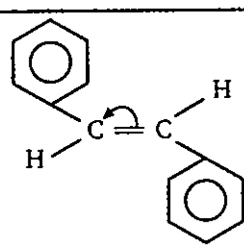
$Ph-C\equiv CH \xrightarrow{Na} (B)$ gas

$Ph-OH \xrightarrow{NaNH_2} (C)$ gas

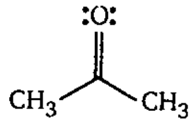
$R-O-H \xrightarrow{NaH} (D)$ gas

Sum of molecular mass of gas $A + B + C + D$ is :

34. **Match the column I and II.**

Column (I)		Column (II)	
Molecule		**Rotational free energy barrier**	
(a)		**(p)**	180 kJ/mol
(b)		**(q)**	88.3 kJ/mol
(c)		**(r)**	21 kJ/mol
(d)		**(s)**	Negative barrier

35. Consider the following reaction of boron trifluoride (BF_3) and acetone :



A. What is the critical HOMO (nucleophile) of this reaction ?

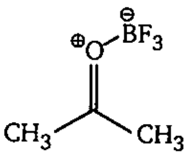
(a) non-bonding orbital on boron
(b) σ-orbital of acetone
(c) π-orbital of acetone
(d) non-bonding electron pair orbital on oxygen

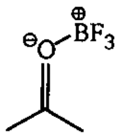
B. What is the critical LUMO (electrophile) of the reaction ?

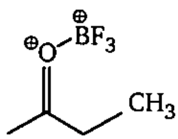
(a) *p*-orbital of BF_3
(b) σ-orbital of BF_3
(c) π^* orbital of acetone
(d) non-bonding electron pair orbital on oxygen

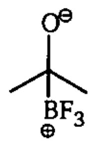
C. Which of the following is the correct product of this reaction ?

(Lone electron pairs are not shown explicitly).

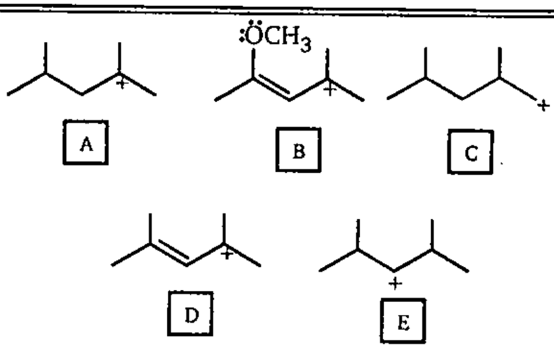
(a) 

(b) 

(c) 

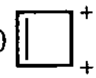
(d) 

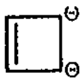
36. Rank the following carbocations according to stability (1 = most stable, 5 = least stable).

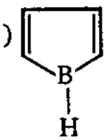


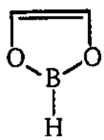
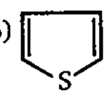
Put the answer in the boxes.

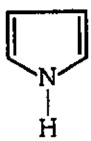
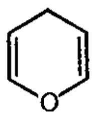
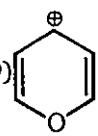
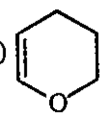
37. Among the given molecules, identify aromatic, anti-aromatic and non-aromatic molecules.

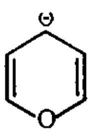
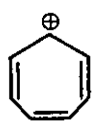
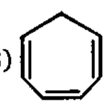
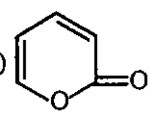
(1)  (2)  (3)  (4) 

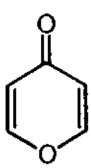
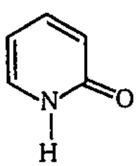
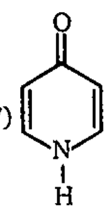
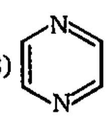
(5)  (6)  (7)  (8) 

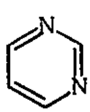
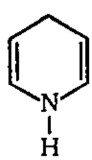
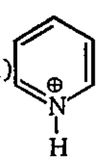
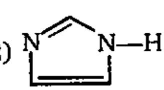
(9)  (10)  (11)  (12) 

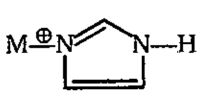
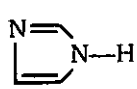
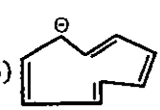
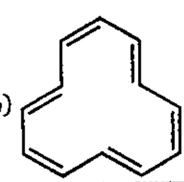
(13)  (14)  (15)  (16) 

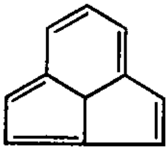
(17)  (18)  (19)  (20) 

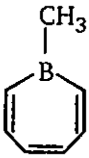
(21)  (22)  (23)  (24) 

(25)  (26)  (27)  (28) 

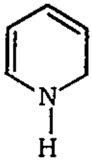
(29)  (30)  (31)  (32) 

(33)  (34)  (35)  (36) 

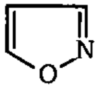
(37) 

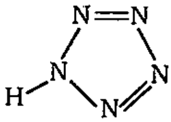
(38) 

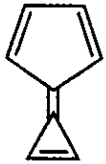
(39) 

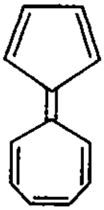
(40) 

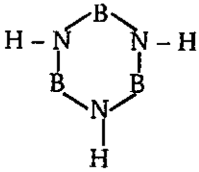
(41) 

(42) 

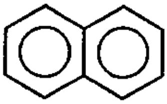
(43) 

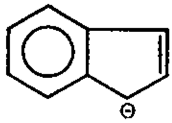
(44) 

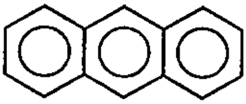
(45) 

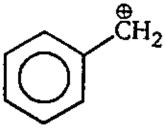
(46) 

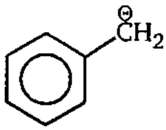
Borazole

(47) 

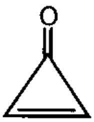
(48) 

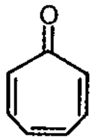
(49) 

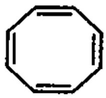
(50) 

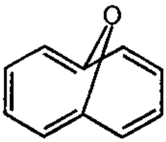
(51) 

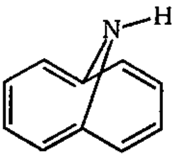
(52) 

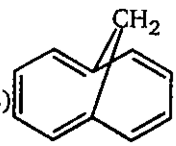
(53) 

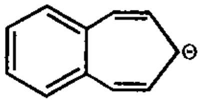
(54) 

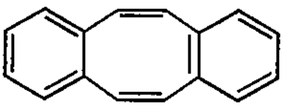
(55) 

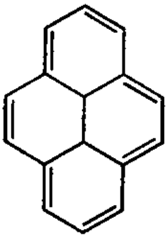
(56) 

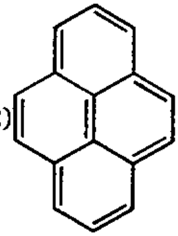
(57) 

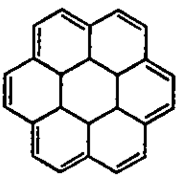
(58) 

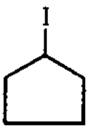
(59) 

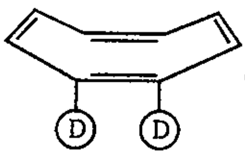
(60) 

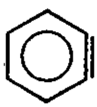
(61) 

(62) 

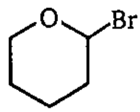
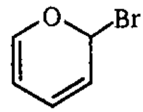
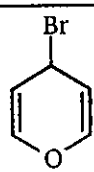
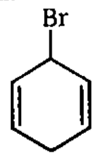
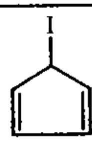
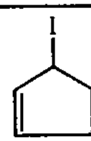
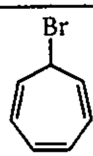
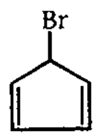
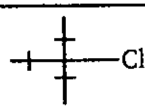
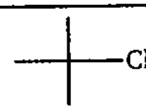
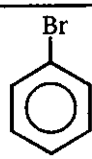
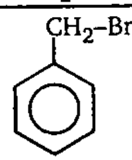
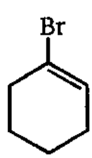
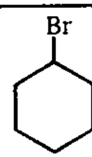
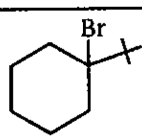
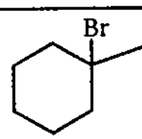
(63) 

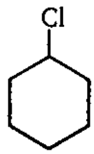
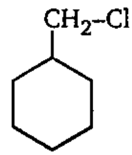
(64) 

(65) 

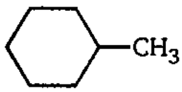
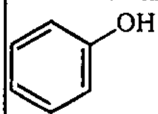
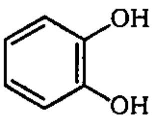
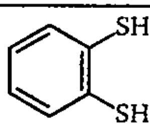
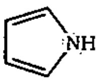
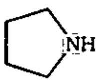
(66) 

38. Among the given pairs, which is more reactive towards $AgNO_3$ (or) toward hydrolysis.

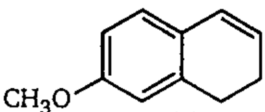
	Compound (A)	Compound (B)	Put the Answer here
1.			
2.			
3.			
4.			
5.			
6.	CH_3-O-CH_2-Cl	$CH_3-CH_2-CH_2-Cl$	
7.			
8.			
9.			

10.			

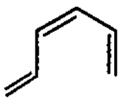
39. Put the answer in boxes given as directed.

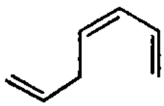
S.No.	Property	Molecules	Correct Answer	Name of force responsible for the property
A.	highest boiling point	NCl_3 $ClNH_2$ NH_4Cl NH_3		
B.	highest boiling point	  		
C.	most soluble in water	  		
D.	highest solubility in benzene	 		

40. Circle any conjugated portions of these molecules.


(A)

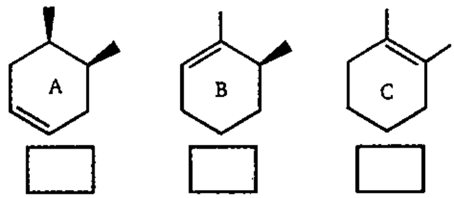
$CH_2 = C = CH - CH = CH_2$
(B)


(C)

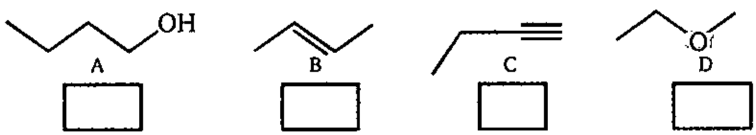

(D)

41. Arrange in the order as directed -

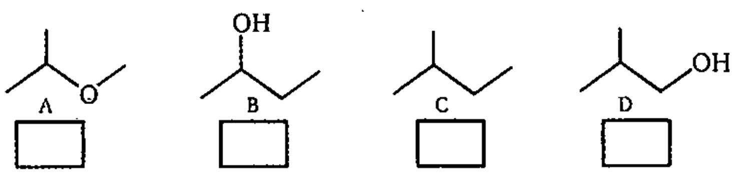
A. The given alkenes in the order of their stability (1- most stable, 3-least stable).



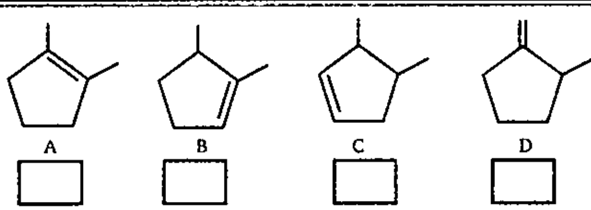
B. Arrange the following in the order of their acidic strength (1-most acidic, 4-least acidic)



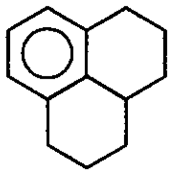
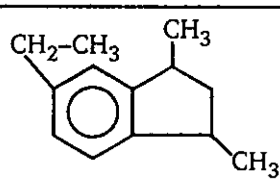
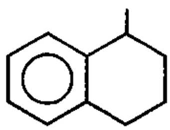
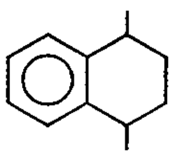
C. Arrange the following molecules in order of expected boiling point. (1=highest bpt ; 4=lowest bpt.)



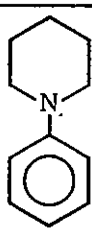
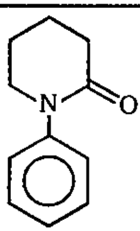
D. Arrange the following alkenes in order of their stability. (1 = most stable ; 5 = least stable).



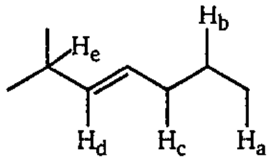
42. Match the column. (Matrix)

Column (I)		Column (II)	
Compounds		Number of Benzylic hydrogen	
(a)		(p)	2
(b)		(q)	3
(c)		(r)	4
(d)		(s)	5

43. Identify (+M) mesomeric & (–M) group of following.

	+M	–M	–I	+I
				
				

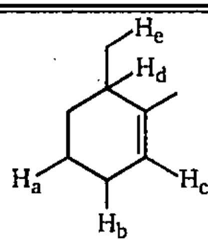
50. Consider the H-atoms in the molecule given below and answer the following.



(A) Identify the type (1°, 2° or 3° alkyl, vinyl, allyl etc.) of these H-atoms.

(B) Arrange them in the decreasing order of their case of abstraction (easiest first).

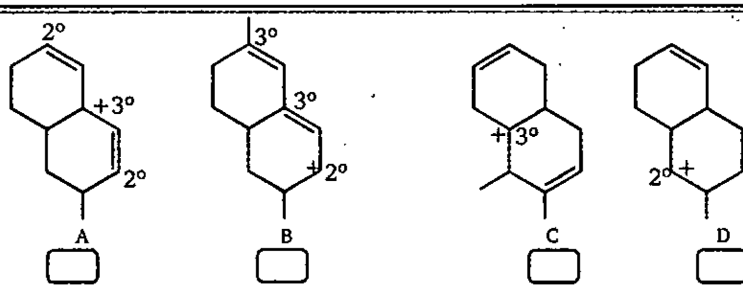
51. Consider the molecule shown below and answer with respect to $H_a \longrightarrow H_e$



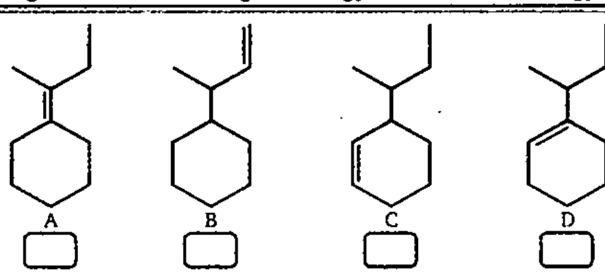
(A) Identify the type of H-atom (1°, 2°, 3° alkyl, vinyl or allyl)

(B) Arrange them in decreasing order of their bond energy.

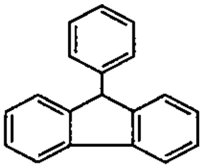
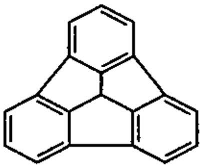
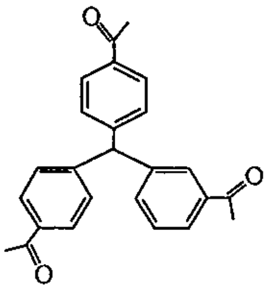
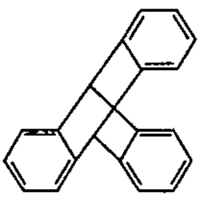
52. Rank the following carbocations in order of stability (1 = most stable).



53. Rank the following alkenes according to energy (1 = lowest energy).

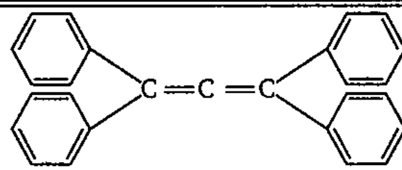


54. Match the column:

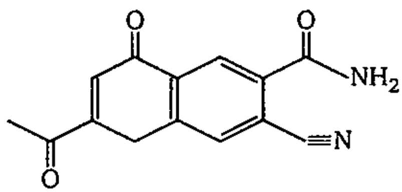
Column (I)		Column (II)	
(Compounds)		(Double bond equivalent value)	
(a)		**(p)**	11
(b)		**(q)**	12
(c)		**(r)**	13
(d)		**(s)**	14
		(t)	15

SUBJECTIVE PROBLEMS

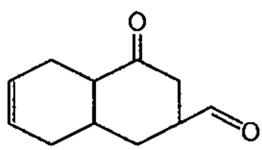
1. How many 2° carbon in the following ?



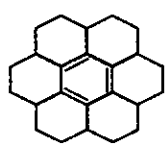
2. Find out the double bond equivalent (DBE) value of the given following compound:



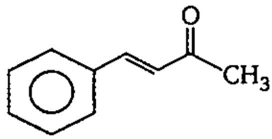
3. Total number of functional groups present in the given following compound :



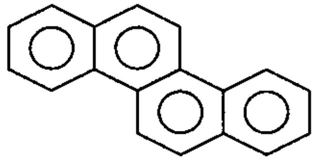
4. Total number of α-hydrogen in the given following compound is:



5. How many carbon atom present in the parent chain in the given following compound?

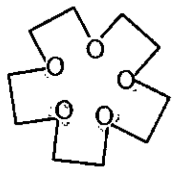


6. Total number of DBE value in :



7. How many isomers of $C_4H_{10}O$ reacts with Na metal to evolve H_2 gas ? (excluding stereoisomer)

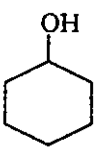
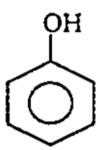
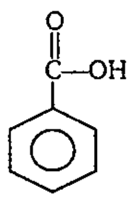
8.

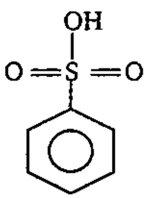


[x]-crown-[y]-ether.

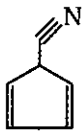
value of $\frac{x+y}{3}=?$

9. Which of the given following compound will react with $NaHCO_3$ or soluble in $NaHCO_3$?

(a)  (b)  (c) 

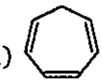
(d)  (e) $CH_3-C\equiv CH$

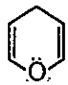
10. How many compound are stable after deprotonation ?

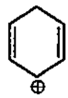
(a) 

(b) 

(c) 

(d) 

(e) 

(f) 

ANSWERS — LEVEL 2

1. a – 4; b – 3; c – 2; d – 1
2. a – 3; b – 2; c – 1
3. A – b; B – e; C – a; D – b
4. A – a, c, f, g, k, l; B – b, d, h, j; C – e, i
5. A –d; B – a
6. C < B < A
7. a – 2, 1, 4, 3; b – 1, 2, 3, 4 ; c – 3, 4, 1, 2; d – 3, 2, 4, 1
8. a – iv > ii > i > iii; b – iii > iv > i > ii
9. a – 4, 2, 3, 1; b – 3, 1, 4, 2; c – 2, 1, 3, 4; d – 2, 3, 4, 1
10. A (i) – d > b > c > a; (ii) – c > a > b > d
    B (i) – c > d > b > a; (ii) – b > d > c > a
11. (a) 3 2 1 4; (b) 2 1 4 3; (c) 3 1 2 4; (d) 3 4 1 2
12. A – c < a < b; B – b < a < c < d; C – d < b < c < a
13. A – c < a < b; B – a < b < c; C – c < b < a; D – d < c < a <b; E – c < a < b; F – c < a < b
14. A – $H_c < H_a < H_b$; B – $H_d < H_c < H_b < H_a$
15. A – 1, 3, 4, 6, 7, 8, 9; B – 2, 5; C – 6; D – 3, 4, 6, 7, 9; E – 6, 8, 9; F – 6; G – 7; H – 9; I – 4,7
16. A – b; B – a; C – d; D – b; E – a; F – d; G – d; H – a
17.

	(i)	(ii)	(iii)	(iv)	(v)
A	6	4	0	10	2
B	0	7	2	9	6
C	5	1	0	5	1
D	1	3	1	3	4
E	2	3	0	2	2
F	10	0	0	10	0

18. a – q; b – p, r; c – p, s; d – q
19. a – p; b– r; c – s; d – q
20. A – c; B – d
21. A – b; B – b; C – a
22. a – p, s; b – q, r; c – q, s; d – p, s
23. a – p, r, s; b – q, r; c – q, r; d – p, r, s

24. A – b; B – c; C – a; D – c; E – a; F – b; G – d

25. A – d; B – a; C – d; D – c

26. A – c; B – b; C – b; D – b; E – b; F – a; G – b; H – c; I – b

27. i. – *sp*; ii – *sp*; iii –sp^2 ; iv – sp^2; v – sp^3; vi – sp^3

28. a – forward b – backward

29. a – p. q, s; b – p, q, r, s; c – p, q, r, s; d – p, q, r, s

30. a – s; b – r; c – q; d – p

31. a – r; b – q; c – s; d – p

32. b

33. 65

34. a – q; b – r; c – s; d – p

35. A – d; B – a; C – a

36. A – 3; B – 1; C – 5; D – 2; E – 4

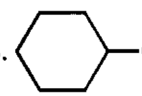
37. Aromatic— 3, 4, 5, 9, 12, 13, 15, 16, 17, 19, 22, 24, 25, 26 ,27, 28, 29, 31, 32, 33, 34, 35, 37, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51 , 53, 54, 56, 57, 58, 61, 62, 63, 66

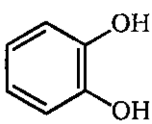
Non-aromatic— 1, 6, 7, 8, 18, 20, 23, 30, 40, 55, 64, 65

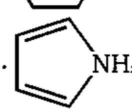
Anti-aromatic— 2, 10, 11, 14, 21, 36, 52, 59, 60

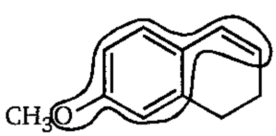
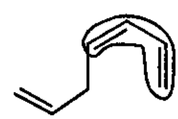
38. 1 – B; 2 – A; 3 – B; 4 – A; 5 – A; 6 – A; 7 – B; 8 – B; 9 – A; 10 – A

39. A. NH_4Cl, cation-anion interactoin

B.  CH_3, van der Waals' forces

C.  , H-bonding (Also dipole-dipole)

D.  NH, Aromatic stacking

40.  $CH_2 = C = CH - CH = CH_2$  

41. **A.** A – 3, B – 2, C – 1,

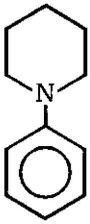
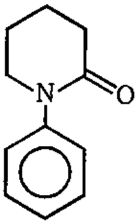
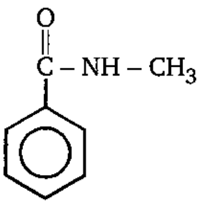
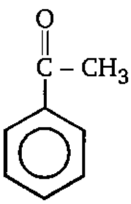
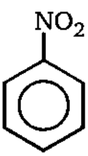
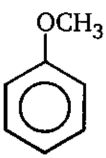
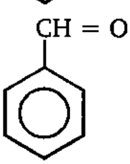
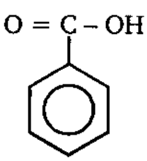
B. A – 1, B – 3, C – 2, D – 4

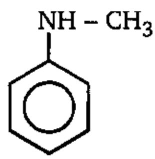
C. A – 3, B – 1, C – 4, D – 2

D. A – 1, B – 2, C – 3, D – 4

42. a – s; b – r; c – q; d – p

43.

		+M	–M	–I	+I
(1)		✓	×	✓	×
(2)		✓	×	✓	×
(3)		×	✓	✓	×
(4)		×	✓	✓	×
(5)		×	✓	✓	×
(6)		✓	×	✓	×
(7)		×	✓	✓	×
(8)		×	✓	✓	×

(9)  ✓ × ✓ ×

44. A – PA; B – PP; C – NPA; D – PA

45. (i) B, (ii) B, (iii) B, (iv) A

46. (a) HCl; (b) CH_3-CH_2-OH; (c) $CH_3-CH_2-CH_2-CH_2-CH_3$;
(d) $CH_3-CH_2-CH_3$; (e) $CH_3-CH_2-CH_2-CH_2-CH_3$

47. (a) BF_3; (b) HO^-; (c) HO^-; (d) HI; (e) HOCl

48. In A, highly electronegative F-atoms are present at the periphery. In liquid term these F-atoms will repel each other due to partial negative charge and thus A will have lower b.pt.

49. $H_d > H_a > H_b > H_c$

50. A– H_a =1° alkyl; H_b = 2° alkyl; H_c =2° allyl; H_d = vinyl; H_e = 3° allyl

B– Easiest to abstract: $H_e > H_c > H_b > H_a > H_d$ Hardest to abstract

51. A– H_a = 2° alkyl; H_b = 2° allyl; H_c = vinyl; H_d = 3° allyl; H_e = 1° alkyl

B– $H_c > H_e > H_a > H_b > H_d$

52. A–2; B–1; C–3; D–4

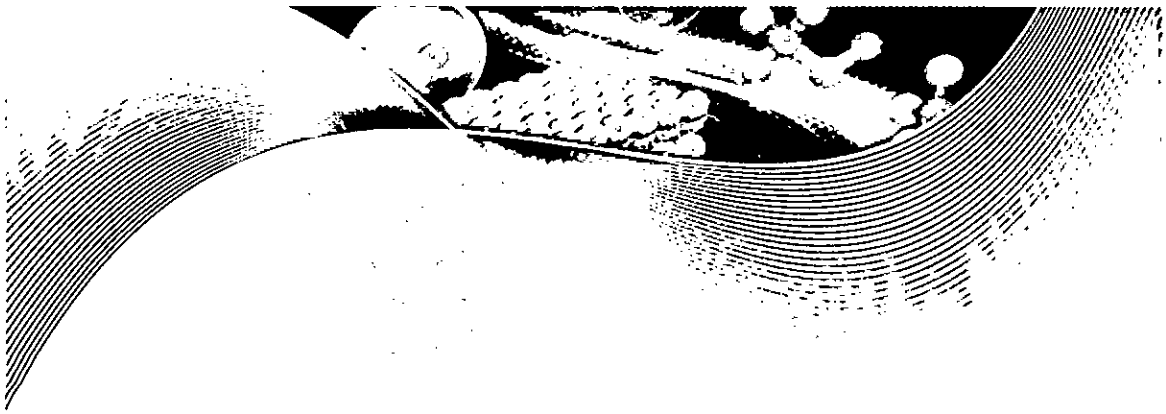
53. A–1; B–4; C–3; D–2

54. a-r; b-t; c-t; d-s

Subjective Solutions:

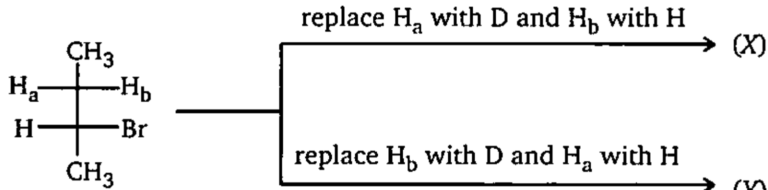
1. 21 **2.** 11 **3.** 3 **4.** 6 **5.** 4 **6.** 13 **7.** 4 **8.** 7

9. 2 (c, d) **10.** 3 (a, c, f)



2 ISOMERISM (Structural & Stereoisomerism)

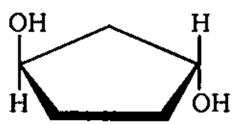
LEVEL-1

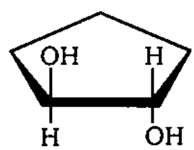
1. 

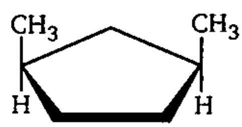
Relation between (*X*) and (*Y*) is :

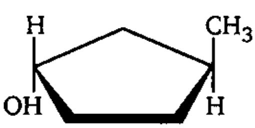
(a) enantiomers (b) diastereomers
(c) *E* and *Z* isomer (d) constitutional isomer

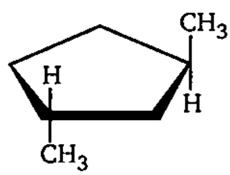
2. Which of the following cyclopentane derivative is optically **inactive** ?

(a) 

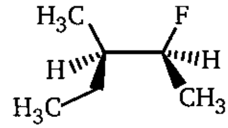
(b) 

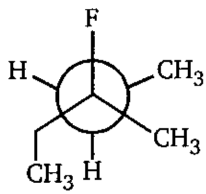
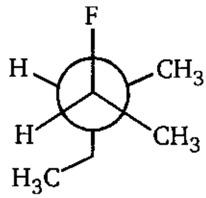
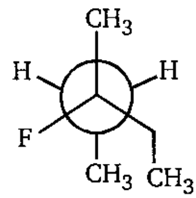
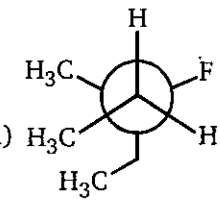
(c) 

(d) 

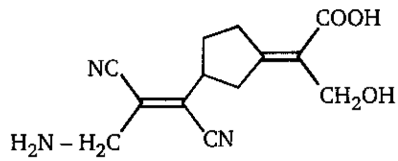
(e) 

3. Which is the most stable conformer along the 2, 3 C – C bond axis of the compound ?



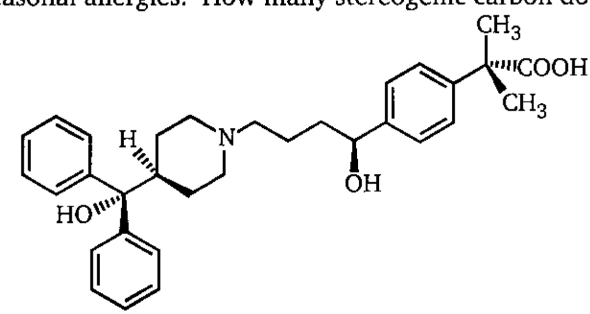
(a)  (b)  (c)  (d) 

4. Assign double bond configurations to the following :



(a) E (b) Z (c) E, E (d) Z, Z

5. Allegra, a common prescription drug with the structure shown below, is given for the treatment of seasonal allergies. How many stereogenic carbon does Allegra possess ?

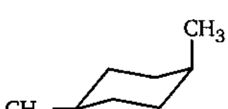


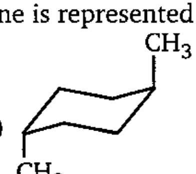
(a) 1 (b) 2 (c) 3 (d) 4

6. How many meso isomers of $C_4H_8Cl_2$ will be ?

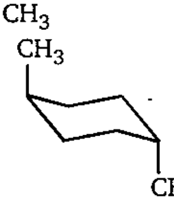
(a) 0 (b) 1 (c) 2 (d) 3

7. The stable form of *trans*-1, 4-dimethylcyclohexane is represented as:

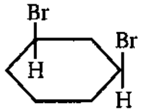
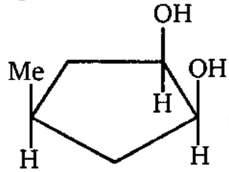
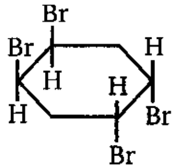
(a) 

(b) 

(c) 

(d) 

8. Which of the following compound is non-resovable (meso) compounds ?

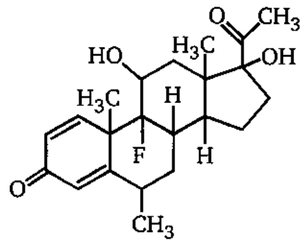
(a)  (b)  (c)  (d) All of these

9. $HO-CH_2-CH_2-F$
(2) (3)

Which conformer of above compound is most stable across C_2-C_3?

(a) staggered (b) eclipsed (partially)
(c) gauche (d) fully eclipsed

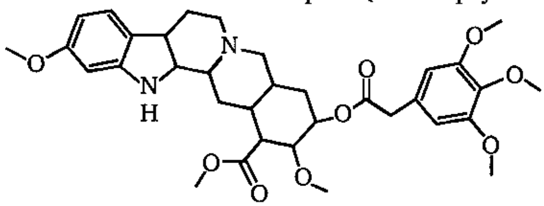
10. The following molecule is fluorometholone, a steroidal anti-inflammatory agent. How many stereogenic centers does it contain ?



fluorometholone

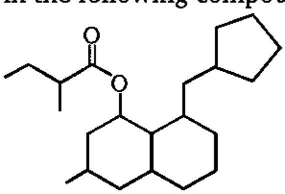
(a) 5 (b) 6 (c) 7 (d) 8

11. How many chiral carbons are there in Reserpine (an antipsychotic drug) ?



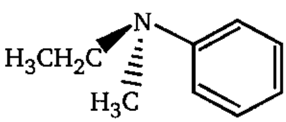
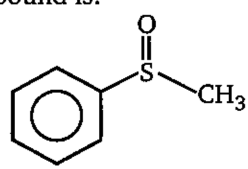
(a) 9 (b) 8 (c) 7 (d) 6

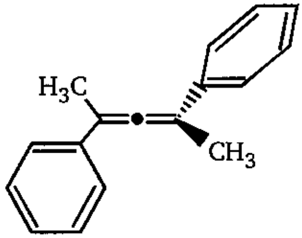
12. How many chiral centers are in the following compound ?

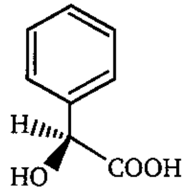


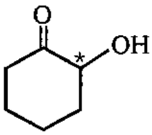
(a) 4 (b) 5 (c) 6 (d) 7

13. Among the following, the optically inactive compound is:

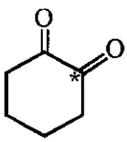
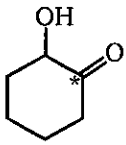
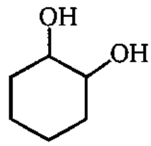
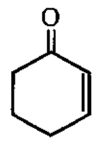
(a)  (b) 

(c) 

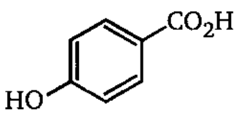
(d) 

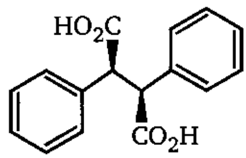
14.  $\xrightleftharpoons{\text{traces of base}}$ (*A*) ; Unknown compound (*A*) is :

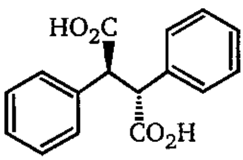
($\overset{*}{C} = \overset{14}{C}$)

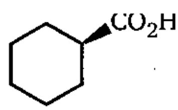
(a)  (b)  (c)  (d) 

15. Which of the following compounds might be useful to the chemist trying to increase the optical purity of the (d) sample ?

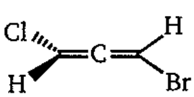
(a) 

(b) 

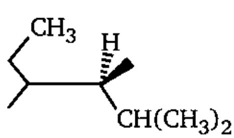
(c) 

(d) 

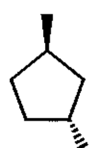
16. Which of the following molecules is (are) chiral ?



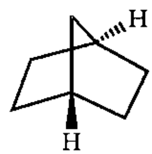
(I)



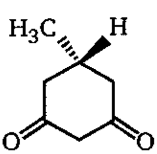
(II)



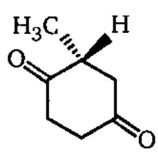
(III)



(IV)



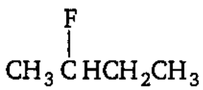
(V)

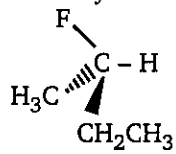


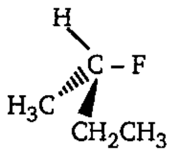
(VI)

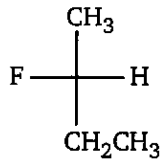
(a) I and II (b) III and IV (c) II, IV and VI (d) I, II, III and VI

17. The structure of (S)-2-fluorobutane is best represented by :

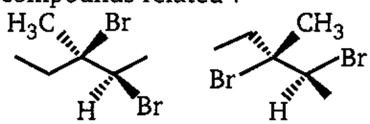
(a) 

(b) 

(c) 

(d) 

18. How are the following compounds related ?

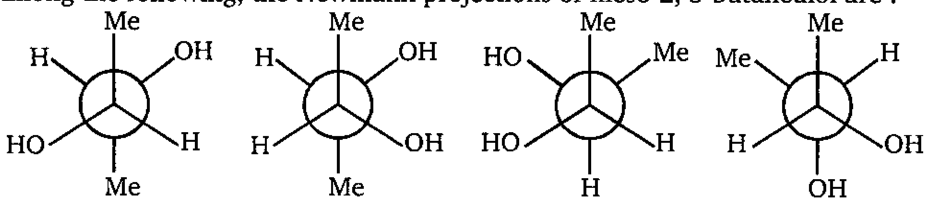


(a) Diastereomers
(b) Enantiomers
(c) Meso compounds
(d) Identical

19. Which one of the following is chiral ?

(a) 1, 1-Dibromo-1-chloropropane
(b) 1, 3-Dibromo-1-chloropropane
(c) 1, 1-Dibromo-3-chloropropane
(d) 1, 3-Dibromo-2-chloropropane

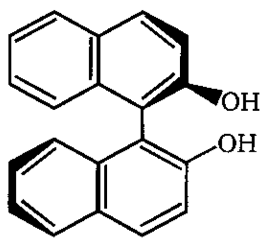
20. Among the following, the Newmann projections of meso-2, 3-butanediol are :



P Q R S

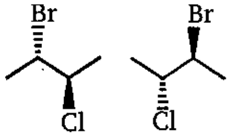
(a) P, Q
(b) P, R
(c) R, S
(d) Q, S

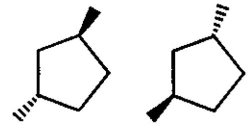
21. The binaphthol (**Bnp**) is:

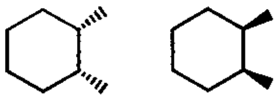


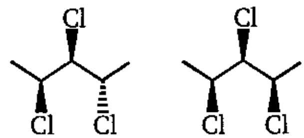
(a) an optically active compound having chiral centre
(b) an optically inactive compound
(c) a meso compound
(d) an optically active compound without having chiral centre

22. Which of the following pairs of compounds is a pair of enantiomers ?

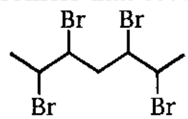
(a) 

(b) 

(c) 

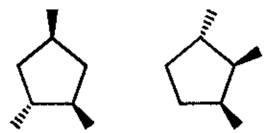
(d) 

23. The maximum number of stereoisomers that could exist for the compound below ?



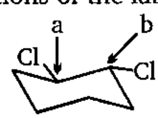
(a) 6 (b) 8 (c) 10 (d) 16

24. The following pair of compounds is best described as :



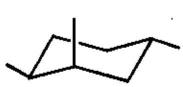
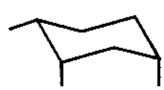
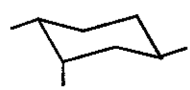
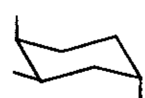
(a) identical (b) diastereomers
(c) enantiomers (d) none of the above

25. Determine the absolute configurations of the labeled carbons (*a* and *b*):

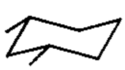
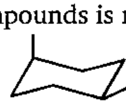
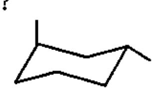
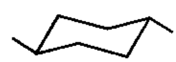


(a) a = R ; b = R (b) a = R ; b = S
(c) a = S ; b = R (d) a = S ; b = S

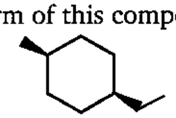
26. Which of the structures (a – d) will be produced if a "ring flip" occurs in the following compound in chair form ?

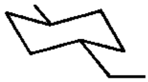
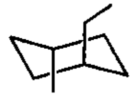
(a)  (b)  (c)  (d) 

27. Which of the following compounds is most stable ?

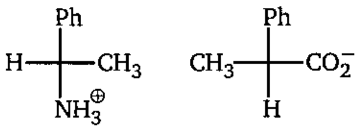
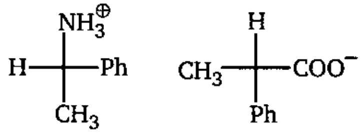
(a)  (b)  (c)  (d) 

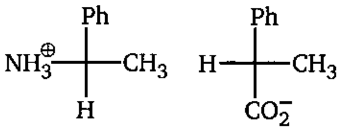
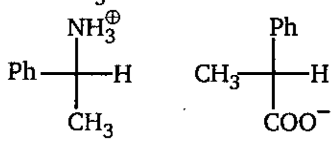
28. Which is the most stable chair form of this compound ?



(a)  (b)  (c)  (d) 

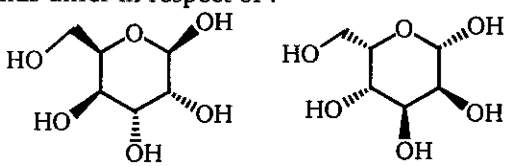
29. Which pairs of the salts would have identical solubilities in methanol ?

(I)  (II) 

(III)  (IV) 

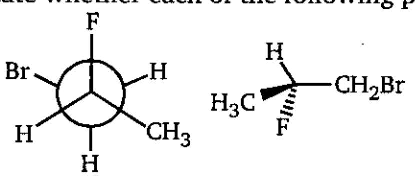
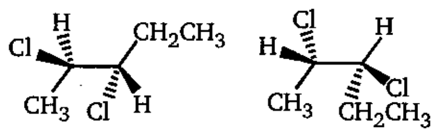
(a) I & IV (b) I & III (c) I & II (d) II & IV

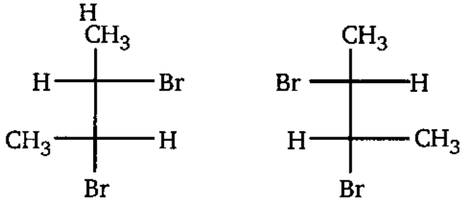
30. The following compounds differ in respect of :



(a) their chemical and physical properties
(b) nothing
(c) the direction in which they rotate plane of polarized light
(d) their interactions with molecules

31. Indicate whether each of the following pairs are identical, or ?

(I)  (II) 

(III) 

	I	II	III
(a)	enantiomers	diastereomers	enantiomers
(b)	identical	enantiomers	enantiomers
(c)	enantiomers	diastereomers	identical
(d)	enantiomers	identical	identical

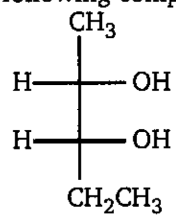
32. Which of the following is achiral ?

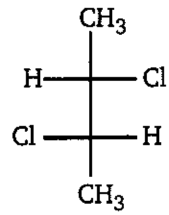
(a)  (b) 

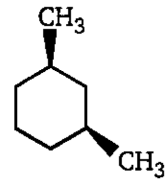
(c) 

(d) a molecule of 3-methylheptane

33. Which of the following compounds are meso forms ?


1


2


3

(a) 1 only
(b) 3 only
(c) 1 and 2
(d) 2 and 3

34. The separation of a racemic mixture into pure enantiomers is termed as :

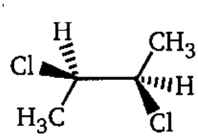
(a) Racemization (b) Isomerization (c) Resolution (d) Equilibration

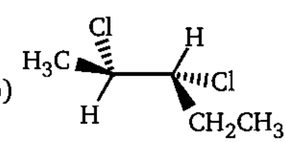
35. Rank of the following groups in order of R, S precedence (IV is highest) :

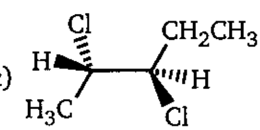
$-CH(CH_3)_2$ (1) $-CH_2CH_2Br$ (2) $-CH_2Br$ (3) $-C(CH_3)_3$ (4)

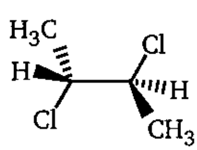
	I	II	III	IV
(a)	3	2	4	1
(b)	1	4	2	3
(c)	3	4	1	2
(d)	3	4	2	1

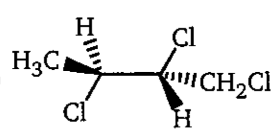
36. Which of the following is a meso compound ?

(a) 

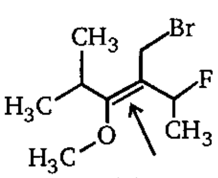
(b) 

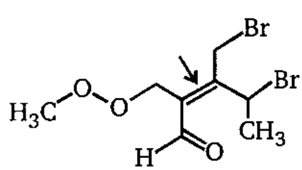
(c) 

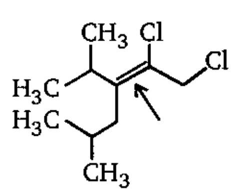
(d) 

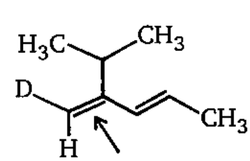
(e) 

37. Among the following structures, select E isomers (arrows indicate the bonds to be considered) ?


(1)

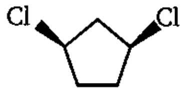

(2)

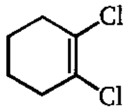

(3)

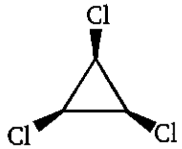

(4)

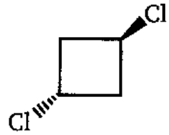
(a) 1 and 2 (b) 1 and 3 (c) 1 and 4 (d) 2 and 3

38. Which of the following compounds has a zero dipole moment ?

(a) 

(b) 

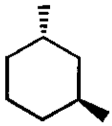
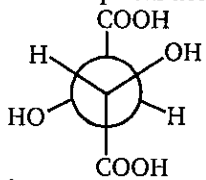
(c) 

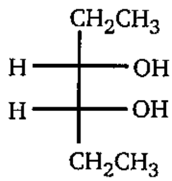
(d) 

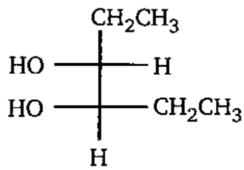
39. On Pluto, where everything is frozen, astronauts discovered two forms of butane gauche and anti. Assuming that there are no rotations around single bonds, which statement about the two forms is correct ?

(a) They are enantiomers
(b) They are diastereoisomers
(c) They are meso compounds
(d) The gauche form has two stereogenic centers, and the anti has only one

40. Which of the following will show optical activity ?

(A) 
(B) 

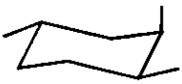
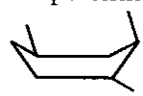
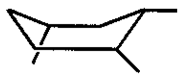
(C) 

(D) 

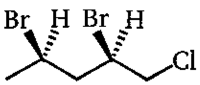
(E) 50/50 mixture of C and D

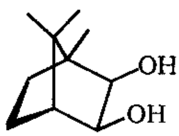
(a) A, D and E (b) A and E only (c) B, C and D (d) All except C

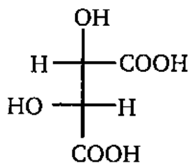
41. Among the structure shown below, which has lowest potential energy ?

(a) 
(b) 
(c) 
(d) 

42. Which of the following molecules is/are chiral ?

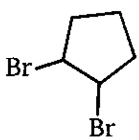
(I) 

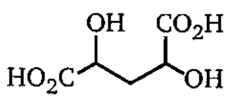
(II) 

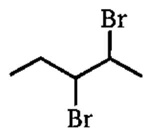
(III) 

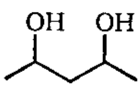
(a) I (b) II (c) III (d) I, II

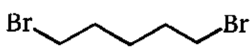
43. A compound was synthesized by a student, but its structure was not identified. However, his wonderfully helpful instructor told him that it was a meso compound with 5 carbons and 2 stereogenic centers. Which of the following structures should the student consider as possibilities for his compound ?

(I) 

(II) 

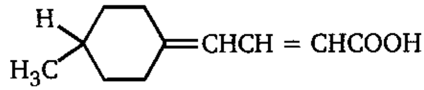
(III) 

(IV) 

(V) 

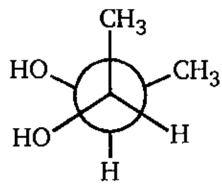
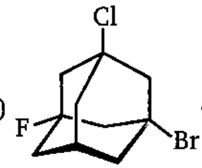
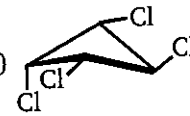
(a) I, II, IV (b) II, IV (c) I, III, V (d) II, IV, V

44. How many isomers are possible for the following molecule ?



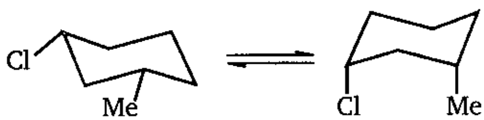
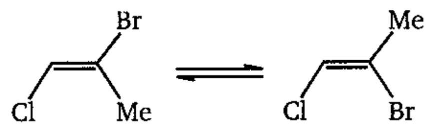
(a) 1 (b) 2 (c) 3 (d) 4

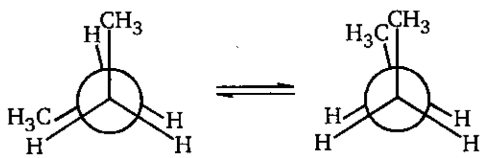
45. Which of the following molecules are chiral ?

(I)  (II)  (III)  (IV) 

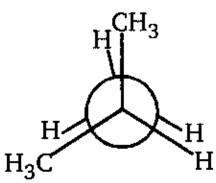
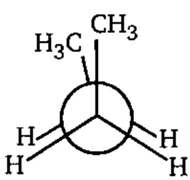
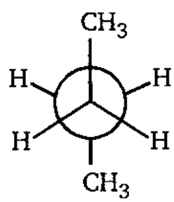
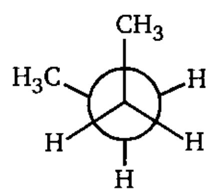
(a) I, II, III and IV (b) II, III and IV (c) II and IV (d) I and II

46. Which equilibrium is not rapid at room temperature ?

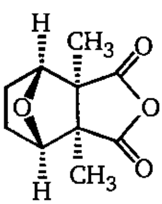
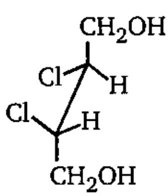
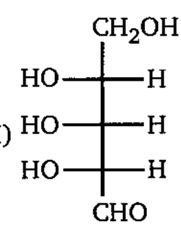
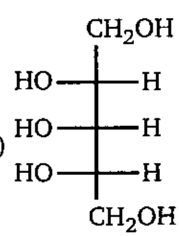
(a)  (b) 

(c)  (d) 

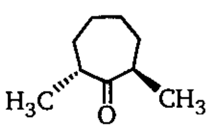
47. Which is the lowest energy conformation of butane ?

(a)  (b)  (c)  (d) 

48. Which of the structures given below are chiral ?

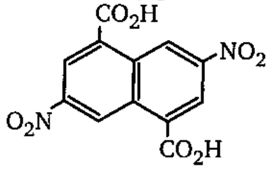
(I)  (II)  (III)  (IV) 

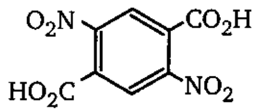
Fischer projections

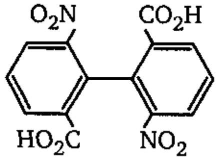
(V) 

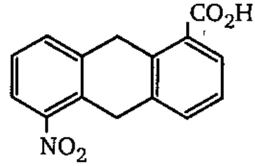
(a) I, II, III (b) II, III, V (c) II, III (d) I, II

49. Which of the following carboxylic acids could be resolved by reaction with an enantiomerically pure chiral amine ?

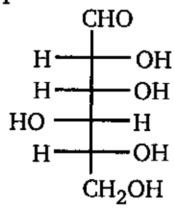
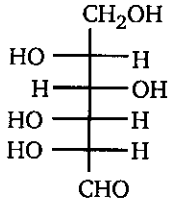
(a) 

(b) 

(c) 

(d) 

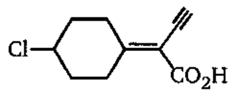
50. What is the relationship between the molecules in the following pairs ?

 and 

(Fischer projections)

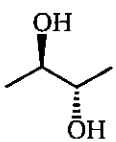
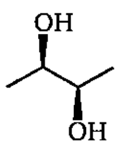
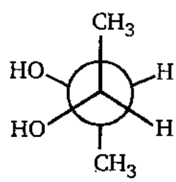
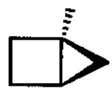
(a) enantiomers (b) diastereomers (c) identical (d) structural isomers

51. What are the correct designations for the structure below ?



(a) E, E (b) Z, E
(c) E, Z (d) No geometrical isomers are possible

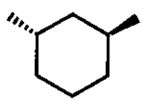
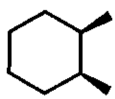
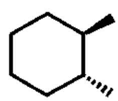
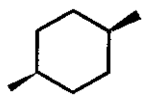
52. Which of the following molecules are chiral ?

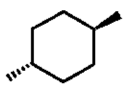
(I)  (II)  (III)  (IV) 

(V) 

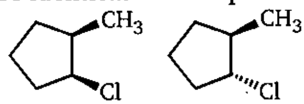
(a) I and III (b) I and V (c) II and III (d) II, III, IV

53. Which one of the following isomeric structures has the lowest energy ?

(a)  (b)  (c)  (d) 

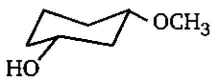
(e) 

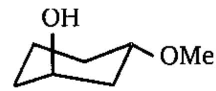
54. The following compounds are identical with respect to :

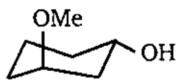


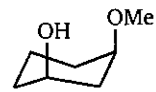
(a) molecular composition
(b) boiling point
(c) melting point
(d) IUPAC name

55. Among the following, the most stable isomer is :

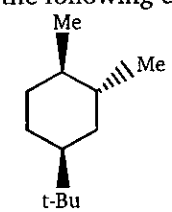
(a) 

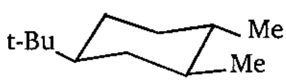
(b) 

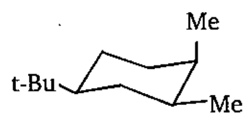
(c) 

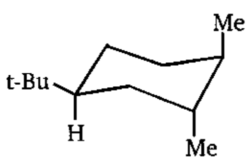
(d) 

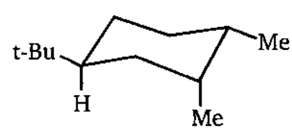
56. The most stable conformation of the following compound is :



(a) 

(b) 

(c) 

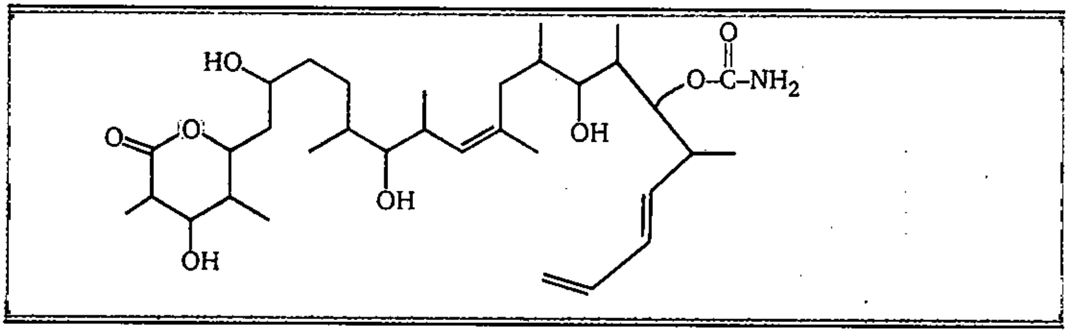
(d) 

57. Which of the following molecules have non-zero dipole moments ?

(I) gauche conformation of 1, 2-dibromoethane
(II) anti conformation of 1, 2-dibromoethane
(III) *trans*-1, 4-dibromocyclohexane
(IV) *cis*-1, 4-dibromocyclohexane
(V) tetrabromomethane
(VI) 1, 1-dibromocyclohexane

(a) I and II
(b) I and IV
(c) II and V
(d) I, IV and VI

58. What is the maximum number of stereoisomers possible for discodermolide ?



(a) 2^{14} (b) 2^{15} (c) 2^{16} (d) 2^{17}

59. An aqueous solution containing compounds *A* and *B* shows optical activity. *A* and *B* are stereoisomers. Which of the following possibilities cannot be correct ?

(a) *A* has two chiral centers, but *B* does not have any because it has a symmetry plane

(b) *A* and *B* are enantiomers

(c) *A* and *B* are diastereomers

(d) *A* and *B* are not present in equal amounts

60. Which of the following structures represents the lowest-energy form of (1S, 2S, 4R)-trimethyl -cyclohexane ?

(a)  (b) 

(c)  (d) 

61. Which one of the following is a diastereomer of (R)-4-bromo-cis-2-hexene ?

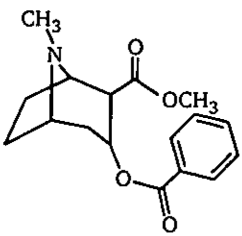
(a) (S)-4-bromo-*cis*-2-hexene

(b) (S)-5-bromo-*trans*-2-hexene

(c) (R)-4-bromo-*trans*-2-hexene

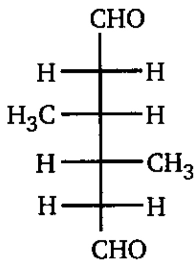
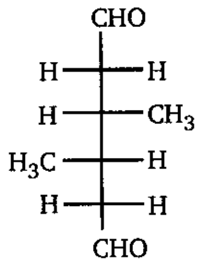
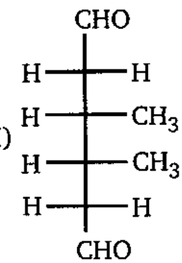
(d) (R)-5-bromo-*trans*-2-hexene

62. The structural formula of cocaine is shown below. How many stereogenic carbon atoms are there in this molecule ?



(a) 1 (b) 2 (c) 3 (d) 4

63. Which of the following statements best describes the stereochemical relationships of compound I, II and III shown below ?

(I)  (II)  (III) 

(a) All compounds are chiral

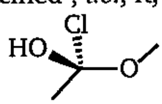
(b) None of the compounds is chiral

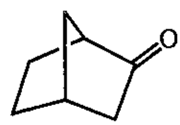
(c) I and II are meso compounds

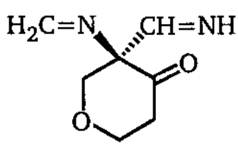
(d) I and II are diastereomers, and III is a meso compound

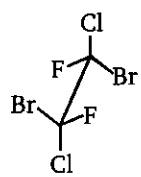
(e) I and II are chiral

64. What is the absolute configuration of the following molecules ? (NS = the molecule has no center) Note : For the purpose of this question only, the order of stereocenters is not specified ; *i.e.*, R, S = S, R.

(I) 

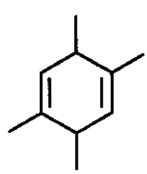
(II) 

(III) 

(IV) 

	I	II	III	IV
(a)	R	R, S	R	NS
(b)	R	R, R	S	R, R
(c)	R	R, S	NS	NS
(d)	R	R, S	R	R, S

65. The number of all the possible stereoisomers formed by the given compound is :



(a) 2

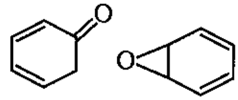
(b) 3

(c) 32

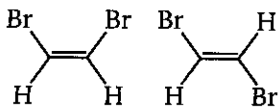
(d) 64

66. The relationship among the following pairs of isomers is:

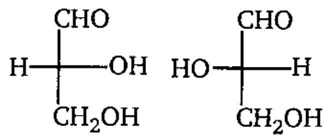
(I)



(II)



(III)

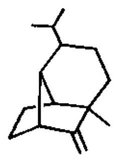


(IV)

I	A: Constitutional
II	B: Configurational
III	C: Conformational
IV	D: Optical

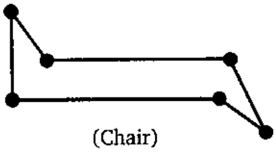
(a) I – A, II – B, III – B, IV – D
(b) I – A, II – A, III – B, IV – D
(c) I – B, II – A, III – B, IV – D
(d) I – B, II – B, III – A, IV – B

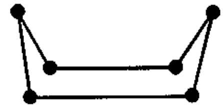
67. The structural formula of sativene is shown below. How many stereogenic centers are there in this molecule ?

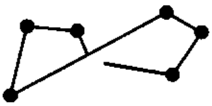


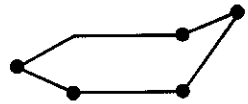
(a) 2
(b) 3
(c) 4
(d) 5

68. Which of the following is the least stable conformer of cyclohexane ?

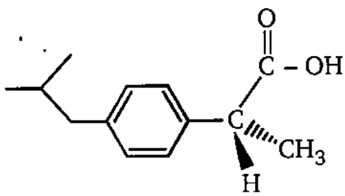
(a) 
(Chair)

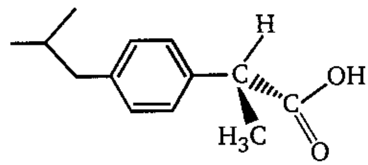
(b) 
(Boat)

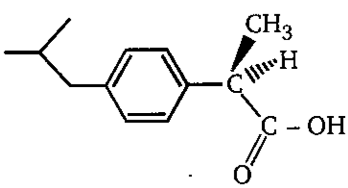
(c) 
(Twist boat)

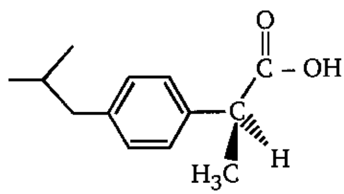
(d) 
(Half-chair)

69. The S- enantiomer of ibuprofen is responsible for its pain-relieving properties. Which one of the following structures shown below is (S)-ibuprofen ?

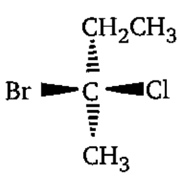
(a) 

(b) 

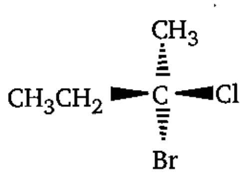
(c) 

(d) 

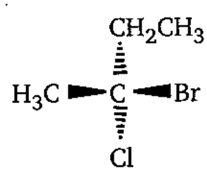
70. Which of the following depict the same ?



1



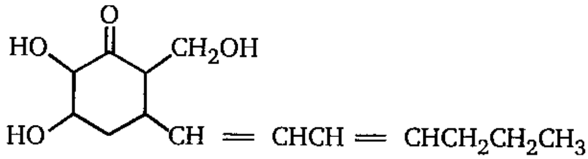
2



3

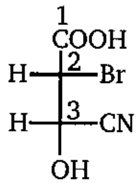
(a) 1 and 2
(b) 1 and 3
(c) 2 and 3
(d) 1, 2, and 3

71. A naturally occurring substance has the constitution shown below. How many may have this constitution ?



(a) 2 (b) 8 (c) 16 (d) 64

72. The absolute configurations of the two centers in the following molecule are :

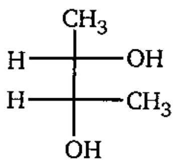
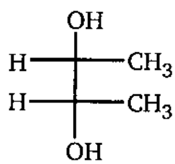
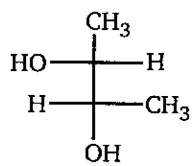
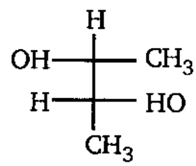


(a) 2(R), 3(S) (b) 2(R), 3(R) (c) 2(S), 3(S) (d) 2(S), 3(R)

73. The total number of stereoisomer possible for 2, 3-dichloro butane :

(a) 2 (b) 3
(c) 4 (d) 5

74. Which of the following structure is not meso-2,3-butanediol ?

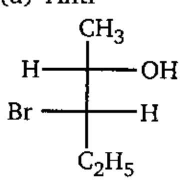
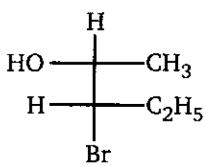
(a)  (b)  (c)  (d) 

75. A solution of optically active 1-phenylethanol racemizes in acidified aqueous medium. It is due to :

(a) enolization (b) carbonium ion formation
(c) carbanion formation (d) reversible oxidation-reduction

76. The most stable conformation of ethylene glycol is :

(a) Anti (b) Gauche (c) Partially eclipsed (d) Fully eclipsed

77.  

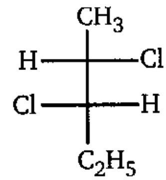
The molecules represented by the above two structures are :

(a) identical (b) enantiomers
(c) diastereomers (d) epimers

78. The correct order of priority of groups $-SCH_3$ (I), $-NO_2$ (II), $-C\equiv CH$ (III) and $-CH_2C_6H_5$ (IV), on the basis of CIP classification, is (increasing order) :

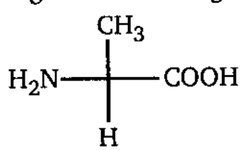
(a) I, III, II, IV (b) IV, III, II, I
(c) II, IV, I, III (d) III, IV, II, I

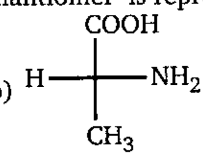
79. The configuration at C-2 and C-3 of the compound given :

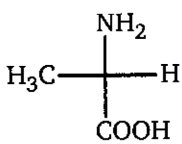


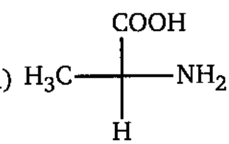
(a) 2R, 3S (b) 2S, 3R (c) 2S, 3S (d) 2R, 3R

80. Amongst the following amino acids, the (R) - enantiomer is represented by :

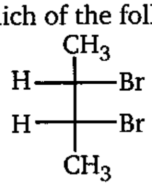
(a) 

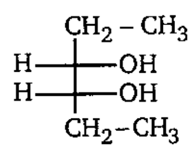
(b) 

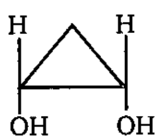
(c) 

(d) 

81. Which of the following is a meso compound ?

(a) 

(b) 

(c) 

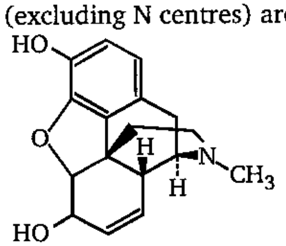
(d) All of these

82. Predict stereochemistry of product when *d* and *l*-amine reacts with *ℓ*-acid:

(a) Diastereomers (b) Meso

(c) Racemic (d) Pure Enantiomer

83. How many chiral center (excluding N centres) are there in morphine?



(a) 4 (b) 5

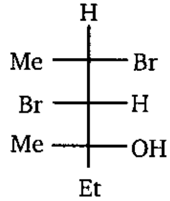
(c) 6 (d) More than 6

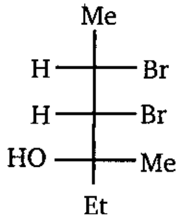
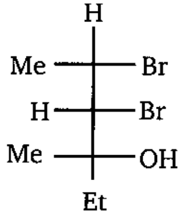
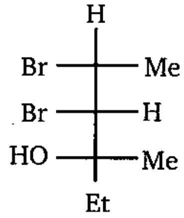
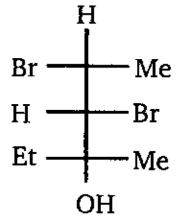
84. Which dimethylcyclobutane is optically active ?

(a) *trans*-1, 2 (b) *cis*-1, 2

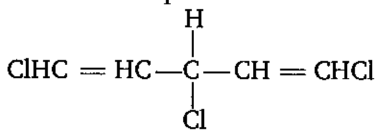
(c) *trans*-1, 3 (d) *cis*-1, 3

85. Which of the following is the enantiomer of the compound shown below ?



(a)  (b)  (c)  (d) 

86. How many different stereoisomers are possible for the following compound ?



(a) 1 (b) 2 (c) 3 (d) 4

87. The following compounds are best described as :

(R)-$PhCH(OH)CH_3$ and (S)-$PhCH(OH)CH_3$

(a) enantiomers
(b) diastereomers
(c) not stereoisomers
(d) conformational isomers (differing by single bond rotation)

88. Rank the following substituent groups in order of decreasing priority according to the Cahn-Ingold-Prelog system :

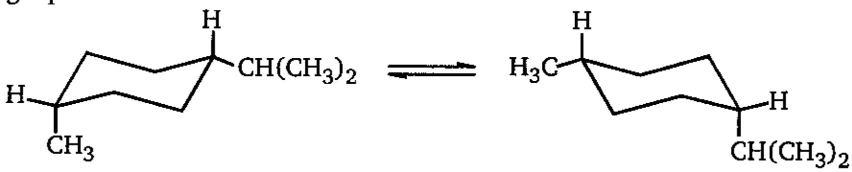
$-CH(CH_3)_2$ $-CH_2Br$ $-CH_2CH_2Br$
1 2 3

(a) $2 > 3 > 1$ (b) $1 > 3 > 2$ (c) $3 > 1 > 2$ (d) $2 > 1 > 3$

89. Compare the stabilities of the following two compounds :
A : *cis*-1-Ethyl-3-methylcyclohexane
B : *trans*-1-Ethyl-3-methylcyclohexane

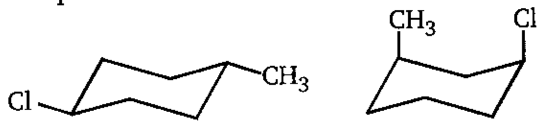
(a) A is more stable (b) A and B are of equal stability
(c) B is more stable (d) No comparison can be made

90. What, if anything, can be said about the magnitude of the equilibrium constant K for the following equilibrium ?



(a) $K = 1$ (b) $K < 1$
(c) $K > 1$ (d) No estimate of K can be made

91. What is the relationship between the two structures shown ?



(a) Constitutional isomers
(b) Stereoisomers
(c) Different drawing of the same conformation of the same compound
(d) Different conformation of the same compound

92. Which of the following statements is true ?

(a) van der Waals' strain in *cis*-1, 2-dimethylcyclopropane is the principal reason for its decreased stability relative to the *trans* isomer
(b) Cyclohexane gives off more heat per CH_2 group on being burned in air than any other cycloalkane
(c) The principal source of strain in the boat conformation of cyclohexane is angle strain
(d) The principal source of strain in the gauche conformation of butane is torsional strain

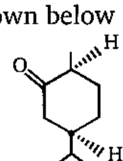
93. $Ph-CH=NO_2H \xrightarrow[3\,\text{days}]{\text{isomerises}} \underset{(50-50\%)}{(x)}$, Isomer (x) is :

(a) $Ph-NO-CH_2OH$ (b) $Ph-CH_2-NO_2$
(c) $Ph-NH-CO_2H$ (d) None

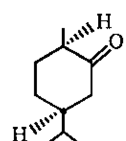
94. Which of the following will not show geometrical isomerism ?

(a) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH-CH_2-CH_3$ (b) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH=CH-CH_2-CH_3$
(c) $CH_3-CH=CH-CH_3$ (d) $CH_3-CH_2-CH=CH-CH_2-CH_3$

95. The two compounds shown below are :

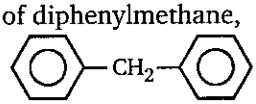


and



(a) diastereomers (b) enantiomers (c) epimers (d) regiomers

96. The molecular formula of diphenylmethane,

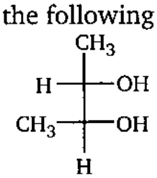


, is $C_{13}H_{12}$;

How many structural isomers are possible when one of the hydrogen is replaced by a chlorine atom ?

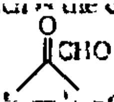
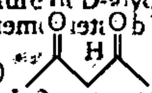
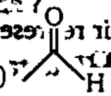
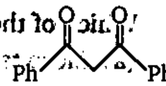
(a) 6 (b) 4 (c) 8 (d) 7

97. Correct configuration of the following molecule is :



(a) 2S, 3S (b) 2S, 3R (c) 2R, 3S (d) 2R, 3R

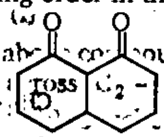
98. Maximum enol content is in :

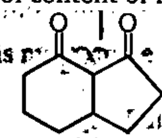
(a)  (b)  (c)  (d) 

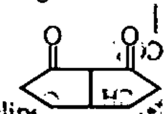
99. Which of the following will have one of the stereoisomer meso ?

(a) 2-chlorobutane (b) 2, 3-dichlorobutane
(c) 2,3-dichloropentane (d) 2-hydroxypropanoic acid

100. The correct decreasing order in the enol content of following molecules is :


(I)


(II)


(III)

(a) I > II > III (b) II > I > III (c) III > II > I (d) II > III > I

101. Total number of stereoisomers of the compound 1-bromo-3-chlorocyclobutane is:

(a) 0 (b) 1 (c) 2 (d) 3

102. Total number of stereoisomers of the 1,3-dichlorocyclohexane is:

(a) 0 (b) 1 (c) 3 (d) 4

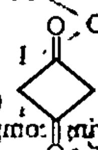
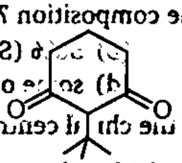
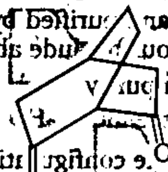
103. Total number of stereoisomers of the compound 1, 4-dichlorocyclohexane is :

(a) 0 (b) 1 (c) 2 (d) 4

104. Total number of stereoisomers of the compound 2-4-dichloroheptane is:

(a) 0 (b) 2 (c) 3 (d) 4

105. In which of the following keto form is more dominating than enol form:

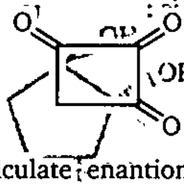
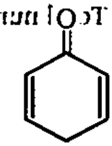
(a)  (b)  (c)  (d) all of these

106. Among the following compounds, which will give maximum enol content in solution :

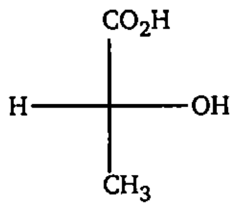
(a) $C_6H_5-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-C_6H_5$ (b) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

(c) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_3$ (d) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-COOC_2H_5$

107. Which of the following has unstable enol form ?

(a)  (b)  (c)  (d) 

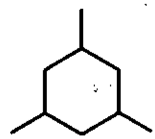
108. Calculate enantiomeric excess of mixture containing 6g of (+) 2-butanol and 4g of (–) -2-butanol.

120. 

How many representations of lactic acid are possible in Fischer projection (*d* & *l*) ?

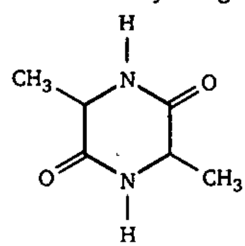
(a) 8 (b) 12
(c) 24 (d) 36

121. Total number of stereoisomer formed by the given compound is :



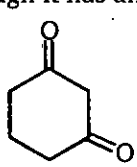
(a) 2 (b) 3
(c) 4 (d) 8

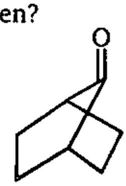
122. The number of stereoisomers formed by the given compound is :

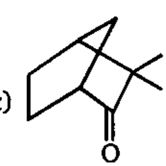


(a) 2 (b) 3
(c) 4 (d) 5

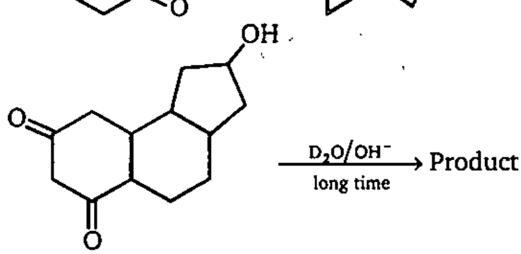
123. Which of the following compound does not undergo base - catalyzed exchange in D_2O even though it has an α-hydrogen?

(a) 

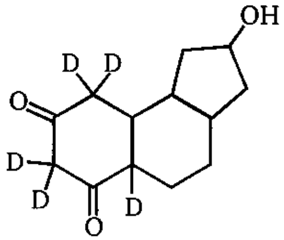
(b) 

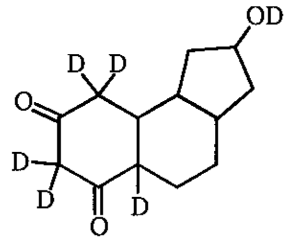
(c) 

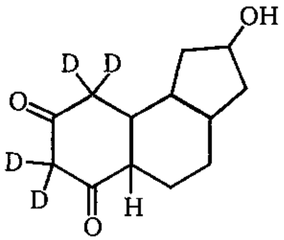
(d) both (b) & (c)

124. 

Identify the product formed in the above reaction:

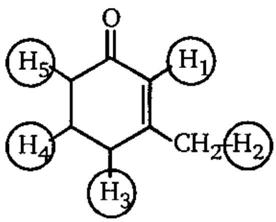
(a) 

(b) 

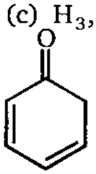
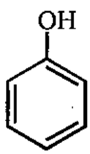
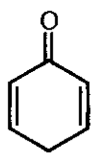
(c) 

(d) None of these

125. In 3-methyl-2-cyclohexenone which hydrogen cannot undergo deuterium exchange when it reacts with $CH_3O^{\ominus}/CH_3OD$?



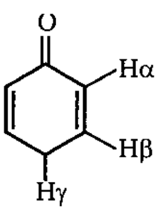
(a) H_1, H_4
(b) H_4
(c) H_3, H_2
(d) H_5, H_3

126.   

(I) (II) (III)

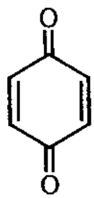
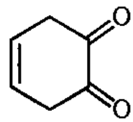
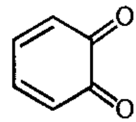
The tautomer of II is :

(a) I
(b) III
(c) both I and III
(d) none of these

127. 

In the enolization of the given molecule, the H-atom involved is :

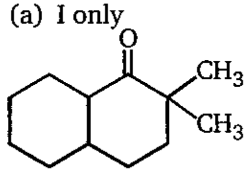
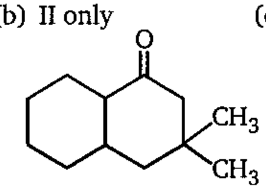
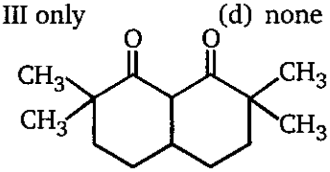
(a) α-H
(b) β-H
(c) γ-H
(d) cannot be enolized

128.   

(I) (II) (III)

Among the given structure which can exhibit tautomerism ?

(a) I only (b) II only (c) III only (d) none of these

129.   

(I) (II) (III)

Identify the which can exhibit tautomerism ?

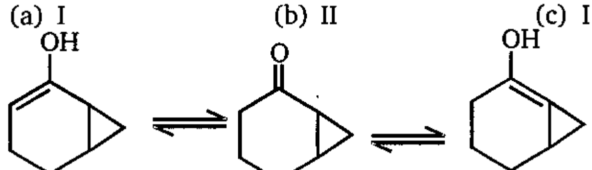
(a) I only (b) II only (c) III only (d) all of these

130. $CH_3 - CH = O \rightleftharpoons CH_2 = CH - OH$

(I) (II)

Between the two tautomers which is more stable ?

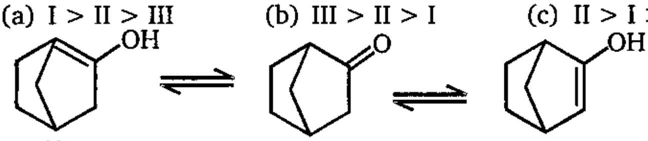
(a) I (b) II (c) I = II (d) none of these

131. 

(I) (II) (III)

Correct stability order of the given tautomers is :

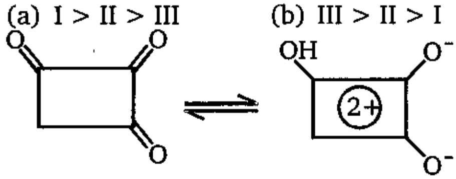
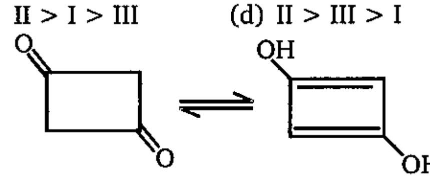
(a) I > II > III (b) III > II > I (c) II > I > III (d) II > III > I

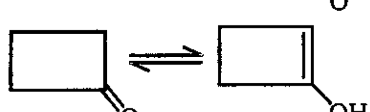
132. 

(I) (II) (III)

Correct stability order of the given tautomers is :

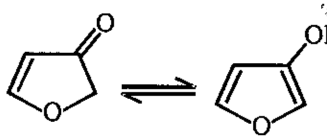
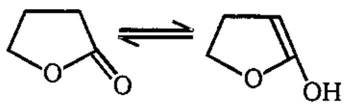
(a) I > II > III (b) III > II > I (c) II > I > III (d) II > III > I

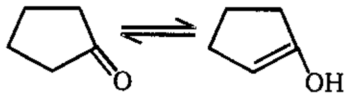
133.  x % ;  y %

 z %

The correct order of enol contents x, y, z is :

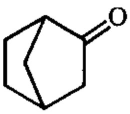
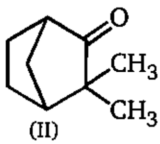
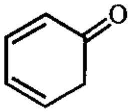
(a) $x > y > z$ (b) $z > y > x$ (c) $y > x > z$ (d) $x > z > y$

134.  $x\%$;  $y\%$

 $z\%$ (x, y, z represent enol content)

The correct order of x, y, z is :

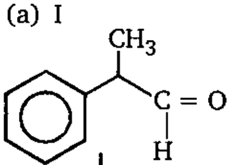
(a) $x > y > z$ (b) $z > y > x$ (c) $y > x > z$ (d) $x > z > y$

135.   

(I) (II) (III)

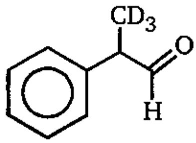
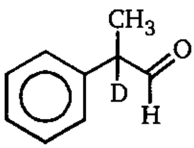
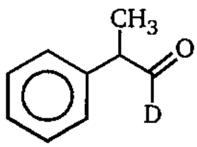
Among the given ketones, the one which does not enolize is :

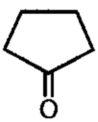
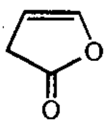
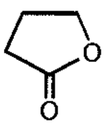
(a) I (b) II (c) III (d) none of these

136. 

$\xrightarrow{D_2O \;|\; OD^{\ominus}}$ Product

The product of this reaction should be :

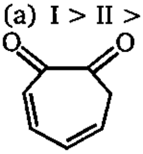
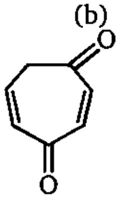
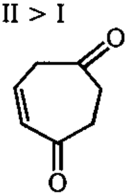
(a)  (b)  (c)  (d) All of these

137.   

(I) (II) (III)

Among the given compounds, the correct order of enol content is :

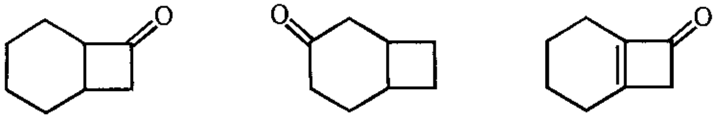
(a) I > II > III (b) III > II > I (c) II > I > III (d) II > III > I

138.   

(I) (II) (III)

Among the given compounds, the correct order of enol content is :

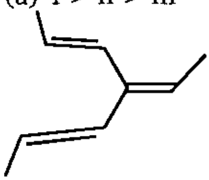
(a) I > II > III (b) III > II > I (c) II > I > III (d) II > III > I

139. 

(I) (II) (III)

Among the given compounds, the correct order of enol content is :

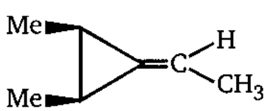
(a) I > II > III (b) III > II > I (c) III > I > II (d) II > I > III

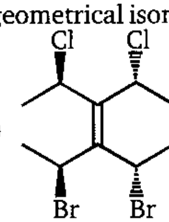
140. 

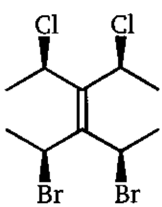
How many geometrical isomers are possible for the above compound ?

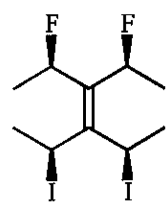
(a) 3 (b) 4 (c) 6 (d) 8

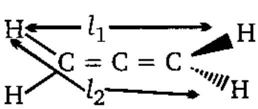
141. Which of the following compound will not show geometrical isomerism across the π-bond ?

(a) 

(b) 

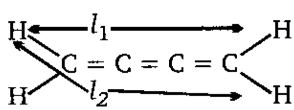
(c) 

(d) 

142. 

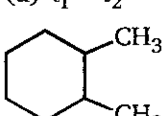
Choose the correct relation between l_1 and l_2 ?

(a) $l_1 = l_2$ (b) $l_1 > l_2$ (c) $l_1 < l_2$ (d) $l_2 = 2l_1$

143. 

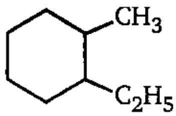
Choose the correct relation between l_1 and l_2 ?

(a) $l_1 = l_2$ (b) $l_1 > l_2$ (c) $l_1 < l_2$ (d) $l_2 = 2l_1$

144. 

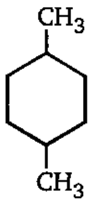
How many geometrical isomers are possible for the above compound ?

(a) 0 (b) 2 (c) 3 (d) 4

145. 

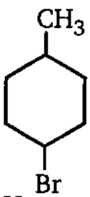
How many geometrical isomers are possible for the above compound ?

(a) 0 (b) 2 (c) 3 (d) 4

146. 

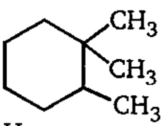
How many geometrical isomers are possible for the above compound ?

(a) 0 (b) 2 (c) 3 (d) 4

147. 

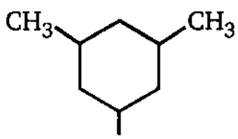
How many geometrical isomers are possible for the above compound ?

(a) 0 (b) 2 (c) 3 (d) 4

148. 

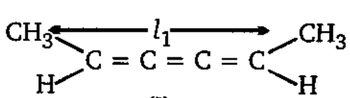
How many geometrical isomers are possible for the above compound ?

(a) 0 (b) 2 (c) 3 (d) 4

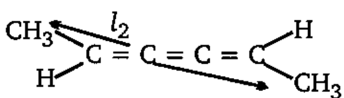
149. 

How many geometrical isomers are possible for the above compound ?

(a) 0 (b) 2 (c) 3 (d) 4

150. 

(I)



(II)

I and II are geometrical isomers of each other because

(a) $l_1 = l_2$ (b) $l_1 > l_2$

(c) $l_2 > l_1$ (d) l_1 and l_2 cannot be compared.

151. $CH_2 = CH - CH = CH - CH = CH_2$

How many geometrical isomers are possible for this compound ?

(a) 2 (b) 3 (c) 4 (d) 8

152. $CH_3-CH=\underset{\displaystyle Br}{\underset{|}{C}}-\underset{\displaystyle Cl}{\underset{|}{C}}=CH-CH_3$

How many geometrical isomers are possible for this compound?

(a) 2 (b) 3

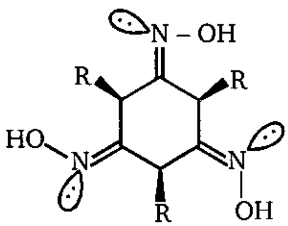
(c) 4 (d) 6

153. $CH_3-CH=\underset{\displaystyle Br}{\underset{|}{C}}-\underset{\displaystyle Br}{\underset{|}{C}}=CH-CH_3$

How many geometrical isomers of this compound are possible ?

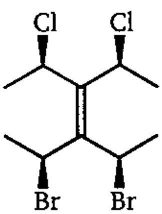
(a) 2 (b) 3

(c) 4 (d) 6

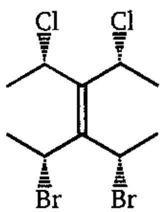
154. 

(a) chiral (b) C_3 axis of symmetry

(c) Optically active (d) All of these

155. 

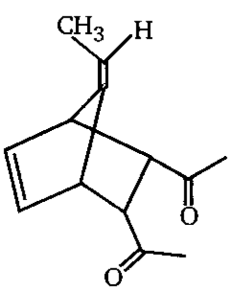
(A)



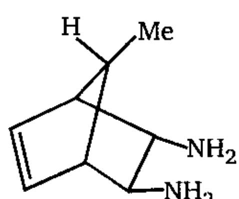
(B)

Relationship between above pair (A) & (B) is :

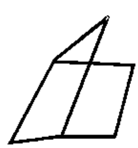
(a) Enantiomer (b) Diastereomers (c) Identical (d) Structural isomer

156. 

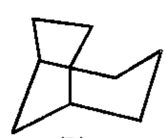
(A)



(B)



(C)

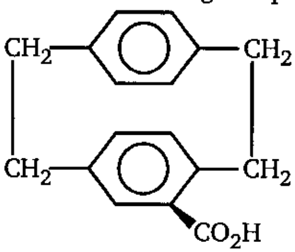


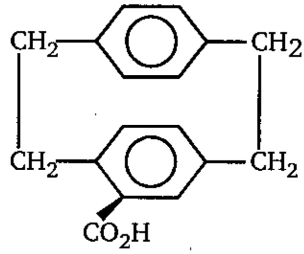
(D)

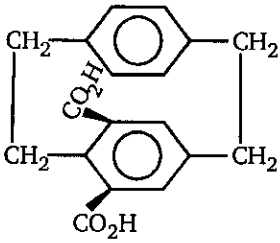
From the above compound (*A*), (*B*), (*C*) & (*D*) chiral compound is :

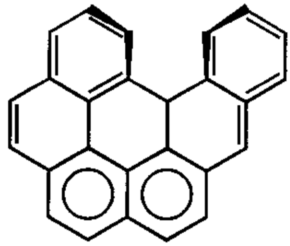
(a) *A* (b) *B* (c) *C* (d) *D*

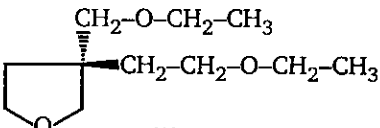
157. Which of the following compound is achiral ?

(a) 

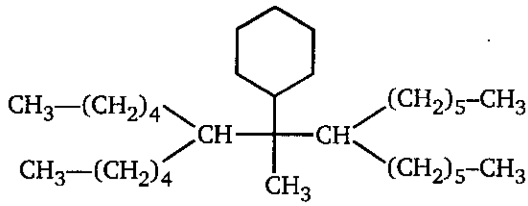
(b) 

(c) 

(d) 

158. 

(A)

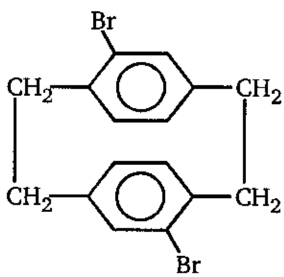


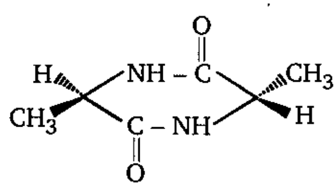
(B)

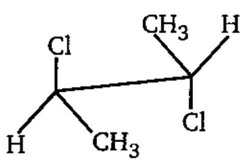
R and S configuration of compound (A) & (B) will be :

(a) R, R
(b) R, S
(c) S, R
(d) S, S

159. Which of following compound has center of symmetry?

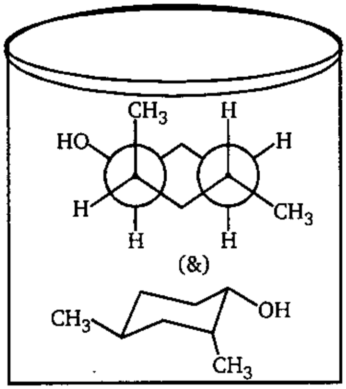
(a) 

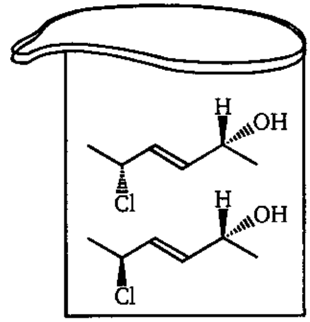
(b) 

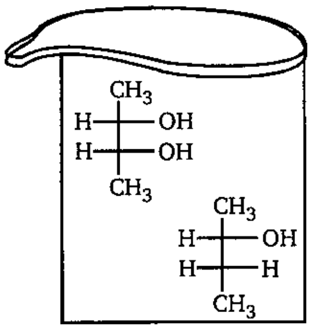
(c) 

(d) All of these

160. Which mixture of structure in each beaker would rotate plane polarized light ?

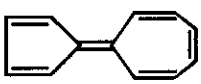
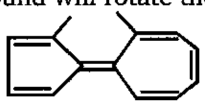
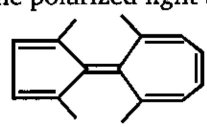
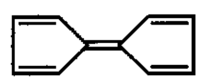
(a) 

(b) 

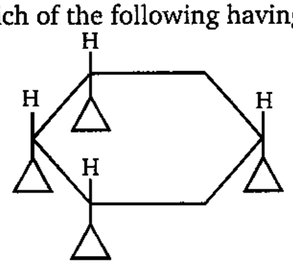
(c) 

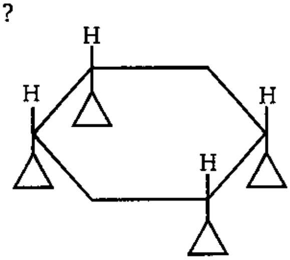
(d) All of these

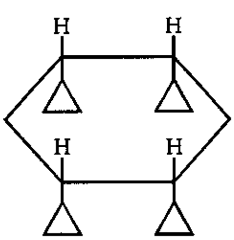
161. Which of following compound will rotate the plane polarized light at room temperature?

(a)  (b)  (c)  (d) 

162. Which of the following having plane of symmetry ?

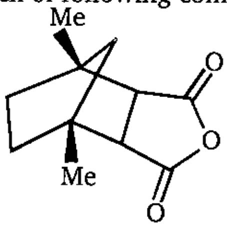
(a) 

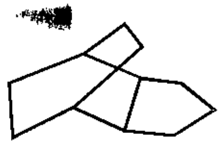
(b) 

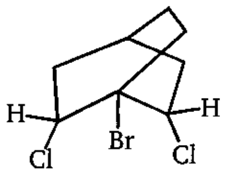
(c) 

(d) All of these

163. Which of following compound is achiral ?

(a) 

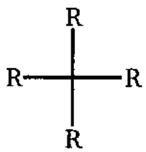
(b) 

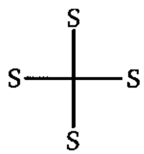
(c) 

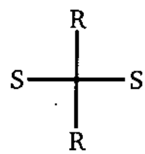
(d) All of these

164. Which of the following compound has plane of symmetry ?

R = $-\underset{\substack{|\\CH_3}}{CH}-Cl$, S = $-\underset{\substack{|\\Br}}{CH}-Cl$

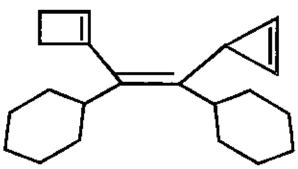
(a) 

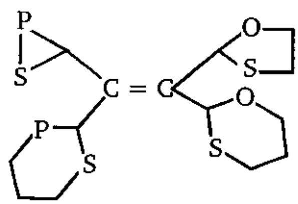
(b) 

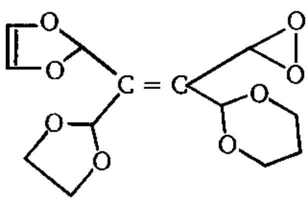
(c) 

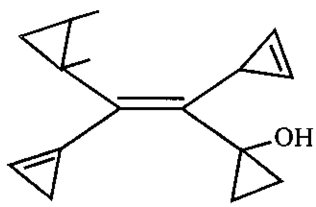
(d) None of these

165. Which of following is E isomer ?

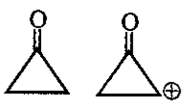
(a) 

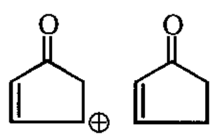
(b) 

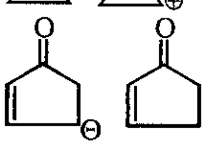
(c) 

(d) 

166. Among the given pairs, in which pair second compound has less enol content than first compound?

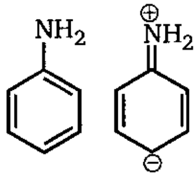
(a) 

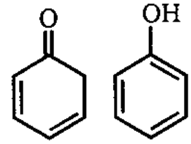
(b) 

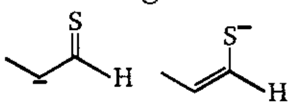
(c) 

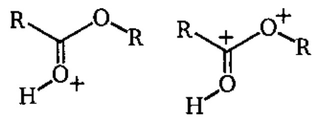
(d) none of these

167. Which of the following is incorrect relation between given pairs ?

(a)  = Resonance

(b)  = Tautomers

(c)  = Resonance

(d)  = Tautomers

168. $\underset{(A)}{Ph-\underset{OH}{\underset{|}{CH}}-\overset{O}{\overset{||}{C}}-H} \xrightarrow[H_2O]{HO^{\ominus}} (B)$; (A) and (B) are isomer and isomerization effectively carried out by trace of base (B). Identify (B).

(a) $Ph-CH_2-\overset{O}{\overset{||}{C}}-O-H$

(b) $Ph-\overset{O}{\overset{||}{C}}-O-CH_3$

(c) $Ph-\overset{O}{\overset{||}{C}}-CH_2-OH$

(d) $H-\overset{O}{\overset{||}{C}}-CH_2-O-Ph$

169. $CH_3-CH=CH-CH=CH-CH_3$; total number of geometrical isomer is :

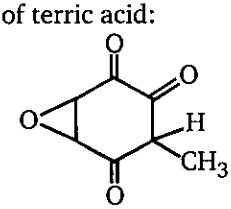
(a) 2

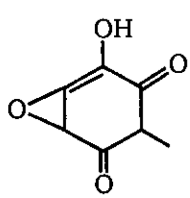
(b) 3

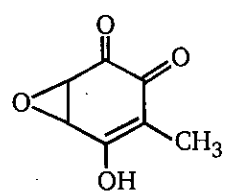
(c) 4

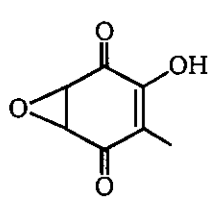
(d) 6

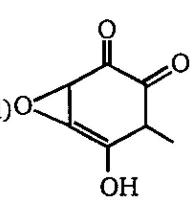
170. Identify most stable enol form of terric acid:



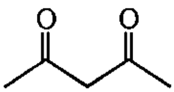
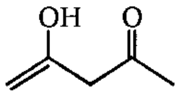
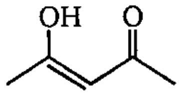
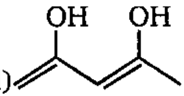
(a) 

(b) 

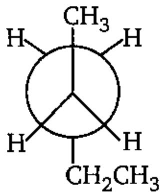
(c) 

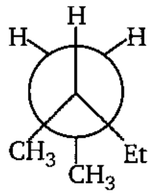
(d) 

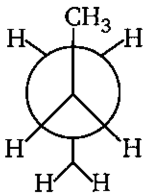
171. Which structure is most stable ?

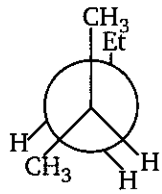
(a)  (b)  (c)  (d) 

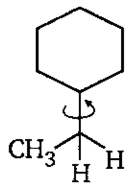
172. Identify conformer of 2-methly pentane :

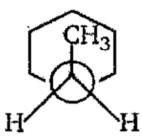
(a) 

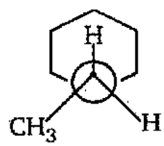
(b) 

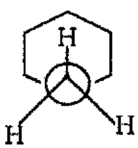
(c) 

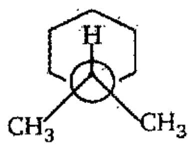
(d) 

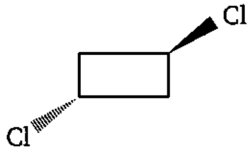
173. The lowest energy conformer of  is:

(a) 

(b) 

(c) 

(d) 

174. 

How many atoms will be bisect during plane of symmetry ?

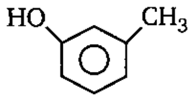
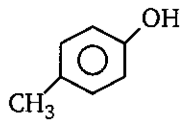
(a) 2
(b) 4
(c) 6
(d) 8

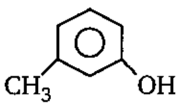
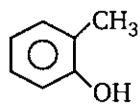
175. The number of all types of isomers of chlorobutane is :

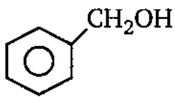
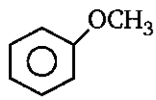
(a) 2 (b) 4

(c) 6 (d) 5

176. Which of the following pairs of compounds are not positional isomers ?

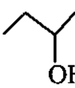
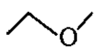
(a)  and 

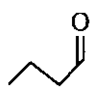
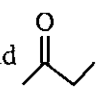
(b)  and 

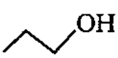
(c)  and 

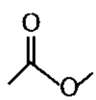
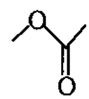
(d) All of these

177. Which of the following pairs of compounds are functional isomers ?

(a)  and 

(b)  and 

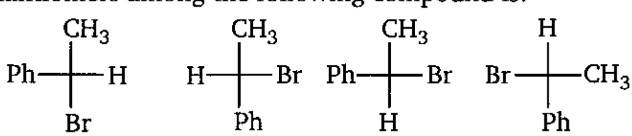
(c)  and 

(d)  and 

178. The isomeric alcohol which has a chiral carbon atom is:

(a) *n*-butyl alcohol (b) *iso*-butyl alcohol (c) *sec*-butyl alcohol (d) *tert*-butyl alcohol

179. The pair of enantiomers among the following compound is:



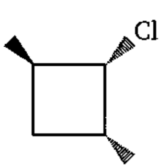
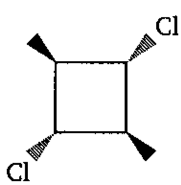
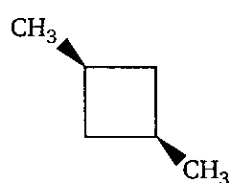
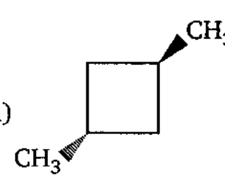
I II III IV

(a) I and IV (b) II and IV (c) II and III (d) I and II

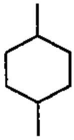
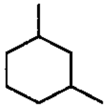
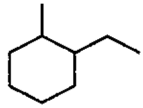
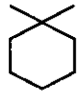
180. Which of the following is chiral?

(a) Cell phone (b) Spiral staircase (c) Scissor (d) All of these

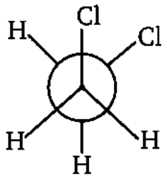
181. In which of the following compound, possess plane of symmetry as well as centre of symmetry?

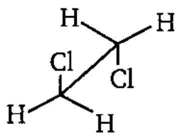
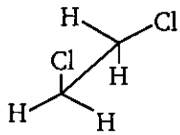
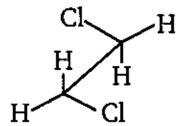
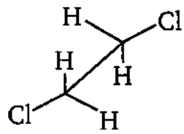
(a)  (b)  (c)  (d) 

182. Which of the following compound has one of the stereoisomers as a meso compound?

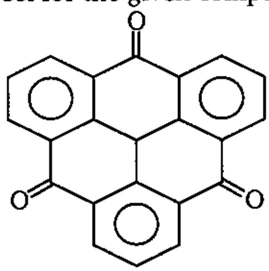
(a)  (b)  (c)  (d) 

183. For the following Newman projection



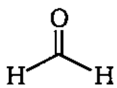
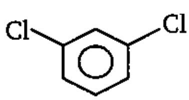
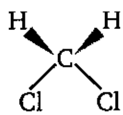
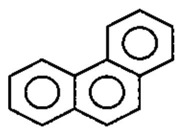
(a)  (b)  (c)  (d) 

184. Which of the following is correct for the given compound?



(a) It possess centre of symmetry
(b) It possess C_4 axis of symmetry
(c) It possess plane of symmetry
(d) Compound is chiral

185. Which of the following molecules has axis of symmetry and a coaxial plane of symmetry?

(a)  (b)  (c)  (d) 

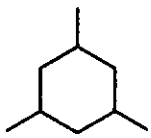
(e) All of these

ANSWERS – LEVEL 1

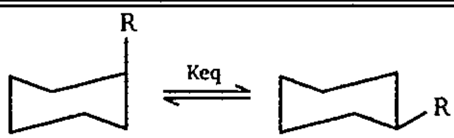
1.	(b)	2.	(c)	3.	(b)	4.	(c)	5.	(a)	6.	(b)	7.	(c)	8.	(d)
9.	(c)	10.	(d)	11.	(b)	12.	(c)	13.	(a)	14.	(b)	15.	(b)	16.	(d)
17.	(c)	18.	(a)	19.	(b)	20.	(b)	21.	(d)	22.	(b)	23.	(c)	24.	(d)
25.	(a)	26.	(b)	27.	(d)	28.	(b)	29.	(a)	30.	(c)	31.	(c)	32.	(a)
33.	(b)	34.	(c)	35.	(c)	36.	(d)	37.	(c)	38.	(d)	39.	(b)	40.	(a)
41.	(a)	42.	(d)	43.	(a)	44.	(d)	45.	(a)	46.	(b)	47.	(c)	48.	(b)
49.	(c)	50.	(c)	51.	(d)	52.	(d)	53.	(e)	54.	(a)	55.	(d)	56.	(c)
57.	(d)	58.	(b)	59.	(a)	60.	(a)	61.	(c)	62.	(d)	63.	(e)	64.	(d)
65.	(b)	66.	(b)	67.	(d)	68.	(d)	69.	(d)	70.	(d)	71.	(d)	72.	(a)
73.	(b)	74.	(a)	75.	(b)	76.	(b)	77.	(a)	78.	(b)	79.	(c)	80.	(b)
81.	(d)	82.	(a)	83.	(b)	84.	(a)	85.	(a)	86.	(d)	87.	(a)	88.	(d)
89.	(a)	90.	(b)	91.	(b)	92.	(a)	93.	(b)	94.	(a)	95.	(b)	96.	(b)
97.	(a)	98.	(d)	99.	(b)	100.	(a)	101.	(c)	102.	(c)	103.	(c)	104.	(d)
105.	(d)	106.	(a)	107.	(c)	108.	(b)	109.	(d)	110.	(a)	111.	(c)	112.	(c)
113.	(a)	114.	(d)	115.	(b)	116.	(b)	117.	(c)	118.	(d)	119.	(b)	120.	(c)
121.	(a)	122.	(b)	123.	(d)	124.	(b)	125.	(b)	126.	(c)	127.	(c)	128.	(b)
129.	(d)	130.	(a)	131.	(c)	132.	(d)	133.	(d)	134.	(d)	135.	(b)	136.	(b)
137.	(c)	138.	(a)	139.	(d)	140.	(b)	141.	(b)	142.	(a)	143.	(c)	144.	(b)
145.	(b)	146.	(b)	147.	(b)	148.	(a)	149.	(b)	150.	(c)	151.	(a)	152.	(c)
153.	(b)	154.	(d)	155.	(c)	156.	(a)	157.	(c)	158.	(d)	159.	(d)	160.	(d)
161.	(b)	162.	(d)	163.	(d)	164.	(d)	165.	(d)	166.	(c)	167.	(d)	168.	(c)
169.	(b)	170.	(c)	171.	(c)	172.	(d)	173.	(b)	174.	(c)	175.	(d)	176.	(c)
177.	(b)	178.	(c)	179.	(c)	180.	(d)	181.	(d)	182.	(b)	183.	(b)	184.	(c)
185.	(e)														

LEVEL-2

1. Match the Column (I) and (II).

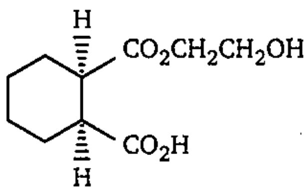
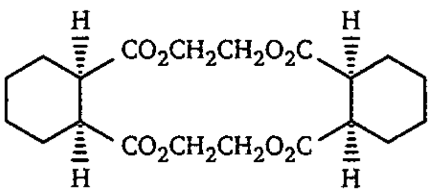
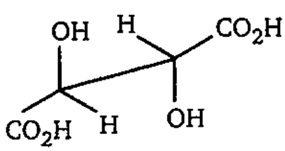
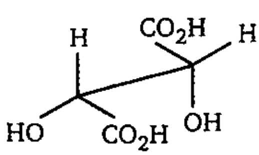
Column (I)		Column (II)	
Reaction		**Stereoisomers**	
(a)	$CH_3-CH=CH-CH=N-OH$	**(p)**	2
(b)		**(q)**	4
(c)	$CH_3-CH=CH-CH=CH-CH=CH-CH_3$	**(r)**	6
(d)	$CH_3-CH=CH-CH=CH-CH=CH-Ph$	**(s)**	8

2. Match the Column (I) and (II).

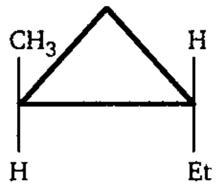
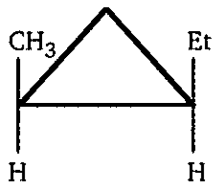
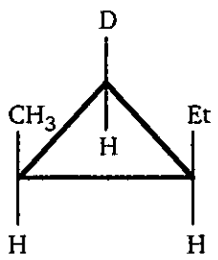
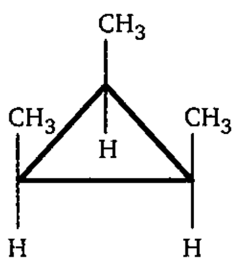


Column (I)		Column (II)	
Group		**Equilibrium Constant**	
(a)	$R = -H$	**(p)**	38
(b)	$R = -CH_3$	**(q)**	23
(c)	$R = -Et$	**(r)**	18
(d)	$R = -CH(CH_3)-CH_3$	**(s)**	1

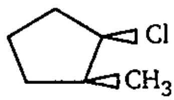
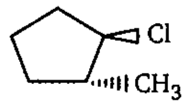
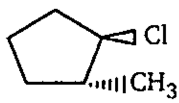
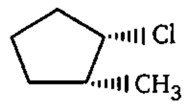
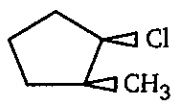
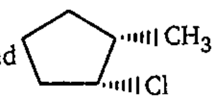
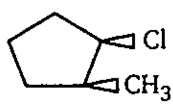
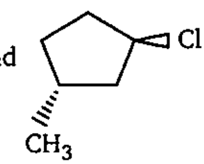
3. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Molecule		**Nature**	
(a)		(p)	Chiral
(b)		(q)	Achiral
(c)		(r)	Meso
(d)		(s)	Compound containing even number of chiral centers

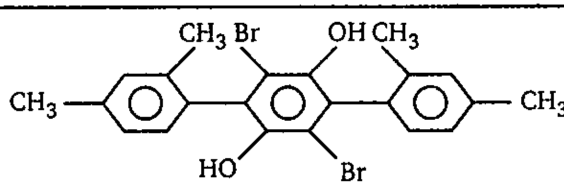
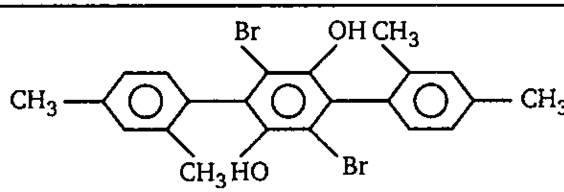
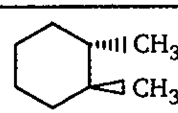
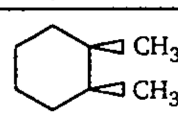
4. **Match the Column (I) and (II). (Matrix)**

Column (I)		Column (II)	
Compound		**Isomerism**	
(a)		**(p)**	Geometrical isomerism
(b)		**(q)**	Optical isomerism
(c)		**(r)**	Compound containing plane of symmetry
(d)		**(s)**	Compound containing center of symmetry

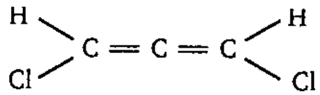
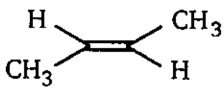
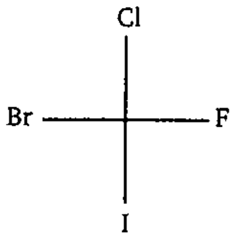
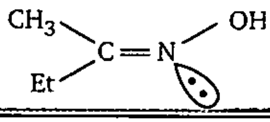
5. Match the Column (I) and (II).

Column (I)		Column (II)	
Molecules		**Relationship**	
(a)	 and 	**(p)**	Identical
(b)	 and 	**(q)**	Enantiomer
(c)	 and 	**(r)**	Diastereomer
(d)	 and 	**(s)**	Structural Isomerism

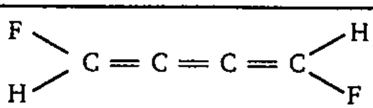
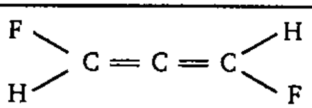
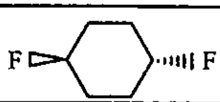
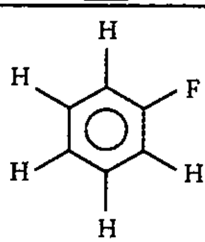
6. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Compound		**Nature**	
(a)		**(p)**	*cis*-compound
(b)		**(q)**	*trans*-compound
(c)		**(r)**	Optically active
(d)		**(s)**	Optically inactive

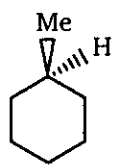
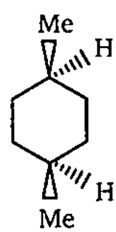
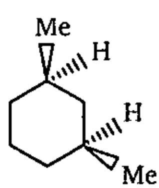
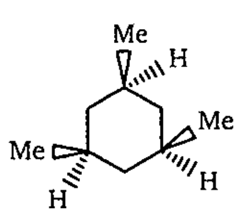
7. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Molecule		Property	
(a)		(p)	Chiral centers containing compound
(b)		(q)	Presence of stereocenter
(c)		(r)	Optically active compound
(d)		(s)	Compound containing plane of symmetry

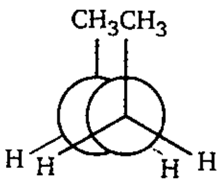
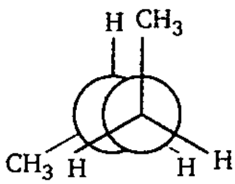
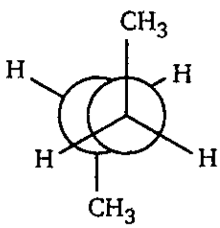
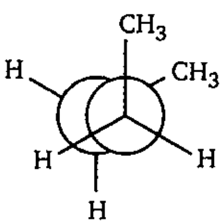
8. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Molecule		Property	
(a)		(p)	Polar molecule
(b)		(q)	Optically active
(c)		(r)	Optically inactive
(d)		(s)	Plane of symmetry

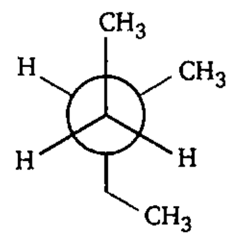
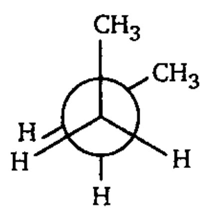
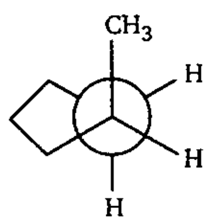
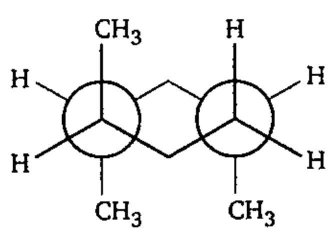
9. Match the Column (I) and (II). (Matrix)

Column (I)		**Column (II)**	
Molecule		**Property**	
(a)		**(p)**	Meso compound
(b)		**(q)**	Achiral
(c)		**(r)**	Chiral compound
(d)		**(s)**	Compound will show geometrical isomerism

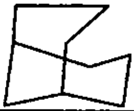
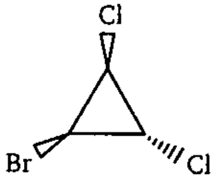
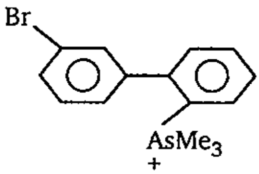
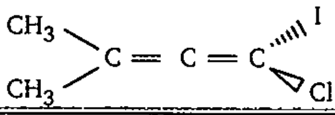
10. Match the Column (I) and (II).

Column (I)		Column (II)	
Modified Newmann Projection		**Conformers**	
(a)		**(p)**	Fully eclipsed
(b)		**(q)**	Partially eclipsed
(c)		**(r)**	Gauche
(d)		**(s)**	Staggered

11. Match the Column (I) and (II).

Column (I)		Column (II)	
Newmann Projection		**Name of the Compound**	
(a)		**(p)**	3-methyl pentane
(b)		**(q)**	*n*-butane
(c)		**(r)**	Methyl-cyclopentane
(d)		**(s)**	1,2,4-trimethyl cyclohexane

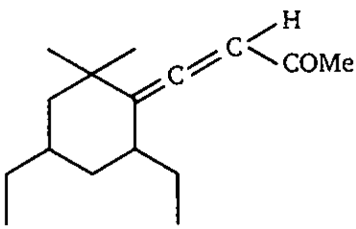
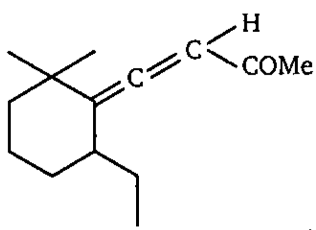
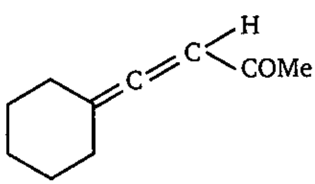
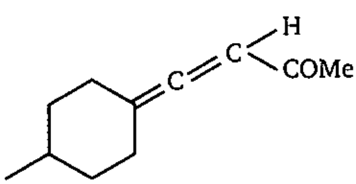
12. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Molecule		**Property**	
(a)		(p)	Rotates plane polarized light
(b)		(q)	Cannot rotate plane polarized light
(c)		(r)	Plane of symmetry
(d)		(s)	Centre of symmetry

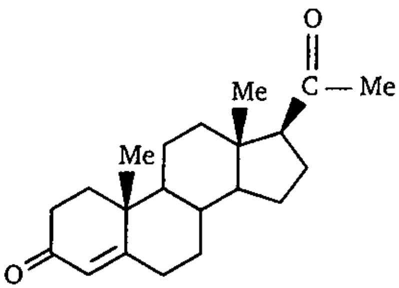
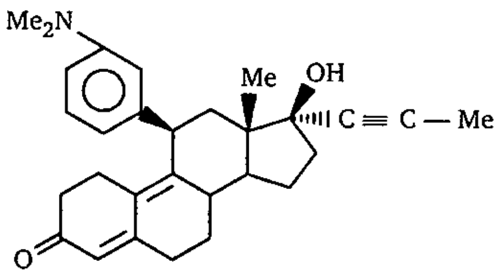
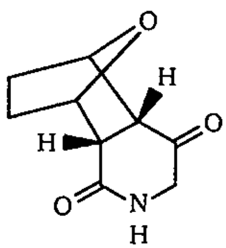
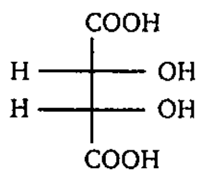
13. Match the Column (I) and (II).

Column (I)		Column (II)	
Molecule		**Stereocenters**	
(a)	$CH_3-CH=CH-CH(Br)-CH_3$	(p)	1
(b)	$H-C\equiv C-CH=CH-CH(Br)-CH(Br)-CH_3$	(q)	2
(c)	$Ph-S(=O)-CH=CH-CH(CH_3)-CH_3$	(r)	3
(d)	$Ph-CH(Cl)-Et$	(s)	4

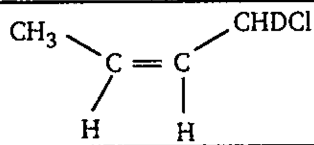
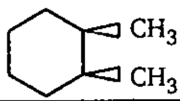
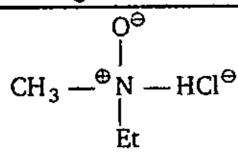
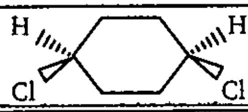
14. Match the Column (I) and (II).

Column (I)		Column (II)	
	Molecule		**Stereoisomers**
(a)		**(p)**	2
(b)		**(q)**	0
(c)		**(r)**	4
(d)		**(s)**	8

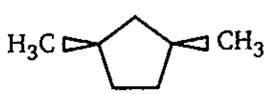
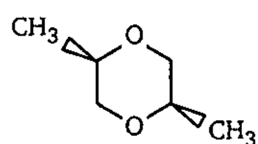
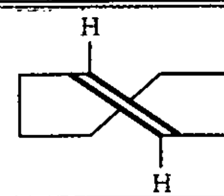
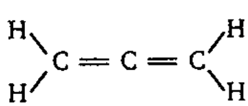
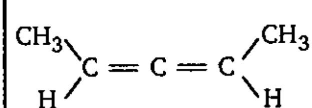
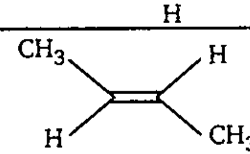
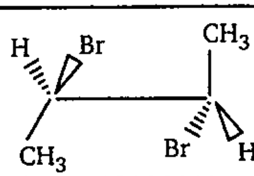
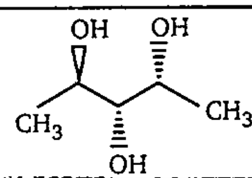
15. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Molecule		Property	
(a)		(p)	Meso Compound
(b)		(q)	Compound having even no. of chiral centres
(c)		(r)	Optically active compound
(d)		(s)	Compound having odd no. of chiral centres.

16. Match the Column (I), (II) and (III). (Matrix)

Column (I)		Column (II)		Column (III)	
Property		Molecule		No. of Chiral Center	
(a)		(p)	Optically active	(w)	0
(b)		(q)	Optically inactive	(x)	1
(c)		(r)	Plane of symmetry	(y)	2
(d)		(s)	Centre of symmetry	(z)	3

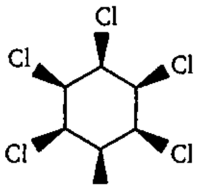
17.

(a)		(b)		(c)	
(d)		(e)		(f)	
(g)		(h)			

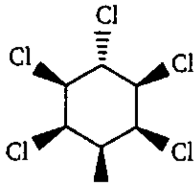
From the above compounds select :

(A)	two of which are chiral and contain chiral centre :	
(B)	two of which are achiral and contains chiral centre :	
(C)	two of which are chiral and does not contain chiral centre :	
(D)	two of which are achiral and does not contain chiral centre :	

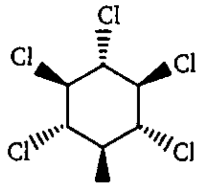
18. Comprehension



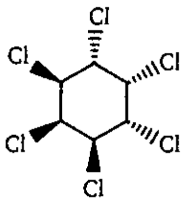
(P)



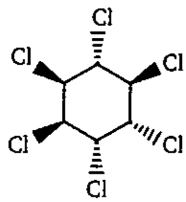
(Q)



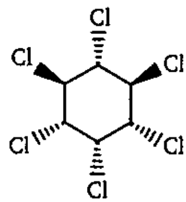
(R)



(S)



(T)



(U)

Consider the given structures and answer A, B & C.

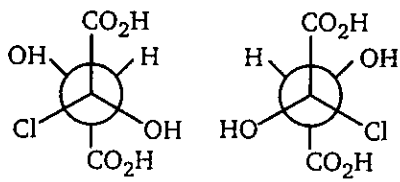
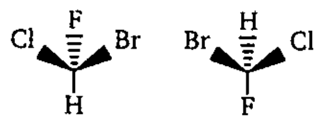
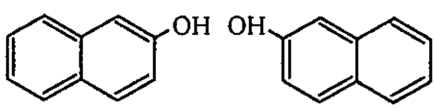
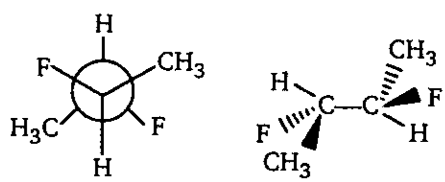
A. Which of the compound is optically active ?

(a) *P* (b) *R* (c) *S* (d) *T*

B. Which of the isomer is most stable ?

(a) *R* (b) *S* (c) *T* (d) *U*

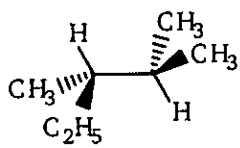
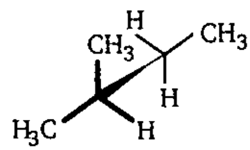
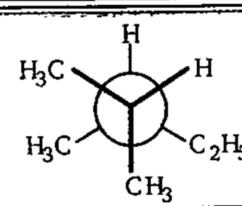
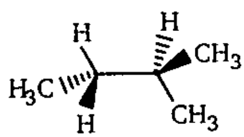
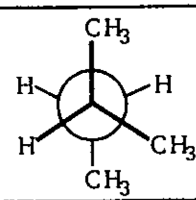
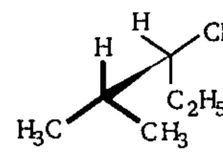
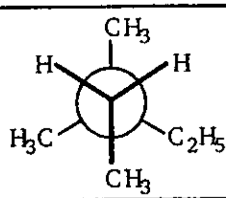
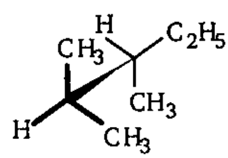
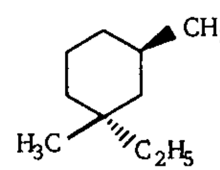
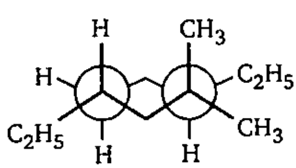
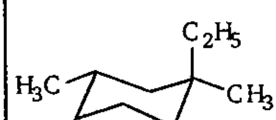
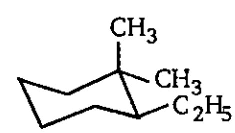
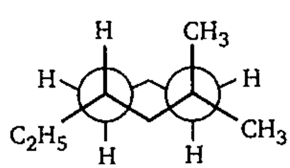
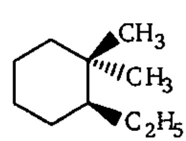
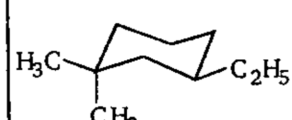
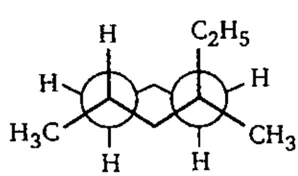
19. Identify relationship between following pairs :

(a)		**(b)**	
(c)		**(d)**	

If they are enantiomer answer will be 1, if they are diastereomers answer will be 2, if they are constitutional isomers answer will be 3 and if they are identical present 4 as the answer. Sum of answer of each part $a + b + c + d$ is : . . . .

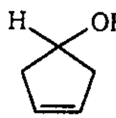
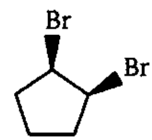
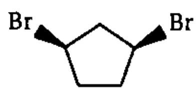
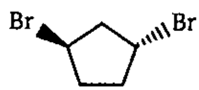
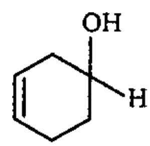
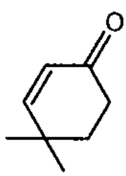
20. In each of the following three questions a hydrocarbon is named. For each select from among the sixteen conformational structures (a through p) all structures that represent possible conformers of that compound. Write letters (a through p), corresponding to your selections, in each answer box.

A.	2-methylbutane	
B.	2,3-dimethylpentane	
C.	1-ethyl-1, 3-dimethyl cyclohexane	

(a)		**(b)**		**(c)**	
(d)		**(e)**		**(f)**	
(g)		**(h)**		**(i)**	
(j)		**(k)**		**(l)**	
(m)		**(n)**		**(o)**	
(p)					

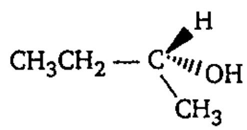
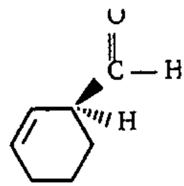
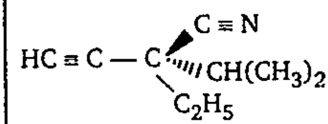
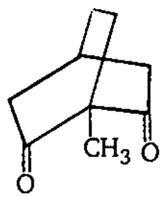
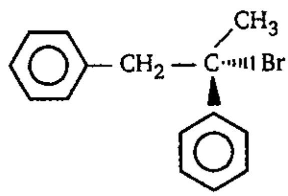
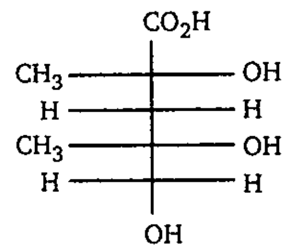
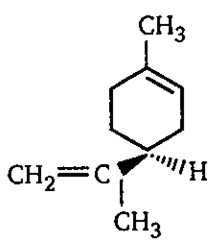
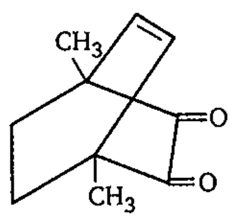
21. Examine structures a through j, shown below, with respect to their symmetry or lack of it. Assume that the five-membered rings and the ring in compound g are planar. The wedge-hatched bonds in b, c, d & e designate specific configurations. Also, for the acyclic compounds assume stable anti conformations. Answer each of the following questions by writing letters (a through j), corresponding to your selections, in each answer box. If there is no structure that fits the description enter an x in the answer box.

A.	Which structures are chiral ?	
B.	Which structures have a plane of symmetry ?	
C.	Which structures have a center of symmetry ?	

(a)		**(b)**		**(c)**	
(d)		**(e)**		**(f)**	
(g)		**(h)**	$C_2H_5CHCl_2$	**(i)**	$C_2H_5CHClC_2H_5$
(j)	$C_2H_5CHClCH_3$				

22. **(i) 1,2-dichlorocyclopropane** = ***w***
(ii) 1,3-dimethyl-cyclobutane = *x*
(iii) 2-bromo-3-chlorobutane = ***y***
(iv) 1,3-dimethyl cyclohexane = ***z***
Calculate total number of stereoisomer of the above compounds.
Sum of $w + x + y + z = \ldots\ldots$

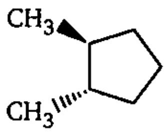
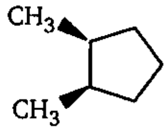
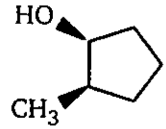
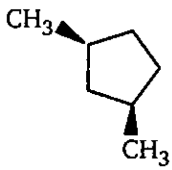
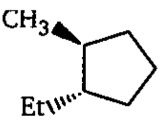
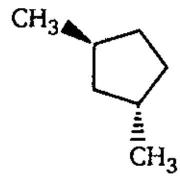
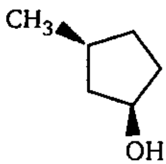
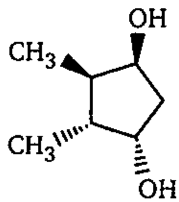
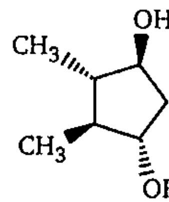
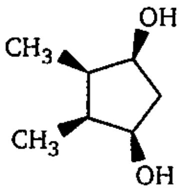
27. The configuration of eight compounds, a through h are shown below, using various kind of stereo representations. To answer the question given below, write (a through h) indicating your choice.

(a)		(b)		(c)	
(d)		(e)		(f)	
(g)		(h)			

A.	Which of these configuration are achiral?	
B.	Which configuration has no stereogenic center?	
C.	Which configuration has more than one stereogenic center?	
D.	Which of these configuration are meso compound?	

28. The structural formula of ten compounds, (I) through (X) are drawn below, you may select any one of these structure.

Answer the following question about that compound.

I		II		III	
IV		V		VI	
VII		VIII		IX	
X					

A. How many chiral centre are present in this compound ?

(a) 0 (b) 1 (c) 2 (d) 3
(e) 4 (f) 5

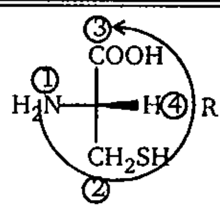
B. Is this compound chiral or achiral ?

(a) Chiral (b) Achiral

C. What symmetry element are present in this compound ?

(a) None (b) Plane of symmetry (c) Center of symmetry

29. The structure of one of the enantiomers of the amino acid cysteine is shown below.

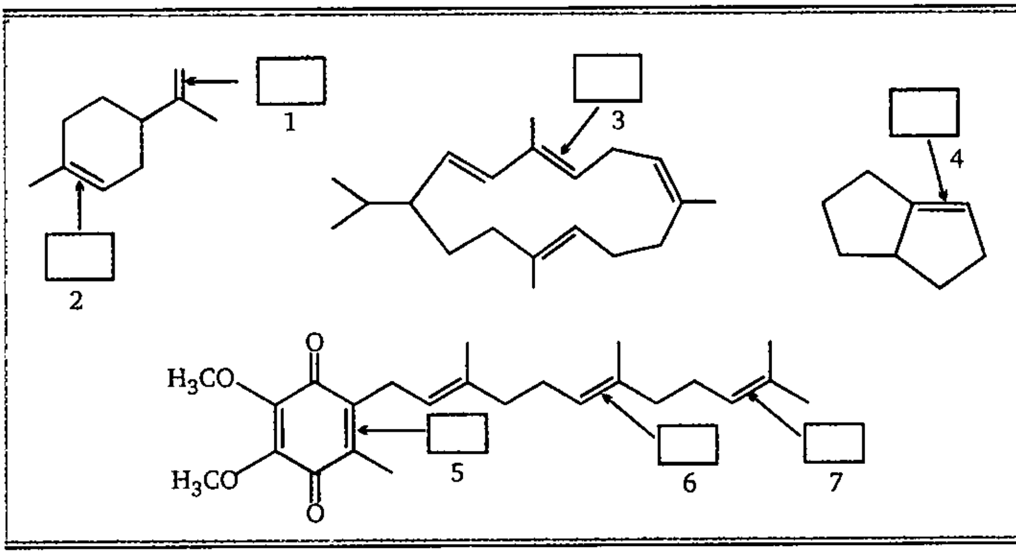


Classify this structure as :

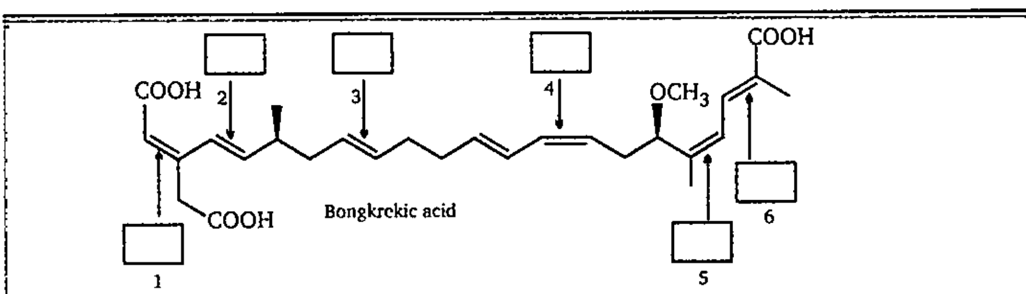
(a) R or S (b) D or L

30. Identify the following double bonds either E, Z or None (N) in the compounds given below either.

A.



B. (a) Bongkrekic acid is a toxic compound produced by Pseudomonas cocovenenans, and isolated from a mold that rows on bongkrek, a fermented Indonesian coconut dish. (a) Label each double bond as E, Z or neither (N).

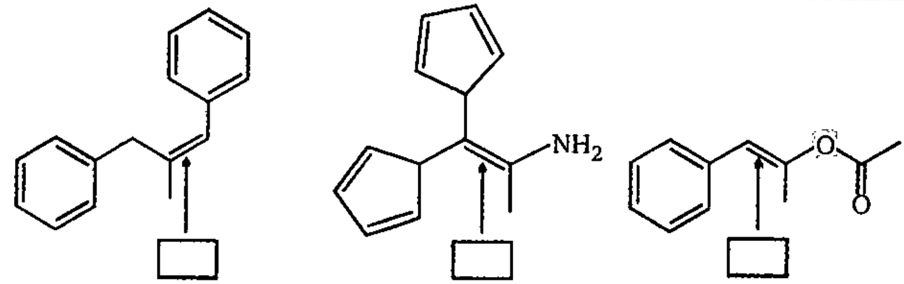


(b) How many total stereoisomers (including all types) are possible for bongkrekic acid ?

....

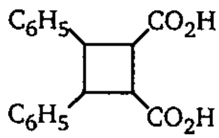
(c) How many sites of unsaturation are present in bongkrekic acid ? ....

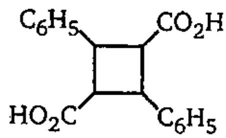
31. Designate the following double bonds as E, Z or none (N) configuration in the boxes provided below.

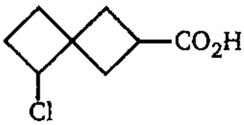


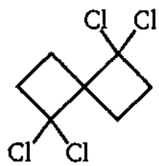
1 2 3

32. The following compounds may exist as two or more stereoisomers. These may be classified as enantiomer pairs or meso compounds.

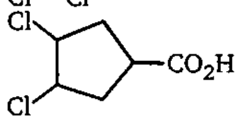
(a)

truxinic acid

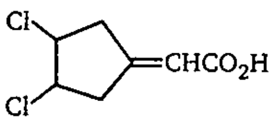
(b)

truxillic acid

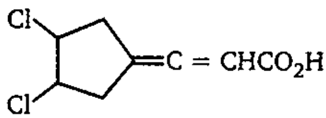
(c)


(d)


(e) $C(CH_3CHCl)_4$

(f)


(g)


(h)


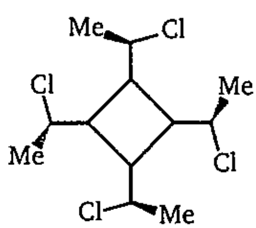
Answer the following question about the above structure.

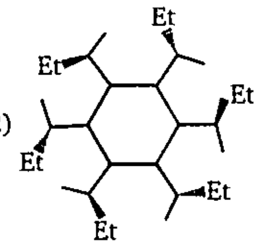
(A) Total number of stereoisomers :

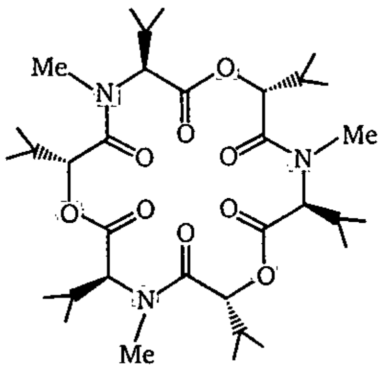
(B) Number of enantiomeric pairs :

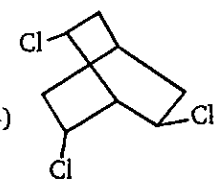
(C) Number of meso compounds :

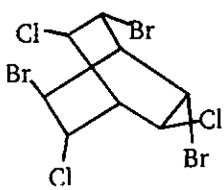
33. Identify axis of symmetry in the given compound.

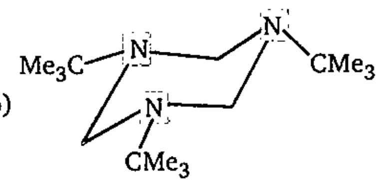
(1)


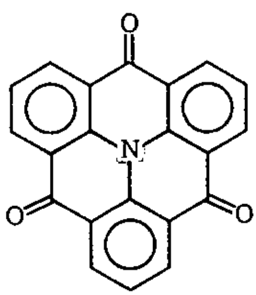
(2)


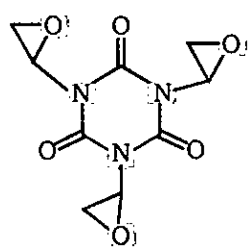
(3)


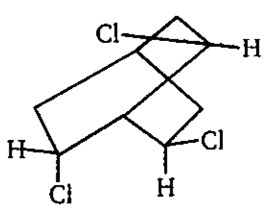
(4)


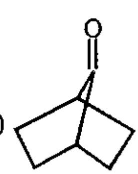
(5)


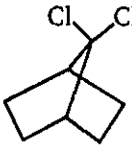
(6)


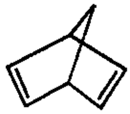
(7)


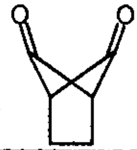
(8)


(9)


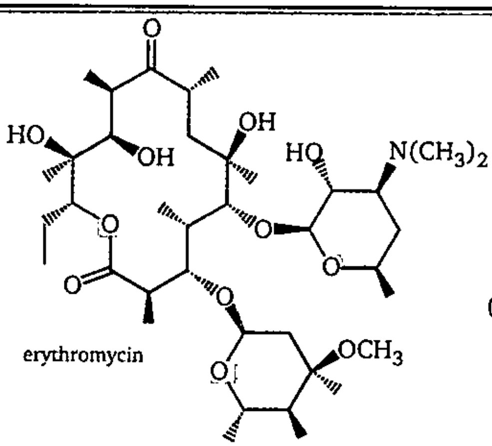
(10)


(11) 

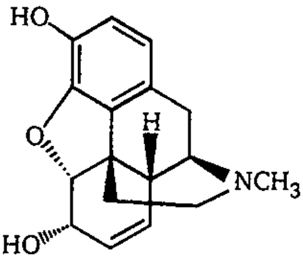
(12) 

(13) 

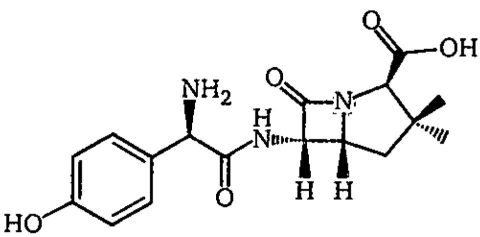
34. For each of the following pharmaceutical compounds, identify all stereogenic (*i.e.*, all asymmetric carbon atoms) and label the configuration of each as being either (R) or (S).

(1) 

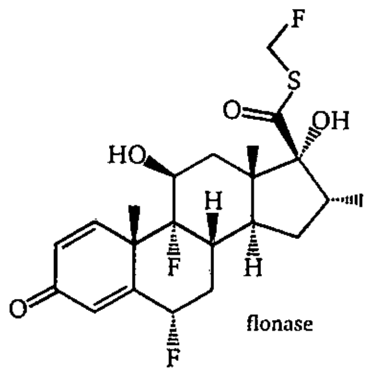
erythromycin

(2) 

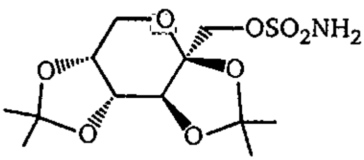
morphine

(3) 

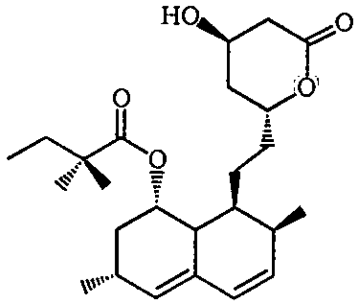
amoxicillin

(4) 

flonase

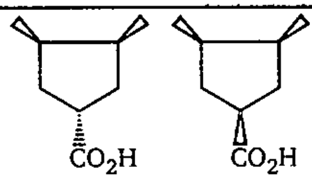
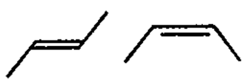
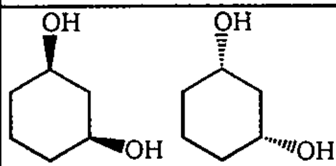
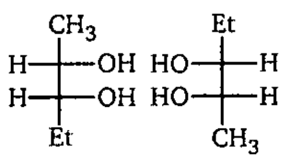
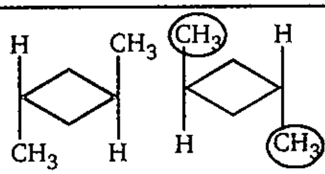
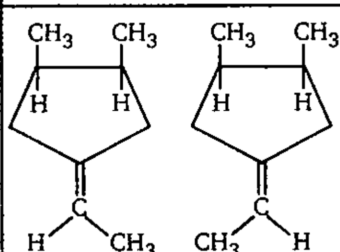
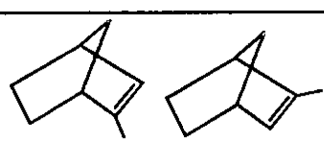
(5) 

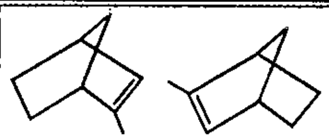
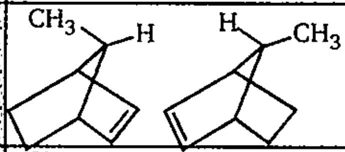
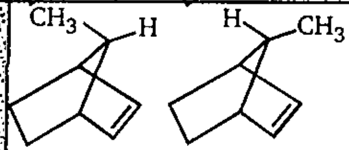
topomax

(6) 

zocor

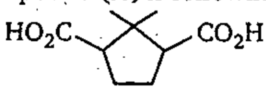
35. Find relationship between given pair :

		Identical	Enantiomer	Diastereomer	Constitutional Isomer
1.					
2.					
3.					
4.					
5.					
6.					
7.					

8.					
9.					
10.					

36. Comprehension

Structural formula of compound (A) is following:



A. The correct statement(s) about the compound (A) is/are:

(a) The total number of stereoisomers possible for (A) is 3
(b) The total number of mesoisomer possible for (A) is 1
(c) The total number of pair of enantiomer possible for (A) is 1
(d) All of these

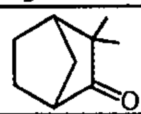
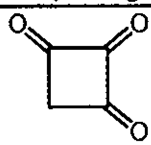
B. Number of plane of symmetry in *cis*-form of compound (A) is:

(a) 0 (b) 1 (c) 2 (d) 3

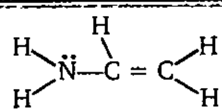
37. Match the column. **(Matrix)**

Column (I)		Column (II)	
No. of Carbon		No. of structural isomer	
(a)	C_4H_{10}	**(p)**	2
(b)	C_5H_{12}	**(q)**	3
(c)	C_6H_{14}	**(r)**	5
(d)	C_7H_{16}	**(s)**	9

38. Match the column. **(Matrix)**

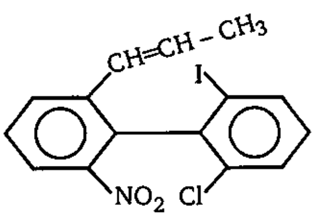
Column (I)		Column (II)	
Compound		**% of enol content**	
(a)		**(p)**	100 %
(b)		**(q)**	76 %
(c)	$CH_3-\overset{\overset{O}{\parallel}}{C}-CH_2-\overset{\overset{O}{\parallel}}{C}-CH_3$	**(r)**	8%
(d)	$CH_3-\overset{\overset{O}{\parallel}}{C}-CH_2-\overset{\overset{O}{\parallel}}{C}-O-Et$	**(s)**	Keto-Enol is not possible

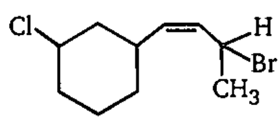
39. Draw a most stable conformation (N – C) bond in the following compound.



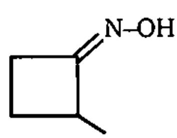
40. Find total number of stereoisomers for each compound given below :

(1) $Ph-\overset{\overset{O}{\parallel}}{S}-CH=CH-CH_2-CH=C=C=CH-CH=CH-CH_3$

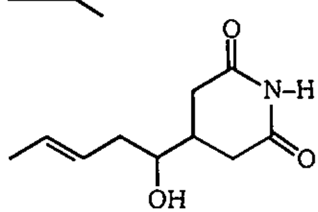
(2) 

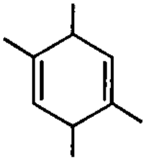
(3) 

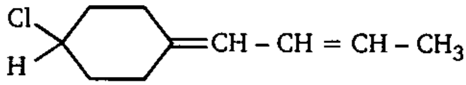
(4) $Ph-\underset{\underset{OH}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-NH-CH_3$

(5) 

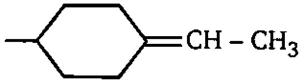
(6) $H-O-\overset{\overset{O}{\parallel}}{C}-\underset{\underset{OH}{|}}{CH}-\underset{\underset{OH}{|}}{CH}-\overset{\overset{O}{\parallel}}{C}-H$

(7) 

(8) 

(9) 

(10) $CH_3-CH=CH-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3$

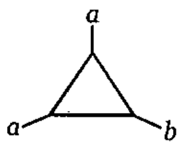
(11) 

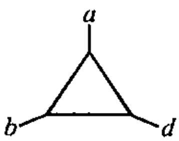
41. Find the total number of stereoisomer for each compound :

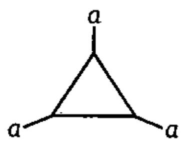
(1)  ⟶ a

(2)  ⟶ b

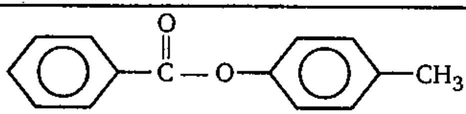
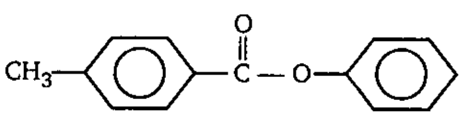
(3)  ⟶ c

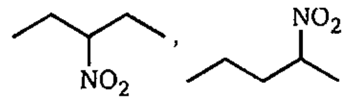
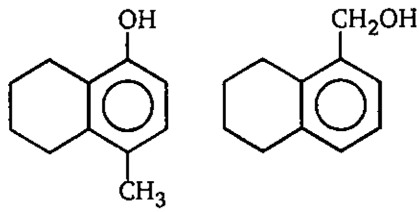
(4)  ⟶ d

(5)  ⟶ e

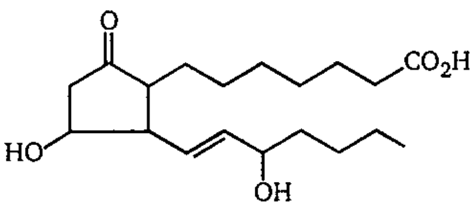
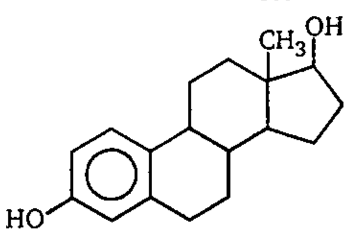
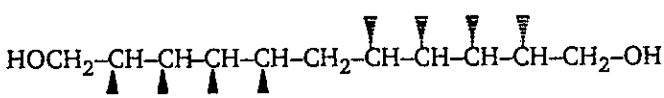
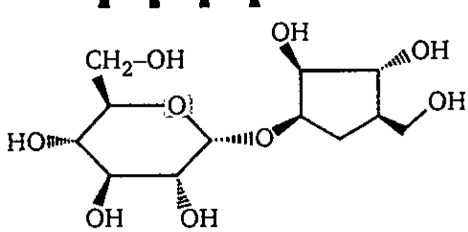
(6)  ⟶ f

42. Match the column :

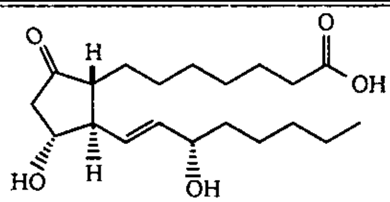
Column (I)		Column (II)	
Pair		Isomeric Relationship	
(a)	 	**(p)**	Chain
(b)	$CH_3-CH_2-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-OH$, $CH_3-\underset{\displaystyle CO_2H}{\underset{\|}{CH}}-CH_3$	**(q)**	Positional

(c)		**(r)**	Functional
(d)		**(s)**	Metamers

43. Find sum of stereoisomer of following compound.

			Number of stereoisomers
(a)		⟶	(*a*)
(b)		⟶	(*b*)
(c)		⟶	(*c*)
(d)		⟶	(*d*)

44.



1 Prostaglandin E_1

Prostaglandin E_1 1 is a compound produced by the body to regulate a variety of processes including blood clotting, fever, pain and inflammation.

A. Which of the following functional groups is not contained in 1 ?

(a) A ketone (b) An alcohol (c) A carboxylic acid (d) An alkene (e) A nitrile

B. How many asymmetric (stereogenic) centres are present in compound 1?

(a) 3 (b) 4 (c) 5 (d) 6

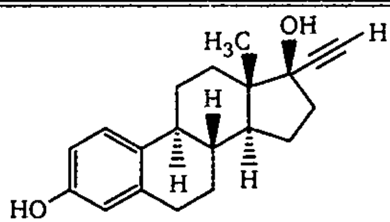
C. How many sp^2 hybridised carbon atoms are present in compound 1 ?

(a) 1 (b) 2 (c) 3 (d) 4

D. What is the geometric configuration about the double bond in compound 1?

(a) *E* (b) *Z*

45.



Ethynylestradiol (1)

The synthetic steroid ethynylestradiol (1) is a compound used in the birth control pill.

A. How many sp^3 hybridised carbon atoms are present in compound (1)?

(a) 8 (b) 9 (c) 10 (d) 11 (e) 12

B. How many sp^2 hybridised carbon atoms are present in compound (1) ?

(a) 4 (b) 5 (c) 6 (d) 7 (e) 8

C. How many *sp* hybridised carbon atoms are present in compound (1) ?

(a) 2 (b) 4 (c) 6 (d) 8 (e) 10

D. Which of the following functional group is contained in compound (1) ?

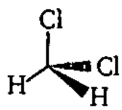
(a) A ketone (b) An alcohol (c) A carboxylic acid (d) An ester

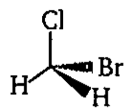
E. How many asymmetric (stereogenic) centres are present in compound (1) ?

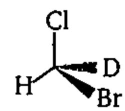
(a) 2 (b) 3 (c) 4 (d) 5

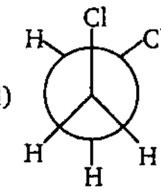
SUBJECTIVE PROBLEMS

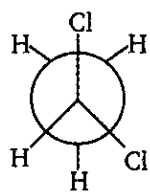
1. Number of chiral isomers are:

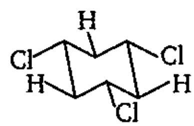
(a) 

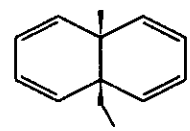
(b) 

(c) 

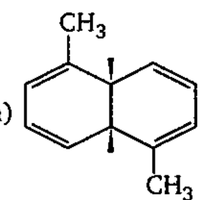
(d) 

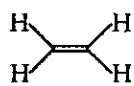
(e) 

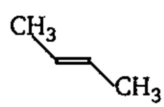
(f) 

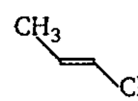
(g) 

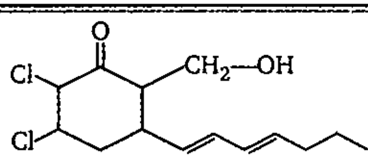
Consider only a conformation with Me group perpendicular to the aromatic ring

(h) 

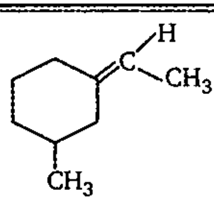
(i) 

(j) 

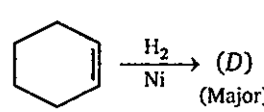
(k) 

2. 

Number of stereoisomer are

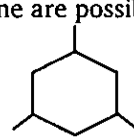
3. (i) 

(C)

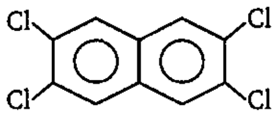
(ii) 

Sum of number of stereoisomer (*C*) Degree of unsaturations in (*D*).

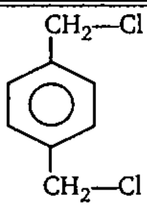
4. How many 5 membered parent chain alkane are possible for C_7H_{16}?

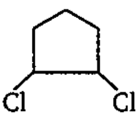
5. Theoretical possible geometrical isomer of 

6. Total number of possible structural isomers of $C_5H_{11}Br$.
7. Total number of plane of symmetry present in given compound is



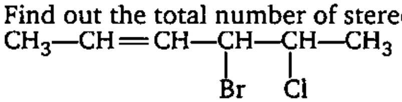
8. Total number of isomers for $C_4H_6Br_2$ containing cyclobutane ring are (including stereoisomer) ?
9. Total number of structural isomers of C_9H_{18} containing cyclohexane ring.
10. How many structural isomer are possible for $C_4H_{10}O$ (only alcohol).
11. Number of structural isomer of C_6H_{14} is .

12. (a)  ⟶ (x) (Number of plane of symmetry)

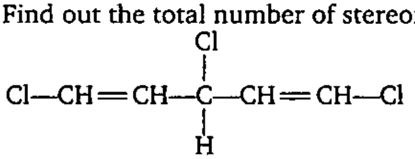
(b)  ⟶ (y) (Number of mesoisomer of 1, 2-dichlorocyclopentane)

Sum of $(x+y=?)$

13. Find out the total number of stereocentre in the given compound.



14. Find out the total number of stereoisomers of the given following compound.



15. Find the total number of isomers of C_7H_{14} (only 5-membered ring).

ANSWERS — LEVEL 2

1. a – q; b – p; c – r; d – s
2. a – s; b – r; c – q; d – p
3. a – p, s; b – q, r, s; c – q, r, s; d – p, s
4. a – p, q; b – p, q; c – p, q; d – p, r
5. a – r; b – r; c – p; d – s
6. a – p, r; b – q, s; c – q, r; d – p, s
7. a – q, r; b – q, s; c – p, q, r; d – q, s
8. a – r, s; b – p, q; c – r, s; d – p, r, s
9. a – q; b – q, s; c – p, q, s; d – q, s
10. a – p; b – q; c – s; d – r
11. a – p; b – q; c – r; d – s
12. a – q, r; b – p; c – p; d – q, r
13. a – r; b – s; c – r; d –p
14. a – s; b – r; c – q; d – p
15. a – q, r; b – r, s; c – q, r; d – p, q
16. (a – p – x); (b – q, r – y); (c – p – x); (d – q, r – w)
17. A – b,h; B – a, g; C – c, e; D – d, f
18. A – d; B – a
19. $a+b+c+d=13$
20. A – b, d, e; B – a, c, f, h; C – i, k, p
21. A – e, f, j; B – a, c, d, g, h, i, b; C – None
22. $w+x+y+z=12$
23. A – (c & e), (b & d); B – (a & b) or (a & d); C – (a & c) or (a & e), (b & c), (b & e), (c & d) and (d & e)
24. A – (a & c) (b & f); B – (a & d) or (c & d), (a & e) (c & d); C – (d & e)
25. a – True; b – True; c – True; d – False
26. b, e, f, g, h, i
27. A – d, h; B – d; C – f, h; D – h
28.

Compound	A	B	C
I	c	a	a
II	c	b	b
III	c	a	a
IV	c	b	b
V	c	a	a
VI	c	a	a
VII	c	a	a
VIII	e	b	b
IX	e	a	a
X	e	b	b

29. (a) R (b) L

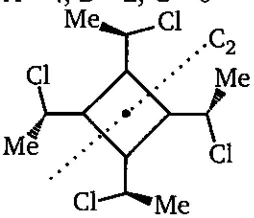
30A. 1 – N; 2 – Z; 3 – E; 4 – Z; 5 – Z; 6 – E; 7 – N

B. (a) 1 – Z; 2 – E; 3 – E; 4 – Z; 5 – Z; 6 – E (b) 2^9 (c) 10

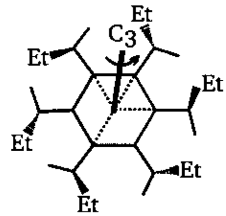
31. 1 – Z; 2 – N; 3 – E

32. (a) A – 10, B – 4, C – 2 (b) A – 5, B – 0, C – 5
(c) A – 4, B – 2, C – 0 (d) A – 2, B – 1, C – 0
(e) A – 5, B – 2, C – 1 (f) A – 4, B – 1, C – 2
(g) A – 4, B – 2, C – 0 (h) A – 4, B – 1, C – 2

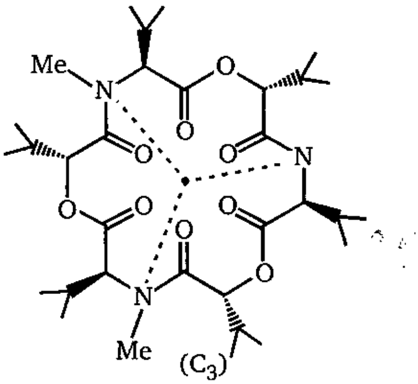
33. (1)



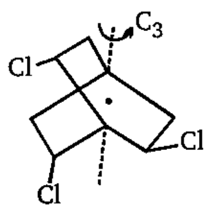
(2)



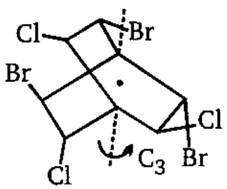
(3)



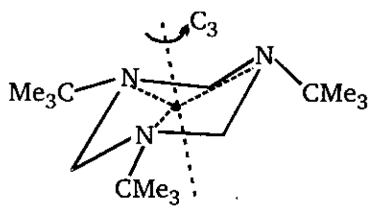
(4)



(5)



(6)

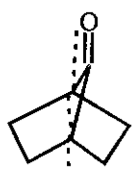


(7) C_3 axis, C_2 axis

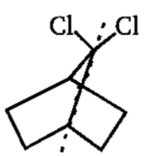
(8) C_3-axis

(9) C_3 axis

(10)

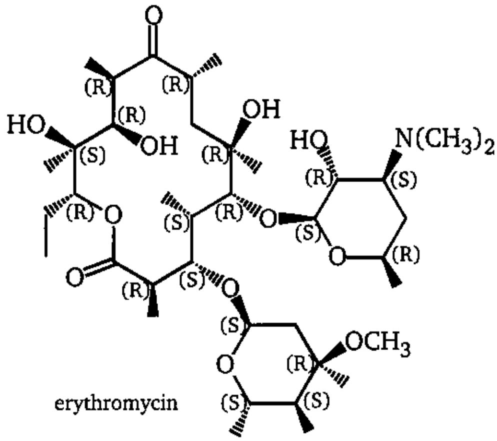


(11)

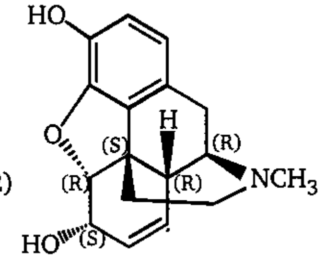


(12) C_2-axis

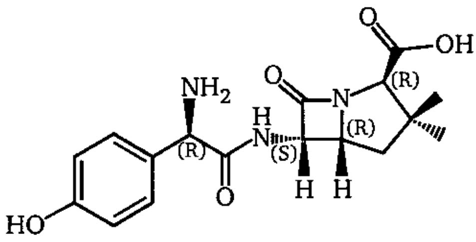
(13) C_2-axis

34. (1) 

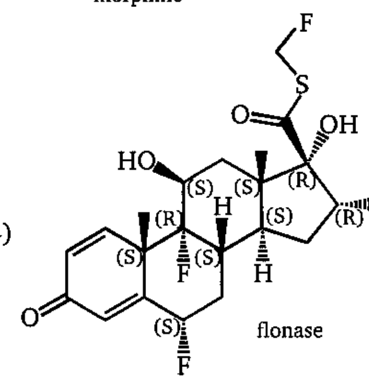
erythromycin

(2) 

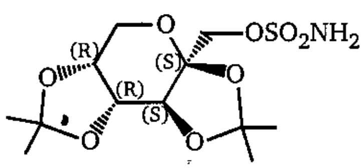
morphine

(3) 

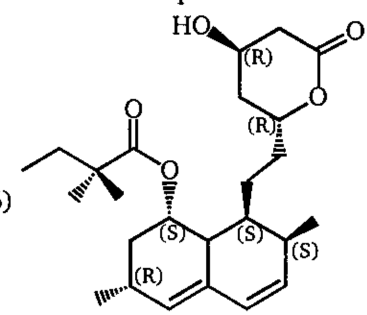
amoxicillin

(4) 

flonase

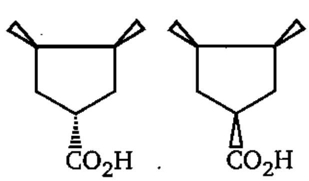
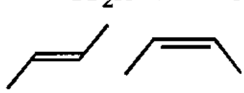
(5) 

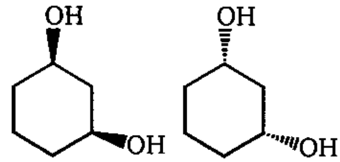
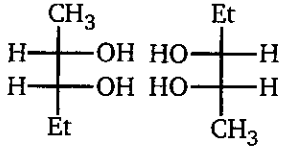
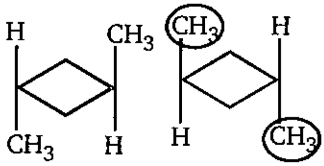
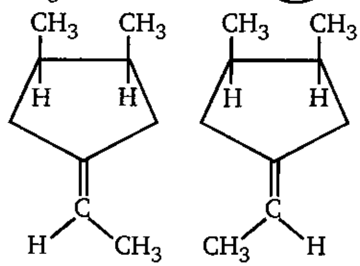
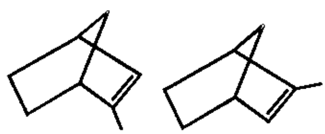
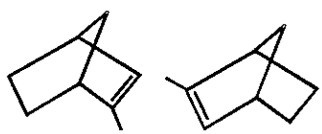
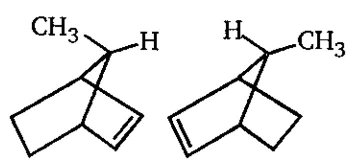
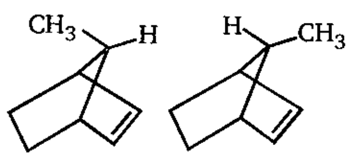
topomax

(6) 

zocor

35.

	Identical	Enantiomer	Diastereomer	Constitutional Isomer
(1) 	×	×	✓	×
(2) 	×	×	✓	×

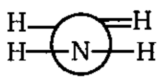
(3)		✓	×	×	×
(4)		✓	×	×	×
(5)		✓	×	×	×
(6)		×	✓	×	×
(7)		×	✓	×	×
(8)		✓	×	×	×
(9)		✓	×	×	×
(10)		×	×	✓	×

36. (A) - (d) (B) - (b)

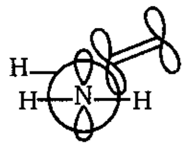
37. a – p; b – q; c – r; d – s

38. a – s; b – p; c – q; d – r

39.



(Resonance)



π-(vacant-p-orbital)

40. (1) 16 (2) 4 (3) 16 (4) 4 (5) 4
(6) 4 (7) 4 (8) 3 (9) 4 (10) 4
(11) 2

41. a – 2, b – 4, c – 3, d – 4, e – 8, f – 2

42. a – s; b – p; c – q; d – r

43. a – 2^5, b – 2^5, c – $2^7 + 2^3$, d – 2^9

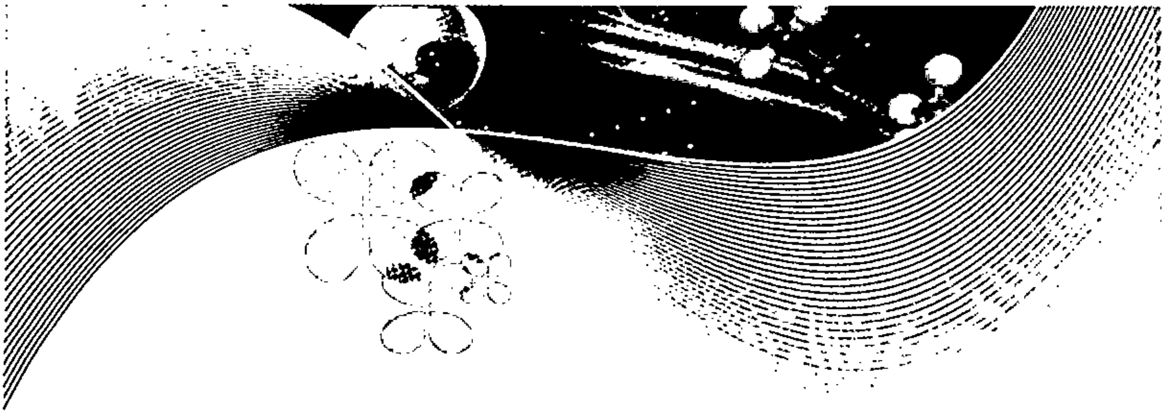
44. A – e; B – b; C – d; D – a

45. A – e; B – c; C – a; D – b; E – d

Subjective Problems:

1. 3 (c, f, h) **2.** 64 **3.** 5 **4.** 5 **5.** 2 **6.** 8. **7.** 3

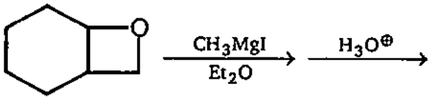
8. 6 **9.** 12 **10.** 4 **11.** 5 **12.** 4 **13.** 4 **14.** 4 **15.** 8

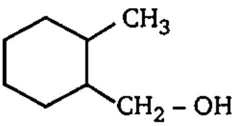


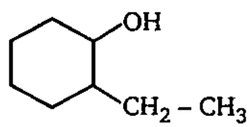
3 GRIGNARD REAGENT

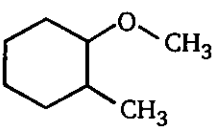
LEVEL-1

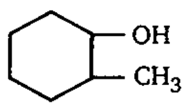
1. What is the major product of the following reaction ?

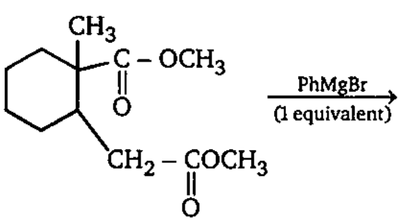


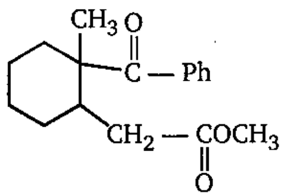
(a) 

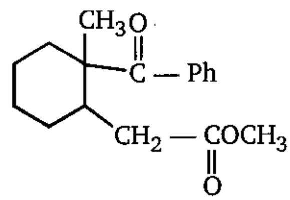
(b) 

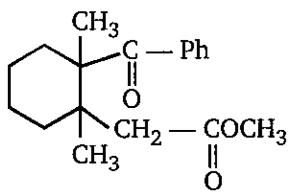
(c) 

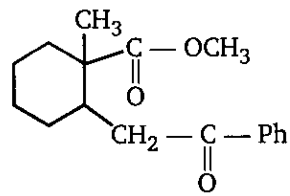
(d) 

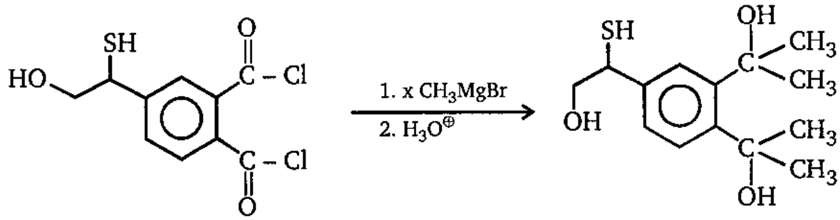
2.  (P). Product (P) is :

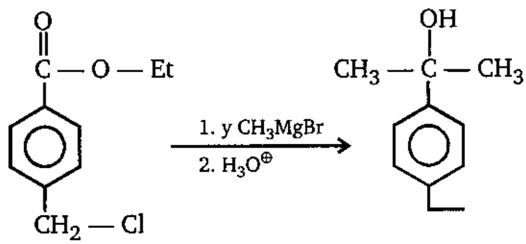
(a) 

(b) 

(c) 

(d) 

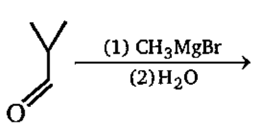
3. **Reaction- 1 ;** 

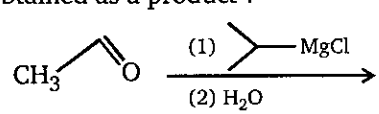
Reaction- 2 ; 

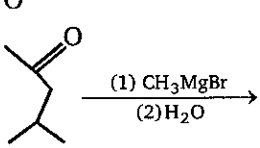
What is the ratio of (x/y) in above problem ?

(a) 1.5 (b) 2 (c) 2.5 (d) 3

4. In which of the following reaction 2° alcohol is obtained as a product ?

(a) 

(b) 

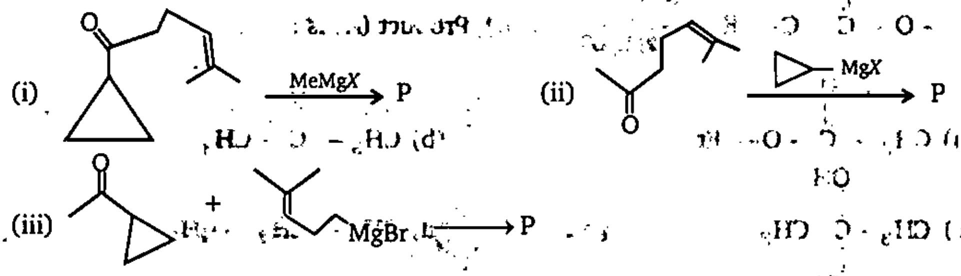
(c) 

(d) Both (a) and (b)

5. What product would you expect to obtain from Grignard reaction when an excess of phenylmagnesium bromide reacts with dimethyl carbonate $CH_3OCOOCH_3$?

(a) $CH_3-C(OH)(Ph)-Ph$ (b) $CH_3-CH(OH)-Ph$ (c) $Ph-C(OH)(Ph)-Ph$ (d) $CH_3-C(=O)-Ph$

6. In which of the following reactions product formed is same ?



(a) (i) and (ii) (b) (ii) and (iii) (c) (i) and (iii) (d) (i), (ii) and (iii)

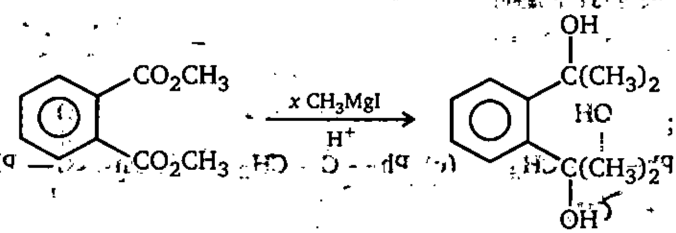
7. Which of the following reaction sequences would be the best for synthesis of 2-pentanone ?

(a) $CH_3-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow[Et_2O]{CH_3MgI} \xrightarrow{H_3O^{\oplus}}$

(b) $\begin{array}{c} CH_2-CH_2 \\ | \quad\quad | \\ CH_3-CH-O \end{array} \xrightarrow[Et_2O]{CH_3MgI} \xrightarrow{H_3O^{\oplus}}$

(c) $CH_3-CH_2-CH_2-C\equiv N \xrightarrow[Et_2O]{CH_3MgI} \xrightarrow{H_3O^{\oplus}}$

(d) $CH_3-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow[Et_2O]{CH_3MgI} \xrightarrow{H_3O^{\oplus}}$

8. 

; Dimethyl phthalate

Number of moles (x) of Grignard reagent consumed in the above reaction is :

(a) 2 (b) 3 (c) 4 (d) 5

9. $Ph-\overset{OH}{\overset{|}{C}}-CH_3$ with CH_2-CH_3 on the central carbon

$$Ph-\underset{CH_2-CH_3}{\underset{|}{\overset{OH}{\overset{|}{C}}}}-CH_3$$

Which of the following combinations can not be used to prepare alcohol given above ?

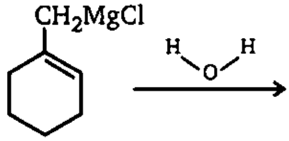
(a) PhMgBr + 2-butanone $\xrightarrow{NH_4Cl}$

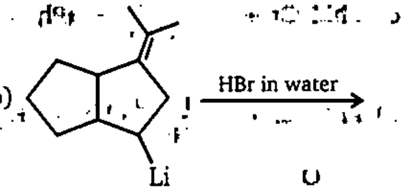
(b) EtMgBr + $Ph-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow{NH_4Cl}$

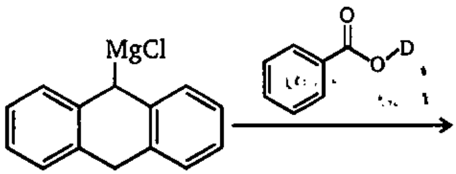
(c) $CH_3MgBr + Ph-\overset{O}{\overset{\|}{C}}-Et \xrightarrow{NH_4Cl}$

(d) $EtMgBr + Ph-\overset{O}{\overset{\|}{C}}-CH_2-CH_3 \xrightarrow{NH_4Cl}$

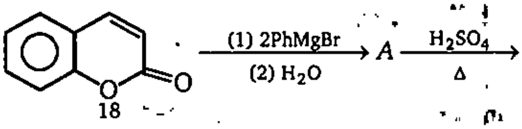
17. In which of the following reaction an acid-base reaction takes place ?

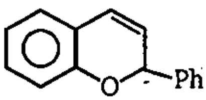
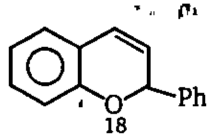
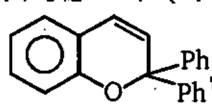
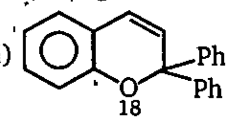
(a) 

(b) 

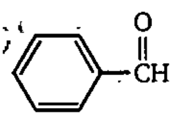
(c) 

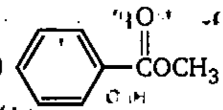
(d) All of these

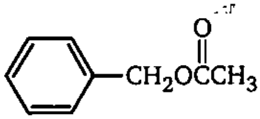
18.  (B), Product (B) in this reaction is :

(a)  (b)  (c)  (d) 

19. All of the following compounds react with ethylmagnesium bromide. Alcohols are formed from three of the compounds. Which one does not give an alcohol ?

(a) 

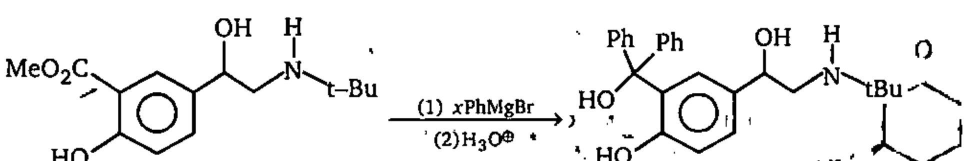
(b) 

(c) 

(d) Ph – O – C(=O) – O – H

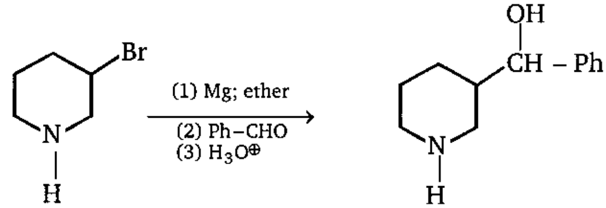
20. A student was carrying out a Grignard reaction between PhMgBr and ethyl benzoate. She ran out of anhydrous ether just after the Grignard reagent was made. Which of the following solvents can still be used to dissolve the ethyl benzoate for its reaction with already formed PhMgBr ?

(a) acetone (b) ethyl acetate (c) absolute alcohol (d) benzene

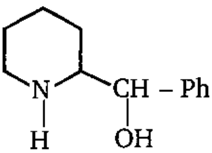
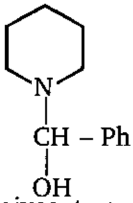
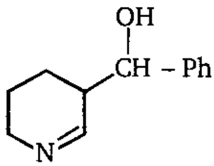
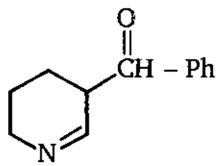
21. 

Number of equivalents of Grignard reagent (x) used in reaction (1) is :

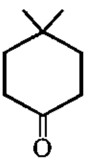
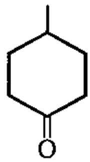
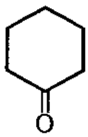
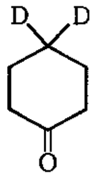
(a) 3 equivalent (b) 4 equivalent (c) 5 equivalent (d) 6 equivalent

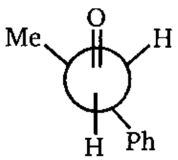
22. 

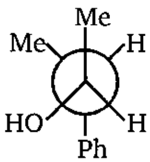
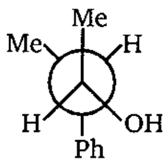
The given product can not be obtained in the above reaction. Identify the correct product obtained.

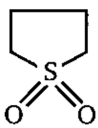
(a)  (b)  (c)  (d) 

23. Which of the following gives two isomers of 3° alcohol, when treated with phenyl magnesium bromide ?

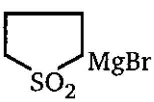
(a)  (b)  (c)  (d) 

24.  $\xrightarrow{MeMgBr}$ Product of the reaction is :

(a)  (b)  (c) Both (a) and (b) (d) None of these

25.  $\xrightarrow{RMgBr}$ Product; The product of the reaction is :

(a) $HSO_2—CH_2—CH_2—CH_2—CH_2—R$ (b) $H—SO_2(CH_2)_3—R$

(c)  (d) $H—SO_2(CH)_3—R$

26. When carboxylic acid reacts with organolithium reagents to give ketones, side reaction sometimes occur. For example,

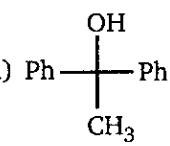
$$\underset{\text{}}{HOCH_2CH_2\overset{\overset{\large CH_3}{|}}{C}HCH_2CH_2\overset{\overset{\large O}{\|}}{C}OH} \xrightarrow[\text{tetrahydro furan}]{(x)\ CH_3Li} \xrightarrow[H_2]{NH_4Cl}$$

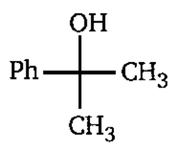
$$\underset{\text{Compound } A\ 63\%}{HOCH_2CH_2\overset{\overset{\large CH_3}{|}}{C}HCH_2CH_2-\overset{\overset{\large O}{\|}}{C}-CH_3} + \underset{37\%}{\text{compound } (B)}$$

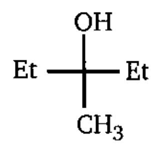
Value of (x) in above reaction is :

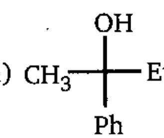
(a) 2 (b) 3 (c) 4 (d) 5

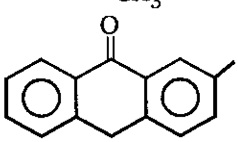
27. Which of the following alcohol can not be prepared by the reaction of acid chloride with excess of Grignard reagent followed by acidification ?

(a) 

(b) 

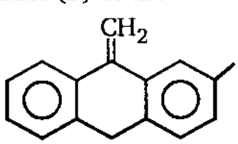
(c) 

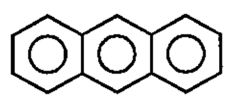
(d) 

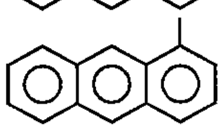
28. 

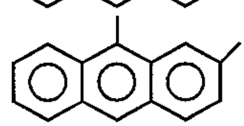
$\xrightarrow[\text{(ii) } NH_4Cl]{\text{(i) MeMgI}} (A) \xrightarrow[\Delta]{H^+} \underset{\text{(major)}}{(B)}$;

Product (B) of the above reaction is :

(a) 

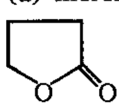
(b) 

(c) 

(d) 

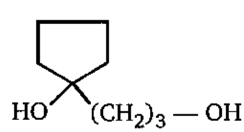
29. The reaction of elemental sulphur with Grignard reagent followed by acidification leads to the formation of

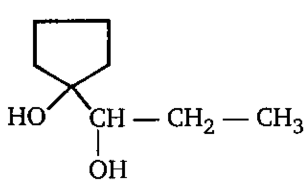
(a) mercaptan (b) sulphoxide (c) thioether (d) sulphonic acid

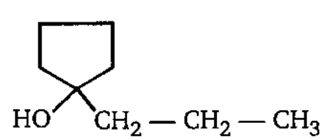
30. 

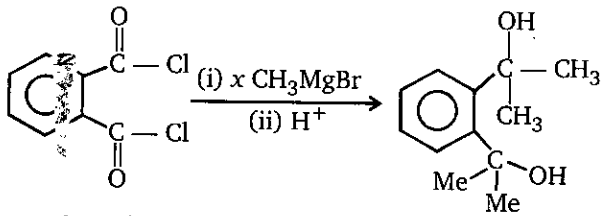
$+ MgBrCH_2CH_2CH_2CH_2MgBr \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) THF}}$ product; Product of the reaction is :

(a) $HO-(CH_2)_3-\overset{\overset{\large O}{\|}}{C}-CH_2-CH_2-CH_3$

(b) 

(c) 

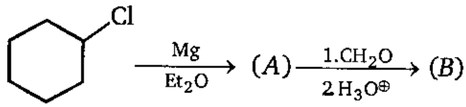
(d) 

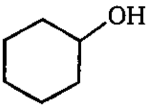
31. 

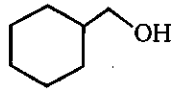
Number of moles of CH_3MgBr consumed in above reaction is :

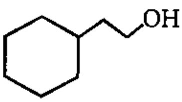
(a) 2 (b) 4 (c) 6 (d) 8

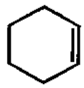
32. End product of the given reaction is :



(a) 

(b) 

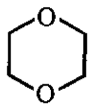
(c) 

(d) 

33. Which of the following compound is not a suitable solvent for Grignard reaction ?

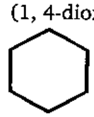
(a) 

(THF)

(b) 

(1, 4-dioxane)

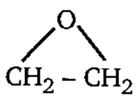
(c) $CH_3-O-CH_2-CH_2-O-CH_3$

(d) 

34.  (2 mole) $\xrightarrow[Et_2O]{Mg}$ Predict major product of the reaction :

(a)  (b)  (c)  (d) 

35. Which of the following reaction sequences would be the best for synthesis of t-butyl alcohol ?

(a) CH_3CH_2MgBr +  $\xrightarrow{Et_2O} \xrightarrow{H_3O^{\oplus}}$

(b) $CH_3CH_2CH_2MgBr \xrightarrow[Et_2O]{CO_2} \xrightarrow{H_3O^{\oplus}}$

(c) $CH_3MgBr + CH_3-\overset{\overset{\large O}{\|}}{C}-CH_3 \xrightarrow{Et_2O} \xrightarrow{H_3O^{\oplus}}$

(d) $CH_3CH_2MgBr + CH_3-\overset{\overset{\large O}{\|}}{C}-H \xrightarrow{Et_2O} \xrightarrow{H_3O^{\oplus}}$

36. What is the major product of the following reaction ?

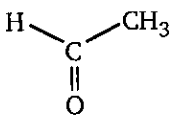
$$CH_3-C\equiv N \xrightarrow[Et_2O]{CH_3MgI} \xrightarrow{H_3O^{\oplus}}$$

(a) $CH_3-CH_2-NH-CH_3$

(b) $CH_3-\overset{\overset{\displaystyle N-H}{\|}}{C}-CH_3$

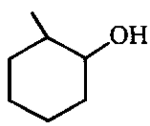
(c) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$

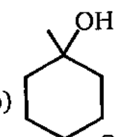
(d) $CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-OH$

37.  $\xrightarrow[(2)\,H^+]{(1)\ PhMgBr}$ Products; Product obtained in this reaction are :

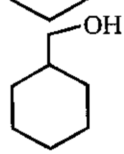
(a) diastereomers (b) racemic (c) pure enantiomer (d) meso

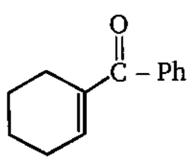
38. $CH_3CO_2Et + (CH_2)_5(MgBr)_2 \xrightarrow[(2)\ H^+]{} \underset{(A)}{C_7H_{14}O}$; compound (*A*) will be :

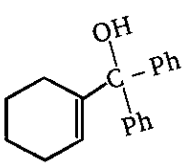
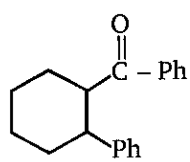
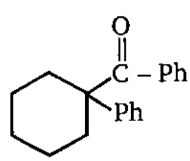
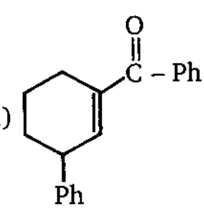
(a) 

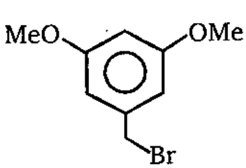
(b) 

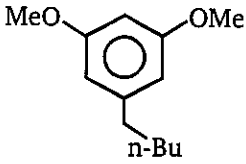
(c) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-(CH_2)_4-CH_3$

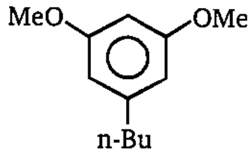
(d) 

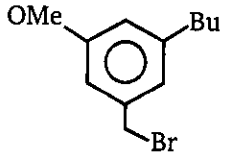
39.  $\xrightarrow[(2)\ H^+]{(1)\ PhMgBr/CuCl} \underset{C_{19}H_{20}O}{(A)}$; *A* will be :

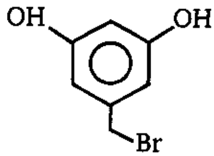
(a)  (b)  (c)  (d) 

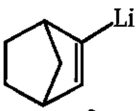
40.  $\xrightarrow[(n-Bu=n-butyl\ group)]{n-Bu_2CuLi}$ Product of the reaction will be :

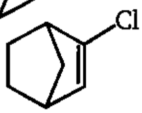
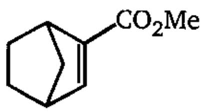
(a) 

(b) 

(c) 

(d) 

41.  $\xrightarrow{Cl-\overset{O}{\overset{\|}{C}}-O-Me}$ (?) ; Product of this reaction is :

(a)  (b)  (c)  (d) 

42. Ethyl acetoacetate when reacts with one mole methyl magnesium iodide then product of reaction will be :

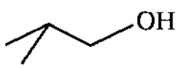
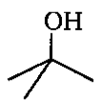
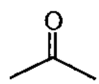
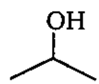
(a) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

(b) $CH_3-\underset{CH_3}{\overset{O^{\ominus}\overset{\oplus}{Mg}Br}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

(c) $CH_3-\overset{O}{\overset{\|}{C}}-\underset{\overset{\oplus}{Mg}Br}{\overset{\ominus}{C}H}-CO_2Et$

(d) $CH_2^- - \overset{O}{\overset{\|}{C}}-CH_2-CO_2Et$

43. $\underset{(excess)}{CH_3MgBr} + Et-O-\overset{O}{\overset{\|}{C}}-O-Et \xrightarrow[(2)\ H^{\oplus}]{} (A)$; Product A is :

(a)  (b)  (c)  (d) 

44. For the sequence of reactions, $A \xrightarrow[\text{ether}]{C_2H_5MgI} B \xrightarrow{H_2O/H^+}$ tert-Pentyl alcohol. The compound A in the sequence is :

(a) 2-Butanone (b) Acetaldehyde (c) Acetone (d) Propanal

45. $PhMgBr + CH_3-CN \xrightarrow[H_3O^{\oplus}]{} (A)$ $Ph-\overset{O}{\overset{\|}{C}}-O-H \xrightarrow[(2)\ H_3O]{(1)\ \text{excess } CH_3-Li} (A)$

Same product (A) will form in both reactions. A is :

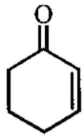
(a) $Ph-\underset{CH_3}{\overset{OH}{C}}-CH_3$ (b) $Ph-CHO$ (c) $Ph-\overset{O}{\overset{\|}{C}}-CH_3$ (d) $Ph-CH_2-CO_2H$

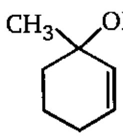
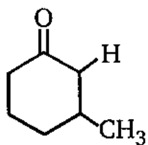
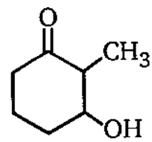
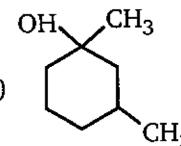
46. Which of the following Grignard reagent can be prepared ?

(a) $Br-Mg-CH_2-CH_2-CH_2-O-H$ (b) $Br-Mg-CH_2-CH_2-SH$

(c) $BrMg-CH_2-CH_2-NH_2$ (d) $BrMg-CH_2-CH_2-\underset{\substack{|\\CH_3}}{N}-CH_3$

47. In the reaction sequence :

 $\xrightarrow[\text{(ii) } H_2O/H^+]{\text{(i) } CH_3MgBr/CuCl}$ (X), Product (X) will be :

(a)  (b)  (c)  (d) 

48. $(C_2H_5O)_2CO \xrightarrow[H_3O^+]{CH_3MgBr(\text{excess})} A$. A (alcohol) can also be obtained by :

(a) $CH_3CH_2CHO \xrightarrow[H_3O^+]{CH_3MgBr(2\text{mol})}$ (b) $CH_3\overset{\overset{O}{\|}}{C}OC_2H_5 \xrightarrow[H_3O^+]{CH_3MgBr(2\text{ mol})}$

(c) $CH_3\overset{\overset{O}{\|}}{C}CH_3 \xrightarrow[H_3O^+]{CH_3MgBr\ (1\text{mol})}$ (d) as in (b) and (c)

49. The principal product of the reaction between methyl butanoate and 2 moles of CH_3MgBr after hydrolysis is :

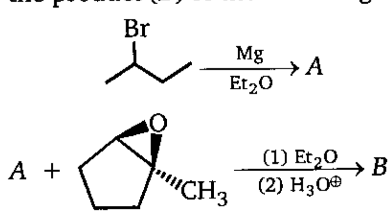
(a) $C_3H_7COCH_3$ (b) $C_3H_7C(OH)(CH_3)_2$

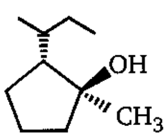
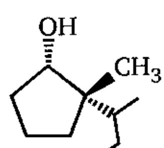
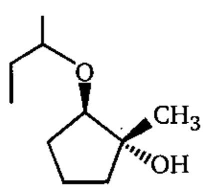
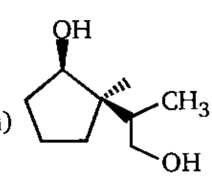
(c) $C_3H_7CHOHCH_3$ (d) $C_3H_7COCH(CH_3)_2$

50. Which of the following compounds will form hydrocarbon on reaction with Grignard reagent ?

(a) CH_3CH_2OH (b) CH_3CHO (c) CH_3COCH_3 (d) $CH_3CO_2CH_3$

51. What is the product (B) of the following reaction sequence ?



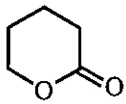
(a)  (b)  (c)  (d) 

52. Which, if any, of the following pairs of reagents could be used to prepare 2-phenyl-2-butanol?

(a) $CH_3CH_2MgBr + Ph-\overset{O}{\overset{\|}{C}}-CH_3$ (b) $CH_3CH_2MgBr + C_6H_5CH_2\overset{O}{\overset{\|}{C}}H$

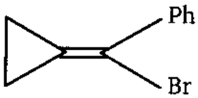
(c) $CH_3MgI + C_6H_5CH_2\overset{O}{\overset{\|}{C}}CH_3$ (d) $C_6H_5MgCl + CH_3\overset{O}{\overset{\|}{C}}CH_2CH_2CH_3$

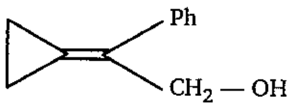
53. What is the product of the following reaction?

 $+ 2CH_3MgBr \xrightarrow[\text{2. } H_3O^+]{\text{1. diethyl ether}}$ Product

(a) $HO-\underset{CH_3}{\underset{|}{C}}HCH_2CH_2CH_2\underset{CH_3}{\underset{|}{C}}H-OH$ (b) $CH_3OCH_2CH_2CH_2CH_2\underset{OH}{\underset{|}{C}}HCH_3$

(c) $HOCH_2CH_2CH_2CH_2\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-OH$ (d) $HOCH_2CH_2CH_2CH_2\underset{CH_3}{\underset{|}{C}}HOCH_3$

54.  $\xrightarrow[\text{ether}]{Mg} A \xrightarrow[\text{2. } H^+]{\text{1. HCHO}} B$; Product (B) is :

(a) 

(b) $Ph-C\equiv C-CH_2-CH_2-CH_2-OH$

(c) $Ph-C\equiv C-CH_2-CH_2-OH$

(d) $Ph-CH_2-C\equiv C-CH_2-CH_2-OH$

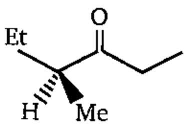
55. What sequence of steps represents the best synthesis of 4-heptanol $(CH_3CH_2CH_2)_2CHOH$?

(a) $CH_3CH_2CH_2MgBr$(2moles) + formaldehyde ($H_2C=O$) in diethyl ether followed by H_3O^+

(b) $CH_3CH_2CH_2MgBr$ + butanol ($CH_3CH_2CH_2CH=O$) in diethyl ether followed by H_3O^+

(c) $CH_3CH_2CH_2CH_2MgBr$ + acetone [$(CH_3)_2C=O$] in diethyl ether followed by H_3O^+

(d) $(CH_3CH_2CH_2)_2CHMgBr$ + formaldehyde ($H_2C=O$) in diethyl ether followed by H_3O^+

56.  $\xrightarrow[\text{(2) } NH_4Cl]{\text{(1) MeMgBr}}$ Comment on stereochemistry of products :

(a) diastereomers (b) racemic

(c) single stereoisomer (d) meso

57. $\begin{matrix} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-SH \end{matrix} + \underset{\text{(Excess)}}{CH_3MgBr} \longrightarrow xCH_4$

What is the value of x in the above reaction ?

(a) 1 (b) 2
(c) 3 (d) 4

58. 0.40 g of an organic compound (A), (M.F.- C_5H_8O) reacts with x mole of CH_3MgBr to liberate 224 mL of a gas at STP. With excess of H_2, (A) gives pentan-1-ol. The correct structure of (A) is :

(a) $CH_3-C\equiv C-CH_2-CH_2-OH$
(b) $CH_3-CH_2-C\equiv C-CH_2-OH$
(c) $H-C\equiv C-CH_2-CH_2-CH_2-OH$
(d) $H-C\equiv C-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3$

59. $CH_3-CH=CH_2 \xrightarrow[\text{hv (low conc.)}]{Br_2} \xrightarrow[\text{Dry ether}]{Mg} \xrightarrow[NH_4Cl]{CH_3-\overset{\overset{O}{||}}{C}-CH_3} \xrightarrow[\Delta]{H^+} \underset{\text{(major)}}{(X)}$

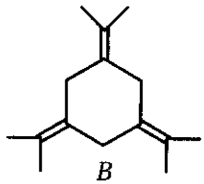
End product (X) of the above reaction is :

(a) $CH_2=CH-CH_2-\overset{\overset{CH_2}{||}}{C}-CH_3$
(b) $H_2C=CH-CH=\underset{\underset{CH_3}{|}}{C}-CH_3$
(c) $H_2C=CH-CH_2-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$
(d) $H_2C=CH-CH_2-CH-\underset{\underset{CH_3}{|}}{CH_2}-OH$

60. $\underbrace{CH_2-CH}_{O}-CH_2-Br \xrightarrow[\text{dry ethane}]{Mg} (A) \xrightarrow{CH_3I} (B)$; Product ($B$) is :

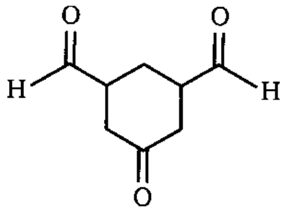
(a) $\underbrace{CH_2-CH}_{O}-CH_2-CH_3$ (b) $CH_3-O-CH_2-CH_2-CH_3$
(c) $H_2C=CH-CH_2-O-CH_3$ (d) $\underbrace{H_2C-CH}_{O}-CH_3$

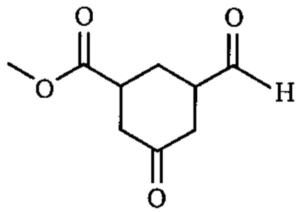
61. Compound A was treated with a large excess of CH_3MgBr. The resulting product was exposed to $POCl_3$/pyridine to give compound B, as one of many products :

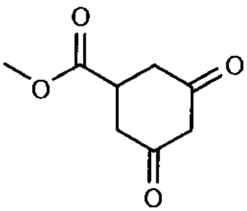


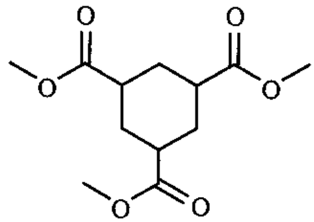
B

Which of the following compounds can be A ?

(a) 

(b) 

(c) 

(d) 

62. Identify product Z in the following reaction sequence :

$$H_2C = CHCH_2Br \xrightarrow{\text{NaCN}} Y \xrightarrow[\text{2. } H_3O^+]{\text{1. } C_6H_5MgBr, \text{ diethylether}} Z$$

(a) $H_2C = CHCH_2\overset{\overset{\displaystyle O}{\|}}{C}C_6H_5$

(b) $H_2C = CHCH_2NH\overset{\overset{\displaystyle O}{\|}}{C}C_6H_5$

(c) $H_2C = CHCH_2\overset{\overset{\displaystyle OH}{|}}{C}HC_6H_5$

(d) $H_2C = CHCH_2\overset{\overset{\displaystyle NH_2}{|}}{C}H\ C_6H_5$

ANSWERS — LEVEL 1															
1.	(b)	**2.**	(d)	**3.**	(b)	**4.**	(d)	**5.**	(c)	**6.**	(d)	**7.**	(c)	**8.**	(c)
9.	(d)	**10.**	(c)	**11.**	(b)	**12.**	(b)	**13.**	(b)	**14.**	(c)	**15.**	(b)	**16.**	(b)
17.	(d)	**18.**	(d)	**19.**	(d)	**20.**	(d)	**21.**	(c)	**22.**	(b)	**23.**	(b)	**24.**	(c)
25.	(c)	**26.**	(b)	**27.**	(d)	**28.**	(d)	**29.**	(a)	**30.**	(b)	**31.**	(b)	**32.**	(b)
33.	(d)	**34.**	(b)	**35.**	(c)	**36.**	(c)	**37.**	(b)	**38.**	(b)	**39.**	(b)	**40.**	(a)
41.	(b)	**42.**	(c)	**43.**	(b)	**44.**	(c)	**45.**	(c)	**46.**	(d)	**47.**	(b)	**48.**	(d)
49.	(b)	**50.**	(a)	**51.**	(a)	**52.**	(a)	**53.**	(c)	**54.**	(b)	**55.**	(b)	**56.**	(a)
57.	(c)	**58.**	(c)	**59.**	(b)	**60.**	(c)	**61.**	(d)	**62.**	(a)				

LEVEL-2

1. Comprehension

Grignard reagent is usually prepared by

$R-X + Mg \xrightarrow{Et_2O} RMgX$ Grignard reagent

$Ar-X + Mg \xrightarrow{Et_2O} ArMgX$ Grignard reagent

Grignard reagent acts as a strong base. Grignard reagent carry out nucleophilic attack in absence of acidic hydrogen. Grignard reagent form complex with its ether solvent. Complex formation with molecule of ether is an important factor in the formation and stability of Grignard reagent.

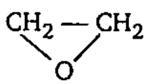
A. What is the correct order of reactivity of halides with magnesium ?

(a) $R-Cl > R-Br > R-I$
(b) $R-Br > R-Cl > R-I$
(c) $R-I > R-Br > R-Cl$
(d) $R-I = R-Br = R-Cl$

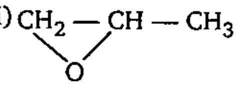
B. Which of the following will undergo acid-base reaction with Grignard reagent ?

(a) $HC \equiv CH$
(b) $R-OH$
(c) $R-CO_2H$
(d) All of these

C. Which of the following reactants give primary alcohol as a major product when reacts with $RMgX$ followed by acidification ?

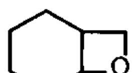
(i) 

(ii) $H-\overset{O}{\overset{\|}{C}}-H$

(iii) 

(iv) $CH_3-\overset{O}{\overset{\|}{C}}-H$

(v) 

(vi) 

(a) i, ii, v
(b) i, ii, v, vi
(c) ii, iv, vi
(d) v, iv, iii, vi

D. $Cl-\overset{O}{\overset{\|}{C}}-O-Et \xrightarrow[(2)\ NH_4Cl]{(1)\ xRMgX} 3°$ alcohol. Value of x is :

(a) 2
(b) 3
(c) 4
(d) 5

E. $H-O-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-O-Et \xrightarrow[(2)\ H^+]{(1)\ x\ PhMgBr} HO-CH_2-CH_2-\underset{Ph}{\underset{|}{\overset{OH}{\overset{|}{C}}}}-Ph$, Value of x is :

(a) 2
(b) 3
(c) 4
(d) 5

F. Which of the following Grignard reagents is not possible ?

(a) $HS-CH_2-CH_2-CH_2MgBr$ (b) $HO-CH_2-CH_2-CH_2MgBr$

(c) $NH_2-CH_2-CH_2-CH_2MgBr$ (d) All of these

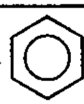
G. How many different Grignard reagents when react with EtOH, give n-butane as product (excluding stereoisomerism).

(a) 1 (b) 2 (c) 3 (d) 4

2. Match the column I and II. (Matrix)

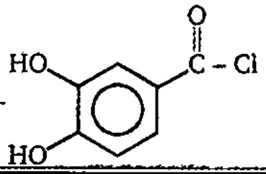
Column (I)		Column (II)	
Reactant		**Product**	
(a)	$\underset{(excess)}{PhMgBr}+Cl-\overset{O}{\overset{\|\|}{C}}-O-Et\xrightarrow[H^{\oplus}]{}$	**(p)**	$Ph-CH_2-OH$
(b)	$\underset{(excess)}{PhMgBr}+H-\overset{O}{\overset{\|\|}{C}}-O-Et\xrightarrow[H^{\oplus}]{}$	**(q)**	$Ph-\underset{OH}{\underset{\|}{CH}}-Ph$
(c)	$\underset{(excess)}{PhMgBr}+H-\overset{O}{\overset{\|\|}{C}}-H\xrightarrow[H^{\oplus}]{}$	**(r)**	$Ph-\overset{OH}{\overset{\|}{\underset{Ph}{\underset{\|}{C}}}}-Ph$
(d)	$\underset{(excess)}{PhMgBr}+CH_3-\overset{O}{\overset{\|\|}{C}}-O-Et\xrightarrow[H^{\oplus}]{}$	**(s)**	$Ph-\overset{OH}{\overset{\|}{\underset{CH_3}{\underset{\|}{C}}}}-Ph$

3. Match the column I and II. (Matrix)

Column (I)		Column (II)	
Reaction		**Reactant**	
(a)	$PhMgBr + (A) \xrightarrow[H^{\oplus}]{} 1^{\circ}$alcohol	**(p)**	$CH_3-\overset{O}{\overset{\|\|}{C}}-CH_2-\overset{O}{\overset{\|\|}{C}}-CH_3$
(b)	$PhMgBr + (B) \xrightarrow[H^{\oplus}]{} 2^{\circ}$alcohol	**(q)**	$CH_3-\overset{O}{\overset{\|\|}{C}}-CH_3$
(c)	$PhMgBr + (C) \xrightarrow[H^{\oplus}]{} 3^{\circ}$alcohol	**(r)**	$CH_3-\overset{O}{\overset{\|\|}{C}}-H$
(d)	$PhMgBr + (D) \xrightarrow[H^{\oplus}]{}$ 	**(s)**	$H-\overset{O}{\overset{\|\|}{C}}-H$

Match the missing reactant A, B, C, D

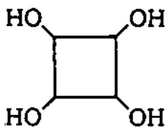
4. Match the column I and II. (Matrix)

Column (I)		Column (II)	
Reaction		**Moles of PhMgBr used**	
(a)	$PhMgBr + Et-O-\overset{\overset{O}{\parallel}}{C}-O-Et \xrightarrow[H^{\oplus}]{} 3^{o}alcohol$	**(p)**	1
(b)	$PhMgBr + HO-CH_2-\overset{\overset{O}{\parallel}}{C}-CH_3 \xrightarrow[H^{\oplus}]{} 3^{\circ}\ alcohol$	**(q)**	2
(c)	$PhMgBr + CH_3-\overset{\overset{O}{\parallel}}{C}-CH_3 \xrightarrow[H^{\oplus}]{} 3^{o}alcohol$	**(r)**	3
(d)	PhMgBr +  $\xrightarrow[H^{\oplus}]{}$ 3°alcohol	**(s)**	4

5. When 20 g of a compound (*A*) (M.F. = $C_4H_{10}O_4$) reacts with excess of CH_3MgBr, 14.6 L of CH_4 is obtained at STP. What is structural formula of (*A*) ?

(a) CH_2-OH | $(CH-OH)_2$ | CH_2-OH

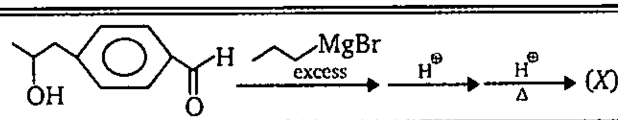
(b) $HO-CH_2-\underset{\underset{OH}{|}}{\overset{\overset{CH_2OH}{|}}{C}}-CH_2OH$

(c) 

(d) Both (a) & (b)

SUBJECTIVE PROBLEMS

1.



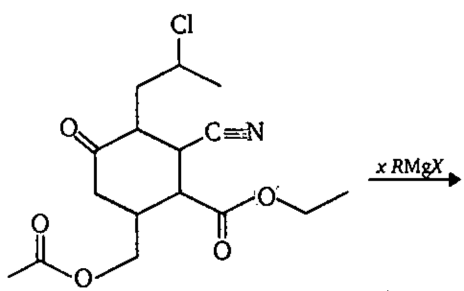
How many geometrical isomer of (*X*) is possible ?

2. How many isomer of C_4H_8O when reacts with CH_3MgBr followed by acidification to give 2° alcohol (only consider carbonyl isomers)?

(including stereoisomer)

3.

Total number of *RMgX* are consumed in the following reaction



4. How many isomers of $C_4H_{10}O$ reacts with CH_3MgBr to evolve CH_4 gas ? (Excluding stereoisomer)

ANSWERS — LEVEL 2

1. A – c; B – d; C – a; D – b; E – b; F – d; G – b
2. a – r; b – q; c – p; d – s
3. a – s; b – r; c – q; d – p
4. a – r; b – q; c – p; d – s
5. (d)

Subjective Problems

1. 4 **2.** 2 **3.** 7 **4.** 4

4A HYDROCARBONS (ALKANES)

LEVEL-1

1. On halogenation, an alkane gives only one monohalogenated product. The alkane may be :
   (a) 2-methyl butane
   (b) 2, 2-dimethyl propane
   (c) cyclopentane
   (d) both (b) and (c)

2. Which of the following compounds can be best prepared by Wurtz-reaction ?
   (a) Iso-butane
   (b) *n*-butane
   (c) *n*-pentane
   (d) Iso-pentane

3. A hydrocarbon *A* (V.D. = 36) forms only one monochloro substitution product. *A* will be :
   (a) iso-pentane
   (b) neo-pentane
   (c) cyclohexane
   (d) methyl-cyclohexane

4. Ethyl iodide and *n*-propyl iodide are allowed to undergo Wurtz reaction. The alkane which will not be obtained in this reaction is :
   (a) butane
   (b) propane
   (c) pentane
   (d) hexane

5. $$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3 \xrightarrow[h\nu]{Cl_2}$$

   Number of chiral centers generated during monochlorination in the above reaction :
   (a) 1
   (b) 2
   (c) 3
   (d) 4

6. $CH_3Cl \longrightarrow CH_4$

Above conversion can be achieved by :

(a) Zn / H^+ (b) $LiAlH_4$

(c) Mg / (ether) then H_2O (d) all of these

7. n-Butane $\xrightarrow{Cl_2/h\nu}$

Give the total number of monochloro products(including stereoisomers), which are possible in the above reaction.

(a) 2 (b) 3 (c) 4 (d) 5

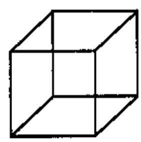
8. $CH_4 + Cl_2 \xrightarrow{h\nu} CH_3Cl + HCl$

To obtain high yields of CH_3Cl, the ratio of CH_4 to Cl_2 must be :

(a) high (b) low

(c) equal (d) can't be predicted

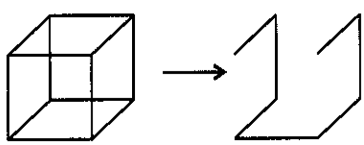
9. Double bond equivalent of cubane is :



Cubane

(a) 4 (b) 5 (c) 6 (d) 7

10. How many bond cleavages are required to convert cubane into non-cyclic skeleton ?

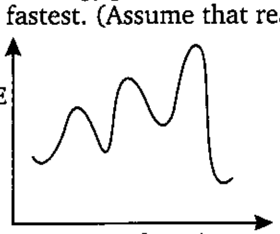


Cubane Non-cyclic skeleton

(a) 2 (b) 3 (c) 4 (d) 5

11. Draw an energy profile diagram for a three step reaction in which first step is slowest and last step is fastest. (Assume that reaction is exothermic)

(a) PE

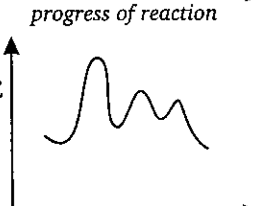


progress of reaction

(b) PE

progress of reaction

(c) PE

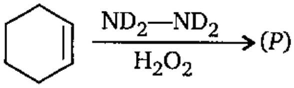


progress of reaction

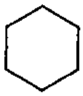
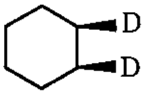
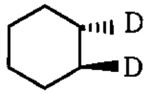
(d) None of these

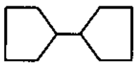
12. $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2—CH_3 \xrightarrow[h\nu]{Cl_2} (x)$ = Number of monochloro product including stereoisomers.

(a) 4 (b) 5 (c) 6 (d) 7

13. 

Product (*P*) is :

(a)  (b)  (c)  (d) both (b) & (c)

14. $(A) \xrightarrow{H_2(1mole)/Pt}$ 

Double bond equivalent (degree of Unsaturation) of (*A*) is :

(a) 1 (b) 2 (c) 3 (d) 4

15. Arrange the following alkanes in decreasing order of their heats of combustion.

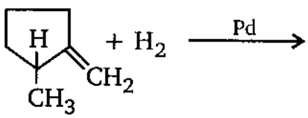
(i) $CH_3—\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}—CH_3$ (Neo–pentane) (i)

(ii) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2—CH_3$ (Iso–pentane) (ii)

(iii) $CH_3—CH_2—CH_2—CH_2—CH_3$ (*n*–pentane)

(a) (i) > (ii) > (iii) (b) (iii) > (i) > (ii)

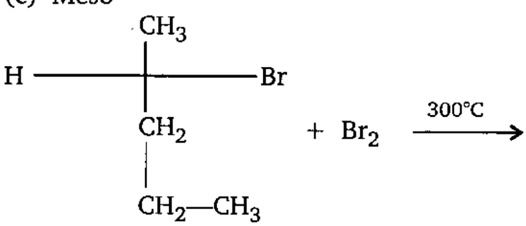
(c) (iii) > (ii) > (i) (d) (i) > (iii) > (ii)

16. 

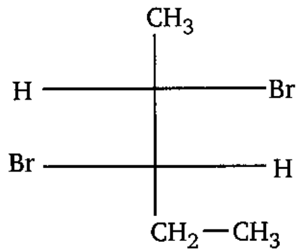
Product of the above reaction will be :

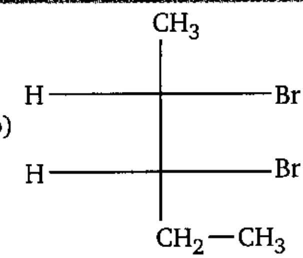
(a) Racemic mixture (b) Diastereomers

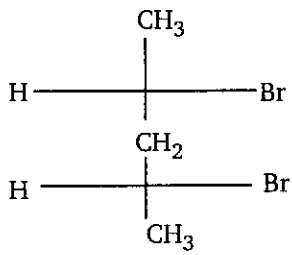
(c) Meso (d) Constitutional isomers

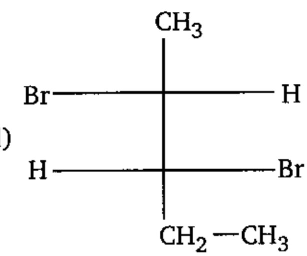
17. 

Which of the following compound will not be obtained as a product in the above reaction ?

(a) 

(b) 

(c) 

(d) 

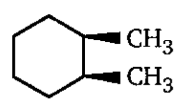
18. Following are the structures of four isomer of hexane. Among the names given below, which correctly identifies the fifth isomer ?

$CH_3CH_2CH_2CH_2CH_2CH_3$ $\quad$ $(CH_3)_3CCH_2CH_3$

$(CH_3)_2CHCH_2CH_2CH_3$ $\quad$ $(CH_3)_2CHCH(CH_3)_2$

(a) 2-Methyl pentane
(b) 2-Ethyl butane
(c) 2,3-Dimethyl butane
(d) 3-Methyl pentane

19. Which of the following describes the best relationship between the methyl groups in the chair conformation of the substance shown below ?



(a) Trans
(b) Anti
(c) Gauche
(d) Eclipsed

20. Compare the stabilities of the following two compounds (*A*) and (*B*):

A : *cis*-1-ethyl-3-methyl cyclohexane $\quad$ *B* : *trans*-1-ethyl-3-methyl cyclohexane

(a) *A* is more stable
(b) *B* is more stable
(c) *A* and *B* are of equal stability
(d) No comparison can be made

21. Which conformation of ethane has the lowest potential energy ?

(a) Eclipsed
(b) Skew
(c) Staggered
(d) All will have equal potential energy

22. Ethane is subjected to combustion process. During the combustion the hybrid state of carbon changes from :

(a) sp^2 to sp^3
(b) sp^3 to sp
(c) sp to sp^3
(d) sp^2 to sp^2

23. $CH_3-CH_2-CH_2-CH_3 \xrightarrow[\Delta]{AlCl_3} CH_3-\underset{\underset{\displaystyle CH_3}{|}}{CH}-CH_3$

Above reaction is an example of :

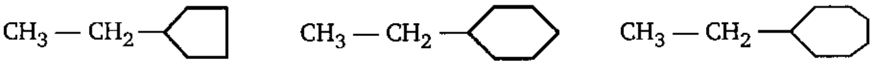
(a) isomerization
(b) polymerization
(c) cracking
(d) de-hydrogenation

24. Which of the following has highest chlorine content ?
(a) Pyrene (b) DDT (c) Chloral (d) Gammaxene

25. Pure methane can be prepared by :
(a) Wurtz reaction
(b) Kolbe electrolysis method
(c) soda-lime de-carboxylation
(d) reduction with H_2

26. Calcium carbide + heavy water $\longrightarrow$?
The product of the above reaction is :
(a) C_2H_2 (b) CaD_2 (c) $Ca(OD)_2$ (d) CD_4

27.



Ethyl cyclopentane (I) Ethyl cyclohexane (II) Ethyl cycloheptane (III)

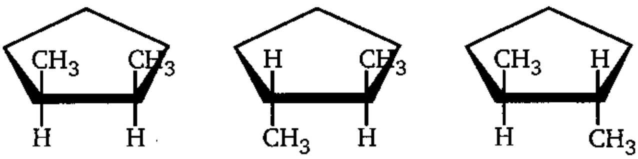
Arrange the compounds I, II and III in decreasing order of their heats of combustion:
(a) II > I > III
(b) I > II > III
(c) III > II > I
(d) III > I > II

28. An alkane (mol. wt. = 86) on bromination gives only two monobromo derivatives (excluding stereoisomers). The alkane is :

(a) $CH_3—CH(CH_3)—CH_2—CH_2—CH_3$
(b) $CH_3—C(CH_3)_2—CH_2—CH_3$
(c) $CH_3—CH(CH_3)—CH(CH_3)—CH_3$
(d) $CH_3—C(CH_3)_2—CH_3$

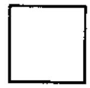
29. Order of the bond strength of C — H bonds involving sp, sp^2 and sp^3 hybridized carbon atoms is :
(a) $sp > sp^2 > sp^3$
(b) $sp^3 > sp^2 > sp$
(c) $sp^2 > sp^3 > sp$
(d) $sp^2 > sp > sp^3$

30.



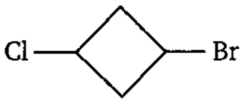
(I) (II) (III)

Among the structures given , select the enantiomers :
(a) I and II
(b) I and III
(c) II and III
(d) I, II and III

31.  (I)  (II)  (III)

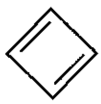
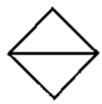
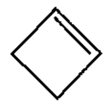
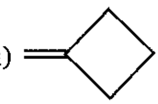
The correct order of reactivity of I, II & III towards addition reactions is :

(a) I > III > II (b) I > II > III (c) III > II > I (d) III > I > II

32. 

$\xrightarrow{\text{Na/Dry ether}}$ (A) 97%

Product (A) of above reaction is :

(a)  (b)  (c)  (d) 

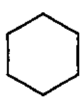
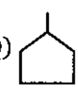
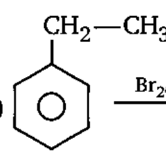
33. Which of the following reactants is suitable for preparation of methane and ethane by using one step only ?

(a) $H_2C = CH_2$ (b) CH_3OH
(c) $CH_3 - Br$ (d) $CH_3 - CH_2 - OH$

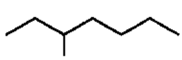
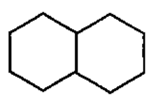
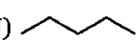
34. How many carbon atoms does an alkane (not a cycloalkane) need before it is capable to exist in enantiomeric form ?

(a) 4 (b) 5 (c) 6 (d) 7

35. Among the following free radical bromination reactions, select those in which 2° halide is the major product —

(P)  $\xrightarrow{Br_2/h\nu}$ (Q)  $\xrightarrow{Br_2/h\nu}$ (R) 

$\xrightarrow{Br_2/h\nu}$

(S)  $\xrightarrow{Br_2/h\nu}$ (T)  $\xrightarrow{Br_2/h\nu}$ (U)  $\xrightarrow{Br_2/h\nu}$

(a) P, Q, R, S (b) P, R, U (c) P, R, S, T (d) P, Q, R, S, T

36. $(A) + Cl_2 \xrightarrow{h\nu}$ monochloro product

To maximise the yield of monochloro product in the above reaction ?

(a) Cl_2 must be added in excess
(b) Reactant (A) must be added in excess
(c) Reaction must be carried out in dark
(d) Reaction must be carried out with equimolar mixture of Cl_2 and A

37. $CH_3 - CH_2 - CH_2 - CH_3 \xrightarrow{Br_2/h\nu}$

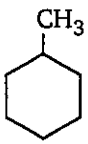
Major product in the above reaction is :

(a) Racemic mixture (b) Meso
(c) Diastereomers (d) Constitutional isomers

38. Select the chain propagation steps in the free-radical chlorination of methane.

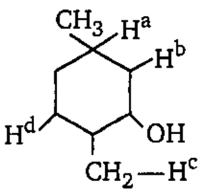
(1) $Cl_2 \longrightarrow 2Cl^{\bullet}$
(2) $Cl^{\bullet} + CH_4 \longrightarrow CH_3Cl + H^{\bullet}$
(3) $Cl^{\bullet} + CH_4 \longrightarrow \dot{C}H_3 + HCl$
(4) $H^{\bullet} + Cl_2 \longrightarrow HCl + Cl^{\bullet}$
(5) $\dot{C}H_3 + Cl_2 \longrightarrow CH_3Cl + Cl^{\bullet}$

(a) 2, 3, 5
(b) 1, 3, 6
(c) 3, 5
(d) 2, 3, 4

39.  $\xrightarrow{Br_2/hv}$ Monobromo derivatives

The number of possible monobromo products is (excluding stereoisomers):

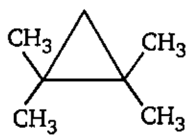
(a) 4 (b) 5 (c) 8 (d) 10

40.  $+ Br^{\bullet} \longrightarrow$

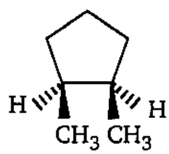
$Br^{\bullet}$ will abstract which of the hydrogen most readily ?

(a) a (b) b (c) c (d) d

41. Arrange the following compounds in decreasing order of their heats of combustion :



(i)



(ii)

(iii)

(a) (iii) > (ii) > (i)
(b) (ii) > (i) > (iii)
(c) (iii) > (i) > (ii)
(d) (i) > (ii) > (iii)

42. $\underset{a}{CH_3}-\underset{b}{CH_2}-\underset{c}{CH_2}-\underset{d}{CH_2}-F$

Arrange the hydrogens *a, b, c, d*, in decreasing order of their reactivities towards chlorination:

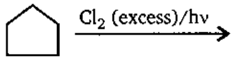
(a) $a > b > c > d$
(b) $b > c > d > a$
(c) $b > c > a > d$
(d) $c > b > a > d$

43. On catalytic reduction (H_2/Pt) how many alkenes will give *n*-butane ?

(a) 1
(b) 2
(c) 3
(d) 4

44. On catalytic reduction (H_2/Pt) how many alkenes will give 2-methylbutane ?

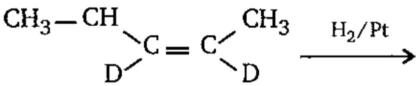
(a) 1
(b) 2
(c) 3
(d) 4

45. 

How many dichloro products are formed in the above reaction (including stereoisomers)?

(a) 5 (b) 6

(c) 7 (d) 9

46. 

Product of the above reaction will be :

(a) Racemic mixture (b) Diastereomers

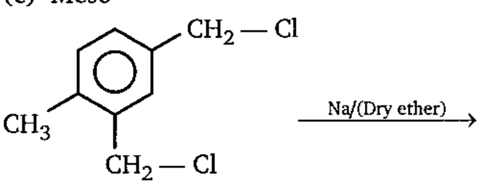
(c) Meso (d) Constitutional isomers

47. $Ph-CH_2-CH(D)-CH_3 \xrightarrow{Br_2/h\nu}$

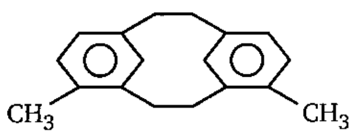
Product of the above reaction will be :

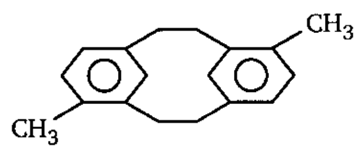
(a) Diastereomers (b) Racemic mixture

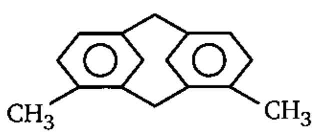
(c) Meso (d) Constitutional isomers

48. 

Products obtained in above Wurtz reaction is :

(a) 

(b) 

(c) 

(d) Both (a) and (b)

49. Rank the transition states that occur during the following reaction steps in order of increasing stability (least → most stable) :

1. $H_3C-\overset{+}{O}H_2 \longrightarrow CH_3^+ + H_2O$

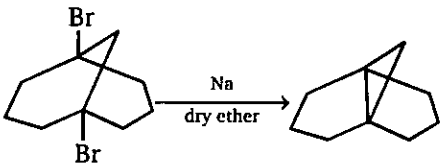
2. $(CH_3)_3C-\overset{+}{O}H_2 \longrightarrow (CH_3)_3C^+ + H_2O$

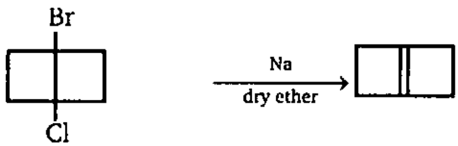
3. $(CH_3)_2CH-\overset{+}{O}H_2 \longrightarrow (CH_3)_2CH^+ + H_2O$

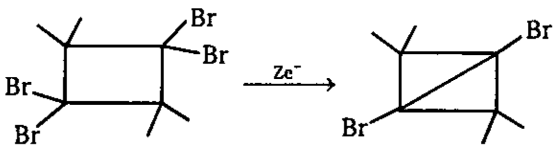
(a) 1 < 2 < 3 (b) 2 < 3 < 1

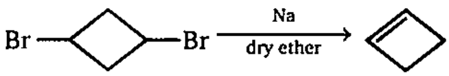
(c) 1 < 3 < 2 (d) 2 < 1 < 3

50. Which of the following does not represent major product of that reaction ?

(a)


(b)


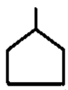
(c)


(d)


ANSWERS — LEVEL 1															
1.	(d)	**2.**	(b)	**3.**	(b)	**4.**	(b)	**5.**	(b)	**6.**	(d)	**7.**	(b)	**8.**	(a)
9.	(b)	**10.**	(d)	**11.**	(c)	**12.**	(c)	**13.**	(b)	**14.**	(c)	**15.**	(c)	**16.**	(b)
17.	(d)	**18.**	(d)	**19.**	(c)	**20.**	(a)	**21.**	(c)	**22.**	(b)	**23.**	(a)	**24.**	(a)
25.	(c)	**26.**	(c)	**27.**	(c)	**28.**	(c)	**29.**	(a)	**30.**	(c)	**31.**	(b)	**32.**	(b)
33.	(c)	**34.**	(d)	**35.**	(b)	**36.**	(b)	**37.**	(a)	**38.**	(c)	**39.**	(b)	**40.**	(a)
41.	(d)	**42.**	(c)	**43.**	(c)	**44.**	(c)	**45.**	(c)	**46.**	(a)	**47.**	(a)	**48.**	(d)
49.	(c)	**50.**	(d)												

1. Comprehension

For the given question (1, 2, 3), consider the following reaction.

 $+ X_2 \xrightarrow{\text{light}}$ monohalogenation product

A. Light is involved in which step of the reaction :

(a) Initiation only (b) Termination only
(c) Propagation only (d) Propagation and Termination

B. Which halogen will give the best yield of a single monohalogenation product ?

(a) F_2 (b) Cl_2 (c) Br_2 (d) I_2

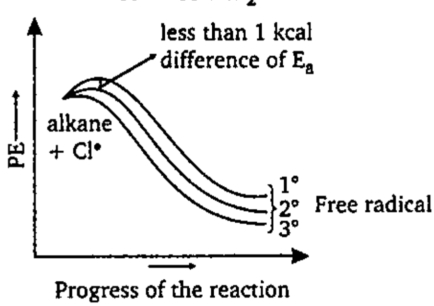
C. How many monohalo derivatives are possible (excluding stereoisomers) ?

(a) 3 (b) 4 (c) 5 (d) 6

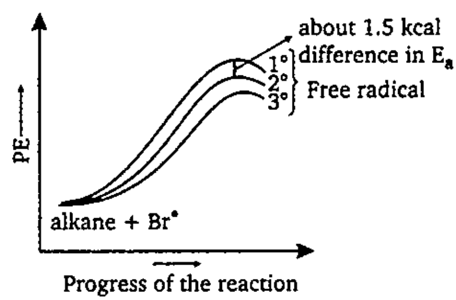
2. Comprehension

Halogenation is a substitution reaction, where halogen replaces one or more hydrogens of hydrocarbon.

$$R - H + X_2 \xrightarrow{h\nu} R - X + HX$$



Chlorination is exothermic and transition state resembles with products



Bromination is endothermic and transition state resembles with products

Chlorine free radical make 1°, 2°, 3° radicals with almost equal ease, whereas bromine free radicals have a clear preference for the formation of tertiary free radicals. So, bromine is less reactive, and more selective whereas chlorine is less selective and more reactive.

The relative rate of abstraction of hydrogen by Br• is

$$\underset{(1600)}{3^\circ} > \underset{(82)}{2^\circ} > \underset{(1)}{1^\circ}$$

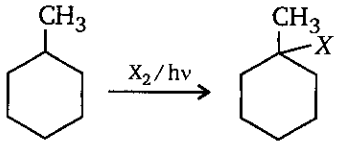
The relative rate of abstraction of hydrogen by Cl• is :

$$\underset{(5)}{3^\circ} > \underset{(3.8)}{2^\circ} > \underset{(1)}{1^\circ}$$

Consider the above argument and answer A to G :

A. 1-halo-2,3-dimethyl butane will be obtained in better yields, if halogen is :

(a) Br_2 (b) Cl_2 (c) I_2 (d) Can't be predicted

B. 

Above product will obtained in better yield if X is

(a) Cl_2 (b) I_2 (c) Br_2 (d) Can't be predicted

C. $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}H-CH_3 \xrightarrow{Cl_2/h\nu}$ Product

Major product in the above reaction is :

(a) $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}H-CH_2-Cl$ (b) $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle Cl}{|}}{C}}H-CH_3$

(c) $CH_3-CH_2-CH_2-Cl$ (d) $CH_3-\underset{\underset{\displaystyle Cl}{|}}{C}H-CH_2-CH_3$

D. Which of the following will give five monochloro products, when allowed to react with Cl_2 in presence of sun light (excluding stereoisomers) ?

(a) n-pentane (b) Iso-pentane (c) 2-methyl-pentane (d) 3-methyl pentane

E. $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-CH_2-\overset{\overset{\displaystyle CH_3}{|}}{C}H-CH_3 \xrightarrow{Br_2/h\nu} CH_3-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-CH_2-CH_2-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle Br}{|}}{C}}-CH_3$

2, Bromo-2, 5, 5 trimethyl hexane (x%)

What is the value of x (% yield of product)?

(a) 18 % (b) 82 % (c) 90 % (d) 60 %

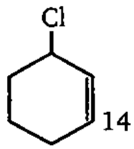
F. What would be the product ratio x/y in the chlorination of propane if all the hydrogen were abstracted at equal rate ?

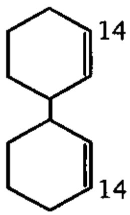
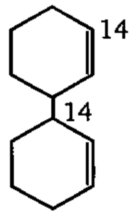
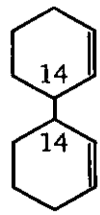
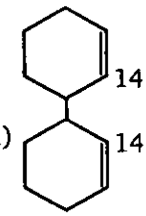
$$CH_3-CH_2-CH_3 \xrightarrow[h\nu]{Cl_2} \underset{(x)}{CH_3-CH_2-CH_2-Cl} + \underset{(y)}{CH_3-\underset{\underset{\displaystyle Cl}{|}}{C}H-CH_3}$$

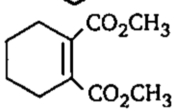
(a) $\frac{1}{3}$ (b) $\frac{3}{1}$ (c) $\frac{9}{1}$ (d) $\frac{1}{9}$

G. How many dichloro products (including stereoisomers) will be formed when R-2-chloropentane reacts with Cl_2 in presence of UV radiation ?

(a) 5 (b) 6 (c) 7 (d) 8

3.  $\xrightarrow[\text{dry ether}]{\text{Na}}$ (A); Product (A) is :

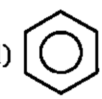
(a)  (b)  (c)  (d) 

4.  $\xrightarrow[\text{Pt}]{H_2\text{ (1 mole)}}$ (A); Product (A) is :

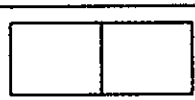
(a) Meso compound (b) Racemic mixture (c) Diastereomers (d) Optically active

5. $Ph—CH_2—\overset{\overset{\displaystyle O}{\|}}{C}—OH \xrightarrow[(2)\ H^{\oplus}]{(1)\ NaOH,\ CaO,\ \Delta} (A)$

Product (A) is :

(a) $Ph—CO_2H$ (b) $Ph—CH_2—OH$ (c) $Ph—CH_3$ (d) 

6. **Match the column I with column II and with column III.**

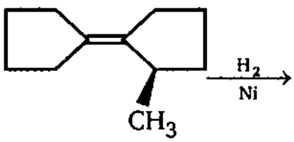
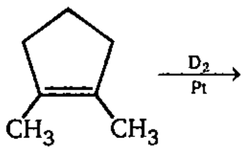
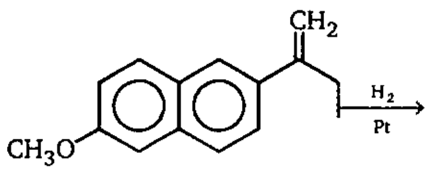
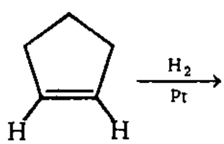
Column (I)		Column (II)		Column (III)	
Compound		Mono-chloro products (excluding stereoisomerism)		Monochloro products (including stereoisomerism)	
(a)		**(p)**	1	**(w)**	1
(b)	$CH_3—\underset{\displaystyle CH_3}{\underset{\vert}{CH}}—CH_2—CH_3$	**(q)**	2	**(x)**	3
(c)	$CH_3—\underset{\displaystyle CH_3}{\underset{\vert}{\overset{\displaystyle CH_3}{\overset{\vert}{C}}}}—\underset{\displaystyle CH_3}{\underset{\vert}{\overset{\displaystyle CH_3}{\overset{\vert}{C}}}}—CH_3$	**(r)**	3	**(y)**	5
(d)	$CH_3—CH_2—CH_2—CH_3$	**(s)**	4	**(z)**	6

7.

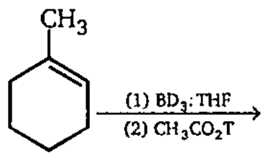
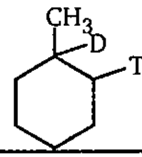
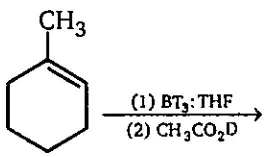
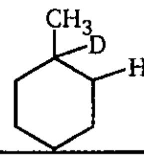
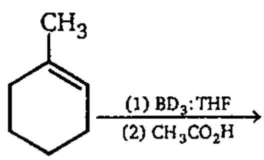
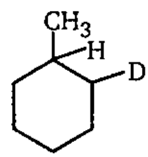
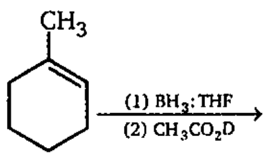
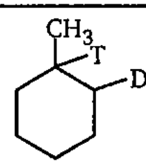
A.	*R*-2-chloropentane $\xrightarrow[hv]{Cl_2}$ Optically active di-chloro products (*P*)
B.	$\boxed{}$ $\xrightarrow[hv]{Cl_2}$ Optically active dichloro products (*Q*)
C.	*R*-2-chlorobutane $\xrightarrow[hv]{Cl_2}$ Optically active di-chloroproducts (*R*)

Sum $P + Q + R$ is :

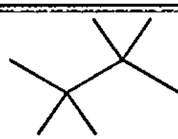
8. Match the column I and II.

Column (I)		**Column (II)**	
Reaction		**Type of Reaction**	
(a)		**(p)**	Meso compound
(b)		**(q)**	Diastereomers
(c)		**(r)**	Racemic
(d)		**(s)**	Optically inactive due to absence of chiral center

9. Match the column :

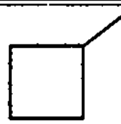
Column (I)		Column (II)	
Reaction		Product	
(a)		(p)	
(b)		(q)	
(c)		(r)	
(d)		(s)	

10. How many distinct monochlorinated products, (including stereoisomers) may be obtained when the alkane shown below is heated in the presence of Cl_2 ?



(a) 1 (b) 2 (c) 3 (d) 4 (e) 6

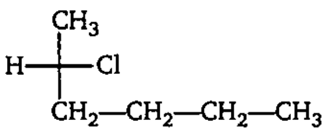
11. How many distinct monochlorinated products, (including stereoisomers) may be obtained when the alkane shown below is heated in the presence of Cl_2 ?



(a) 2 (b) 4 (c) 5 (d) 6 (e) 8

12. Match the column :

	Column (I)		Column (II)
	Wurtz reaction		**Number of dimerization product**
(a)	$CH_3-Cl \xrightarrow[\text{dry ether}]{Na}$	**(p)**	5
(b)	$CH_3-Cl+CH_3-CH_2-Cl \xrightarrow[\text{dry ether}]{Na}$	**(q)**	6
(c)	$CH_3-Cl+CH_3-CH_2-Cl$ $+CH_3-CH_2-CH_2-Cl \xrightarrow[\text{dry ether}]{Na}$	**(r)**	3
(d)	$H_2C=CH-CH=CH-CH_2-Cl$ $+CH_3-CH_2-Cl \xrightarrow[\text{dry ether}]{Na}$	**(s)**	1

13.  $\xrightarrow[h\nu]{Cl_2}$ (x). (x) = total number of di-chloro product

S-2-chloro hexane

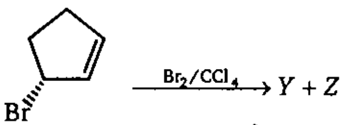
ANSWERS — LEVEL 2

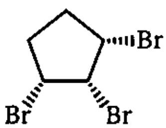
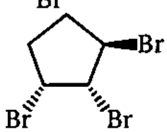
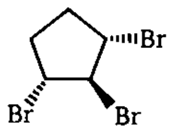
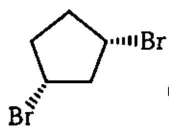
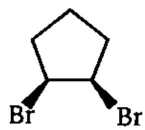
1. A – a; B – c; C – b
2. A – b; B – c; C – a; D – c; E – c; F – b; G – c
3. a, b, c
4. a
5. c
6. a – q – x; b – s – z; c – p – w; d – q – x
7. $P + Q + R = 10$
8. a – q; b – p; c – r; d – s
9. a – p; b – s; c – q; d – r
10. a
11. e
12. a – s; b – r; c – p; d – q
13. 9

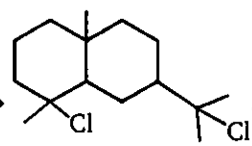
4B HYDROCARBONS (ALKENES)

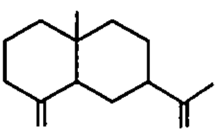
LEVEL-1

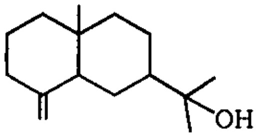
1. (R)-3-bromocyclopentene (shown below) reacts with Br_2/CCl_4 to form two products, Y and Z, Y is not optically active (does not rotate plane-polarized light). What is the structure of Y ?

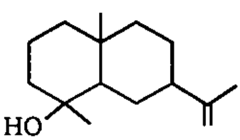


(a)  (b)  (c)  (d)  (e) 

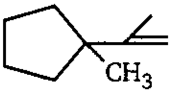
2. $A \xrightarrow{2HCl}$  . Reactant (A) can be:

(a) 

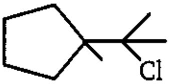
(b) 

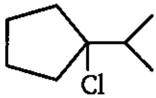
(c) 

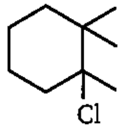
(d) All of these

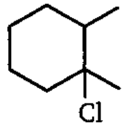
3. 

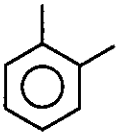
$\xrightarrow{HCl}$; Major product of the reaction is :

(a) 

(b) 

(c) 

(d) 

4.  $\xrightarrow[Zn]{O_3}$

Which of the following products cannot be obtained in ozonolysis of *o*-xylene?

(a) $\begin{matrix} CHO \\ | \\ CHO \end{matrix}$

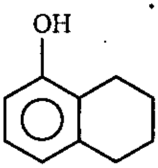
(b) $CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-H$

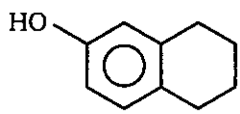
(c) $CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-CH_3$

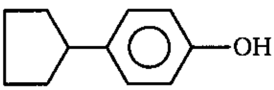
(d) $CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-CHO$

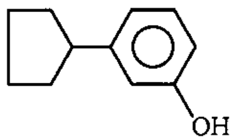
5. 

$\xrightarrow{H^+}$ Major product of the reaction is :

(a) 

(b) 

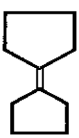
(c) 

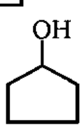
(d) 

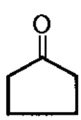
6. $\begin{matrix} CH_2-CO_2K \\ | \\ CH_2-CO_2K \end{matrix} \xrightarrow{\text{electrolysis}} \underset{\text{(major)}}{(A)}$ (Kolbe electrolysis method)

Product (*A*) of the reaction is :

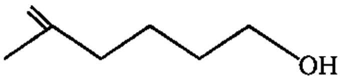
(a) CH_3-CH_3
(b) $CH_2=CH_2$
(c) $CH_3-CH=CH_2$
(d) none of these

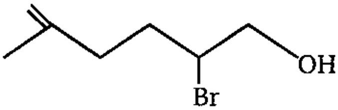
7.  $\xrightarrow[Zn]{O_3} A \xrightarrow{H_2/Ni} B \xrightarrow[\Delta]{H^+} (C)$; Product (*C*) of the reaction is :

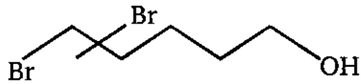
(a) 

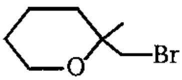
(b) 

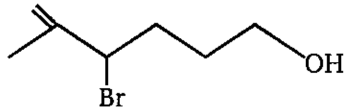
(c) 
(d) 

8.  $\xrightarrow[CH_2Cl_2]{Br_2}$ W. Product W is :

(a) 

(b) 

(c) 

(d) 

9. The reaction of propene with H_3O^+ will proceed with which of the following intermediates ?

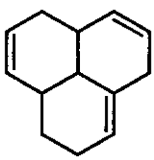
(a) $CH_3-CH_2-\underset{\displaystyle CH_2}{\overset{\oplus OH_2}{|}}$

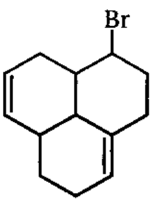
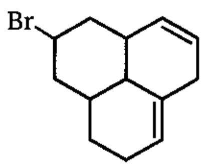
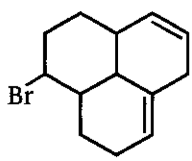
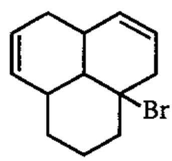
(b) $CH_3-\overset{\oplus}{C}H-\overset{OH}{\overset{|}{C}H_2}$

(c) $CH_3-\overset{\oplus OH_2}{\overset{|}{C}H}-CH_3$

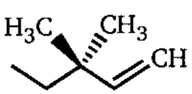
(d) $CH_3-\overset{OH}{\overset{|}{C}H}-CH_3$

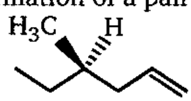
10. Which of the following bromides is the major product of the reaction shown below, assuming that there are no carbocation rearrangement ?

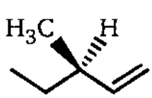
 + $\underset{(1\ \text{equivalent})}{HBr}$ $\longrightarrow$ $C_{13}H_{17}Br$

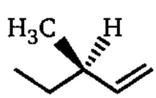
(a)  (b)  (c)  (d) 

11. Which of the following reactions results in the formation of a pair of diastereomers ?

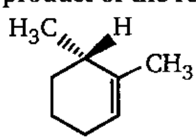
(a)  $\xrightarrow{HBr}$

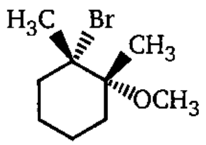
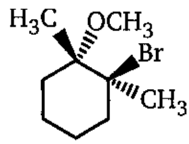
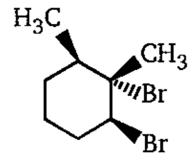
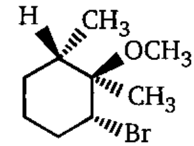
(b)  $\xrightarrow{HBr}$

(c)  $\xrightarrow[ROOR,\ UV]{HBr}$

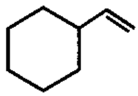
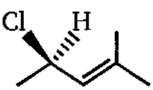
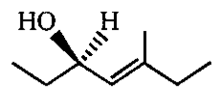
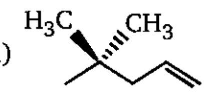
(d)  $\xrightarrow[2.\ H_2O_2,\ OH^-,\ H_2O]{1.\ BH_3,\ THF}$

12. What is a likely product of the reaction shown ?

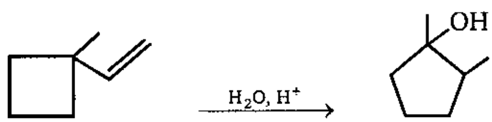
 $\xrightarrow{Br_2/CH_3OH}$

(a)  (b)  (c)  (d) 

13. Which of the following, when undergoing addition of HBr, will form ONLY a pair of diastereomers ?

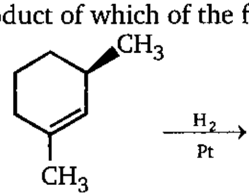
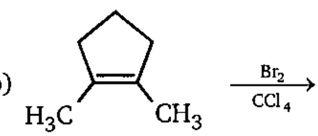
(a)  (b)  (c)  (d) 

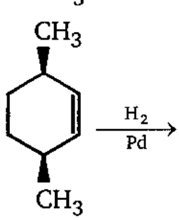
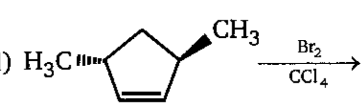
14. How many transition states and intermediates will be formed during the course of following reaction ?



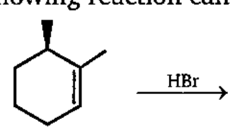
(a) 3 transition states and 3 intermediates
(b) 4 transition states and 3 intermediates
(c) 3 transition states and 2 intermediates
(d) 5 transition states and 4 intermediates

15. Product of which of the following reactions, is racemic mixture ?

(a)  (b) 

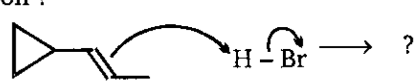
(c)  (d) 

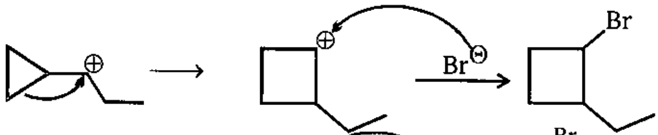
16. The product(s) of the following reaction can best be described as :

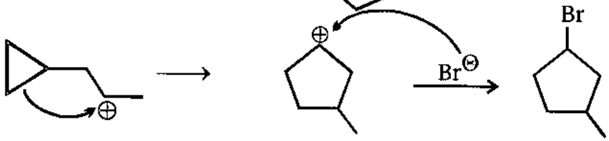


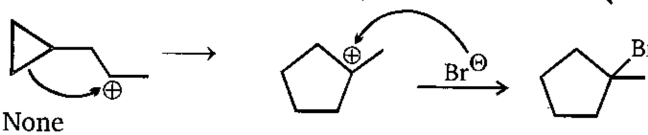
(a) a racemic mixture
(b) a single enantiomer
(c) a pair of diasteriomers
(d) an achiral molecule

17. Taking into account the stability of various carbocations and, as well as the rules governing mechanisms of carbocation rearrangements, which reaction is most likely to occur during the given reaction ?



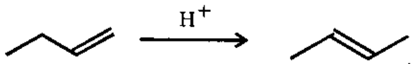
(a) 

(b) 

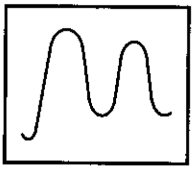
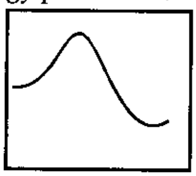
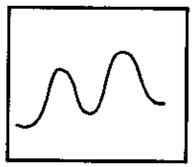
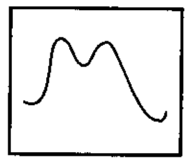
(c) 

(d) None

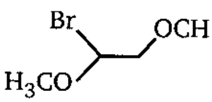
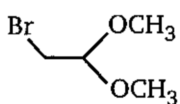
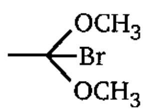
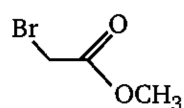
18. Consider the following reaction in which the intermediate carbocation loses H^+ to give the final product ?



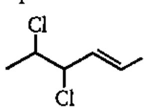
Which of the following energy profiles best represents the overall reaction ?

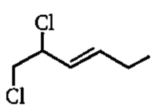
(a)  (b)  (c)  (d) 

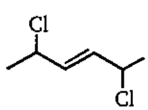
19. Methyl vinyl ether, $H_2C=CH-OCH_3$, reacts with Br_2/CH_3OH. If methanol is reacting as water would, and if this reaction follows a typical mechanism of electrophilic addition, what would be the expected product ?

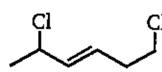
(a)  (b)  (c)  (d) 

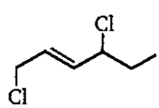
20. 2, 4-hexadiyne (C_6H_6) is allowed to react with Li in NH_3(liq). The product obtained is treated with 1 equivalent of Cl_2 in CCl_4. Which of the following constitutional isomers are possible products ?


(I)


(II)

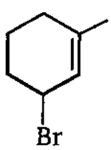
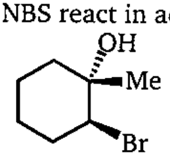
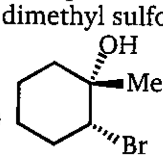

(III)


(IV)

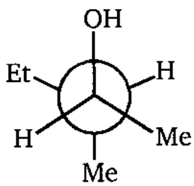

(V)

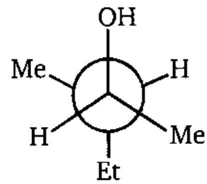
(a) I and II
(b) II and III
(c) I and V
(d) I and III

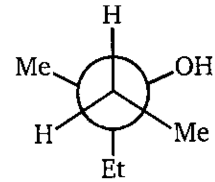
21. Which of the following is the best stereochemical representation when reaction between 1-methylcyclohexene and NBS react in aqueous dimethyl sulfoxide ?

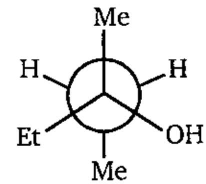
(a)  (b)  (c)  (d) None of these

22. Which of the following is among the major products of the reaction of (E)-3-methyl-2-pentene with BH_3 in THF followed by the addition of H_2O_2/HO^-?

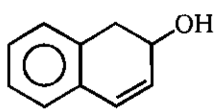
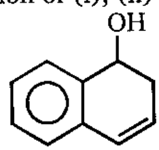
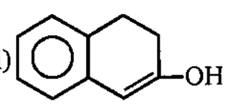
(a) 

(b) 

(c) 

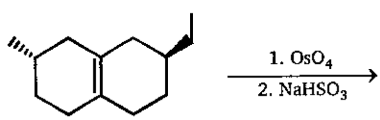
(d) 

23. Compare rate of dehydration of (i), (ii) and (iii) by conc. H_2SO_4.

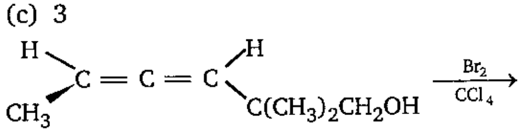
(i) 
(ii) 
(iii) 

(a) (i) > (iii) > (ii)
(b) (i) > (ii) > (iii)
(c) (ii) > (i) > (iii)
(d) (ii) > (iii) > (i)

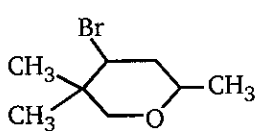
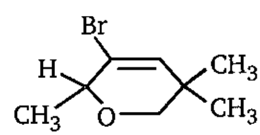
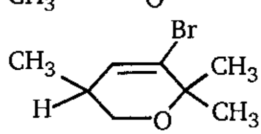
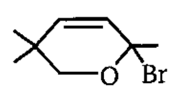
24. How many products will be formed in this reaction ?



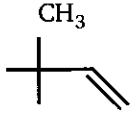
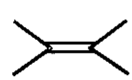
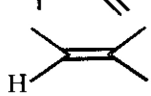
(a) 10
(b) 2
(c) 3
(d) 4

25. 

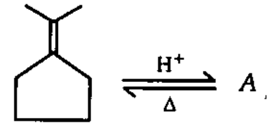
(A). Product (A) of the reaction is:

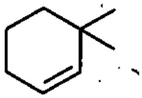
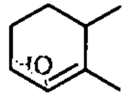
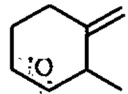
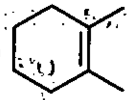
(a) 
(b) 
(c) 
(d) 

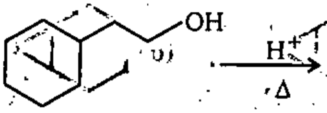
26. $CH_3-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}H + H_2C=CH_2 \xrightarrow[2\text{-}5°C]{HF} (A)$; (A) is:

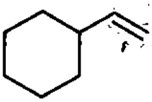
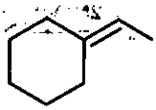
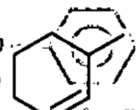
(a) 
(b) 
(c) 
(d) $CH_3-\underset{CH_3}{\underset{|}{C}}H-CH_2-CH=CH_2$

27. Predict the product (A) of the following reaction



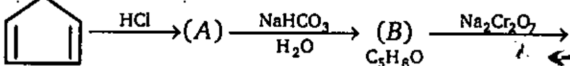
(a)  (b)  (c)  (d) 

28.  (A) Major-product (A) is:

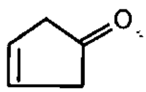
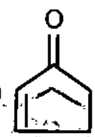
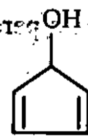
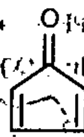
(a)  (b)  (c)  (d) 

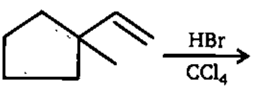
29. Di-imide (N_2H_4) is used to reduce double bond of:

(a) $-\overset{|}{C}=O$ (b) $-C\equiv N$ (c) $-NO_2$ (d) $-CH=CH-$

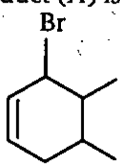
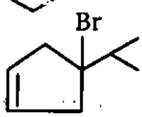
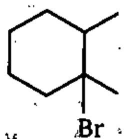
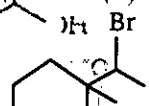
30. 

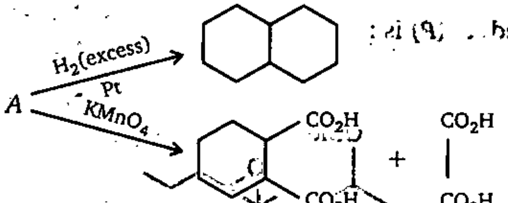
End product of the reaction is :

(a)  (b)  (c)  (d) 

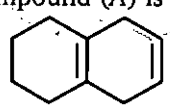
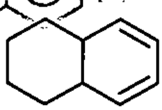
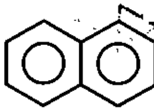
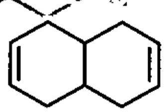
31. 

Product (A) is :

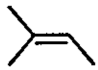
(a)  (b)  (c)  (d) 

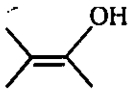
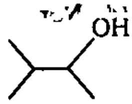
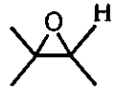
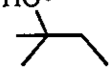
32. 

Compound (A) is :

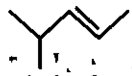
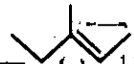
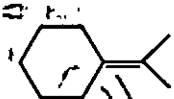
(a)  (b)  (c)  (d) 

40. The major product of the following reaction sequence is :

 $\xrightarrow[2.\ H_2O_2,\ HO^-]{1.\ B_2H_6}$?

(a)  (b)  (c)  (d) 

41. Which one of the following compounds gives acetone $(CH_3)_2C=O$ as one of the product of its ozonolysis ?

(a)  (b)  (c)  (d) 

42. Addition of HCl to 3, 3-dimethyl-1-butene yields two products, one of which has a rearranged carbon skeleton. Among the following carbocations, select the possible intermediates in that reaction ?

$(CH_3)_3C\overset{+}{C}HCH_2Cl$ (1) $(CH_3)_3C\overset{+}{C}HCH_3$ (2) $(CH_3)_2\underset{Cl}{C}\overset{+}{C}(CH_3)_2$ (3) $(CH_3)_2\overset{+}{C}CH(CH_3)_2$ (4)

(a) 1, 2 (b) 1, 3 (c) 1, 4 (d) 2, 3
(e) 2, 4

43. Conversion of cyclohexene to cyclohexanol can be conveniently achieved by :

(a) $NaOH + H_2O$ (b) $Br_2 - H_2O$
(c) hydroboration, oxidation (d) hydroboration hydrolysis

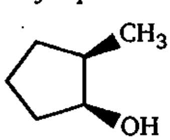
44. *Trans*-cyclohexane-1,2-diol can be obtained by the reaction of cyclohexene with :

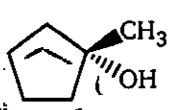
(a) $KMnO_4$ (b) OsO_4
(c) peroxy formic acid $/H_3O^+$ (d) SeO_2

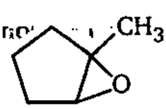
45. Bromination of (E)-2-butenedioic acid gives

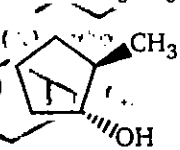
(a) (2R, 3S)-2, 3-dibromosuccinic acid
(b) (2R, 3R)-2, 3-dibromosuccinic acid
(c) a mixture of (2R, 3R) and (2S, 3S)-2, 3-dibromosuccinic acid
(d) (2S, 3S)-2, 3-dibromosuccinic acid

46. The major product formed during the reaction of 1-methyl cyclopentene with CH_3CO_3H is

(a) 

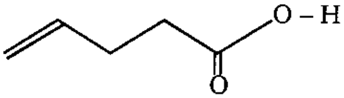
(b) 

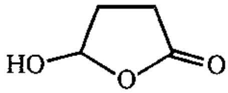
(c) 

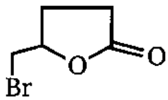
(d) 

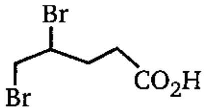
47. $\begin{matrix} CH-CO_2H \\ \| \\ CH-CO_2H \end{matrix} \xrightarrow[\text{(two mole)}]{NaOH} (A) \xrightarrow{\text{electrolysis}} (B)$; Product (B) of the reaction is :

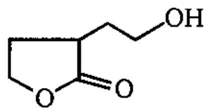
(a) CH_3-CH_3 (b) $H_2C=CH_2$
(c) $H-C\equiv C-H$ (d) $CH_2=CH-CH=CH_2$

48.  $\xrightarrow[\text{NaHCO}_3]{\text{Br}_2}$ (lactone)
(Bromolactonization) Cyclic ester

(a) 

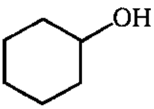
(b) 

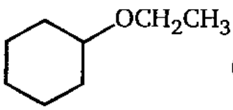
(c) 

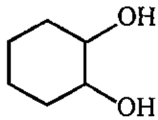
(d) 

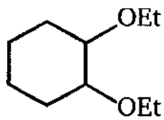
49.  $\xrightarrow[\text{(2) NaBH}_4,\ \text{HO}^-]{\text{(1) (CF}_3\text{CO}_2)_2\text{Hg, CH}_3\text{CH}_2\text{OH}}$ (P) (100%) ; Product (P) is :

Cyclohexene

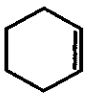
(a) 

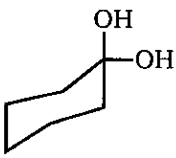
(b) 

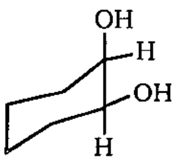
(c) 

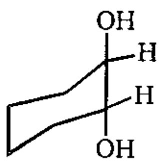
(d) 

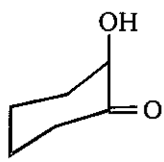
50. What is the major product expected from the following reaction ?

 $\xrightarrow[\text{HO}^-\ \text{cold}]{\text{KMnO}_4}$

(a) 

(b) 

(c) 

(d) 

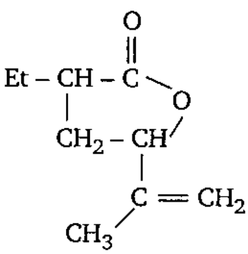
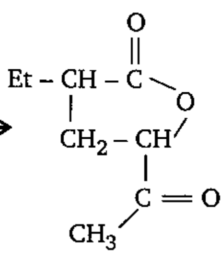
51. $CH_3-CH=CH_2 \xrightarrow[\text{(low conc.)}]{Br_2/h\nu} (A)$; Product (A) of the reaction is :

(a) $CH_3-\underset{\displaystyle|\atop\displaystyle Br}{CH}-CH_2-Br$

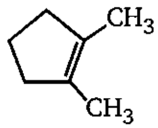
(b) $H_2C=CH-CH_2-Br$

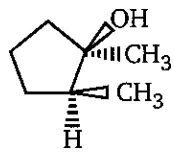
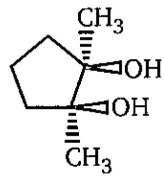
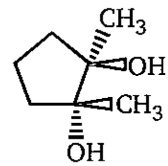
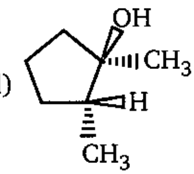
(c) $CH_3-\underset{\displaystyle|\atop\displaystyle Br}{C}=CH_2$

(d) $Br-CH_2-CH_2-CH_2-Br$

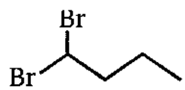
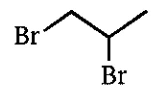
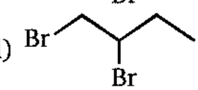
52.  $\xrightarrow{A}$  ; Reagent (A) in the reaction is :

(a) $O_3/Zn(H_2O)$ (b) HIO_4 (c) CrO_3 (d) Cold dil. $KMnO_4$

53.  $\xrightarrow[2.\ NaHSO_3]{1.\ OsO_4}$ Product of the reaction is:

(a)  (b)  (c)  (d) 

54. Which compound is a possible product from addition of Br_2 to 1-butene ?

(a) 
(b) 
(c) 
(d) 

55. Addition of Br_2 to *cis*-2-butene would give a product which is:

(a) achiral (b) racemic
(c) meso (d) optically active

56. Addition of Br_2 to *trans*-2-butene would give a product which is:

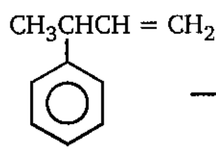
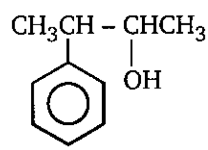
(a) achiral (b) racemic (c) meso (d) optically active

57. Addition of OsO_4 to cyclopentene would give a product which is:

(a) achiral (b) racemic (c) meso (d) optically active

58. Addition of BH_3 followed by H_2O_2 to *trans*-2-butene would give a product which is:

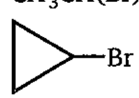
(a) achiral (b) racemic (c) meso (d) optically active

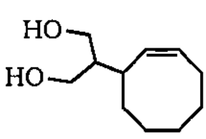
59.  $\xrightarrow{A}$  ; Reagent A may be :

(a) H_2O/H^+ (b) $BH_3.THF/H_2O_2-OH^-$
(c) $Hg(OCOCH_3)_2.THF/NaBH_4.NaOH$ (d) All are possible

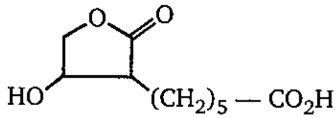
60. The major product of the following reaction is :

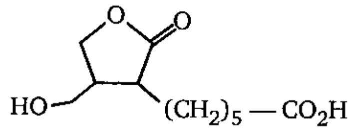
$$CH_3-CH=CH_2+HBr\xrightarrow{(C_6H_5CO)_2O_2}$$

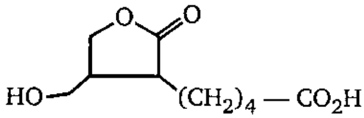
(a) $CH_3-CH_2-CH_2-Br$ (b) $CH_3CH(Br)-CH_3$
(c) $BrCH_2-CH=CH_2$ (d) 

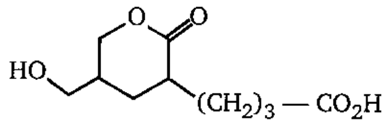
61.  $\xrightarrow[H_2O_2]{O_3}(A)\xrightarrow[\Delta]{-H_2O}(B)$

Identify (B) :

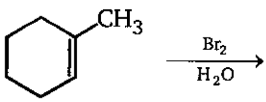
(a) 

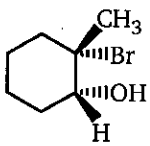
(b) 

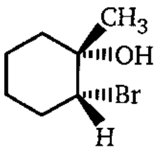
(c) 

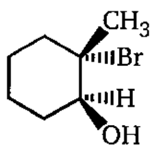
(d) 

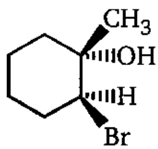
62. Which of the following is a major product of the reaction shown below?



(a) 

(b) 

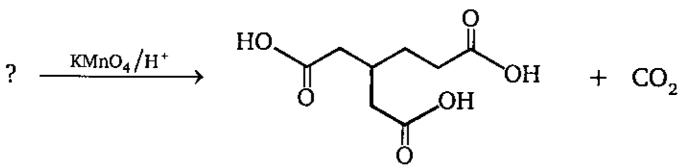
(c) 

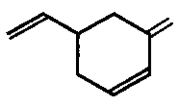
(d) 

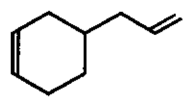
63. In methyl alcohol solution, bromine reacts with ethylene (ethene) to yield $BrCH_2CH_2OCH_3$ in addition to 1, 2-dibromoethane because

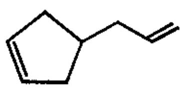
(a) the methyl alcohol solvates the bromine
(b) the ion formed initially may react with Br^- or CH_3OH
(c) this is a free radical reaction
(d) the reaction follows Markovnikov's rule

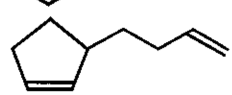
64. Which of the following compound was the starting material for the oxidation shown below ?



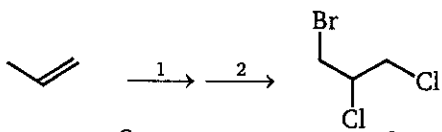
(a) 

(b) 

(c) 

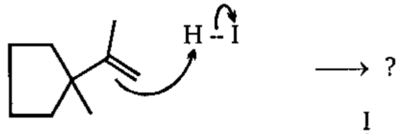
(d) 

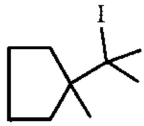
65. Which series of reactions will achieve the following transformation ?

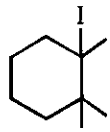


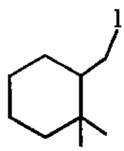
	1	2		1	2
(a)	Cl_2/CCl_4	Br_2	(b)	HBr	Cl_2/CCl_4
(c)	Cl_2/CCl_4	NBS/hν	(d)	NBS/hν	Cl_2/CCl_4

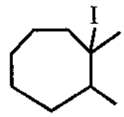
66. Taking into account the stability of various cycloalkanes and carbocations, as well as the rules governing mechanisms of carbocation rearrangements, what is the most likely product of this reaction ?



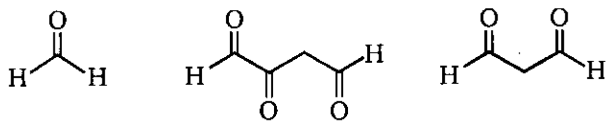
(a) 

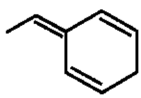
(b) 

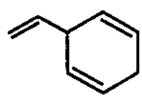
(c) 

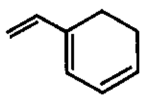
(d) 

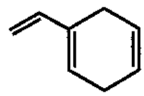
67. A triene is treated with ozone followed by zinc in acetic acid to give the following three products. What is the structure of the triene ?

Products = 

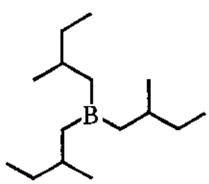
(a) 

(b) 

(c) 

(d) 

68. Which of the following compound would yield trialkylborane shown below when treated with BH_3/THF ?



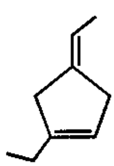
(a) 2-methylbut-1-ene

(b) 2-methylbut-2-ene

(c) 3-methylbut-1-ene

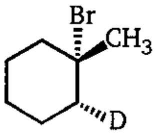
(d) 3-methylbut-1-yne

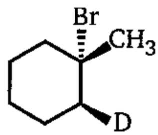
69. If the following compound is treated with Pd/C in excess of hydrogen gas, how many stereoisomers of the product will be obtained ?

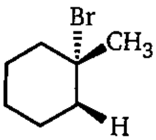


(a) 1 (b) 2
(c) 3 (d) 4

70. Which is the most precise designation of stereochemistry for the products formed in the electrophilic addition of DBr to 1-methylcyclohexene ? (D = ^{2}H, an isotope of hydrogen)

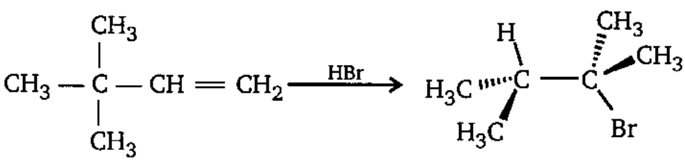
(a) 

(b) 

(c) 

(d) both (a) and (b)

71. Consider the addition of HBr to 3,3-Dimethyl-1-butene shown below. What is the best mechanistic explanation for the formation of the observed product ?



(a) Protonation of the alkene followed by a hydride shift and addition of bromide to the carbocation
(b) Double bond shift in the alkene following by the protonation and addition of bromide to the carbocation
(c) Addition of bromide to the alkene followed by a double bond shift and protonation
(d) Protonation of the alkene followed by a methyl shift and addition of bromide to the carbocation

72. Propene $CH_3CH = CH_2$ can be converted into 1-propanol by oxidation. Indicate which sets of reagents amongst the following is ideal to effect the above conversion ?

(a) $KMnO_4$ (alkaline) (b) Osmium tetroxide (OsO_4/CH_2Cl_2)
(c) B_2H_6 and alk. H_2O_2 (d) O_3/Zn

73. Which is the most suitable reagent among the following distinguish compound (3) from the others ?

(1) $CH_3C \equiv C-CH_3$ (2) $CH_3CH_2-CH_2-CH_3$
(3) $CH_3CH_2C \equiv CH$ (4) $CH_3CH = CH_2$
(a) Bromine in carbon tetrachloride (b) Bromine in acetic acid solution
(c) Alk. $KMnO_4$ (d) Ammonical silver nitrate

74. The principal organic product formed in the reaction given below is :

$CH_2 = CH(CH_2)_8COOH + HBr \xrightarrow{\text{peroxide}} ....$

(a) $CH_3-CHBr(CH_2)_8COOH$ (b) $CH_2 = CH(CH_2)_8COBr$
(c) $CH_2BrCH_2(CH_2)_8COOH$ (d) $CH_2 = CH(CH_2)_7CHBrCOOH$

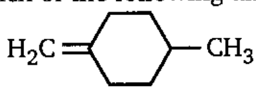
75. When 2-butyne is treated with Pd – $BaSO_4$; the product formed will be :

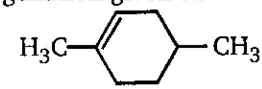
(a) *cis*-2-butene (b) *trans*-2-butene (c) 1-butene (d) 2-hydroxy butane

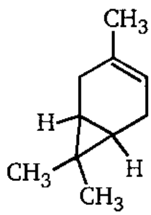
76. In the reaction, $CH_3C \equiv C - CH_3 \xrightarrow[\text{(ii) } Zn/H_2O]{\text{(i) } X} CH_3 - \underset{\underset{O}{\|}}{C} - \underset{\underset{O}{\|}}{C} - CH_3$, X is :

(a) HNO_3 (b) O_2 (c) O_3 (d) $KMnO_4$

77. Which of the following alkene on catalytic hydrogenation given *cis* and *trans*-isomer ?

(a) 

(b) 

(c) 

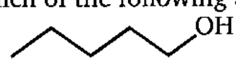
(d) all of these

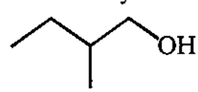
78. In the reaction of hydrogen bromide with an alkene (in the absence of peroxides), the first step of the reaction is the .... to the alkene.

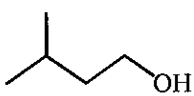
(a) fast addition of an electrophilic (b) slow addition of an electrophile

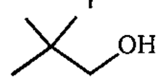
(c) fast addition of a nucleophilic (d) slow addition of a nucleophile

79. Which of the following alcohols cannot be prepared from hydration of an alkene ?

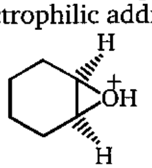
(a) 

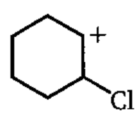
(b) 

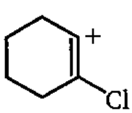
(c) 

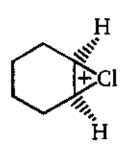
(d) 

80. Which of the species shown below is the most stable form of the intermediate in the electrophilic addition of Cl_2 in water to cyclohexene to form a halohydrin ?

(a) 

(b) 

(c) 

(d) 

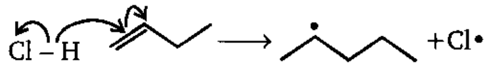
81. The reaction, $(CH_3)_2C = CH_2 + Br^{\bullet} \longrightarrow (CH_3)_2\dot{C} - CH_2Br$

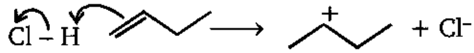
is an example of a/an .... step in a radical chain reaction.

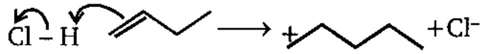
(a) initiation (b) termination

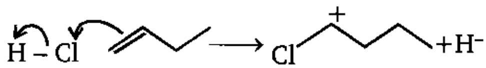
(c) propagation (d) heterolytic cleavage

82. Which of the following most accurately describes the first step in the reaction of hydrogen chloride with 1-butene ?

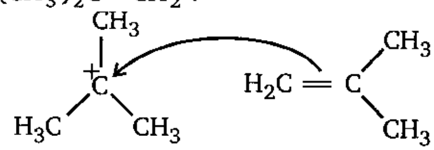
(a) 

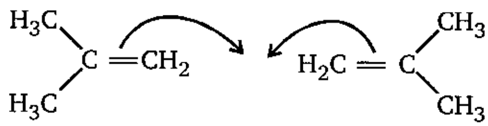
(b) 

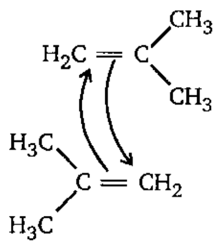
(c) 

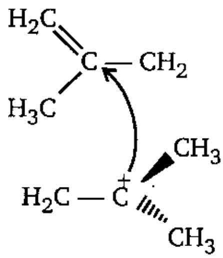
(d) 

83. Which of the following best describes the flow of electrons in the acid-catalyzed dimerization of $(CH_3)_2C=CH_2$?

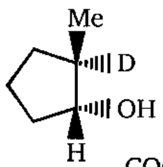
(a) 

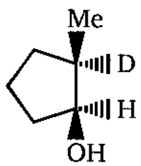
(b) 

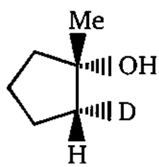
(c) 

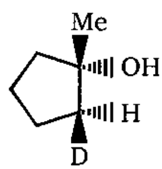
(d) 

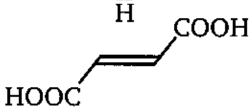
84. Hydroboration of 1-methylcyclopentene using B_2D_6, followed by treatment with alkaline hydrogen peroxide, gives

(a) 

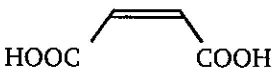
(b) 

(c) 

(d) 

85.  $\xrightarrow[CCl_4]{Br_2}$ HOOCCH(Br)CH(Br)COOH

(P) (X)

 $\xrightarrow[CCl_4]{Br_2}$ HOOCCH(Br)CH(Br)COOH

(Q) (Y)

The correct statements with respect to the above pair of reactions are that

(I) the reactions are stereospecific

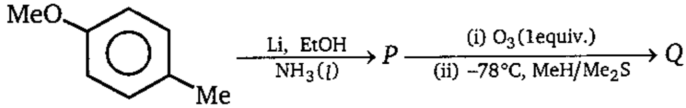
(II) (X) is erythro and (Y) is threoisomer

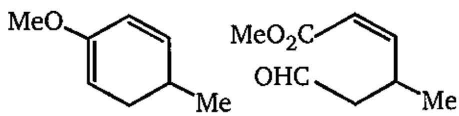
(III) (X) is threo and (Y) is erythro isomer

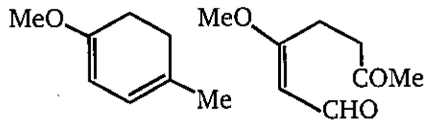
(IV) each of (P) and (Q) gives a mixture of (X) and (Y)

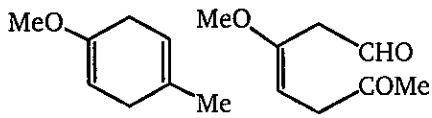
(a) I and II (b) I and III (c) I and IV (d) II and IV

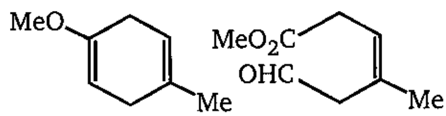
86. The products P and Q in the following sequence of reactions, are



(a) 

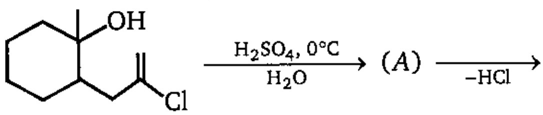
(b) 

(c) 

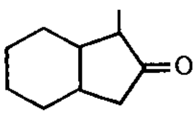
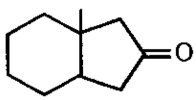
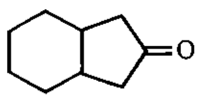
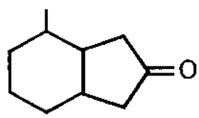
(d) 

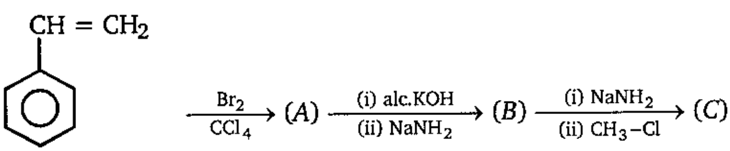
87. 4-Pentenoic acid when treated with I_2 and $NaHCO_3$ gives :

(a) 4, 5-diiodopentanoic acid
(b) 5-iodomethyl-dihydrofuran-2-one
(c) 5-iodo-tetrahydropyran-2-one
(d) 4-pentenolyiodide

88. 

(B); Product (B) of the reaction is:

(a)  (b)  (c)  (d) 

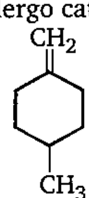
89. 

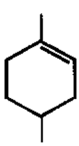
, Product (C) is :

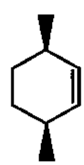
(Styrene)

(a) $Ph-C\equiv CNa$
(b) $Ph-CH_2-C\equiv CH$
(c) $Ph-C\equiv C-CH_3$
(d) $Ph-CH=C=CH_2$

90. Which of the following will give a mixture of *cis* and *trans*-1,4-dimethyl cyclohexane, when undergo catalytic hydrogenation ?

(a) 

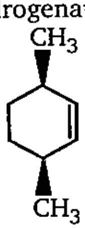
(b) 

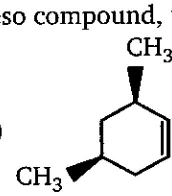
(c) 

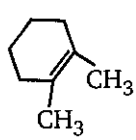
Cis-3-6 dimethyl cyclohexene

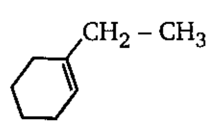
(d) both (a) & (b)

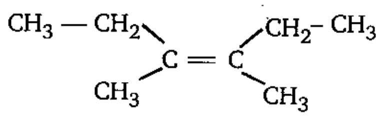
91. An optically active compound A with molecular formula C_8H_{14} undergoes catalytic hydrogenation to give meso compound, the structure of (A) is :

(a) 

(b) 

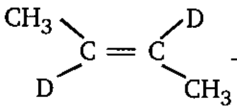
(c) 

(d) 

92.  $+ HBr \xrightarrow[\text{(Per-oxide)}]{R_2O_2}$ Products

How many products will be formed in above reaction ?

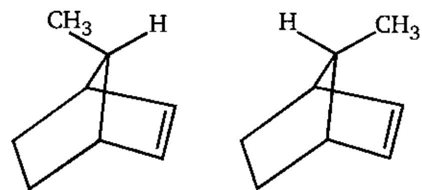
(a) 2 (b) 4
(c) 3 (d) 6

93.  $\xrightarrow[Pt]{H_2}$ Product of the reacion is :

(a) Racemic (b) Diastereomers
(c) Meso (d) Pure enantiomers

94. *cis*-2-butene $\xrightarrow[\text{Peroxide}]{HBr}$ product ; Product of the reaction is :

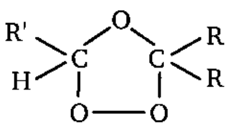
(a) Racemic (b) Diastereomer
(c) Meso (d) *E* and *Z* isomer

95. 

(a) (b)

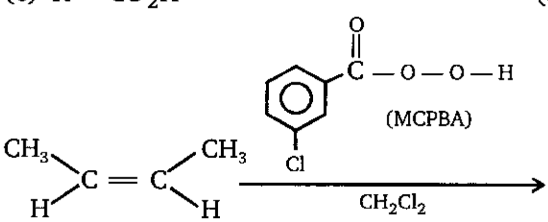
Rate of reaction towards reduction using (H_2/Pt) :

(a) $a > b$ (b) $a = b$
(c) $b > a$ (d) Reduction of given molecule is not possible

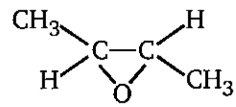
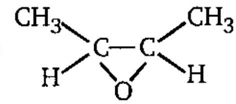
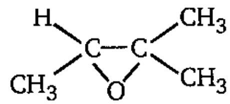
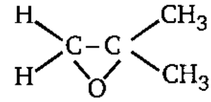
96.  $\xrightarrow[\text{dimethyl sulfide}]{CH_3-S-CH_3}$ Product A + $CH_3-\overset{\overset{O}{\|}}{S}-CH_3$

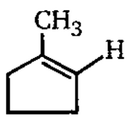
Product A of the above reaction is :

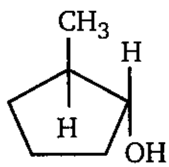
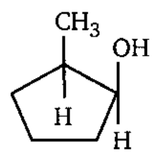
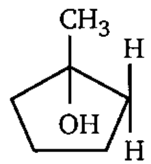
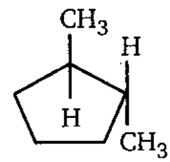
(a) $R-\overset{\overset{O}{\|}}{C}-R$ (b) R′ — CHO
(c) $R-CO_2H$ (d) both (a) and (b)

97.  Product; Product is :

MCPBA ⟶ Metachloroperbenzoic acid

(a) 
(b) 
(c) 
(d) 

98.  $\xrightarrow[(2)\ H_2O_2,\ HO^-]{(1)\ BH_3;\ THF}$ (A) ; Product of the reaction is :

(a) 
(b) 
(c) 
(d) 

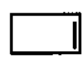
99. $CH_3-CH=CH_2 \xrightarrow[(2)\ CH_3CO_2T]{(1)\ THF:BD_3} (A)$; Product (A) of the above reaction is:

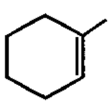
(a) $CH_3-CHD-CH_2D$
(b) $CH_3-CHT-CH_2T$
(c) $CH_3-CHD-CH_2T$
(d) $CH_3-CHT-CH_2D$

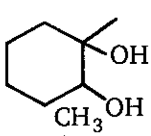
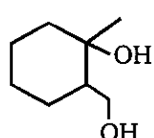
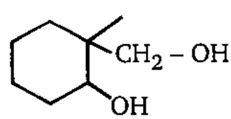
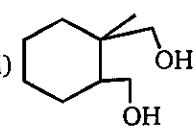
100. Optically active isomer (A) of (C_5H_9Cl) on treatment with one mole of H_2 gives an optically inactive compound (B) compound (A) will be :

(a) $CH_3-\underset{\underset{CH_2Cl}{|}}{CH}-CH=CH_2$
(b) $Cl-\underset{\underset{CH_3}{|}}{CH}-CH=CH-CH_3$
(c) $CH_3-\underset{\underset{Cl}{|}}{CH}-CH_2-CH=CH_2$
(d) $CH_3-CH_2-\underset{\underset{Cl}{|}}{CH}-CH=CH_2$

101. An organic compound C_4H_6 on ozonolysis give $HCHO, CO_2, CH_3CHO$. Compound will be :

(a) $H_2C=CH-CH=CH_2$
(b) $CH_3-CH=C=CH_2$
(C) $CH_3-C\equiv C-CH_3$
(d) 

102.  $\xrightarrow[H_2O]{HCHO,\ H^+}$ major product of this reaction is :

(a) 
(b) 
(c) 
(d) 

103. $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{CH}} \xrightarrow{KMnO_4} (A) \xrightarrow[\Delta]{H^+} (B) \xrightarrow[ROOR]{HBr} (C)$

Product (C) in the above reactions is :

(a) $CH_3-\overset{H}{\overset{|}{\underset{\underset{CH_3}{|}}{C}}}-Br$

(b) $CH_3-\overset{CH_3}{\overset{|}{\underset{\underset{CH_3}{|}}{C}}}-Br$

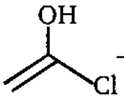
(c) $CH_3-\underset{\underset{CH_2-Br}{|}}{CH}-H$

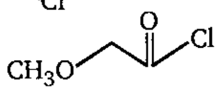
(d) $CH_3-\overset{CH_3}{\overset{|}{\underset{\underset{CH_2-Br}{|}}{CH}}}$

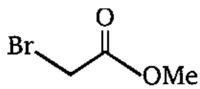
104. $CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2+(CH_3)_2CHCH_3 \xrightarrow[273K]{HF} C_8H_{18}(A)$

Unknown (A) in the above reaction is :

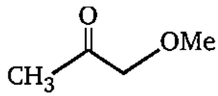
(a) 2, 2, 3-trimethyl pentane
(b) 2, 2, 4-trimethyl pentane
(c) 2, 2-dimethyl hexane
(d) n-octane

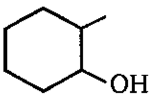
105.  $\xrightarrow{Br_2}$ HBr + (P) $\xrightarrow{MeOH}$ (Q) ; Product (Q) is :

(a) 

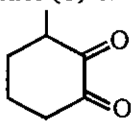
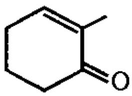
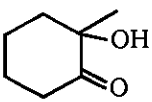
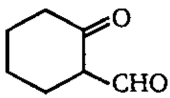
(b) 

(c) $CH_3-\overset{O}{\overset{||}{C}}-OMe$

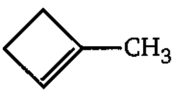
(d) 

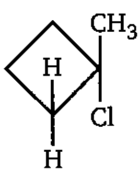
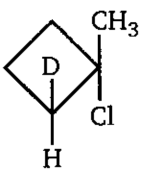
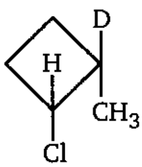
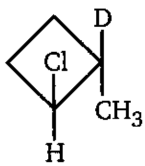
106.  $\xrightarrow[\Delta]{H^+}$ (A) $\xrightarrow[KMnO_4]{\text{cold dil.}}$ (B) $\xrightarrow{CrO_3}$ (C)

Product (C) of the reaction is:

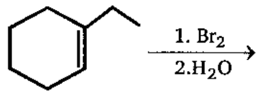
(a) 
(b) 
(c) 
(d) 

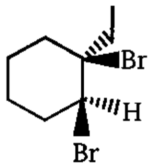
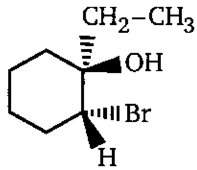
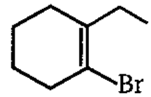
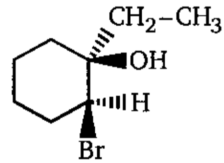
107. What is the major product expected from the following reaction ?

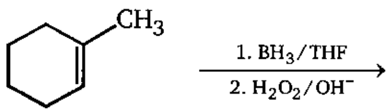
 $\xrightarrow{D-Cl}$ Product

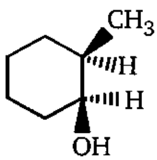
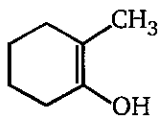
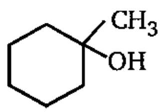
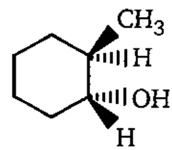
(a) 
(b) 
(c) 
(d) 

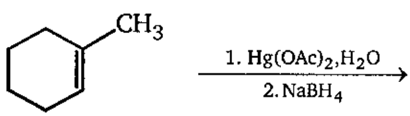
108. Choose the correct product of this reaction :

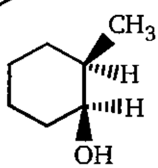
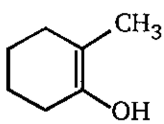
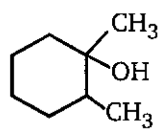
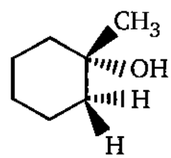


(a)  (b)  (c)  (d) 

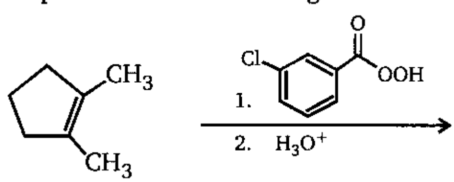
109.  A; Product A is:

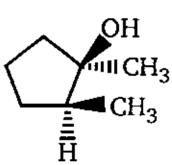
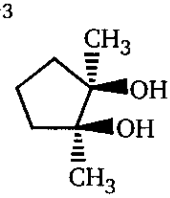
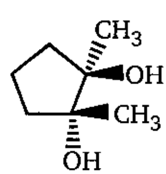
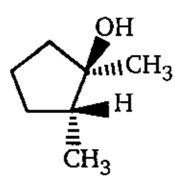
(a)  (b)  (c)  (d) 

110.  Product; Product is :

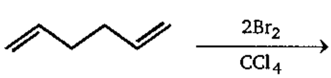
(a)  (b)  (c)  (d) 

111. Choose the correct product of the following reactions :



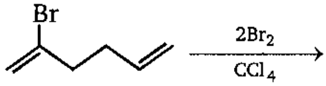
(a)  (b)  (c)  (d) 

112. How many stereoisomeric tetrabromides will be formed in the following reaction ?



(a) 2 (b) 3 (c) 4 (d) 6

113. How many stereoisomeric pentabromides will be formed in the following reaction ?

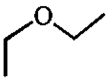


(a) 2 (b) 3
(c) 4 (d) None of these

114.  $\xrightarrow[\text{peroxide}]{\text{HCl}}$ (A) $\xrightarrow[\Delta]{\text{EtONa}}$ (Z) (major)

Identify (Z) in the above sequence of reactions :

(a)  (b) 

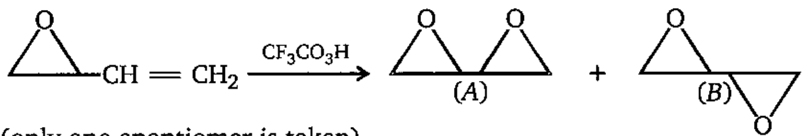
(c)  (d) 

115.
$$\begin{array}{l} CH_3-CH-CO_2K \\ \qquad\quad | \\ CH_3-CH-CO_2K \end{array} \xrightarrow{\text{electrolysis}} (A) \text{ (Major)}$$

Major product (A) of the above reaction :

(a)  (b) 

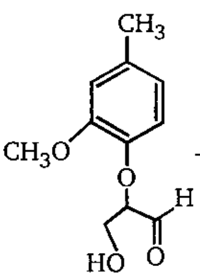
(c)  (d) 

116. 

(only one enantiomer is taken)

Which of the following statement is correct about A and B ?

(a) A and B are mixture of diastereomers
(b) A and B are mixture of enantiomers
(c) A and B are optically active
(d) B is racemic mixture

117.  $\xrightarrow{NaBH_4} A \xrightarrow{O_3} B \xrightarrow{H_2O} (C)$ (one of the product)

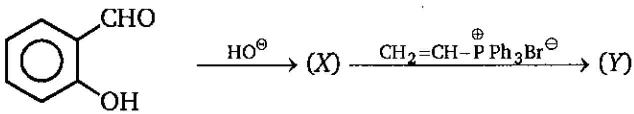
Identify the product (C):

(a) $CH_3-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-O-CH_3$

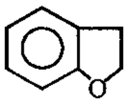
(b) CH_2-OH
$|$
$CH-OH$
$|$
CH_2-OH

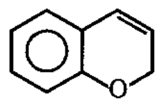
(c) CHO
$|$
$CH-OH$
$|$
CH_2-OH

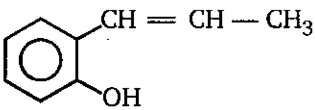
(d) CHO
$|$
$CHOH$
$|$
CHO

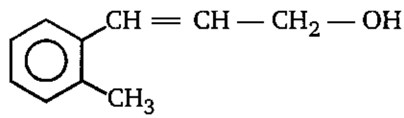
118. 

Product (Y) of the above reaction is :

(a) 

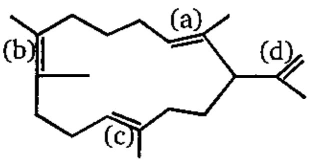
(b) 

(c) 

(d) 

119. In the reaction $Me-C\equiv C-Et \xrightarrow{Na/liq.NH_3} P \xrightarrow[CCl_4]{Br_2} (Q)$; then Q is :

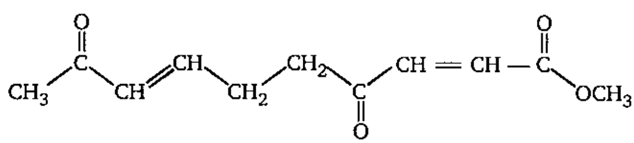
(a) A pure compound which is optically inactive due to internal compensation
(b) A binary mixture which is optically inactive due to external compensation
(c) A binary mixture which is optically active
(d) A pure compound which is optically inactive due to absence of chiral centre

120. 

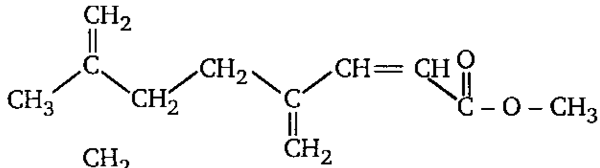
Which (π-bond) will reduce first, when above compound undergoes catalytic hydrogenation ?

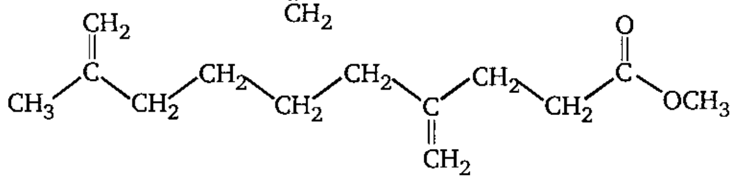
(a) a (b) b (c) c (d) d

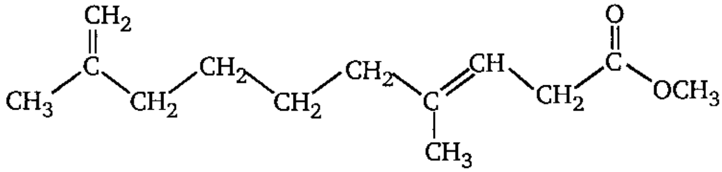
121. Compound A, which is a degradation product of the antibiotic vermiculine has following structure



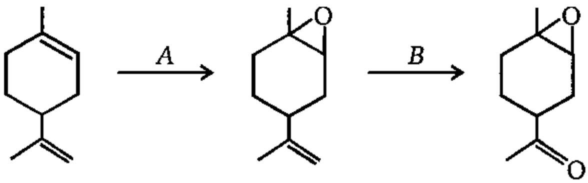
$\underset{C_{11}H_{14}O_4}{(A)} \xrightarrow[Pd/C]{H_2} \underset{C_{11}H_{18}O_4}{(B)} \xleftarrow{(CH_3)_2S} \xleftarrow[CH_2Cl_2]{O_3} \underset{C_{11}H_{18}O_2}{(C)}$. Unknown (C) is:

(a) 

(b) 

(c) 

(d) None of these

122. 

Reagent (A) and (B) in above reaction are :

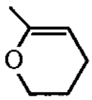
(a) $A = RCO_3H$, $B = H_2O_2$

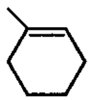
(b) $A = RCO_3H$, $B = HIO_4$

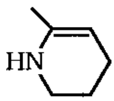
(c) $A = RCO_3H$, $B = O_3$

(d) $A = O_3$, $B = RCO_3H$

123. Rank the following in the increasing order of rate of reaction with HBr .

(P) 

(Q) 

(R) 

(a) $R > P > Q$

(b) $R > Q > P$

(c) $P > R > S$

(d) $P > S > R$

124. Select the reaction(s) that would result in the formation of 2-bromopropane.

(I) $CH_3CH = CH_2 + HBr \xrightarrow{\text{peroxide}}$

(II) $CH_3CH = CH_2 + HBr \xrightarrow{CCl_4}$

(III) $CH_3CH_2CH_3 + Br_2 \xrightarrow{hv}$

(IV) $CH_3CH = CH_2 + Br_2 \xrightarrow{CCl_4}$

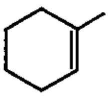
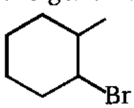
(a) I and III

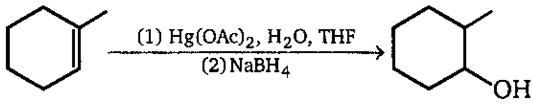
(b) II and III

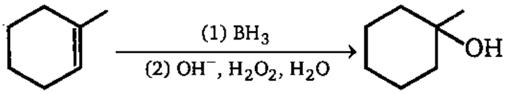
(c) I, II, and III

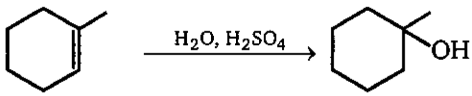
(d) I, II and III

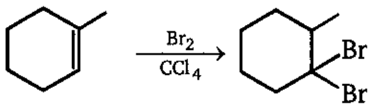
125. Which of the following reactions generates the major product ? Ignore stereoisomerism.

(a)  + HBr $\longrightarrow$ 

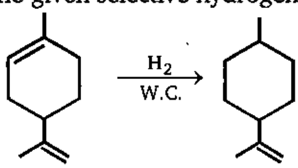
(b) 

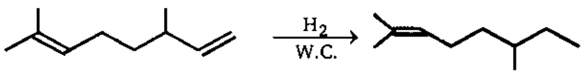
(c) 

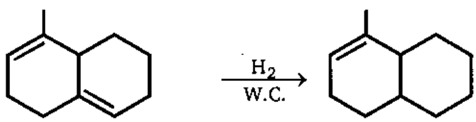
(d) 

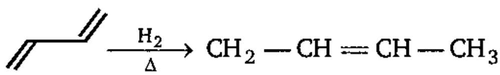
(e) 

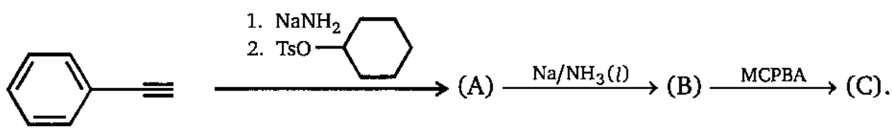
126. In the given selective hydrogenation which combination is incorrect ?

(a)  (W.C. = Wilkinsons catalyst)

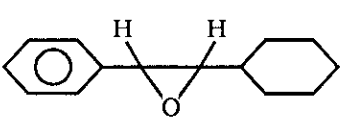
(b)  (W.C. = Wilkinsons catalyst)

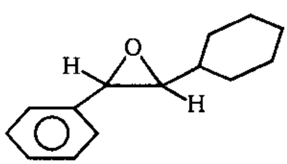
(c) 

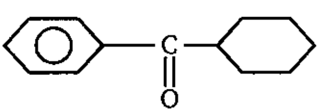
(d) 

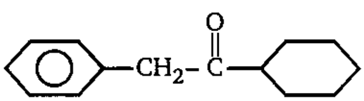
127. 

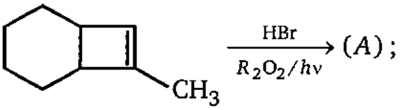
Compound (*C*) in above sequence of reaction is :

(a) 

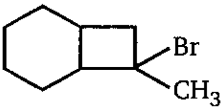
(b) 

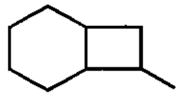
(c) 

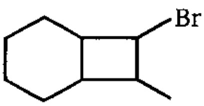
(d) 

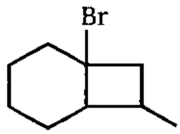
128. 

Major product (A) is :

(a) 

(b) 

(c) 

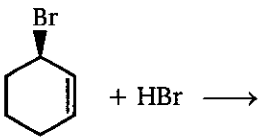
(d) 

129. In the reaction given below, the product would be :

$$CH_3-CH=CH-CH_3 \xrightarrow{H_3O^+} CH_3-CH_2-\underset{}{\overset{OH}{\overset{|}{C}H}}-CH_3$$

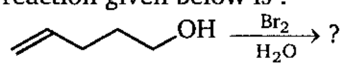
(a) a mixture of diastereomers
(b) optically active
(c) optically pure enantiomer
(d) a racemic mixture

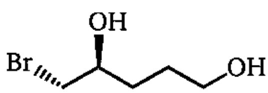
130. Surprisingly, the reaction shown below goes through classical carbocation. What is the major product of this reaction ?

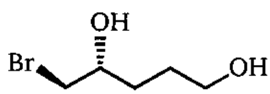


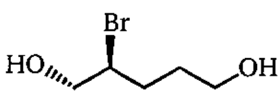
(a) *trans*-1, 3-dibromocyclohexane
(b) *cis*-1, 3-dibromocyclohexane
(c) *trans*-1, 2-dibromocyclohexane
(d) *cis*-1, 2-dibromocyclohexane

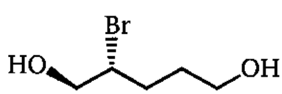
131. The major product of the reaction given below is :

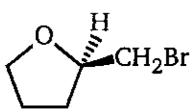


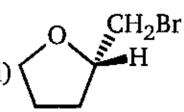
(i) 

(ii) 

(iii) 

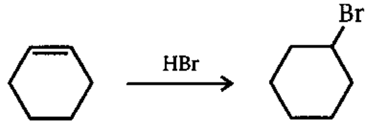
(iv) 

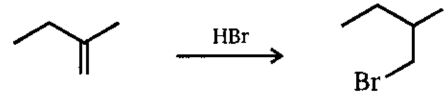
(v) 

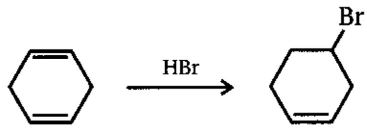
(vi) 

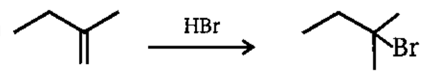
(a) (i) and (ii)
(b) (iii) and (iv)
(c) (v) and (vi)
(d) none of these

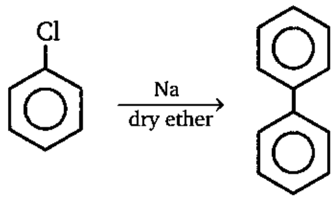
132. Which reaction will occur at the fastest rate ?

(a) 

(b) 

(c) 

(d) 

133. 

Above reaction is known as :

(a) Wurtz reaction
(b) Wurtz fittig reaction
(c) Fittig reaction
(d) Kolbe electrolysis

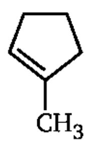
134. $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow{\text{Red P + HI}} A$

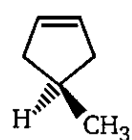
Product A is :

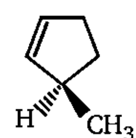
(a) propane (b) propanol (c) prapanoic acid (d) propene

135. Which of the following compound give diastereomers when treated with Br_2 in CCl_4?

(a) 
Methylcyclopentane

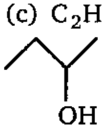
(b) 
1-Methylcyclopentene

(c) 
3-Methylcyclopentene

(d) 
4-Methylcyclopentene

136. A mixture of C_2H_6, C_2H_4 and C_2H_2 is bubbled through alkaline solution of copper (I) chloride, contained in Woulf's bottle. The gas coming out is :

(a) original mixture
(b) C_2H_6
(c) C_2H_6 and C_2H_4 mixture
(d) C_2H_4 and C_2H_2

137.  $\xrightarrow[\Delta]{H^+}$ Possible products (x) $\xrightarrow{Br_2/CCl_4}$ (y) products

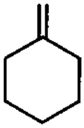
The number of possible products for x and y is :

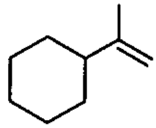
(a) 2, 4
(b) 3, 5
(c) 3, 6
(d) 3, 4

138. Select the incorrect statement :

(a) Bromine is more selective and less reactive
(b) Chlorine is less selective and more reactive
(c) Benzyl free radical is more stable than 2° free radical
(d) Vinyl free radical more stable than allyl free radical

139. Which of the following compound does not evolve CO_2 gas, when undergo oxidative ozonolysis ?

(a) 

(b) 

(c) $H_2C=CH-CH=CH_2$

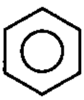
(d) 

140. *cis*-3-hexene $\xrightarrow{(a)}$ meso 3,4-hexanediol

trans-3-hexene $\xrightarrow{(b)}$ meso 3,4-hexanediol.

Choose pair of reagent (a, b) for above conversions.

(a) Cold $KMnO_4, OsO_4$
(b) Cold $KMnO_4, RCO_3H/H_3O^{\oplus}$
(c) $RCO_3H/H_3O^{\oplus}$, cold $KMnO_4$
(d) None of these

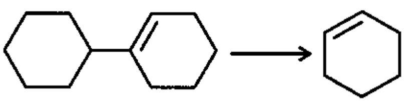
141.  $\xrightarrow[\text{Liq. } NH_3]{Na} (A) \xrightarrow[Zn]{O_3} (B) \xrightarrow{Ph_3P=CH_2 (2\text{mole})} (C)$

Product (C) of the above reaction is :

(a) 1,3-hexadiene
(b) 1,4-pentadiene
(c) 1,3-butadiene
(d) 1,3-heptadiene

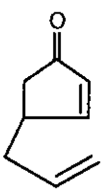
142. How many carbon-hydrogen bond orbitals are available for overlap with the vacant *p*-orbital in ethyl carbocation ?

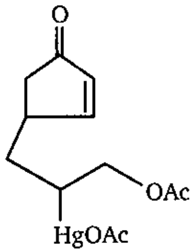
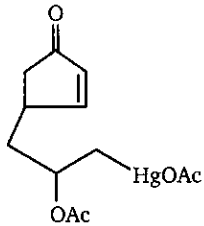
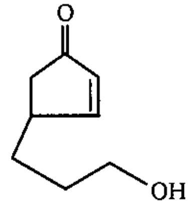
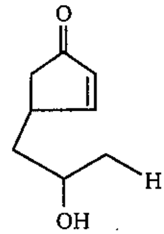
(a) 0
(b) 3
(c) 5
(d) 6

143. 

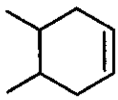
To achieve above conversion, the reagents used will be :

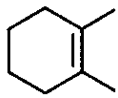
(a) O_3/H_2O_2, HO^-/Δ
(b) HBr, alc. KOH, O_3, $LiAlH_4$, H^+/Δ
(c) HBr, *t*-BuOK, O_3, $KMnO_4$, Δ
(d) HCl, $KMnO_4$(cold), H^+/Δ

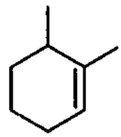
144.  $\xrightarrow[AcOH]{Hg(OAc)_2}$ X (major); Product (X) is:

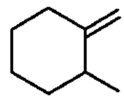
(a)  (b)  (c)  (d) 

145. Decreasing order of heat evolved upon catalytic hydrogenation of given reactants with a H_2 (Pd/C) is :


(a)

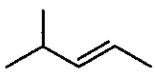

(b)

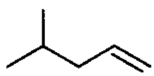

(c)

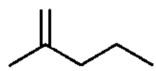

(d)

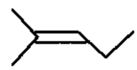
(a) $b > c > a > d$ (b) $d > a > c > b$ (c) $d > c > a > b$ (d) $c > b > c > d$

146.


(a)


(b)

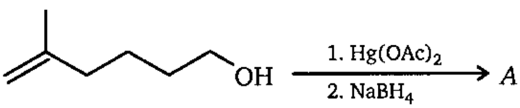

(c)


(d)

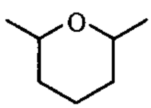
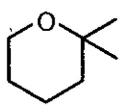
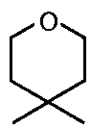
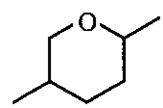
The correct order of heat of hydrogenation of given molecules is :

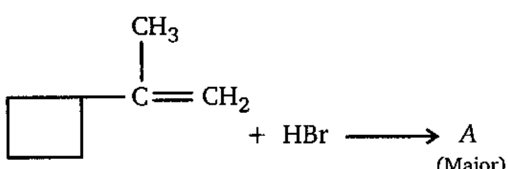
(a) $d > c > a > b$ (b) $d > c > b > a$

(c) $b > a > c > d$ (d) $d > a > c > b$

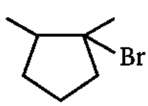
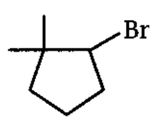
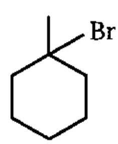
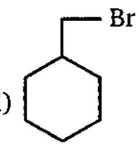
147. 

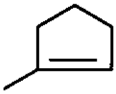
Product (A) of the above reaction is :

(a)  (b)  (c)  (d) 

148. 

Product (A) is :

(a)  (b)  (c)  (d) 

149.  $\xrightarrow[CCl_4]{HBr}$ Product; Comment upon optical activity of the product.

(a) Racemic mixture
(b) Diastereomers
(c) Meso
(d) Optically inactive due to absence of chiral center

150. $CH_3-\overset{\overset{CH_3}{|}}{C}=CH-CH_3 \xrightarrow{Hg(OAc)_2/EtOH} \underset{(90\%)}{(A)}$

Product (A) of the above reaction is :

(a) $CH_3-\underset{\underset{HgOAc}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{OEt}{|}}{CH}-CH_3$

(b) $CH_3-\underset{\underset{OEt}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{HgOAc}{|}}{CH}-CH_3$

(c) $CH_3-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{HgOAc}{|}}{CH}-CH_3$

(d) $CH_3-\underset{\underset{HgOAc}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{OH}{|}}{CH}-CH_3$

151. $Me_2CH-\underset{\underset{OH}{|}}{CH}-Me \xrightarrow[350°C]{Al_2O_3} (A) \xrightarrow[(ii)\ AgOH]{(i)\ HI} (B)$

Product (B) of above reaction :

(a) $Me_2C(OH)CH_2Me$

(b) $Me_2CH-\underset{\underset{OH}{|}}{CH}-Me$

(c) $Me-\underset{\underset{OH}{|}}{CH}-CMe_3$

(d) $HO-CH_2-(CH_2)Me$

152. In which of the following reaction, Markownikoff's rule is violated ?

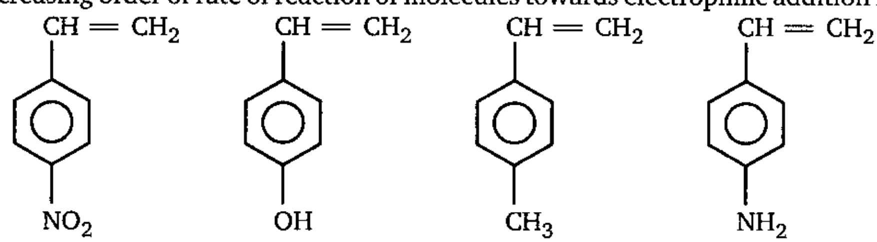
(a) $CH_3-O-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

(b) $CH_3-NH-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

(c) $CH_3-S-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

(d) $O_2N-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

153. Decreasing order of rate of reaction of molecules towards electrophilic addition reaction is :

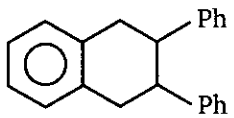


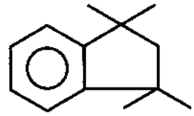
(a) (b) (c) (d)

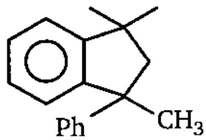
(a) $a > b > c > d$
(b) $b > c > a > d$
(c) $d > b > c > a$
(d) $b > d > c > a$

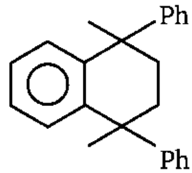
154. $2CH_3-\underset{\underset{Ph}{|}}{C}=CH_2 \xrightarrow{H-A\,(acid)} \underset{(major)}{(A)}$

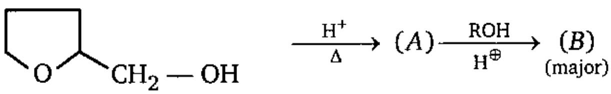
Product (A) is :

(a) 

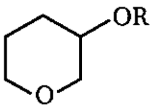
(b) 

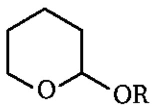
(c) 

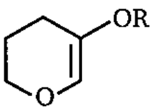
(d) 

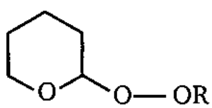
155. 

Product (B) of the above reaction is :

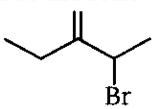
(a) 

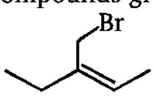
(b) 

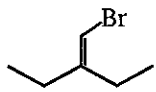
(c) 

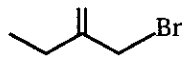
(d) 

156. Which of the following compounds gives the same carbocation on ionization ?


1


2


3


4

(a) 1 and 3
(b) 2 and 4
(c) 1 and 2
(d) 1 and 4

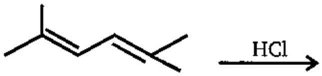
157. For the following reactions the major products are shown :

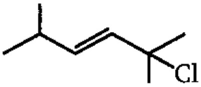
$$H_2C=CH-CH=CH_2 \xrightarrow[0°C]{HBr} H_2C=CH-\underset{\underset{Br}{|}}{CH}-CH_3 \xrightarrow{+\ 25°C} \underset{\underset{Br}{|}}{CH_2}CH=CHCH_3$$

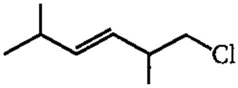
These provide an example of ___1___ control at low temperature and ___2___ control at higher temperature.

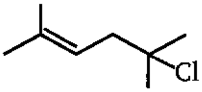
	1	2
(a)	kinetic	thermodynamic
(b)	thermodynamic	kinetic
(c)	kinetic	kinetic
(d)	thermodynamic	thermodynamic

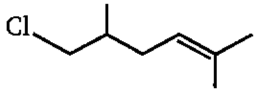
158. What is the product of 1, 4-addition in the reaction shown below ?

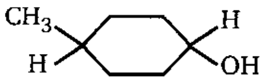


(a) 

(b) 

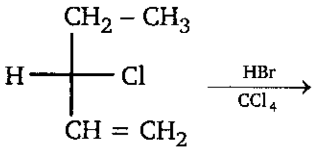
(c) 

(d) 

159. 

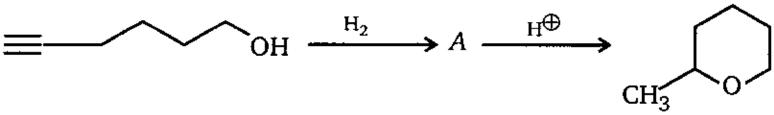
Dehydration of the above compound will give :

(a) meso product
(b) racemic mixture
(c) diastereomer
(d) optically pure enantiomer

160. 

What is stereochemistry of product ?

(a) Racemic mixture
(b) Optically inactive
(c) Diastereomers
(d) Meso product

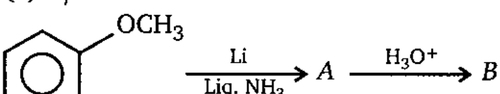
161. 

End product formed in the above reaction is :

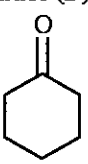
(a) Optically active (b) Racemic (c) Meso (d) Diastereomer

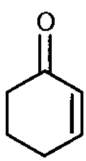
162. How many moles of BH_3 are needed to react completely with 2 mole of 1-pentene in hydroboration-oxidation reaction ?

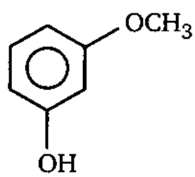
(a) 2 mole
(b) 3 mole
(c) 2/3 mole
(d) 3/2 mole

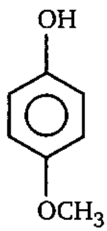
163. 

Product (B) in the above reaction is :

(a) 

(b) 

(c) 

(d) 

164. $H_2\overset{14}{C}=CH-CH_3 \xrightarrow[\text{or high temp}]{\text{low conc. of } Br_2} (?)$

Product of the above reaction is :

(a) $H_2\overset{14}{C}=CH-CH_2-Br$ (b) $H_2C=CH-\overset{14}{C}H_2-Br$

(c) $\underset{Br}{\overset{14}{C}H_2}-\underset{Br}{CH}-CH_3$ (d) both (a) and (b)

165. In which of the following reactions 1,3-butadiene will be obtained as a major product ?

(a) $Br-CH_2-CH_2-CH_2-CH_2-Br \xrightarrow[(CH_3)_3COH]{(CH_3)_3COK\,(2\text{mole})}$

(b) $HO-CH_2-CH_2-CH_2-CH_2-OH \xrightarrow{\text{Conc. } H_2SO_4}$

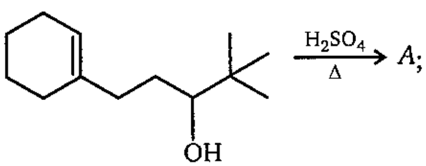
(c) $H_2C=CH-C\equiv CH \xrightarrow[Ni_2B]{H_2(1\text{mole})}$

(d) All of these

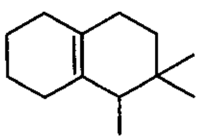
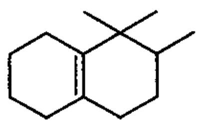
166. $H_2C=C(CH_3)_2 \xrightarrow[20°C]{Cl_2} \xrightarrow[2.\ Ca(OH)_2]{1.\ H_2O} \xrightarrow[\Delta]{H^+} A$; Identify A.

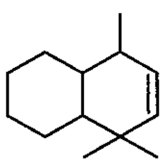
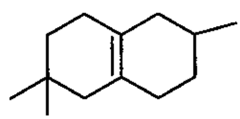
(a) $CH_3-\overset{CH_3}{\overset{|}{C}}-CH_2$ (with O bridging C and CH_2) (b) $CH_3-\underset{CH_3}{\underset{|}{CH}}-CHO$

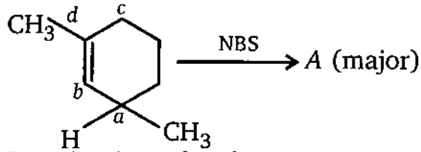
(c) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_3$ (d) $CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2$

167. 

Product (A) is :

(a)  (b) 

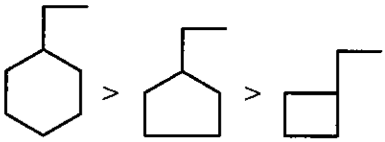
(c)  (d) 

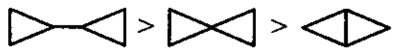
168. 

Bromination take place at :

(a) a (b) b (c) c (d) d

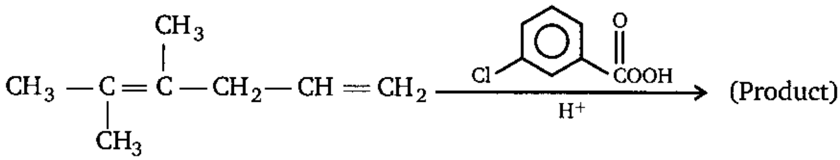
169. Which is incorrect statement about heats of combustion ?

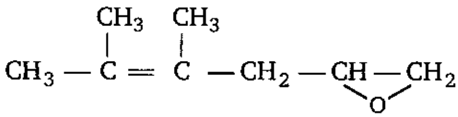
(a) 

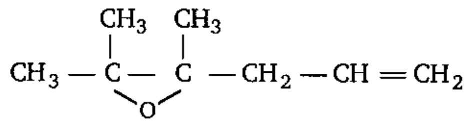
(b) 

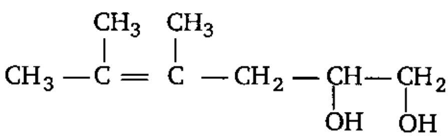
(c) Iso-butene > *trans*-2-butene > 1-butene (d) n-Hexane < n-Heptane < n-Octane

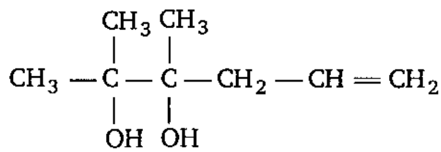
170. Predict the major product of the reaction.

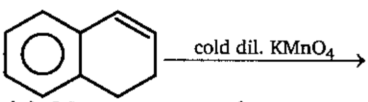


(a) 

(b) 

(c) 

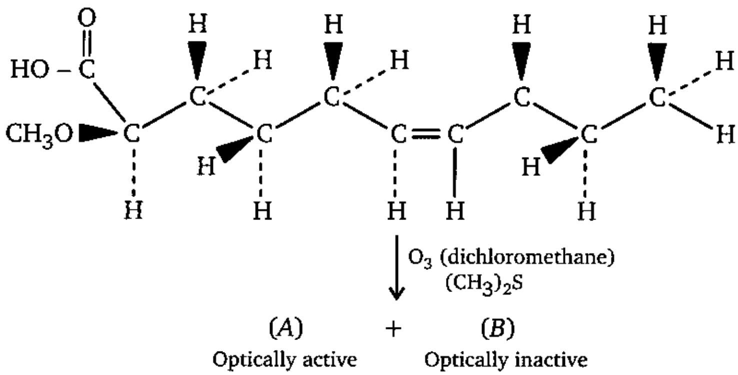
(d) 

171. 

Product of the reaction is:

(a) Meso compound (b) Enantiomeric pair

(c) Diastereomers (d) Optically pure enantiomer

172. 

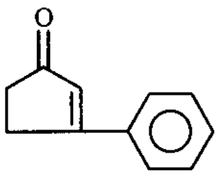
Product (*A*) of above reaction is:

(a) $CH_3O-\underset{\underset{CO_2H}{|}}{CH}-CH_2-CH_2-CHO$

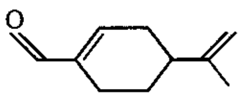
(b) $CH_3O-CH_2-\overset{\overset{CO_2H}{|}}{CH}-CH_2-CO_2H$

(c) $CH_3O-\underset{\underset{CO_2H}{|}}{CH}-CH_2-CH_2-CO_2H$

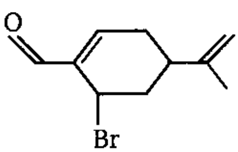
(d) $CH_3O-\underset{\underset{CO_2H}{|}}{CH}-CH_2-CH_2-CH_2-CHO$

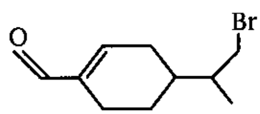
173.  $\xrightarrow[10\%\,Pd/C]{H_2\ (2\text{-}3atm)(1\ mole)}$ Products ; Comment up on optical activity of products.

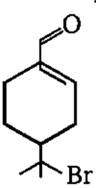
(a) Diastereomers (b) Racemic mixture (c) Meso (d) Optically pure enantiomer

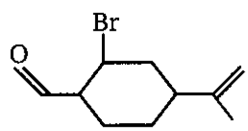
174.  + HBr (1 mole) $\longrightarrow$ Product

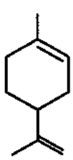
Addition of a mineral acid to an olefin bond leads to major product, Identify it:

(a) 

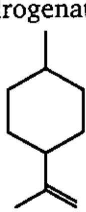
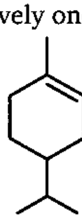
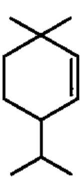
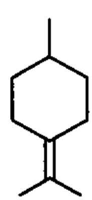
(b) 

(c) 

(d) 

175.  $\xrightarrow[PtO_2]{H_2\,(\text{one mole})}$ Product

In polyenes that contain differently substituted (C═C) double bonds, it is possible to hydrogenate chemeselectively one (C═C) double bond. Product is :

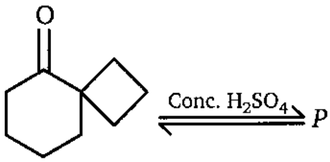
(a)  (b)  (c)  (d) 

176. 

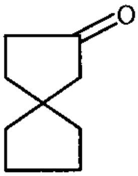
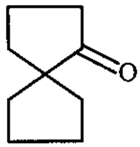
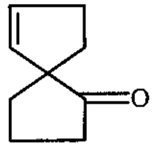
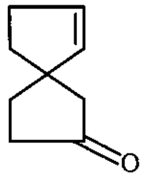
(MCPBA ⟶ meta-chloro perbenzoic acid)

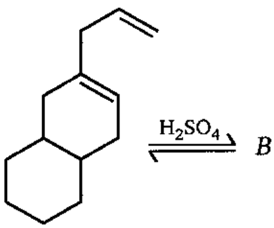
Stereochemistry of the product of above reaction is :

(a) Meso (b) Racemic
(c) Diastereomers
(d) Optically inactive due to absence of chiral center.

177. 

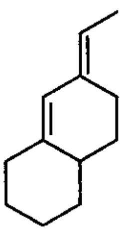
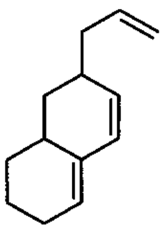
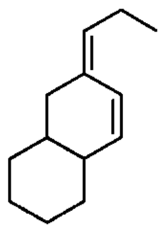
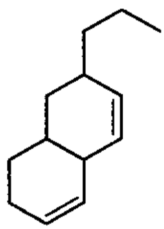
Identify product (P).

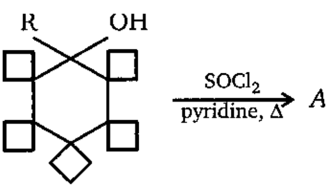
(a) 
(b) 
(c) 
(d) 

178. 

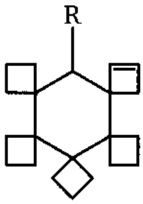
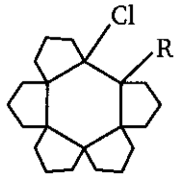
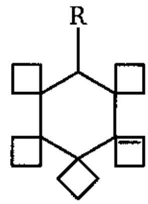
A

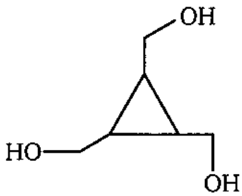
A isomerise to B on addition of traces of acid H_2SO_4. Compound (B) is :

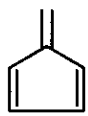
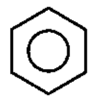
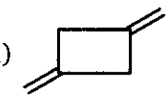
(a) 
(b) 
(c) 
(d) 

179. 

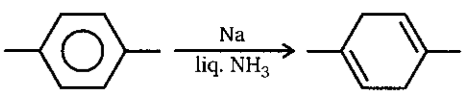
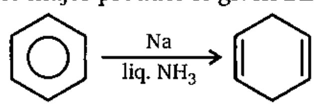
Product (A) of the reaction is :

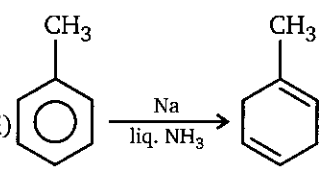
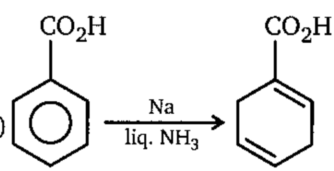
(a)  (b)  (c)  (d) None of these

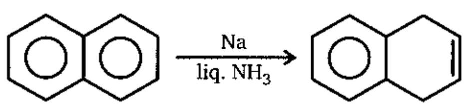
180.  $\xrightarrow[\Delta]{H^+ \text{(excess)}}$ (A). Product (A) is :

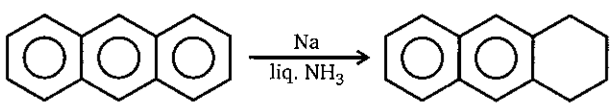
(a)  (b)  (c)  (d) 

181. Which of the following reactions do not represent the major product of given Birch reductions ?

(i)  (ii) 

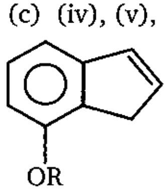
(iii)  (iv) 

(v) 

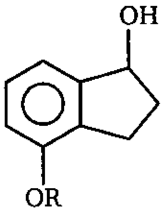
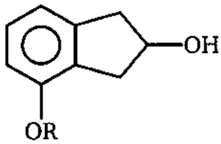
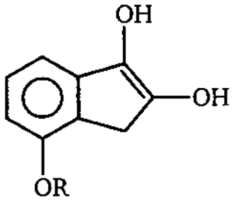
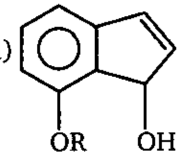
(vi) 

(vii) 2-butyne $\xrightarrow[\text{liq. } NH_3]{Na}$ *cis*-2-butene

(a) (i), (iii), (vi)
(b) (iv), (vi), (vii)
(c) (iv), (v), (vi)
(d) (i), (ii), (v), (vii)

182.  $\xrightarrow{BH_3}$ $\xrightarrow{H_2O_2, HO^-}$ (A)

Product (A) is:

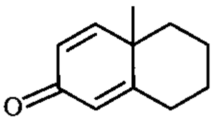
(a)  (b)  (c)  (d) 

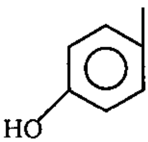
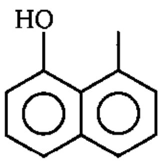
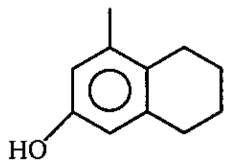
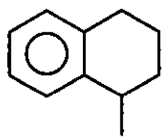
Hint : Think carefully about the relative stabilization of developing positive charge, when the double bond reacts with an electrophile.

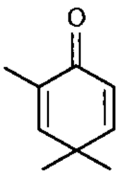
183.  $\xrightarrow{\text{HOCl}} (A) \xrightarrow[\text{H}_2\text{O},\ 25^\circ\text{C}]{\text{NaOH,}} (B)$ 70%

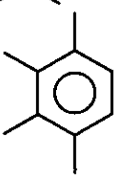
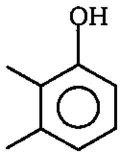
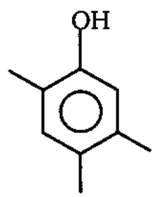
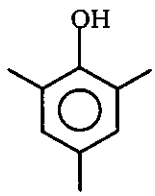
Correct statement about above reaction is:

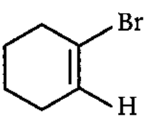
(a) A = *cis*-2-chlorocyclohexanol, B = cyclohexeneoxide
(b) A = *trans*-2-chloro cyclohexanol, B = anti-diol
(c) A = *trans*-2-chlorocyclohexanol, B = cyclohexeneoxide
(d) A = *cis*-2-chlorocyclohexanol, B = anti-diol

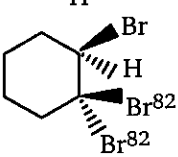
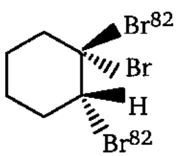
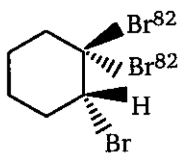
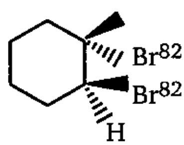
184.  $\xrightarrow{H^{\oplus}}$ Predict the major product:

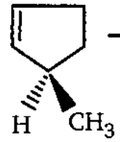
(a)  (b)  (c)  (d) 

185.  $\xrightarrow[(Major)]{H_2SO_4}$ (A) ; Product (A) is :

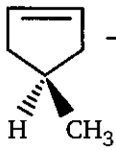
(a)  (b)  (c)  (d) 

186.  $^{82}Br-{}^{82}Br \xrightarrow[CCl_4]{}$ Major product of the reaction is :

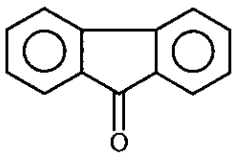
(a)  (b)  (c)  (d) 

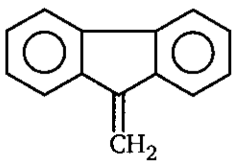
187.  $\xrightarrow[CCl_4]{Br_2}$ stereochemistry of the product is:

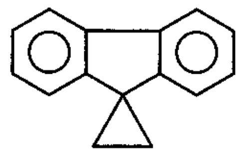
(a) Diastereomers (b) Racemic mixture
(c) Meso (d) Pure Enantiomers

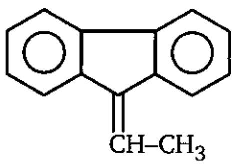
188.  $\xrightarrow[CCl_4]{Br_2}$ Product/s obtained is/are :

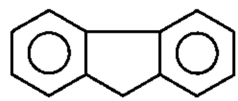
(a) Diastereomers (b) Racemic
(c) Meso (d) Optically pure enantiomers

189.  $\xrightarrow{Ph_3P=CH_2} \xrightarrow{Ph_3P=CH_2} (x)$; Product (x) is :

(a) 

(b) 

(c) 

(d) 

190. $CH_3-CH_2-CH_2-CH_2-\overset{CH_3}{\underset{CH_3}{C}}-CH_2-OH \xrightarrow[\Delta]{H^+} \underset{\text{(major)}}{(A)}$; Product (A) is :

(a) $CH_3-CH_2-CH_2-CH_2-\underset{CH_3}{C}=CH-CH_3$

(b) $CH_3-CH_2-CH_2-CH_2-CH=C\begin{smallmatrix} CH_3 \\ CH_3 \end{smallmatrix}$

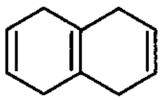
(c) $CH_3-CH_2-CH_2-CH_2-\underset{CH_3}{C}=CH_2$

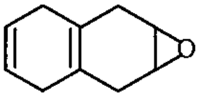
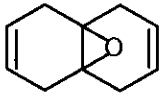
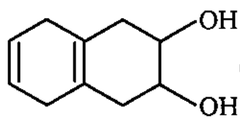
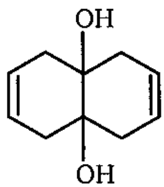
(d) $CH_3-CH_2-\underset{CH_3}{CH}-CH_2-\overset{CH_3}{C}=CH_2$

191. $CH_3-CH=CH-CH_3 \xrightarrow[R_2O_2,\Delta]{HBr}$
(Anti-Markownikoff's addition)

Comment on optical activity of the products:

(a) Racemic (b) Diastereomer
(c) Meso (d) Optically pure enantiomer

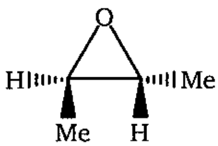
192.  $\xrightarrow{CH_3-\overset{\overset{O}{||}}{C}-O-O-H}$ (A) ; Product (A) is :
(major)

(a)  (b)  (c)  (d) 

193. A (alkene) $\xrightarrow[H_2O]{RCO_3H}$ Racemic mixture; A (alkene) $\xrightarrow{\text{Cold dil. } KMnO_4}$ Meso-compound

Alkene (A) will be :

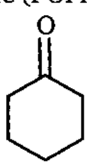
(a) *cis*-2-pentene (b) *cis*-2-hexene
(c) *cis*-4-octene (d) *trans*-2-hexene

194.  $+ PPh_3 \longrightarrow (A) + POPh_3$
(major)

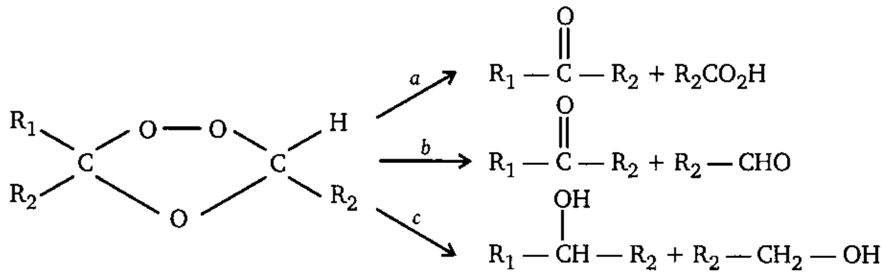
Product (A) is

(a) *trans*-2-butane (b) *cis*-2-butene (c) 1-butene (d) Iso-butene

195. In which of the following reactions, two products will be formed other than phosphonium ylide ($POPh_3$)

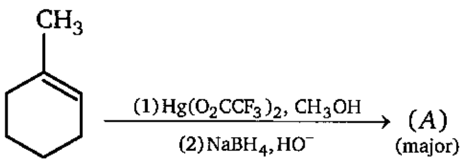
(a)  $+ Ph_3P=CH_2 \longrightarrow$
(b) $CH_3CHO + Ph_3P=\underset{\underset{CH_3}{|}}{C}-CH_3 \longrightarrow$
(c) $Ph-\overset{\overset{O}{||}}{C}-H + Ph_3P=CH-Ph \longrightarrow$
(d) $H-\overset{\overset{O}{||}}{C}-H + Ph_3P=CH-CH_3 \longrightarrow$

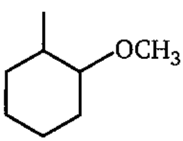
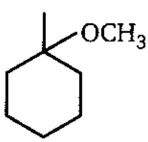
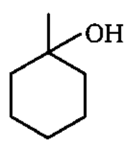
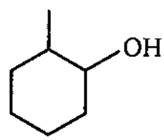
196. To carry out the given conversions, select the correct option:



(a) $a = Ag_2O$, $b = Zn/CH_3CO_2H$, $c = LiAlH_4$
(b) $a = H_2O_2$, $b = CH_3-S-CH_3$, $c = NaBH_4$
(c) Both (a) and (b)
(d) None of these

197. The product (*A*) of given alkoxymercuration de-mercuration is :



(a)  (b)  (c)  (d) 

198. $CH_3-\overset{ONa}{\overset{|}{C}}=CH_2 \xrightarrow{HC\equiv CH} \xrightarrow{H^+} \xrightarrow[Pd\text{-}BaSO_4]{H_2} \xrightarrow[\Delta]{Al_2O_3}$

End product of the reaction is :

(a) $H_2C=CH-\underset{CH_3}{\underset{|}{C}}=CH_2$
(b) $CH_3-CH=CH-CH=CH_2$
(c) $H_2C=CH-CH=CH_2$
(d) $H_2C=CH-CH_2-CH=CH_2$

199. Major product of the given reaction is :

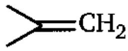
$H_2C=CH-CH_2-I \xrightarrow[CCl_4]{HI\,(excess)}$

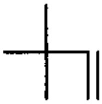
(a) $CH_3-\underset{I}{\underset{|}{CH}}-\underset{I}{\underset{|}{CH_2}}$
(b) $CH_3-\underset{I}{\underset{|}{CH}}-CH_3$
(c) $CH_3-CH_2-CH_2-I$
(d) $I-CH_2-CdH_2-CH_2-I$

200. The rate constant for a reaction can be increased by $\underline{a}$ the stability of the reactant or by $\underline{b}$ the stability of the transition state. Select the correct choice for a and b.

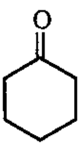
(a) decreasing, decreasing (b) increasing, decreasing
(c) decreasing, increasing (d) increasing, increasing

201. Major product of the given reaction is :

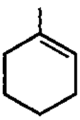
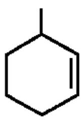
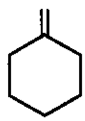
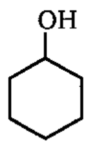
$H_2C=CH_2$ +  $\xrightarrow[\Delta]{H^+}$ Product

(a)  (b) 

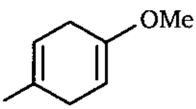
(c)  (d) $H_2C=C(CH_3)-CH_2-CH_2-CH_3$

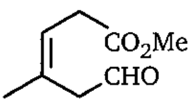
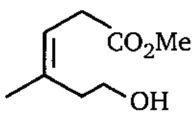
202.  + $Ph_3P=CH_2 \longrightarrow \underset{\text{Major}}{(A)}$

Major product (A) is :

(a)  (b)  (c)  (d) 

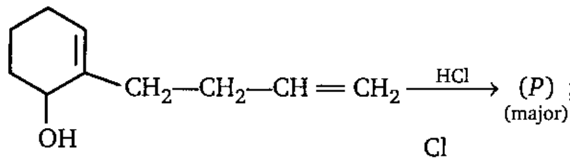
203. In the given reaction, only one alkene undergo preferential oxidation by electrophilic ozone. Identify product (P) of the given reaction:

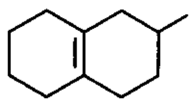
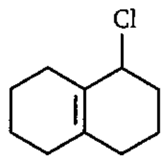
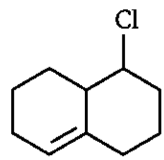
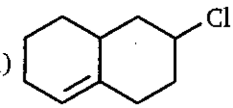
 $\xrightarrow[\text{Me}_2\text{S, }-78°\text{C then NaBH}_4]{O_3}$ (P) (>52%)

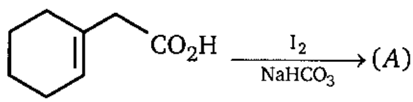
(a)  (b) 

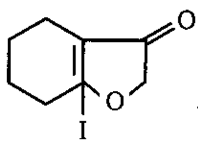
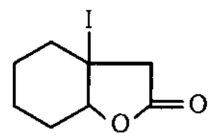
(c) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH=\underset{OMe}{\underset{|}{C}}-CH_2-CHO$

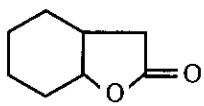
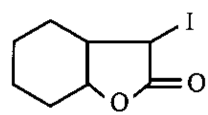
(d) $CH_3-\overset{OH}{\overset{|}{CH}}-CH_2-CH=\underset{OMe}{\underset{|}{C}}-CH_2-CH_2-OH$

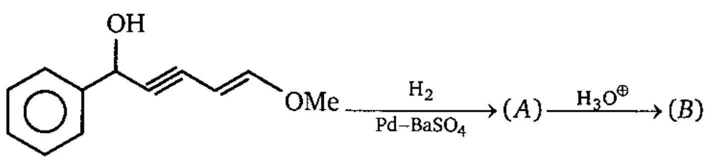
204.  ; Product (P) is:

(a)  (b)  (c)  (d) 

205.  ; Major product of the reaction is :

(a)  (b) 

(c)  (d) 

206. 

Product (B) is :

(a) $Ph-\overset{OH}{\overset{|}{CH}}-CH=CH-CH_2-\overset{O}{\overset{\|}{C}}-H$ (b) $Ph-CH=CH-CHO$

(c) $Ph-(CH=CH)_2-CHO$ (d) $Ph-(CH=CH)_3-CHO$

207. Isobutene, in the presence of H_2SO_4, forms a mixture of two isomeric alkene (C_8H_{16}). The major alkene is :

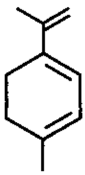
(a) $CH_3-\overset{CH_3}{\underset{CH_3}{C}}-CH=\overset{CH_3}{C}-CH_3$ (b) $CH_3-\overset{CH_3}{\underset{CH_3}{C}}-CH_2-\overset{CH_3}{C}=CH_2$

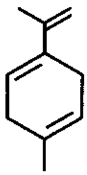
(c) $CH_3-\overset{CH_3}{CH}-CH=CH-\overset{CH_3}{CH}-CH_3$ (d) $CH_2=\overset{CH_3}{C}-CH_2-CH_2-\overset{CH_3}{CH}-CH_3$

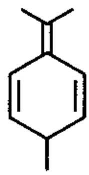
208. An unknown alkene (*A*) reacts with 3 mole of H_2 gas in presence of platinum catalyst to form 1-isopropyl-4-methyl cyclohexane. When unknown alkene (*A*) is ozonized and reduced, following product are obtained

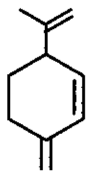
$$H-\overset{\overset{\large O}{\|}}{C}-H, \quad H-\overset{\overset{\large O}{\|}}{C}-CH_2-\overset{\overset{\large O}{\|}}{C}-\overset{\overset{\large O}{\|}}{C}-CH_3, \quad CH_3-\overset{\overset{\large O}{\|}}{C}-CH_2-\overset{\overset{\large O}{\|}}{C}-H$$

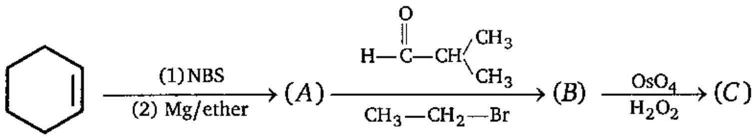
The alkene (*A*) is :

(a) 

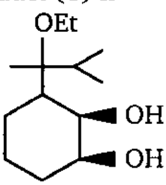
(b) 

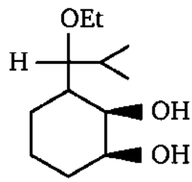
(c) 

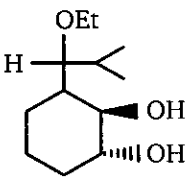
(d) 

209. 

Product (*C*) is

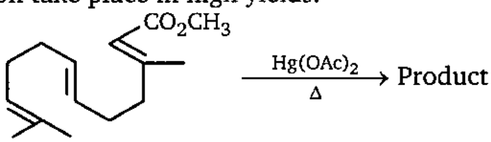
(a) 

(b) 

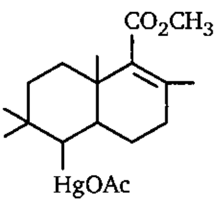
(c) 

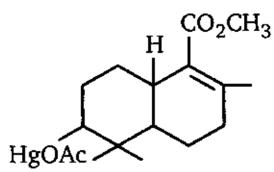
(d) Both (a) and (b)

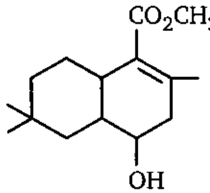
210. The following reaction take place in high yields.

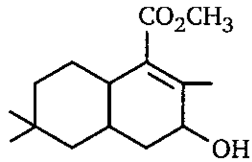


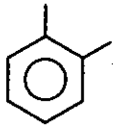
Use your knowledge of alkene chemistry to predict a product even though you have never seen this reaction before

(a) 

(b) 

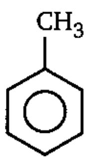
(c) 

(d) 

211.  $\xrightarrow[(2)\,Zn]{(1)\,O_3}$ $H-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-H$ (Glyoxal) $+ CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-CH_3$ (2,3-Butanedione) $+ CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-H$ (Pyrualdehyde)

What is the ratio of glyoxal to pyrualdehyde obtained in the above reaction ?

(a) 1 : 3
(b) 3 : 1
(c) 3 : 2
(d) 2 : 3

212.  $\xrightarrow[\text{liq. } NH_3]{Na}$ (A) $\xrightarrow[Zn]{O_3}$ Products

Which of the following product cannot be obtained in above reaction ?

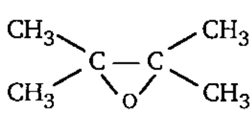
(a) $H-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-H$
(b) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-H$
(c) $CH_3-\underset{CHO}{\underset{|}{CH}}-\overset{O}{\overset{\|}{C}}-H$
(d) None of these

213. $(CH_3)_2C=C(CH_3)_2$ + $(CH_3)_3\overset{+}{N}-\overset{-}{O}$ + $H_2O \xrightarrow{OsO_4(10^{-4}\text{ mole})} A + (CH_3)_3N$

2, 3-dimethyl-2-butane (0.025 mole); TMAO (0.034 moles)

(TMAO $\rightarrow$ trimethyl amine –N – oxide)

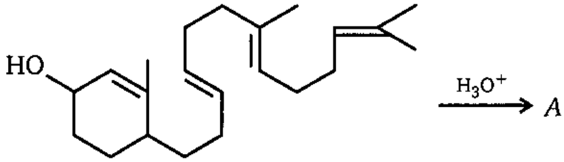
Product (A) is :

(a) 

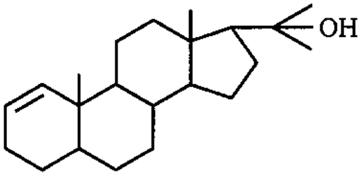
(b) $CH_3-\underset{OH}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-\underset{OH}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH_3$

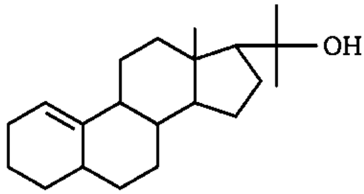
(c) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$

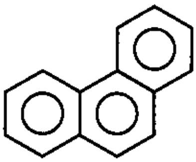
(d) $CH_3-\overset{O}{\overset{\|}{C}}-C(CH_3)_3$

214. 

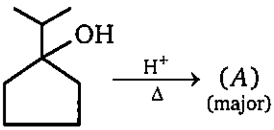
Product (*A*) of the reaction is :

(a) 

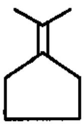
(b) 

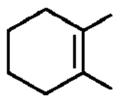
(c) 

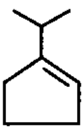
(d) None of these

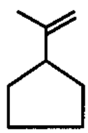
215. 

Product (*A*) is :

(a) 

(b) 

(c) 

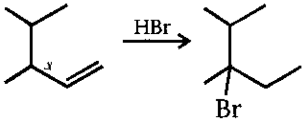
(d) 

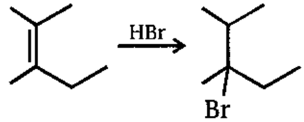
216. $(CH_3)_2C=CH_2$ (*a*) $\quad$ $CH_3(CH_3O)C=CH_2$ (*b*) $\quad$ $CH_3(CH_3OCH_2)C=CH_2$ (*c*)

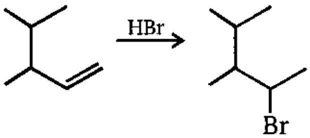
Arrange the above in the decreasing order of reactivity towards HBr :

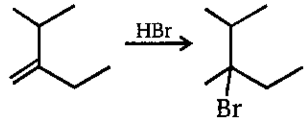
(a) $a > b > c$
(b) $b > a > c$
(c) $b > c > a$
(d) $a > c > b$

217. Which reaction has the lowest $\Delta G^{\ddagger}$ or (Activation-Energy)?

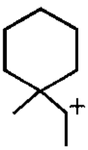
(a) 

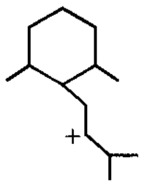
(b) 

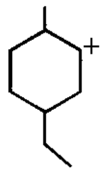
(c) 

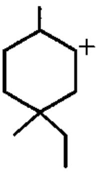
(d) 

218. Which of the following will rearrange ?

(1) 

(2) 

(3) 

(4) 

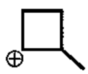
(a) 1

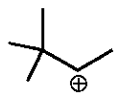
(b) 1 and 3

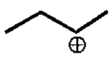
(c) All

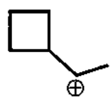
(d) 1, 2, 4,

219. Which of the following is most likely to undergo a favorable hydride shift ?

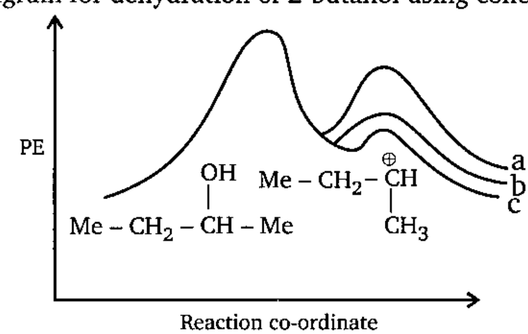
(a) 

(b) 

(c) 

(d) 

220. Energy profile diagram for dehydration of 2-butanol using conc. H_2SO_4 is given below :



Product (b) of above reaction is :

(a) 1-butene

(b) *cis*-2-butene

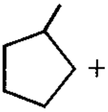
(c) *trans*-2-butene

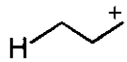
(d) *iso*-butene

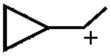
221. How many alkene on catalytic hydrogenation given isopentane as a product ?

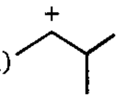
(a) 2 (b) 3
(c) 4 (d) 5

222. Which of the following would not rearrange to a more stable form ?

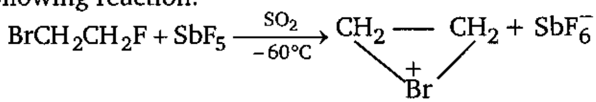
(a) 

(b) 

(c) 

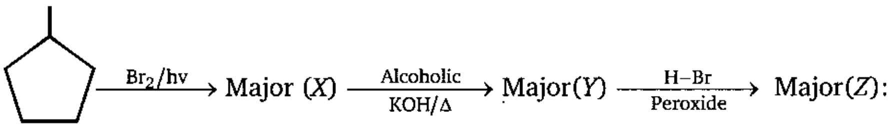
(d) 

223. Consider the following reaction.

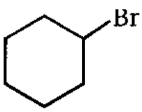


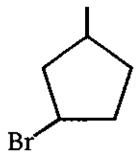
In this reaction SbF_5 acts as:

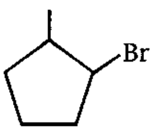
(a) an acid (b) a base
(c) a nucleophile (d) an electrophile

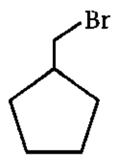
224. 

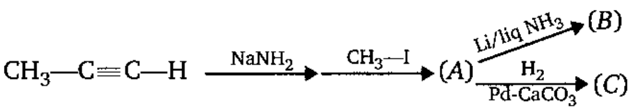
Product (Z) is:

(a) 

(b) 

(c) 

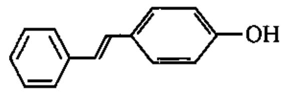
(d) 

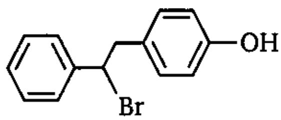
225. 

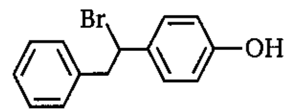
Relation between (B) and (C) is:

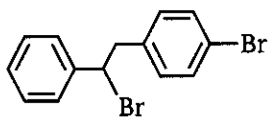
(a) Enantiomer (b) Diastereomer
(c) Geometrical isomer (d) Meso

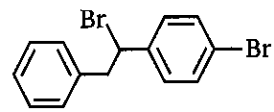
226. The reaction of HBr with the following compound would produce :

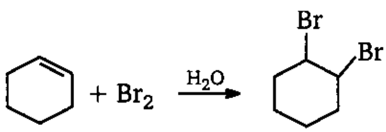


(a) 

(b) 

(c) 

(d) 

227.  is an example of:

(a) Nucleophilic addition
(b) Nucleophilic substitution
(c) Electrophilic addition
(d) Electrophilic substitution
(e) Free radical substitution

ANSWERS — LEVEL 1

1.	(c)	2.	(d)	3.	(c)	4.	(d)	5.	(b)	6.	(b)	7.	(c)	8.	(c)
9.	(c)	10.	(d)	11.	(b)	12.	(d)	13.	(c)	14.	(b)	15.	(b)	16.	(c)
17.	(d)	18.	(d)	19.	(b)	20.	(d)	21.	(b)	22.	(b)	23.	(b)	24.	(b)
25.	(b)	26.	(b)	27.	(d)	28.	(b)	29.	(d)	30.	(b)	31.	(c)	32.	(b)
33.	(a)	34.	(b)	35.	(b)	36.	(b)	37.	(b)	38.	(b)	39.	(b)	40.	(b)
41.	(d)	42.	(e)	43.	(c)	44.	(c)	45.	(a)	46.	(c)	47.	(c)	48.	(b)
49.	(b)	50.	(b)	51.	(b)	52.	(a)	53.	(b)	54.	(d)	55.	(b)	56.	(c)
57.	(c)	58.	(b)	59.	(c)	60.	(a)	61.	(b)	62.	(d)	63.	(a)	64.	(b)
65.	(d)	66.	(b)	67.	(d)	68.	(a)	69.	(c)	70.	(d)	71.	(d)	72.	(c)
73.	(d)	74.	(c)	75.	(a)	76.	(c)	77.	(d)	78.	(b)	79.	(d)	80.	(d)
81.	(c)	82.	(b)	83.	(a)	84.	(a)	85.	(a)	86.	(d)	87.	(b)	88.	(b)
89.	(c)	90.	(d)	91.	(b)	92.	(b)	93.	(a)	94.	(a)	95.	(a)	96.	(d)
97.	(b)	98.	(a)	99.	(c)	100.	(d)	101.	(b)	102.	(b)	103.	(d)	104.	(b)
105.	(b)	106.	(c)	107.	(b)	108.	(b)	109.	(d)	110.	(d)	111.	(c)	112.	(b)
113.	(a)	114.	(b)	115.	(c)	116.	(a)	117.	(b)	118.	(b)	119.	(b)	120.	(d)
121.	(b)	122.	(c)	123.	(a)	124.	(b)	125.	(d)	126.	(a)	127.	(b)	128.	(c)
129.	(d)	130.	(a)	131.	(c)	132.	(d)	133.	(c)	134.	(a)	135.	(d)	136.	(c)
137.	(b)	138.	(d)	139.	(d)	140.	(b)	141.	(b)	142.	(b)	143.	(b)	144.	(b)
145.	(b)	146.	(c)	147.	(b)	148.	(a)	149.	(d)	150.	(b)	151.	(a)	152.	(d)
153.	(c)	154.	(c)	155.	(b)	156.	(c)	157.	(a)	158.	(a)	159.	(b)	160.	(c)
161.	(b)	162.	(c)	163	(b)	164.	(d)	165.	(d)	166.	(b)	167.	(b)	168.	(a)
169.	(c)	170.	(b)	171.	(b)	172.	(d)	173.	(b)	174.	(c)	175.	(b)	176.	(b)
177.	(b)	178.	(c)	179.	(b)	180.	(c)	181.	(b)	182.	(b)	183.	(c)	184.	(c)
185.	(c)	186.	(b)	187.	(a)	188.	(b)	189.	(b)	190.	(b)	191.	(a)	192.	(b)
193.	(c)	194.	(b)	195.	(c)	196.	(c)	197.	(b)	198.	(a)	199.	(b)	200.	(c)
201.	(c)	202.	(c)	203.	(b)	204.	(d)	205.	(b)	206.	(c)	207.	(b)	208.	(b)
209.	(b)	210.	(b)	211.	(c)	212.	(c)	213.	(b)	214.	(a)	215.	(b)	216.	(b)
217.	(d)	218.	(c)	219.	(a)	220.	(b)	221.	(b)	222.	(c)	223.	(d)	224.	(c)
225.	(b,c)	226.	(b)	227.	(c)										

LEVEL-2

1. **Reagents**

A. HCl	B. Br_2	C. $Hg(OAc)_2$ in H_2O	D. $B_2H_6(BH_3)$ in ether
E. H_2O_2	F. $KMnO_4$ in H_2O	G. HOBr	H. $NaBH_4$

In each reagent box write a letter designating the best reagent and condition selected from the above list of reagents.

Reactant	Reagent		Product
$(CH_3)_2CHCH=CH_2$ 3-methyl-1-butene	(i)	☐	$(CH_3)_2CHCH(Cl)CH_3$ 2-Chloro-3-methyl butane
	(ii)	☐	$(CH_3)_2CHCHBrCH_2Br$ 1,2-dibromo-3-methyl butane
	(iii)	☐	$(CH_3)_2CHCHOHCH_2Br$ 1,bromo-3-methyl 2-butanol
	(iv)	☐	$(CH_3)_2CHCH(OH)CH_3$ 3-methyl-2-butanol
	(v)	☐	$(CH_3)_2CHCH(OH)CH_2OH$ 3-methyl-1,2-butanediol

2. **Propene ($CH_3-CH=CH_2$)** can be transformed to compounds (a to j) listed in the left-hand column.

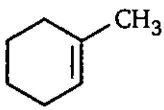
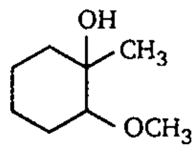
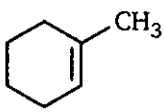
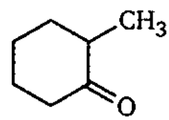
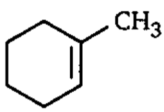
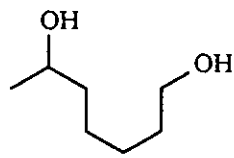
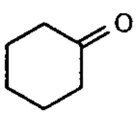
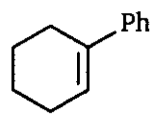
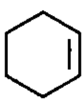
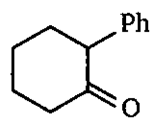
Write letter designating the reagent, you believe will achieve desired transformation. In the case of a multi step sequence write the reagent in the order they are to be used.

	Desired Product	No. of Steps	Write options		Reagent List
a.	$CH_3CHBrCH_2Br$	one		**A.**	$Hg(OAc)_2$ in H_2O
b.	$(CH_3)_2CHOH$	two		**B.**	B_2H_6 in THF

c.	$CH_3CH_2CH_2OH$	two		C.	$NaBH_4$ in alcohol
d.	CH_3COCH_3	three		D.	Br_2 in CH_2Cl_2
e.	CH_3CH_2CHO	three		E.	H_2O_2 in aqueous base
f.	$CH_3CH(OH)CH_2Br$	one		F.	HOBr (NBS in aqueous acetone)
g.	$(CH_3)_2CHBr$	one		G.	HBr in CH_2Cl_2
h.	$CH_3CH(OH)\ CH_2OH$	two		H.	OsO_4 in ether
i.	$CH_3-CH_2-CH_2-Cl$	three		I.	Thionyl chloride ($SOCl_2$)
j.	$CH_3-C\equiv CH$	two		J.	$NaHSO_3$ in aqueous acetone
				K.	NaOH in alcohol and reflux
				L.	$NaNH_2$ (strong base)

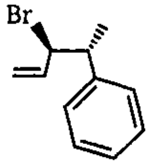
3. In each reaction box write a single letter designating the best reagent and condition selected from the list at bottom of the page.

(F.S., → first step, S.S → second step, T.S. → third step)

Reaction	Reactant	Options	Product
1.		F.S. $\square$ $\longrightarrow$ S.S. $\square$	
2.		F.S. $\square$ $\longrightarrow$ S.S. $\square$ T.S. $\square$	
3.		F.S. $\square$ $\longrightarrow$ S.S. $\square$	
4.		F.S. $\square$ $\longrightarrow$ S.S. $\square$	
5.		F.S. $\square$ $\longrightarrow$ S.S. $\square$ T.S. $\square$	

A. $NaBH_4$/alcohol	**B.** $Ph-CO_3H/CH_2Cl_2$	**C.** PCC	**D.** CH_3ONa/CH_3OH
E. B_2H_6 in THF	**F.** H_2O_2/aq. NaOH	**G.** H_3PO_4 & heat	**H.** $AlCl_3/C_6H_6$
I. O_3 in CH_2Cl_2	**J.** Br_2in CH_2Cl_2	**K.** 20% KOH & heat	**L.** Ph – Li/ether

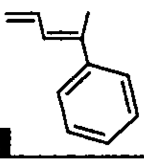
4. Match the reagents a-j with products A-J. There is one best product for each reaction.



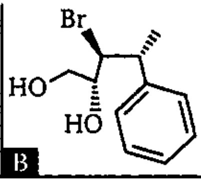
(x)

The molecule (x) is the starting material for all reactions in problem. Do the ones you know first and then tackle the rest by deductive reasoning

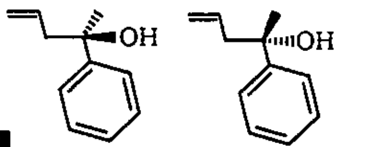
Products



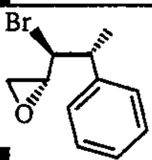
A



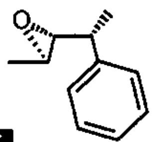
B



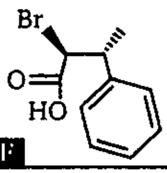
C



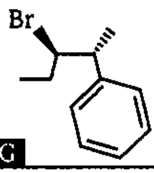
D



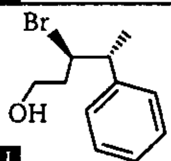
E



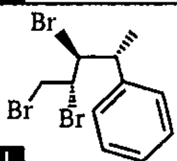
F



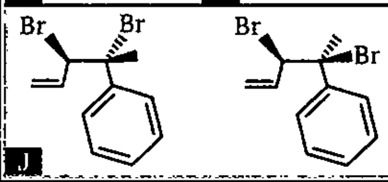
G



H



I



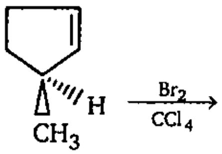
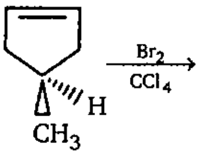
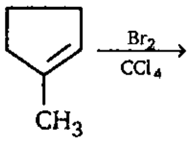
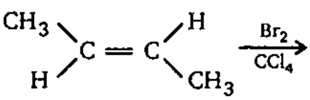
J

	Reagents	Option
(a)	H_2O heat, pH 7	
(b)	$F_3C-C(=O)-O-OH$	
(c)	tBuOK, polar aprotic solvent	
(d)	(1) O_3, ether (2) H_2O, NaOH, H_2O_2	
(e)	Br_2, CCl_4	
(f)	NBS, hv, CCl_4	
(g)	(1) $H_3O(+)$ (2) NaOH, H_2O	
(h)	(1) BH_3, ether (2) H_2O_2	
(i)	(1) OsO_4 (2) NaOH, H_2O	
(j)	$H_2/Pd/C(EtOH)$	

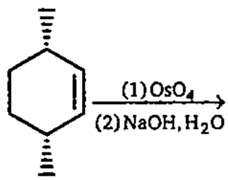
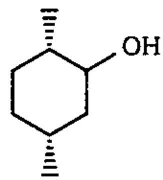
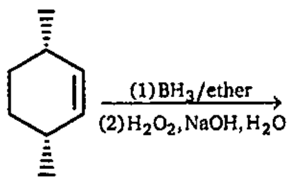
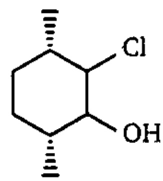
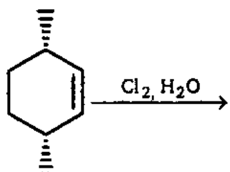
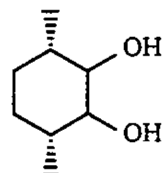
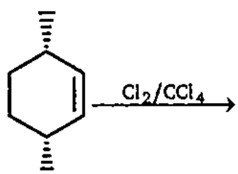
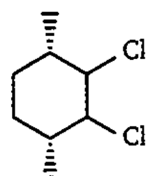
5. Match the column:

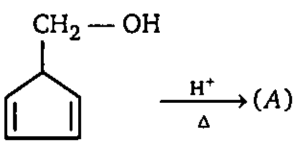
	Column (I)		Column (II)
(a)	$CH_3—C\equiv C—CH_3$	**(p)**	*cis*-product with H_2/Pd - $BaSO_4$
(b)	$CH_3—CH_2—C\equiv CH$	**(q)**	*Trans*-product with Na/liq. NH_3
(c)	$CH_3—C\equiv CH$	**(r)**	White with amm. $AgNO_3$
(d)	$CH_3—C\equiv C—Et$	**(s)**	H_2 gas with Na

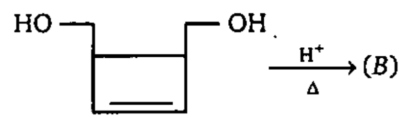
6. Match the column I with column II and with column III (Matrix).

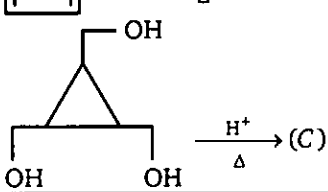
Column-I		Column- II		Column- III	
Reaction		Nature of product formed		Number of chiral center present in product. (Consider only one isomer in case of racemic mixture or Diastereomer)	
(a)		**(p)**	Racemic mixture	**(w)**	0
(b)		**(q)**	Meso	**(x)**	1
(c)		**(r)**	Diastereomer	**(y)**	2
(d)		**(s)**	Vicinal dihalide	**(z)**	3

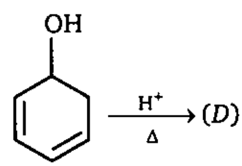
7. Match the column I and II.

Column (I)		Column (II)	
	Reaction		**Product**
(a)		**(p)**	
(b)		**(q)**	
(c)		**(r)**	
(d)		**(s)**	

8. (1) 

(2) 

(3) 

(4) 

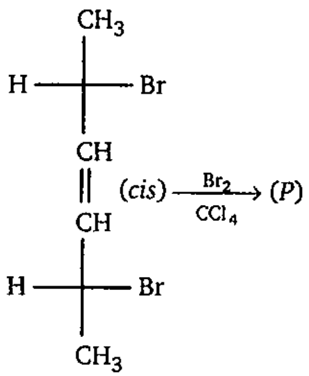
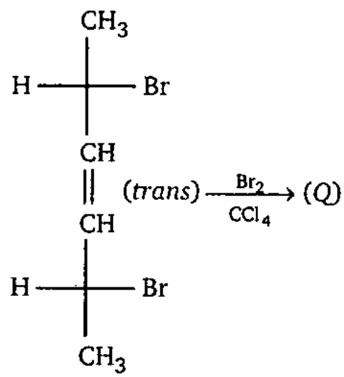
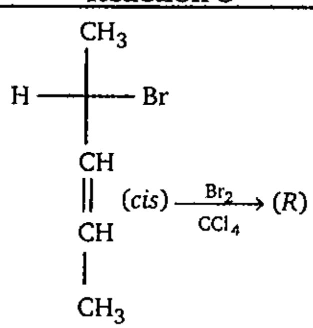
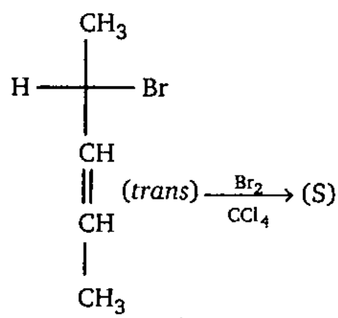
Sum of molecular mass of A, B, C, D (i.e. $A + B + C + D$) is equal to :	

9. (1) $\underset{\text{(all isomers)}}{C_2FClBrI} \xrightarrow[\text{Ni}]{H_2} (A)$ (exclude stereoisomer)

(2) $\underset{\text{(all isomers)}}{C_4H_8\,(\text{alkene})} \xrightarrow[\text{Ni}]{H_2} (B)$ (exclude stereoisomer)

Total number of products *A* and *B* (i.e. *A* + *B*) is equal to :	

10.

Reaction 1	**Reaction 2**
	
Reaction 3	**Reaction 4**
	

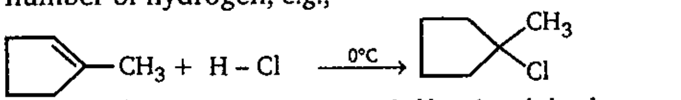
Sum of products *P*, *Q*, *R*, *S* (i.e. *P* + *Q* + *R* + *S*) is equal to :	

11. Comprehension

Vladimir Markovnikov rule :

Alkenes undergo electrophilic addition reactions. It is triggered by the acid acting as a electrophile toward π-electrons of the double bond.

Markovnikov's rule states that when an unsymmetrically substituted alkene reacts with a hydrogen halide, the hydrogen atom adds to the carbon that has the greater number of hydrogen, e.g.,

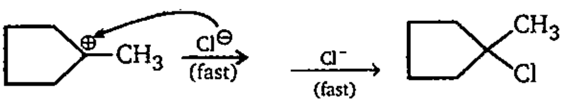


1-methyl cyclopentene 1-chloro-1-methyl cyclopentane

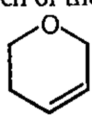
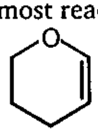
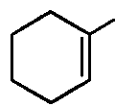
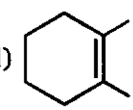
Mechanism :

Step - 1

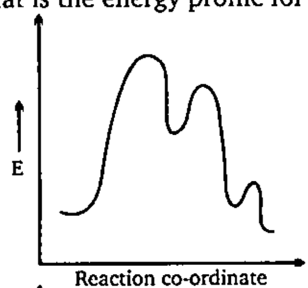
Step- 2

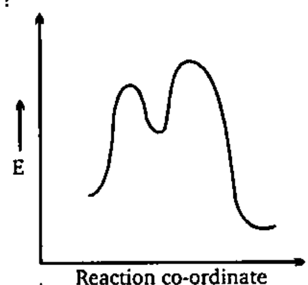


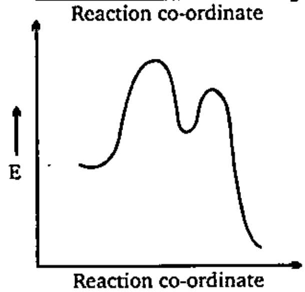
A. Which of the following is most reactive toward Markovnikov addition ?

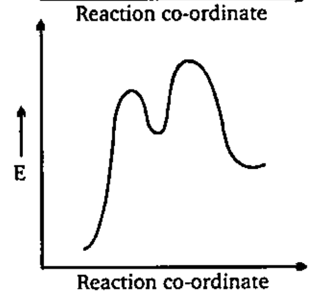
(a)  (b)  (c)  (d) 

B. What is the energy profile for the given reaction ?

(a) 

(b) 

(c) 

(d) 

C. In which of following reactions carbocation rearrangement is possible ?

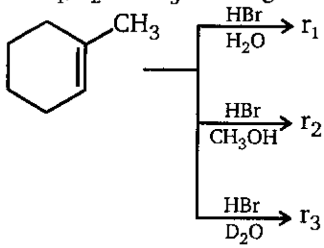
(a) $(CH_3)_2CH-CH=CH_2 \xrightarrow[0^\circ C]{HCl}$

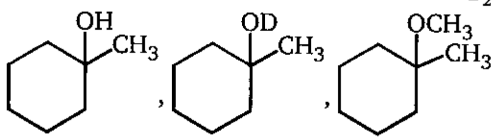
(b) $(CH_3)_3C-CH=CH_2 \xrightarrow[0^\circ C/Cl_4]{HBr}$

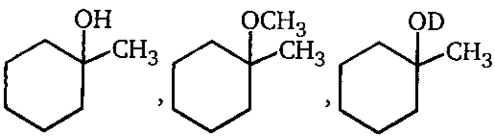
(c) $Ph-CH_2-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

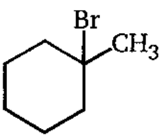
(d) All of these

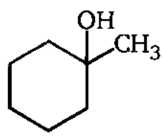
D. Identify the major products r_1, r_2 and r_3 in the given reactions.



(a) 

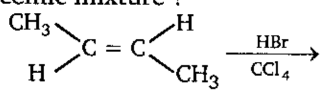
(b) 

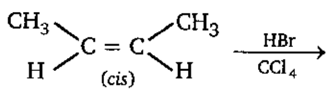
(c)  in all the reactions

(d)  in all the reactions

E. In which of the following reactions, product is racemic mixture ?

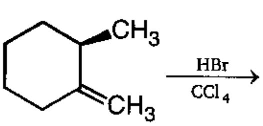
(a) $CH_3-CH_2-CH=CH_2 \xrightarrow[CCl_4]{HBr}$

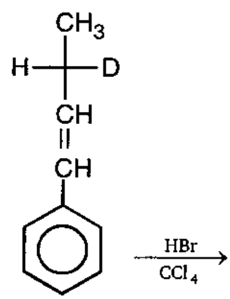
(b) 

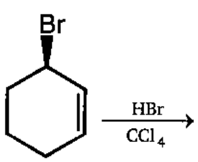
(c) 

(d) All of these

F. In which of the following reactions, diastereomers will be formed ?

(a) 

(b) 

(c) 

(d) All of these

12. Comprehension

$$CH_3-CH_2-CH=CH_2+CH_3OH \xrightarrow{H^{\oplus}} CH_3-CH_2-\underset{\substack{|\\OCH_3}}{CH}-CH_3$$

Consider the above reaction and answer A to E.

A. What is electrophile in first step ?

(a) $\overset{\oplus}{C}H_3$ (b) $H^{\oplus}$

(c) $CH_3-CH_2-\overset{\oplus}{C}H-CH_3$ (d) $HO^{\oplus}$

B. What is nucleophile in first step ?

(a) CH_3OH (b) 1-butene

(c) H_2O (d) CH_3-O-CH_3

C. What is electrophile in second step ?

(a) $\overset{\oplus}{C}H_3$ (b) $H^{\oplus}$

(c) $CH_3-CH_2-\overset{\oplus}{C}H-CH_3$ (d) $CH_3-CH_2-CH_2-\overset{\oplus}{C}H_2$

D. What is nucleophile in second step ?

(a) $CH_3-CH_2-CH=CH_2$ (b) CH_3OH

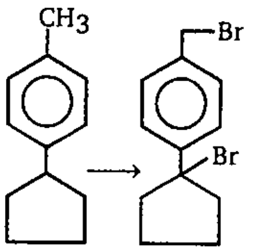
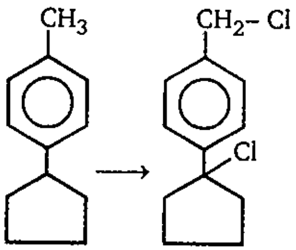
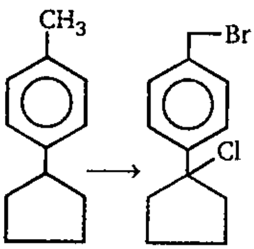
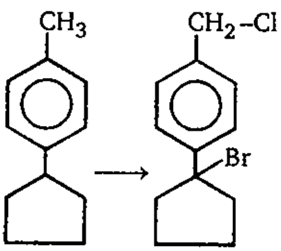
(c) H_2O (d) CH_3-O-CH_3

E. Which step is rate determining step ?

(a) attack of nucleophile CH_3OH (b) attack of electrophile $H^{\oplus}$

(c) attack of nucleophile H_2O (d) attack of electrophile $\overset{\oplus}{C}H_3$

13. Match the column I and II :

Column (I)		Column (II)	
Conversion		**Reagent**	
(a)		**(p)**	SO_2Cl_2 / $h\nu$ (2 equivalent)
(b)		**(q)**	NBS (2 equivalent)
(c)		**(r)**	NBS then $SO_2Cl_2/h\nu$
(d)		**(s)**	SO_2 Cl_2 / $h\nu$ then NBS

ANSWERS — LEVEL 2

1. (i) – A; (ii) – B; (iii) – G; (iv) – C; (v) – F

2. a – D; b – A, C; c – B, E; d – A, C, F; e – B, E, F; f – F; g – G; h – I, K; i – B, E, I; j – D, L

3. Reaction 1 : B, D; Reaction 2 : E, F, C Reaction 3 : I, A

Reaction 4 : L, G Reaction 5 : B, L, C

4. a – C; b – D; c – A; d – F; e – I; f – J; g – E; h – H; i – B; j – G

5. a – p, q; b – r, s; c – r, s; d – p, q

6. a – r, s – z; b – p, s – y; c – p, s – y; d – q, s – y

7. a – r; b – p; c – q; d – s

8. $A + B + C + D = 312$

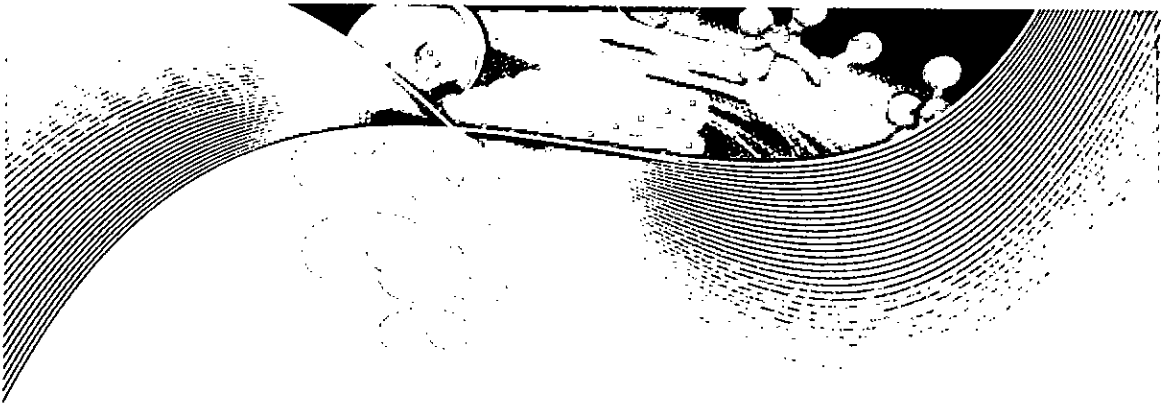
9. $A + B = 5$

10. $P + Q + R + S = 8$

11. A – b; B – c; C – d; D – b; E – d; F – d

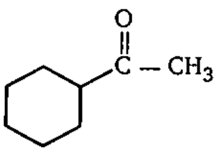
12. A – b; B – b; C – c; D – b; E – b

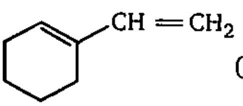
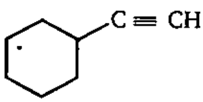
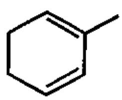
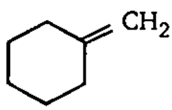
13. a-q; b-p; c-s; d-r



4C HYDROCARBONS (ALKYNES)

LEVEL-1

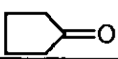
1.  $\xrightarrow[0°C]{PCl_5}$ (A) (70-80%) $\xrightarrow[(2)\ H^{\oplus}]{(1)\ 3NaNH_2,\ \text{mineral oil}}$ (B) (46%) ; Product (B) is :

(a) 
(b) 
(c) 
(d) 

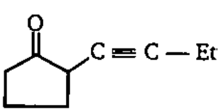
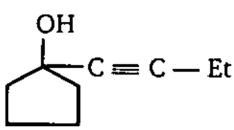
2.  $\xrightarrow[CCl_4]{Br_2}$ $\xrightarrow[(ii)\ NaNH_2]{(i)\ alc.KOH}$ (A) (major); Product (A) is :

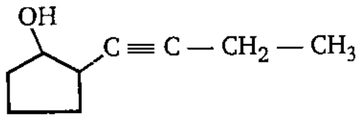
(a) $H_2C=CH-CH=CH_2$
(b) $CH_3-C\equiv C-CH_3$
(c) $CH_3-CH_2-C\equiv CH$
(d) $CH_3-CH=C=CH_2$

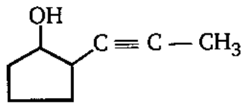
3. $CH_3CH_2C\equiv CH$ $\xrightarrow[liq.\ NH_3]{NaNH_2}$ I $\xrightarrow[Et_2O]{\text{(cyclopentanone)}}$ J $\xrightarrow{H^{\oplus}}$ (K)



Product (K) of the above reaction is :

(a) 
(b) 

(c) 

(d) 

4. $CH_3-CH_2-CH_2-C\equiv CH + \underset{\text{Lithium amide}}{LiNH_2} \longrightarrow (A) \xrightarrow{(CH_3)_2SO_4} (B)$

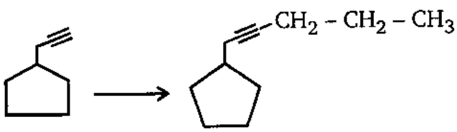
Give the structural formula of compound (B) :

(a) $CH_3-(CH_2)_2-C\equiv C-SO_3H$

(b) $CH_3-(CH_2)_2-C\equiv C-CH_3$

(c) $CH_3-(CH_2)_2-C\equiv C-CH_2-O-\overset{O}{\overset{\|}{\underset{\underset{O}{\|}}{S}}}-H$

(d) $CH_3-CH_2-C\equiv C-CH_2$

5.  ; This conversion can be acheived by :

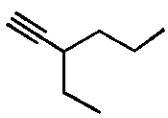
(a) $NaNH_2$, CH_3CHO

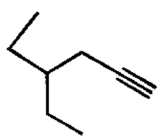
(b) $NaNH_2$, $CH_3-CH_2-CH_2-Br$

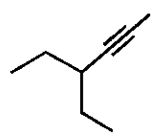
(c) KOH, CH_3-CH_2-Br

(d) KOH, $\underset{Br}{\underset{|}{CH_2}}-\underset{Br}{\underset{|}{CH_2}}$

6. Which alkyne will give 3-ethylhexane on catalytic hydrogenation ?

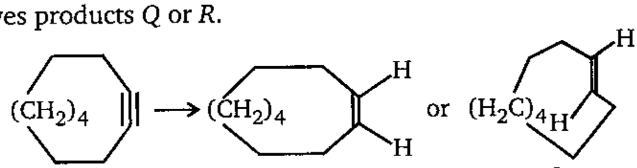
(a) 

(b) 

(c) 

(d) All of these

7. Reactant P gives products Q or R.



P Q R

The possible reagents are :

(I) $2Na/liq.NH_3$ (II) $H_2/Pd/CaCO_3$(quinoline) (III) $2H_2/Pd/C$

The correct statement with respect to the above conversion is/are :

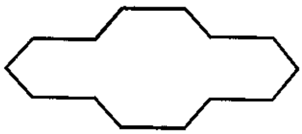
(a) Q is obtained on treatment with reagent (I)

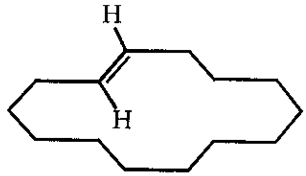
(b) R and Q are obtained on treatment with reagent (II)

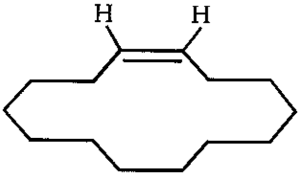
(c) R is obtained on treatment with reagent (I)

(d) R is obtained on treatment with reagent (II)

8. $Br-(CH_2)_{12}-C\equiv CH \xrightarrow{NaNH_2} (A) \xrightarrow[\text{Catalyst}]{\text{Lindlar}} (B)$; Product (B) is :

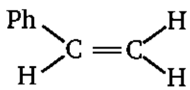
(a) 

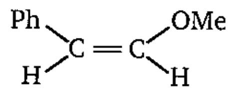
(b) 

(c) 

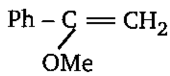
(d) $Br-(CH_2)-CH=CH_2$

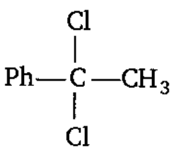
9. $Ph-C\equiv CH \xrightarrow[\text{MeOH}]{MeO^-}$ Major product of the reaction is :

(a) 

(b) 

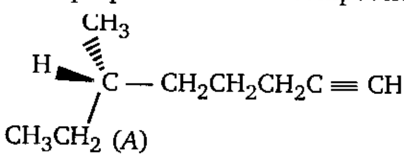
(c) $Ph-C\equiv C-OMe$

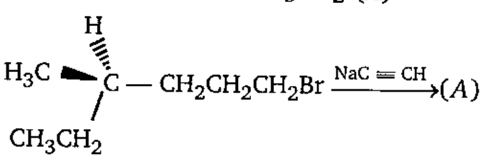
(d) 

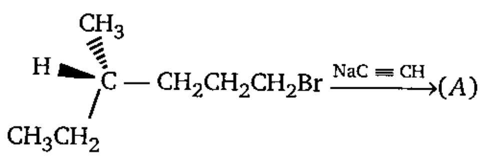
10.  $\xrightarrow[\text{Product}]{3NaNH_2}$ (A) ; Product (A) is :

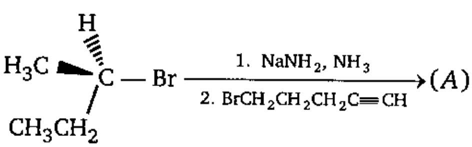
(a) $Ph-CH=CH_2$ (b) $Ph-C\equiv CH$ (c) $Ph-CH_2-CH_3$ (d) $Ph-C\equiv \overset{\ominus\oplus}{CNa}$

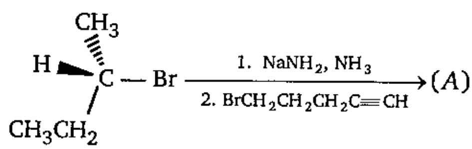
11. Which combination is best for preparation of the compound (A) shown below ?



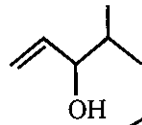
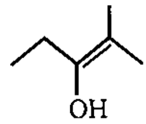
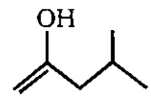
(a) 

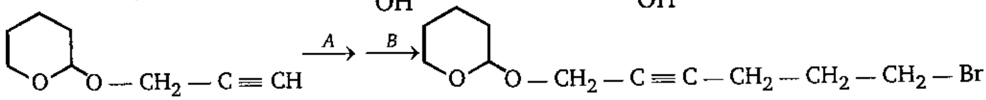
(b) 

(c) 

(d) 

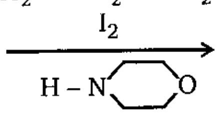
12. Which one of the following is the intermediate in the preparation of a ketone by hydration of an alkyne in the presence of sulfuric acid and mercury (II) sulphate ?

(a)  (b)  (c)  (d) 

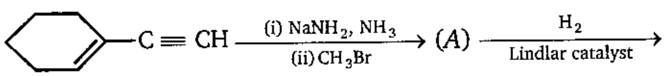
13. 

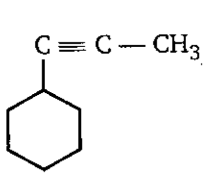
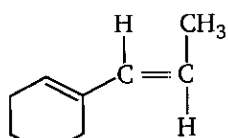
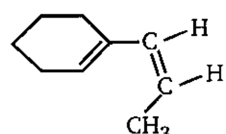
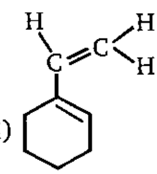
To carry out above conversion, (*A*) and (*B*) respectively, are :

(a) $NaNH_2, Cl-CH_2-CH_2-CH_2-Br$
(b) $NaNH_2, F-CH_2-CH_2-CH_2-Br$
(c) $NaNH_2, I-CH_2-CH_2-CH_2-Br$
(d) $NaNH_2, I-CH_2-CH_2-CH_2-I$

14. $H-C\equiv C-Ph$  Product; Product obtained in this reaction is :

(a) $Ph-C(I)=CH-I$
(b) $Ph-CH(I)-CH_2-I$
(c) $Ph-C\equiv C-I$
(d) $I-C\equiv C-H$

15.  ; Product (*B*) is :

(a)  (b)  (c)  (d) 

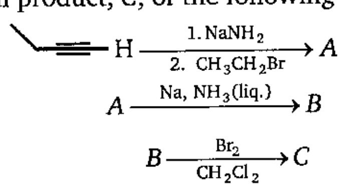
16. Which of the following alkyne on treatment with H_2(2 mole)/ Pt gives an optically inactive compound ?

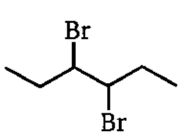
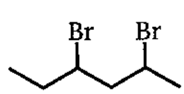
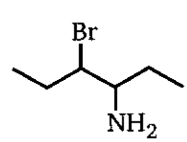
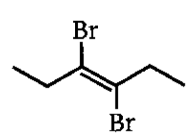
(a) 3-Methyl-1-pentyne
(b) 4-Methyl-1-hexyne
(c) 3-Methyl-1-heptyne
(d) None of the above

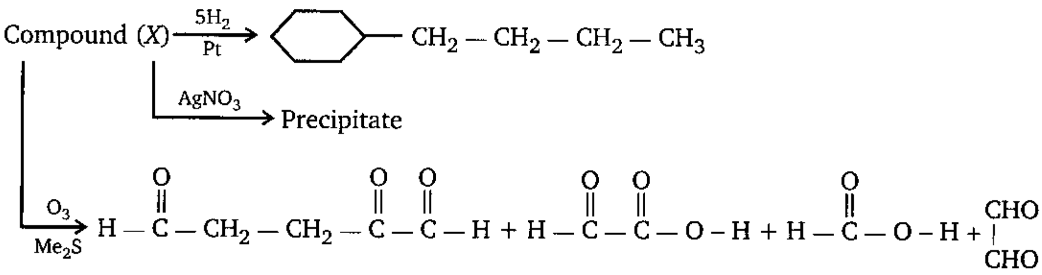
17. $\underset{\text{(Calcium carbide)}}{CaC_2} \xrightarrow{H_2O} (A) \xrightarrow{\text{Red hot Cu tube}} (B)$, Product (*B*) of the reaction is :

(a) Toluene (b) Ethyl-benzene (c) Benzene (d) Butyne

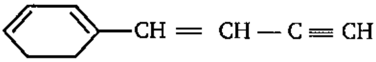
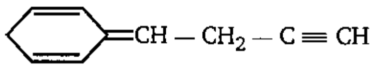
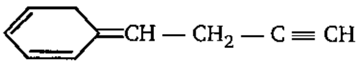
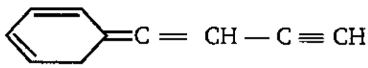
18. What is the final product, *C*, of the following reaction sequence ?



(a)  (b)  (c)  (d) 

19. 

Compound (*X*) will be :

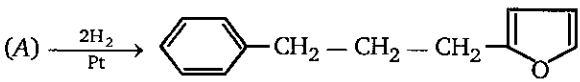
(a) 
(b) 
(c) 
(d) 

20. Choose the sequence of steps that describes the best synthesis of 1-butene from ethanol :

(a) (1) $NaC \equiv CH$; (2) H_2, Lindlar Pd
(b) (1) $NaC \equiv CH$; (2) Na, NH_3
(c) (1) HBr, heat ; (2) $NaC \equiv CH$; (3) H_2, Lindlar Pd
(d) (1) HBr, heat ; (2) $KOC(CH_3)_3$, DMSO ; (3) $NaC \equiv CH$; (4) H_2, Lindlar catalyst

21. Which alkyne yields butanoic acid ($CH_3CH_2CH_2CO_2H$) as the only organic product on treatment with ozone followed by the hydrolysis ?

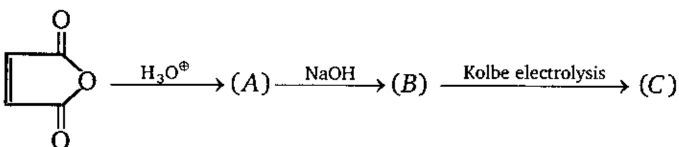
(a) 1-Butyne (b) 4-Octyne (c) 1-Pentyne (d) 2-Hexyne

22. 

Carlina oxide

Unit of unsaturation in compound (*A*) ?

(a) 7 (b) 8 (c) 9 (d) 10

23. 

Product (*C*) of above reaction is:

(a) $H_2C = CH_2$
(b) $CH_3 - C \equiv C - CH_3$
(c) $HC \equiv CH$
(d) $CH_3 - CH = CH - CH_3$

24. To convert 1-butyne to 1-D-butanal, one would carry out the following steps :

(I) Sodium amide, then D_2O
(II) Disiamy lborane, then hydrogen peroxide/sodium hydroxide
(III) The transformation can not be carried out with the indicated reagents.

(a) I, followed by II (b) II, followed by I (c) III (d) II

25. An unknown compound (A) has a molecular formula C_4H_6. When (A) is treated with excess of Br_2 a new substance (B) with formula $C_4H_6Br_4$ is formed. (A) forms a white ppt. with ammonical silver nitrate solution. (A) may be :

(a) But-1-yne (b) But-2-yne
(c) But-1-ene (d) But-2-ene

26. One mole of 1,2-dibromopropane on treatment with X moles of $NaNH_2$ followed by treatment with ethyl bromide gave a pentyne. The value of X is :

(a) One (b) Two (c) Three (d) Four

27. $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}H-C\equiv CH \xrightarrow{\text{excess HBr}}$

The product of the above reaction is :

(a) $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}H-\overset{\overset{\displaystyle Br}{|}}{C}H-\overset{\overset{\displaystyle Br}{|}}{C}H_2$

(b) $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}H-\overset{\overset{\displaystyle Br}{|}}{C}=CH_2$

(c) $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}H-\underset{\underset{\displaystyle Br}{|}}{\overset{\overset{\displaystyle Br}{|}}{C}}-CH_3$

(d) $CH_3-\overset{\overset{\displaystyle CH_3}{|}}{C}H-CH_2-\underset{\underset{\displaystyle Br}{|}}{\overset{\overset{\displaystyle Br}{|}}{C}}H$

28. $CH_3-C\equiv C-CH_3 \xrightarrow{\text{Cold } KMnO_4} (A)$

Product (A) is:

(a) $CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle O}{\|}}{C}-H$

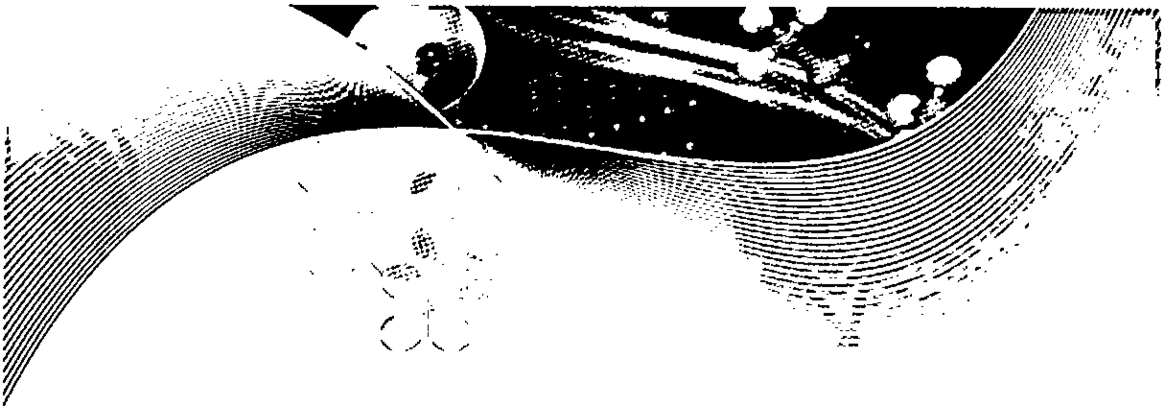
(b) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$

(c) $CH_3-\overset{\overset{\displaystyle OH}{|}}{C}H-\overset{\overset{\displaystyle OH}{|}}{C}H-CH_3$

(d) $O=CH-CH_2-CH_2CH=O$

ANSWERS — LEVEL 1

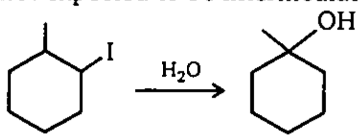
1.	(b)	**2.**	(b)	**3.**	(b)	**4.**	(b)	**5.**	(b)	**6.**	(d)	**7.**	(c)	**8.**	(c)
9.	(b)	**10.**	(d)	**11.**	(b)	**12.**	(d)	**13.**	(c)	**14.**	(c)	**15.**	(c)	**16.**	(a)
17.	(c)	**18.**	(a)	**19.**	(a)	**20.**	(c)	**21.**	(b)	**22.**	(c)	**23.**	(c)	**24.**	(c)
25.	(a)	**26.**	(c)	**27.**	(c)	**28.**	(b)								

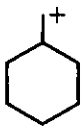


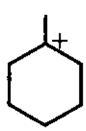
5A ALKYL HALIDES

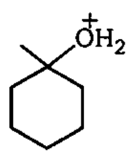
Substitution Reactions (S_{N^1}, S_{N^2}, S_{N^i})

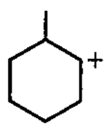
1. Which of the following is not expected to be intermediate of the following reaction ?

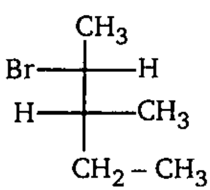


(a) 

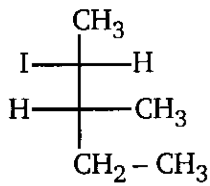
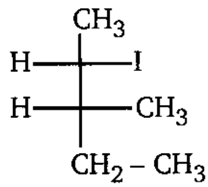
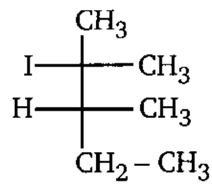
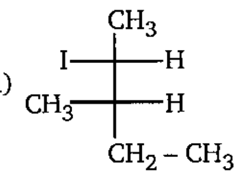
(b) 

(c) 

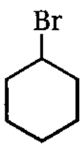
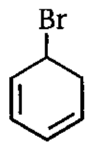
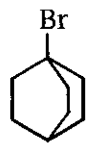
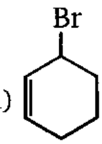
(d) 

2. 

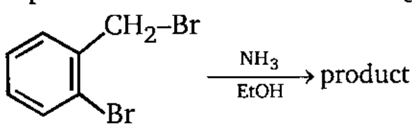
$+ NaI \xrightarrow[\text{Acetone}]{}$ product; S_{N^2} product of the reaction is :

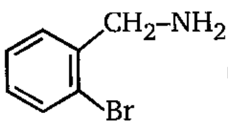
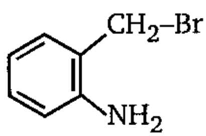
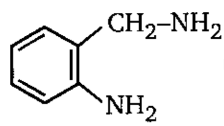
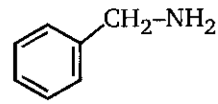
(a)  (b)  (c)  (d) 

3. Rate of S_{N^2} will be negligible in :

(a)  (b)  (c)  (d) 

4. What is the major product obtained in the following reaction ?



(a)  (b)  (c)  (d) 

5. $Cl-CH_2-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2-CH_2-Cl+I^- \xrightarrow[DMF]{}$ product; Major product of this reaction is:

(a) $I-CH_2-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2-CH_2-Cl$

(b) $Cl-CH_2-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2-CH_2-I$

(c) $H_2C=\overset{CH_3}{\overset{|}{C}}-CH_2-CH_2=Cl$

(d) $Cl-CH_2-\underset{CH_3}{\overset{CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2=CH_2$

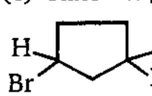
6. Which of the following expressions is representative of the rate law for a S_{N^2} reaction ?

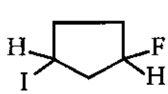
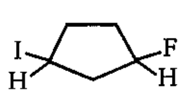
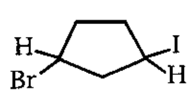
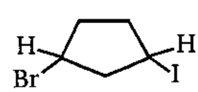
(a) Rate = k [electrophile]

(b) Rate = k [electrophile] [nucleophile]

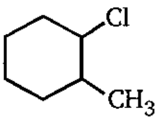
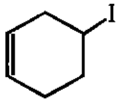
(c) Rate = k [nucleophile]^2

(d) Rate = k[electrophile]^2

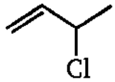
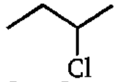
7.  + NaI (1 mole) $\xrightarrow{\text{Acetone}}$ $\underset{\text{(major)}}{(A)}$; Major product of this reaction is :

(a)  (b)  (c)  (d) 

8. Which of the following alkyl halide undergo rearrangement in S_{N^1} reaction ?

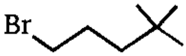
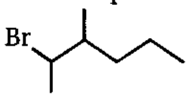
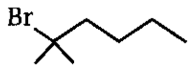
(a) $CH_3 - \overset{CH_3}{\underset{CH_3}{C}} - \underset{I}{CH} - CH_3$ (b)  (c)  (d) All of these

9. Arrange the following three chlorides in decreasing order towards S_{N^1} reactivity.

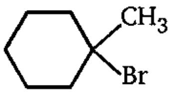
(1)  (2)  (3) 

(a) 1 > 2 > 3
(b) 2 > 3 > 1
(c) 2 > 1 > 3
(d) 3 > 2 > 1

10. Which compound undergoes nucleophilic substitution with NaCN at the fastest rate ?

(a)  (b)  (c)  (d) 

11. Rank the following in order of decreasing rate of solvolysis with aqueous ethanol (fastest → slowest)

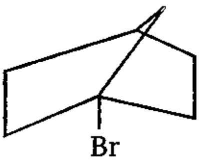
$H_2C = \overset{CH_3}{C} — Br$ (1)  (2) $CH_3 - \overset{Br}{CH}CH_2CH(CH_3)_2$ (3)

(a) 2 > 1 > 3
(b) 1 > 2 > 3
(c) 2 > 3 > 1
(4) 1 > 3 > 2

12. The reaction of 4-bromobenzyl chloride with sodium cyanide in ethanol leads to the formation of :

(a) 4-bromobenzyl cyanide
(b) 4-cyanobenzyl chloride
(c) 4-cyanobenzyl cyanide
(d) 4-bromo-2-cyanobenzyl chloride

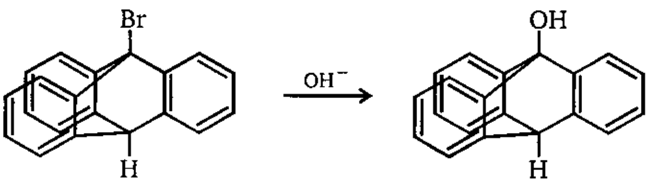
13. Which of the following reactant will not favour nucleophilic substitution reaction ?

(a) 

(b) Ph – Br

(c) $CH_3 - \overset{CH_3}{\underset{CH_3}{C}} - CH_2 - Br$

(d) All the above

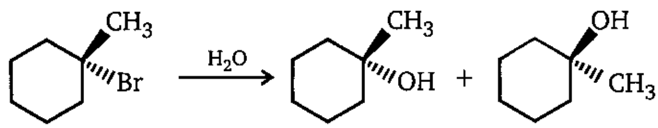
14. 

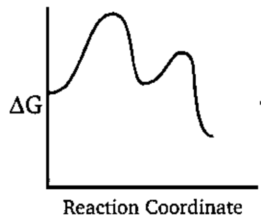
(I) (II)

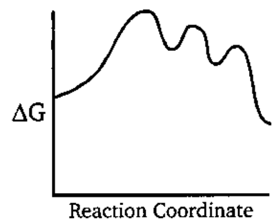
Conversion of I to II :

(a) takes place by S_{N^1}
(b) takes place by S_{N^2}
(c) takes place both by S_{N^1} and S_{N^2}
(d) does not take place

15. Which is the correct reaction coordinate diagram for the following solvolysis reaction ?



(a)


(b)


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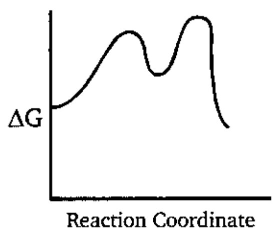
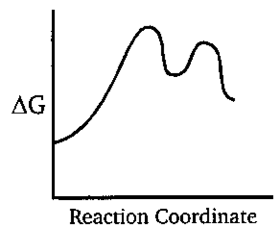
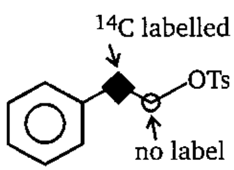
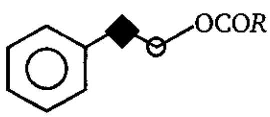
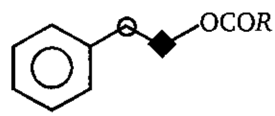


(d)


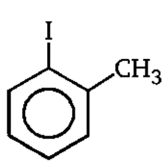
16.


$\xrightarrow{RCO_2H}$ product; Product of this reaction is :

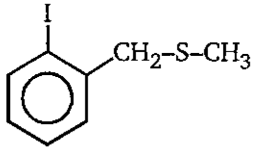
(a)


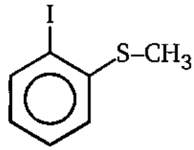
(b)


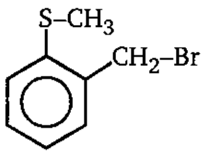
(c) both (a) and (b)
(d) None of these

17.


$\xrightarrow{NBS} (A) \xrightarrow{CH_3SNa} (B)$, Product (B) is :

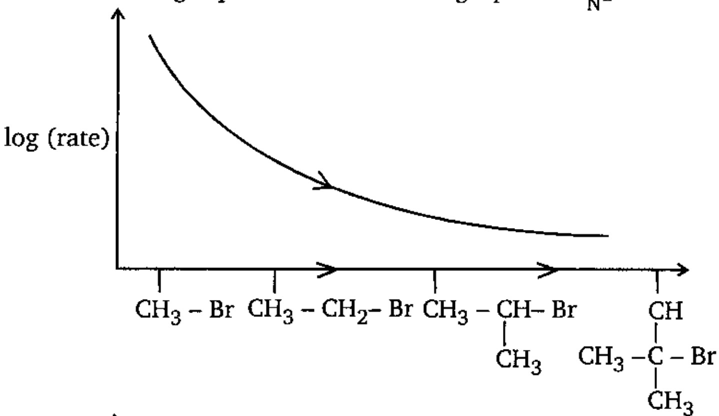
(a) 

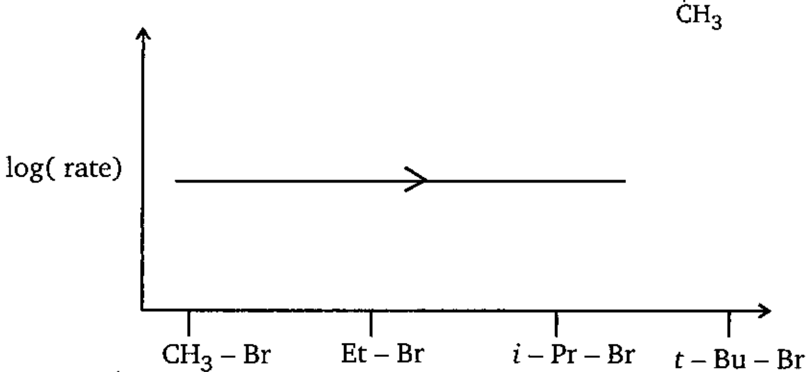
(b) 

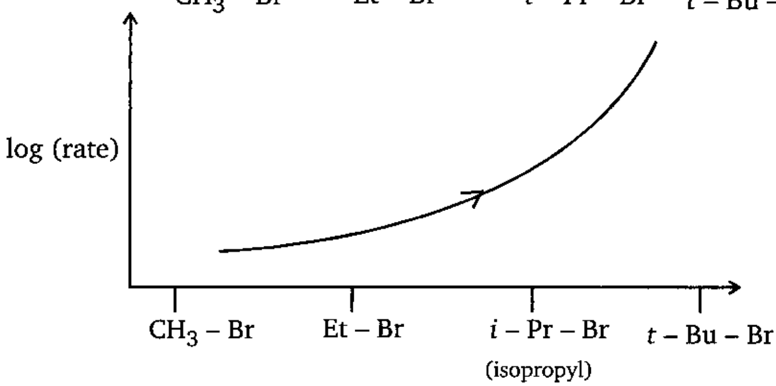
(c) 

(d) None of these

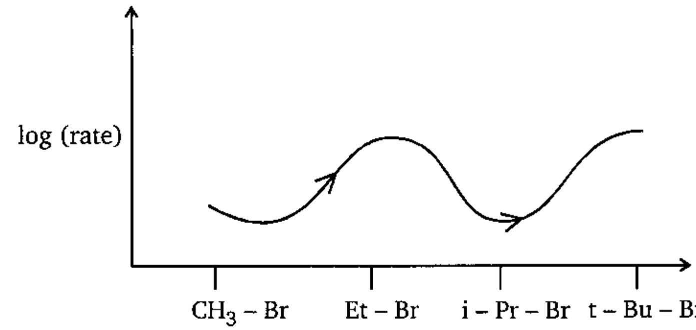
18. Which of the following represents the correct graph for S_{N^2} reaction ?

(a) 

(b) 

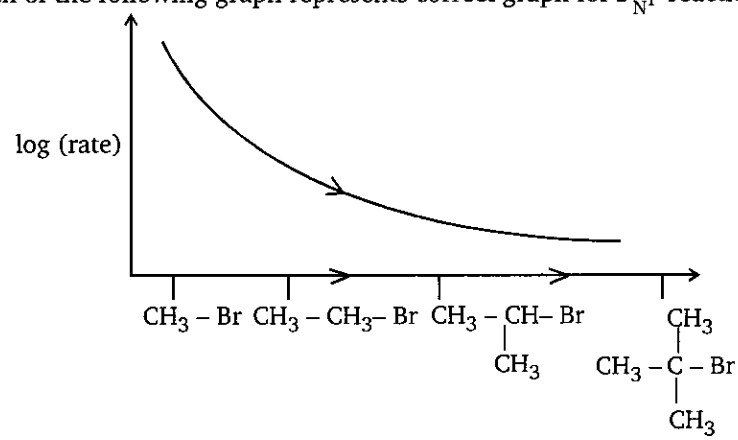
(c) 

(d)

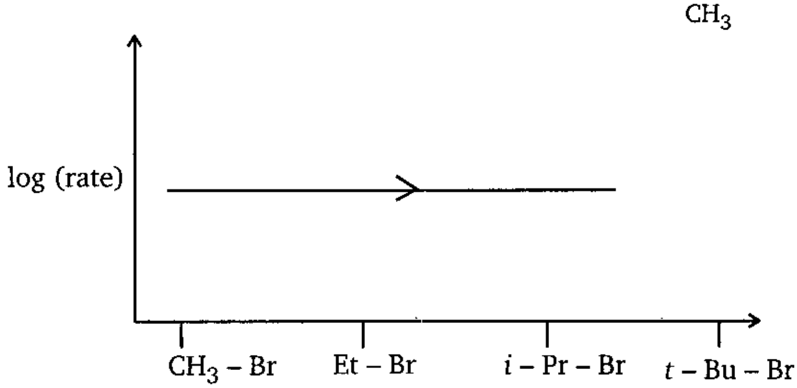


19. Which of the following graph represents correct graph for S_{N^1} reaction :

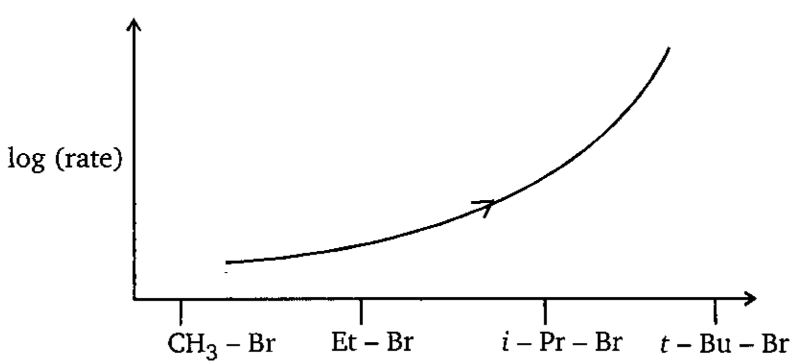
(a)

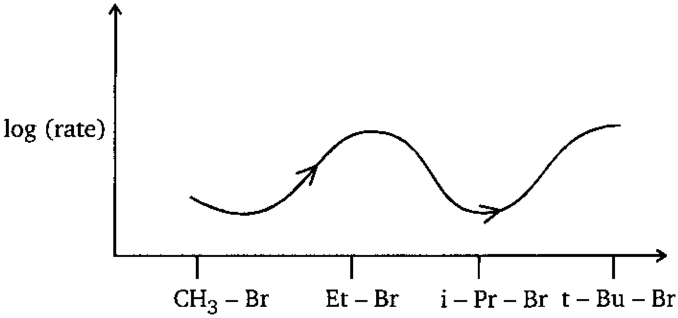


(b)

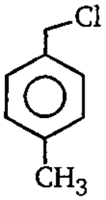


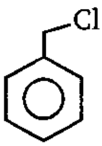
(c)

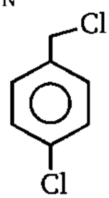


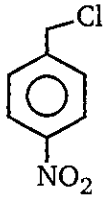
(d) 

20. Which of the following is most reactive toward S_{N^2} reaction ?

(a) 

(b) 

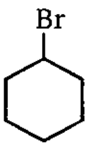
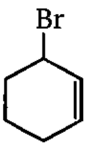
(c) 

(d) 

21. Among the given pairs, in which pair first compound reacts faster than second compound in S_{N^1} reaction ?

(a) $CH_3-CH_2-CH_2-CH_2-Br$ or $CH_3-CH_2-\underset{\underset{Br}{|}}{CH}-CH_3$

(b) $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{Br}{|}}{C}}-CH_2-CH_2$ or $CH_3-\underset{\underset{Br}{|}}{CH}-\overset{\overset{CH_3}{|}}{CH}-CH_3$

(c)  or 

(d) $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{Br}{|}}{C}}-CH_3$ or $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{I}{|}}{C}}-CH_3$

22. What is the major product of the following reaction ?

$$H_2C=CH-CH_2-OH \xrightarrow[\text{excess}]{HBr} \text{Product}$$

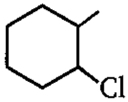
(a) $CH_3-\overset{\overset{Br}{|}}{CH}-CH_2-Br$

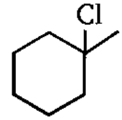
(b) $H_2C=CH-CH_2-Br$

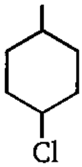
(c) $CH_3-\overset{\overset{Br}{|}}{CH}-CH_2-OH$

(d) $CH_3-\overset{\overset{OH}{|}}{CH}-CH_2-OH$

23. S_{N^1} and S_{N^2} products are same with (excluding stereoisomer) :

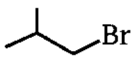
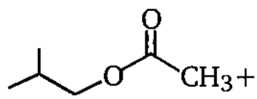
(a) 

(b) 

(c) 

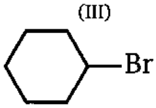
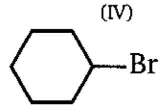
(d) $Ph-\underset{CH_3}{\underset{|}{CH}}-\underset{Cl}{\underset{|}{CH}}-CH_3$

24. Consider the nucleophilic attacks given below. Select in each pair that shows the greater S_{N^2} reaction rate.

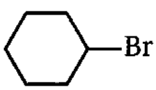
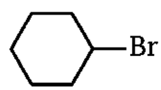
(A)  + ^-CN or  + ^-CN

(I) (II)

(B) $H_3C-Br + {}^-SH$ (III) or $H_3C-Br + CH_3SH$ (IV)

(C)  + Cl^- or  + I^- in DMSO

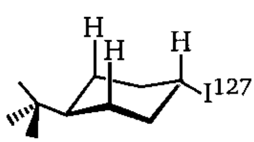
(V) (VI)

(D)  + Cl^- or  + I^- in methanol

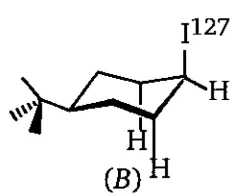
(VII) (VIII)

	A	B	C	D
(a)	(I) ;	(IV) ;	(VI) ;	(VIII)
(b)	(II) ;	(III) ;	(V) ;	(VIII)
(c)	(I) ;	(III) ;	(V) ;	(VIII)
(d)	(I) ;	(III) ;	(V) ;	(VII)

25. Which of the two stereoisomers of 4-*t*-butylcyclohexyl iodide ($^{127}I^-$) will undergo S_{N^2} substitution with $^{128}I^-$ faster, and why ?



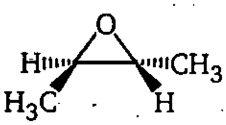
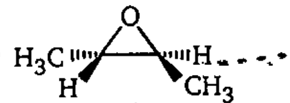
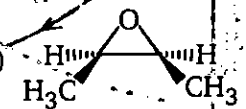
(*A*)



(*B*)

(a) *A* will react faster because it is the more stable of the two isomers
(b) *A* will react faster because it will yield a more stable product, and the transition state for both reactions is of the same energy
(c) *A* will react faster because the approach of $^{128}I^-$ can depart unhindered.
(d) *B* will react faster because it is less stable than *A*, and the transition state for both reactions is of the same energy

26. (Z)-2-Butene reacts with Br_2/H_2O. The resulting bromohydrin when treated with methoxide in methanol undergoes an intramolecular S_N2 reaction. Taking into consideration the stereochemical consequences of the reaction mechanism involved, choose the final product(s) of these transformations.

(I)  (II)  (III) 

(a) (I) only (b) (II) only

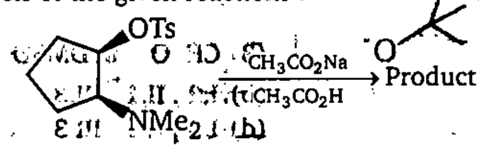
(c) (III) only (d) Equal amounts of (I) and (II)

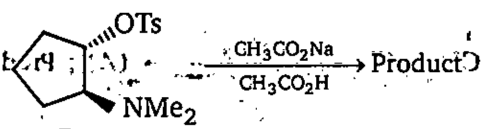
27. Rank the following species in order of decreasing nucleophilicity in a polar protic solvent (most → least nucleophilic) :

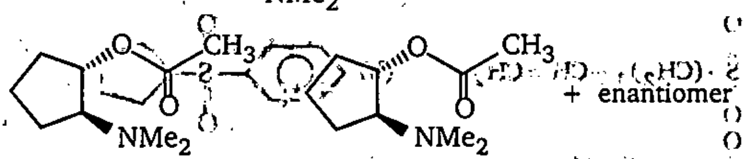
$CH_3CH_2CH_2O^-$ (1) $CH_3CH_2CH_2S^-$ (2) $CH_3CH_2C(=O)O^-$ (3)

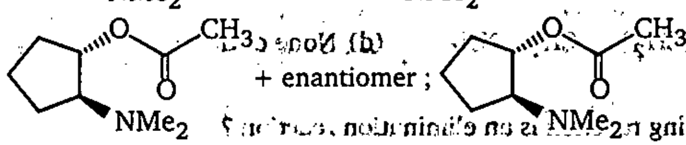
(a) 3 > 1 > 2 (b) 2 > 3 > 1 (c) 1 > 3 > 2 (d) 2 > 1 > 3

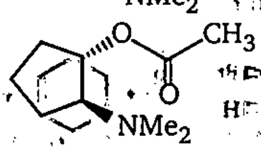
28. Identify products of the given reactions :

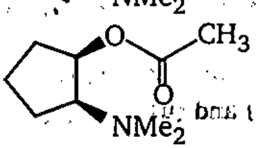
Reaction-1 

Reaction-2 

(a) 

(b) 

(c)  single product is obtained in both the reactions

(d)  single product obtained in both the reactions

38. In the given pairs of alkyl-halide, in which pair the first compound is more reactive than second compound toward S_{N^2} reaction ?

(a) $(CH_3)_2CHBr$ or $CH_3-CH_2-CH_2-Br$

(b) $CH_3-CH_2-CH_2-Br$ or $CH_3-CH_2-CH_2-I$

(c) $Ph-Br$ or $CH_3-CH_2-CH_2-Br$

(d) $CH_2=CH-CH_2-Cl$ or $H_2C=CH-Cl$

39. In the given pair of reaction in which pair the second reaction is more reactive than first toward S_{N^2} reaction ?

(a) $CH_3-CH_2-Cl+CH_3-CH_2-O^- \longrightarrow Et-O-Et$ (or)
$CH_2-CH_2-Cl+CH_3-CH_2-OH \longrightarrow Et-O-Et$

(b) $CH_3-CH_2-Cl+EtO^- \longrightarrow Et-O-Et$
$CH_3-CH_2-Cl+EtS^- \longrightarrow CH_3-CH_2-S-Et$

(c) $Et-Cl+CH_3O^- \longrightarrow Et-O-CH_3$ (or)
$Et-Cl+CH_3O^- \longrightarrow Et-O-CH_3$

(d) $Et-Br+Ph_3P \longrightarrow Et-\overset{\oplus}{P}Ph_3$ (or)
$Et-Br+Ph_3N \longrightarrow Et-\overset{\oplus}{N}Ph_3$

40. Among the following pair of reactions in which pair the second reaction is more reactive than first in S_{N^1} reaction ?

(a) $Me_3CCl+H_2O \longrightarrow Me_3COH$ (or) $Me_3CBr+H_2O \longrightarrow Me_3COH$

(b) $Me_3CCl+CH_3OH \longrightarrow Me_3C-OCH_3$ (or) $Me_3C-Cl+H_2O \longrightarrow Me_3C-OH$

(c) $\underset{(1M)}{Me_3CCl+H_2O} \longrightarrow$ (or) $\underset{(2M)}{Me_3CCl+H_2O}$

(d) All of these

41. Which is a true statement concerning the transition state of an S_{N^2} reaction ?

(a) Closely resembles a carbocation intermediate

(b) The electrophile is responsible for the reaction

(c) Lower is energy than the starting materials

(d) Involves both the nucleophile and electrophile

42. Increasing the concentration of a nucleophile in a typical S_{N^2} reaction by a factor of 10 will cause the reaction rate to :

(a) increase by a factor of 10
(b) increase by a factor of 10^2
(c) decrease by a factor of 10
(d) remain about the same

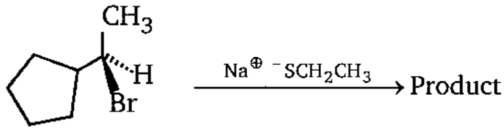
43. Decreasing the concentration of an electrophile in a typical S_{N^2} reaction by a factor of 3 will cause the reaction ratio to :

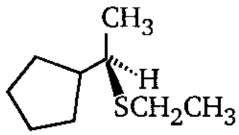
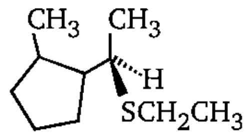
(a) increase by a factor of 3
(b) increase by a factor of 3^2
(c) decrease by a factor of 3
(d) remain about the same

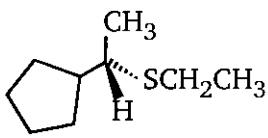
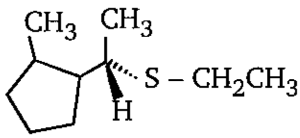
44. Increasing the concentration of an electrophile in a typical S_{N^2} reaction by a factor of 3 and the concentration of the nucleophile by a factor of 3 will change the reaction rate to :

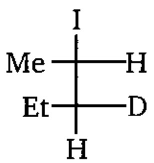
(a) increase by a factor of 6 (b) increase by a factor of 9
(c) decrease by a factor of 3 (d) remain about the same

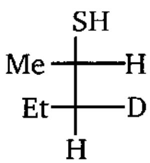
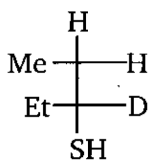
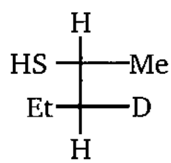
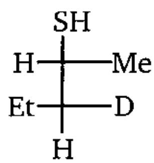
45. Consider the following reaction and select the best choice that represents the reaction.



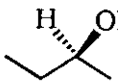
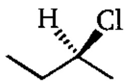
(a)  (b) 

(c)  (d) 

46.  $\xrightarrow{KSH}$ Product; Identify the product.

(a)  (b)  (c)  (d) 

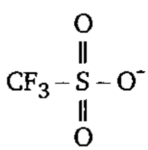
47. The reaction ,

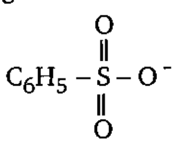
 + $SOCl_2$ $\longrightarrow$  + SO_2 + HCl

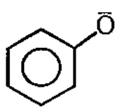
proceeds by the........... mechanism.

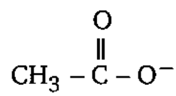
(a) S_{N^i} (b) S_{N^2} (c) S_{E^2} (d) S_{N^1}

48. Consider the following anions.


(I)

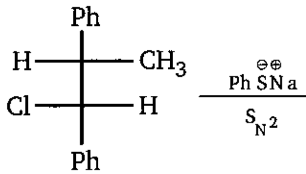

(II)

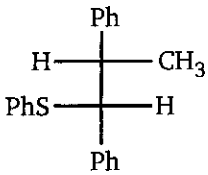

(III)

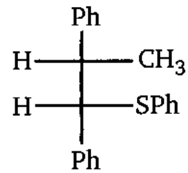

(VI)

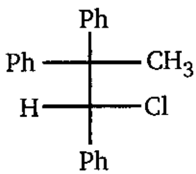
When attached to sp^3-hybridized carbon, their leaving group ability in nucleophilic substitution reaction decreases in the order :

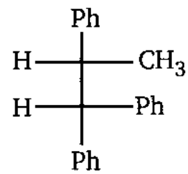
(a) I > II > III > IV (b) I > II > IV > III (c) IV > I > II > III (d) IV > III > II > I

49.  Principal organic product of the reaction will be :

(a) 

(b) 

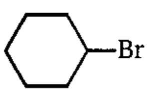
(c) 

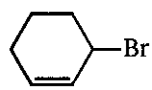
(d) 

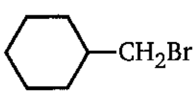
50. Reaction of *R*-2-butanol with *p*-toluenesulphonyl chloride in pyridine followed by reaction with LiBr gives:

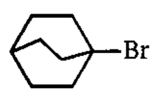
(a) *R*-2-butyl bromide
(b) *S*-2-butyl tosylate
(c) *R*-2-butyl tosylate
(d) *S*-2-butyl bromide

51. The compound which undergoes S_{N^1} reaction most rapidly is :

(a) 

(b) 

(c) 

(d) 

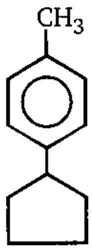
52. Addition of KI accelerates the hydrolysis of primary alkyl halides because :

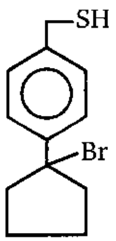
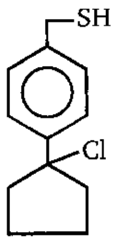
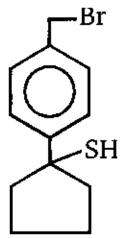
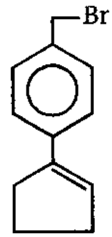
(a) KI is soluble in organic solvents
(b) the iodide ion is a weak base and a poor leaving group
(c) the iodide ion is a strong base
(d) the iodide ion is a powerful nucleophile as well as a good leaving group

53. Which of the following phrases are not correctly associated with S_{N^1} reaction ?

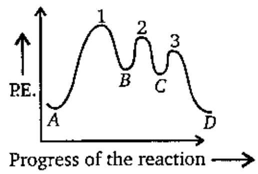
(1) Rearrangement is possible
(2) Rate is affected by polarity of solvent
(3) The strength of the nucleophile is important in determining rate
(4) The reactivity series is tertiary > secondary > primary
(5) Proceeds with complete inversion of configuration

(a) 3, 5
(b) 5 only
(c) 2, 3, 5
(d) 3 only

54.  $\xrightarrow[h\nu]{SO_2Cl_2}$ (*A*) $\xrightarrow{NBS}$ (*B*) $\xrightarrow{KSH}$ (*C*) , Product (*B*) is :

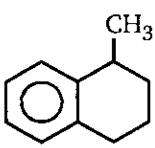
(a)  (b)  (c)  (d) 

55. Energy profile diagram for an exothermic reaction, $A \xrightarrow{1} B \xrightarrow{2} C \xrightarrow{3} D$, is given below.

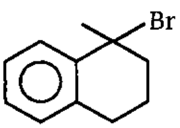
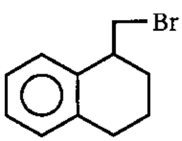
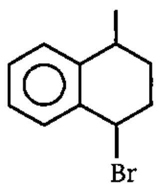
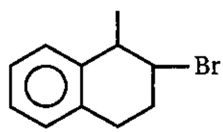


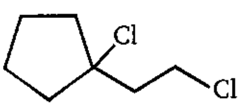
The rate determining step of the reaction is :

(a) $A \longrightarrow B$ (b) $B \longrightarrow C$ (c) $C \longrightarrow D$ (d) can not predict

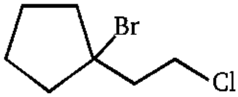
56.  $\xrightarrow{NBS}$ (*A*) Major

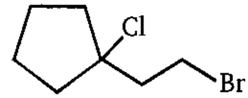
Major product is (*A*) is :

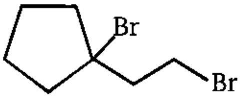
(a)  (b)  (c)  (d) 

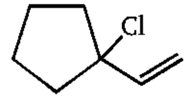
57.  $\xrightarrow[S_N2\text{ conditions}]{LiBr/DMSO}$ Major product (*X*)

The product *X* is :

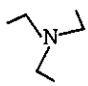
(a) 

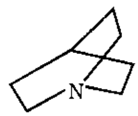
(b) 

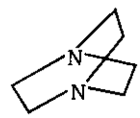
(c) 

(d) 

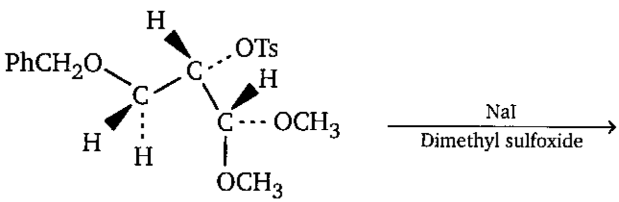
58. Relative rate of reaction of the following amine with methyl iodide is:


(A)

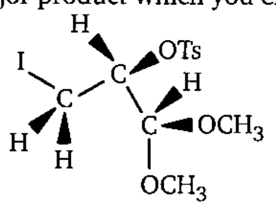

(B)

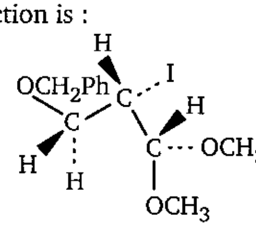

(C)

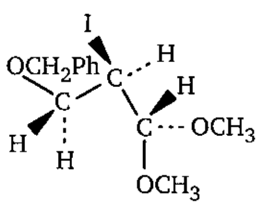
(a) A > B > C (b) A > C > B (c) B > C > A (d) B > A > C

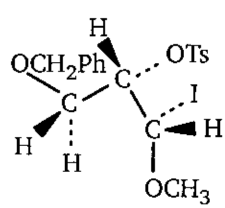
59. 

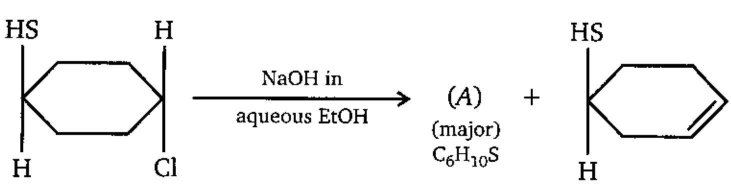
Major product which you expect in the above reaction is :

(a) 

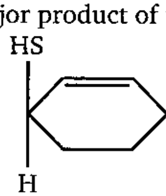
(b) 

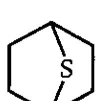
(c) 

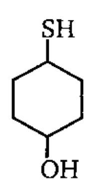
(d) 

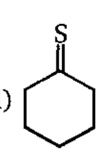
60. 

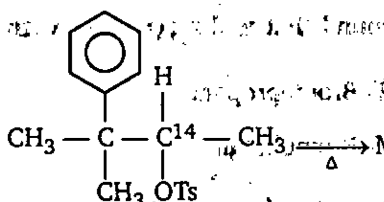
Major product of the above reaction is :

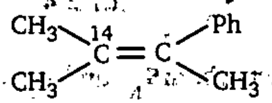
(a) 

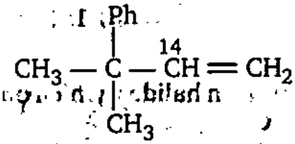
(b) 

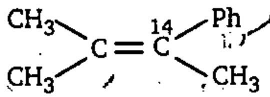
(c) 

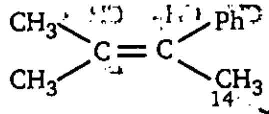
(d) 

61.  Major product of the reaction is:

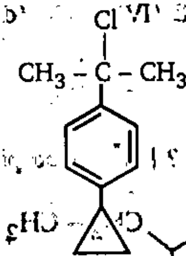
(a) 

(b) 

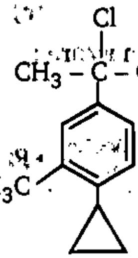
(c) 

(d) 

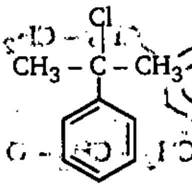
62. The decreasing order of reactivity of the compounds given below towards solvolysis under identical conditions is :



(I)

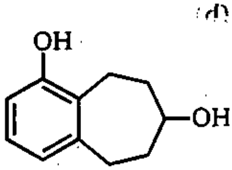


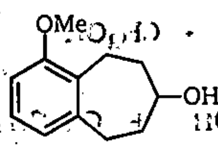
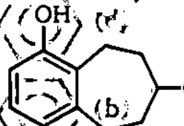
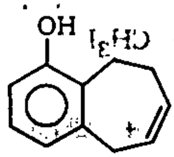
(II)



(III)

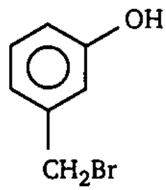
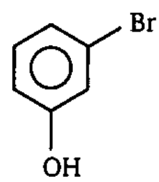
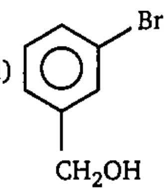
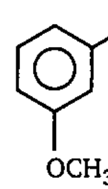
(a) II > III > I (b) I > II > III (c) III > II > I (d) II > I > III

63.  $\xrightarrow[\text{2. MeBr}]{\text{1. One Eq. NaOH}}$ (*A*); Product (*A*) is :

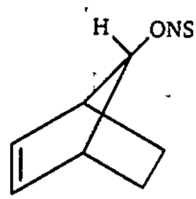
(a)  (b)  (c)  (d) None of these

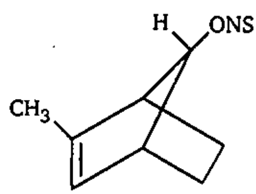
64. (*R*)-2-octyl tosylate is solvolyzed in water under ideal $S_{N}1$ conditions. The product(s) will be:

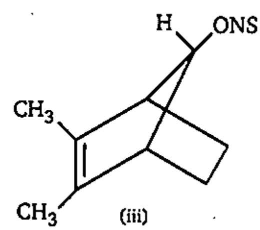
(a) *R*-2-octanol and *S*-2-octanol in a 1 : 1 ratio
(b) *R*-2-octanol and *S*-2-octanol in a 1.5 : 1 ratio
(c) *R*-2-octanol only
(d) *S*-2-octanol only

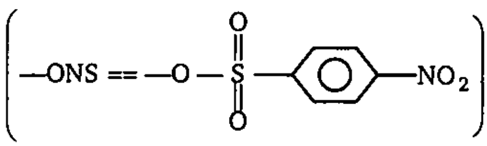
(c)  and  (d)  and 

75. Relative rate of reaction with H_2O.

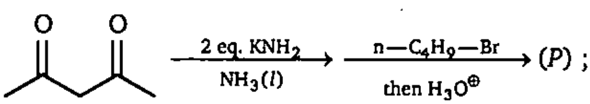

(i)


(ii)

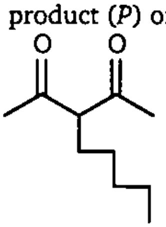
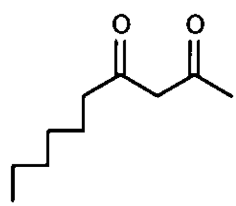
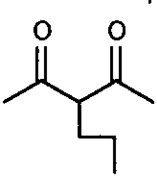
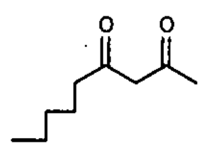

(iii)



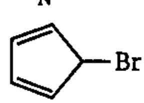
(a) (i) > (ii) > (iii)
(b) (ii) > (i) > (iii)
(c) (iii) > (ii)> (i)
(d) (iii) > (i) > (ii)

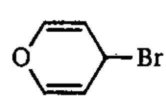
76. 

End product (*P*) of the above reaction is :

(a) 
(b) 
(c) 
(d) 

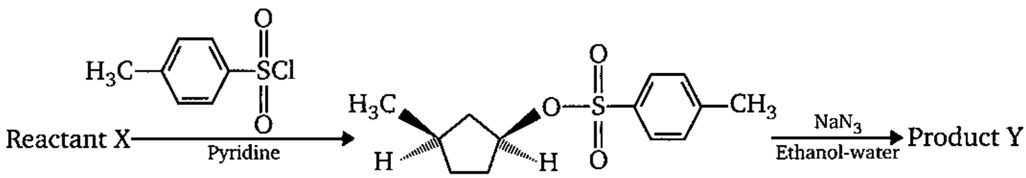
77. Which of the following statements is correct regarding the rate of hydrolysis of the compounds (*A*) and (*B*) by S_{N^1} reaction ?


A

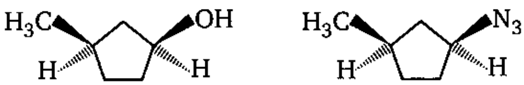

B

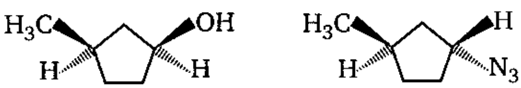
(a) A reacts faster than B
(b) B reacts faster than A
(c) Both A and B reacts at the same rate
(d) Neither A nor B reacts

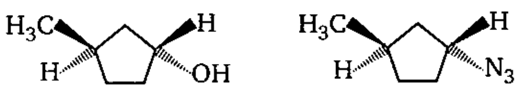
78. What are reactant X and product Y in the following sequence of reactions ?

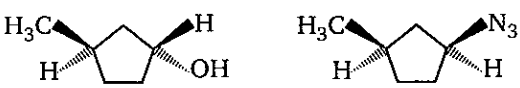


Reactant X Product Y

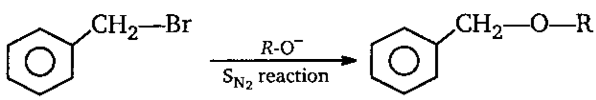
(a) 

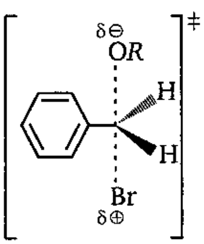
(b) 

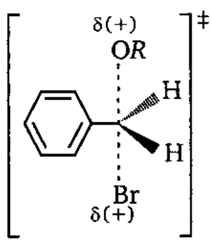
(c) 

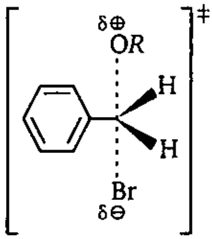
(d) 

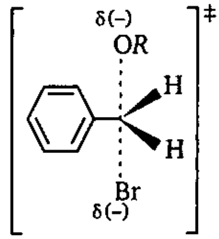
79. Transition state of given S_{N_2} is :



(a) 

(b) 

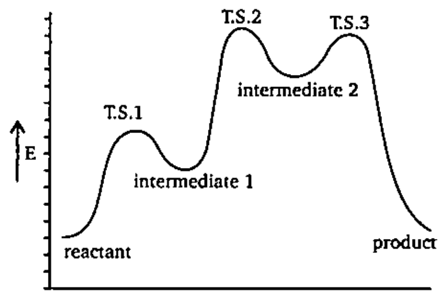
(c) 

(d) 

80. $C_6H_{13}Br + OH^- \longrightarrow C_6H_{13}OH + Br^-$ is an example of:

(a) Nucleophilic addition (b) Nucleophilic substitution
(c) Electrophilic addition (d) Electrophilic substitution
(e) Free radical substitution

81. Transition state 2 is structurally most likely as :



(a) intermediate 1 (b) transition state 3
(c) intermediate 2 (d) product

ANSWERS — LEVEL 1

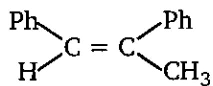
1.	(a)	**2.**	(b)	**3.**	(c)	**4.**	(a)	**5.**	(b)	**6.**	(b)	**7.**	(b)	**8.**	(d)
9.	(b)	**10.**	(a)	**11.**	(c)	**12.**	(a)	**13.**	(d)	**14.**	(d)	**15.**	(b)	**16.**	(c)
17.	(a)	**18.**	(a)	**19.**	(c)	**20.**	(d)	**21.**	(b)	**22.**	(a)	**23.**	(c)	**24.**	(c)
25.	(d)	**26.**	(d)	**27.**	(d)	**28.**	(a)	**29.**	(a)	**30.**	(d)	**31.**	(b)	**32.**	(d)
33.	(d)	**34.**	(c)	**35.**	A(a)	**35.**	B(b)	**36.**	(d)	**37.**	(b)	**38.**	(d)	**39.**	(b)
40.	(d)	**41.**	(d)	**42.**	(a)	**43.**	(c)	**44.**	(b)	**45.**	(c)	**46.**	(d)	**47.**	(a)
48.	(b)	**49.**	(b)	**50.**	(d)	**51.**	(b)	**52.**	(d)	**53.**	(a)	**54.**	(b)	**55.**	(a)
56.	(a)	**57.**	(b)	**58.**	(c)	**59.**	(c)	**60.**	(b)	**61.**	(c)	**62.**	(d)	**63.**	(a)
64.	(b)	**65.**	(c)	**66.**	(c)	**67.**	(d)	**68.**	(c)	**69.**	(d)	**70.**	(c)	**71.**	(c)
72.	(b)	**73.**	(d)	**74.**	(b)	**75.**	(c)	**76.**	(d)	**77.**	(b)	**78.**	(b)	**79.**	(d)
80.	(b)	**81.**	(c)												

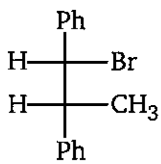
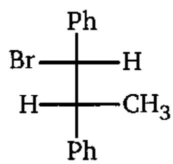
LEVEL-2

1. **Statement-1 :** Nucleophilicity order in polar-protic solvent is $I^- < Br^- < Cl^- < F^-$
   Statement-2 : Due to bigger size of I^- it is less solvated in polar-protic solvent.
   (a) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
   (b) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
   (c) Statement-1 is true, statement-2 is false.
   (d) Statement-1 is false, statement-2 is true.

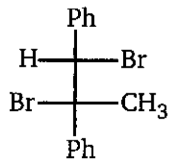
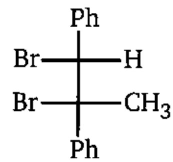
2. **Statement - 1 :** $CH_3-CH_2-Cl + NaI \xrightarrow{\text{Acetone}} CH_3-CH_2-I + NaCl\downarrow$
   Statement- 2 : Acetone is polar-protic solvent and solubility order of sodium halides decreases dramatically in order NaI > NaBr > NaCl. The last being virtually insoluble in this solvent and a 1° and 2° chloro alkane in acetone is completely driven to the side of Iodoalkane by the precipitation reaction.
   (a) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for statement-1.
   (b) Statement-1 is true, Statement-2 is true and Statement-2 is Not the correct explanation for statement-1.
   (c) Statement-1 is true, Statement-2 is false.
   (d) Statement-1 is false, Statement-2 is true.

3. Encircle whichever of the following :
   (a) is the stronger nucleophile (aprotic solvent) : F^- or I^-
   (b) is the stronger nucleophile (protic solvent) : F^- or I^-
   (c) is the stronger base : F^-or I^-
   (d) is the stronger nucleophile (protic solvent) : NH_3 or NH_2NH_2
   (e) is the better leaving group : CH_3COO^- or $CH_3SO_3^-$

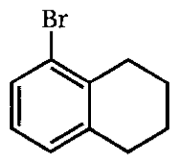
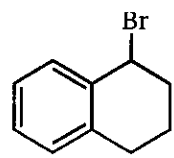
4. Encircle whichever of the following :
   (a) undergoes an S_{N^2} reaction more rapidly, CH_3-Br or $CH_3-\underset{}{\overset{Br}{\overset{|}{C}}}H-CH_3$
   (b) undergoes an S_{N^1} reaction more rapidly, CH_3-Br or $CH_3-\overset{Br}{\overset{|}{C}}H-CH_3$
   (c) undergoes an E_2 reaction to give (Z)-1,2-diphenylpropene : 

 or 

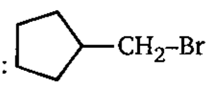
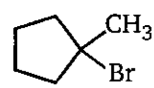
(d) reacts with NaI to give (Z)-1,2-diphenylpropene :

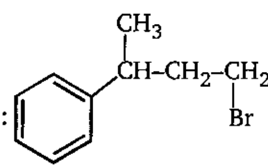
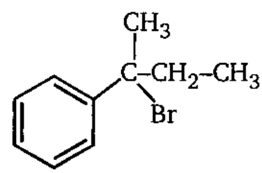
 or 

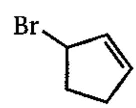
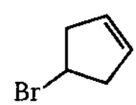
(e) undergoes an S_{N^1} reaction more rapidly,

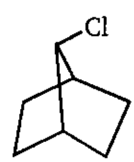
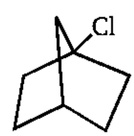
 or 

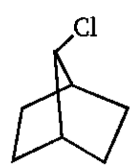
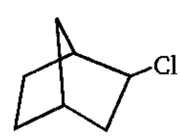
5. Encircle whichever of the following :

(a) undergoes an S_{N^2} reaction more rapidly :  or 

(b) undergoes an E_1 reaction more rapidly :  or 

(c) undergoes an S_{N^1} reaction more rapidly:  or 

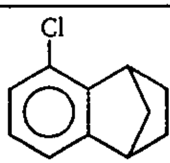
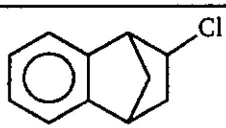
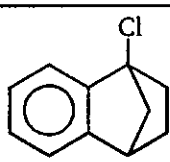
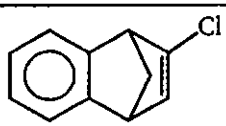
(d) undergoes an S_{N^2} reaction more rapidly:  or 

(e) undergoes an E_2 reaction more rapidly :  or 

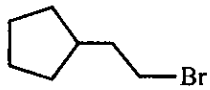
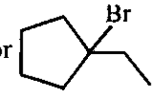
6. Match the column :

Alkyl halide			Relative rate (S_{N^1})		Relative rate (S_{N^2})
(a)	CH_3-Br	(p)	1	(w)	1200
(b)	CH_3-CH_2-Br	(q)	1.05	(x)	40
(c)	$CH_3-CH(CH_3)-Br$	(r)	11	(y)	16
(d)	$CH_3-C(CH_3)_2-Br$	(s)	1,200000	(z)	1

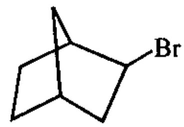
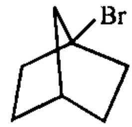
7. Matrix :

Column (I) Compound		Column (II) Type of reaction	
(a)		(p)	S_{N^1} reaction can take place
(b)		(q)	S_{N^2} reaction can take place
(c)		(r)	S_{N^1} is not possible
(d)		(s)	S_{N^2} is not possible

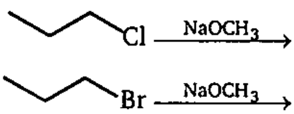
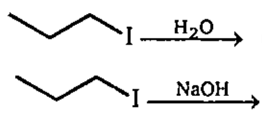
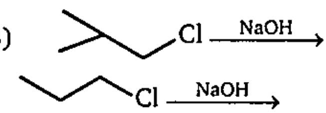
8. Encircle whichever of the following :

(a) undergoes an $S_{N}2$ reaction more rapidly,  or 

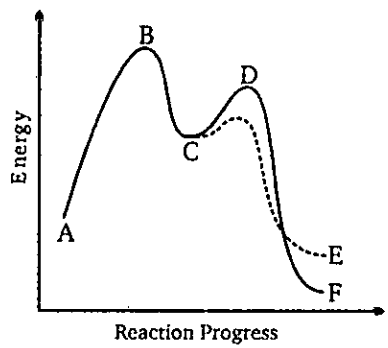
(b) undergoes an $S_{N}1$ reaction more rapidly, $(CH_3)_3C-Br$ or $(CH_3)_3C-I$

(c) undergoes an $S_{N}1$ reaction more rapidly,  or 

9. Reactivity : Circle the reaction that reacts FASTER by $S_{N}2$ in each pair :

(1)  (2)  (3) 

10. Consider the potential energy diagram given below



(X) Name the positions A-D

(Y) Answer the following questions .

(i) Both reaction pathways are : EXOTHERMIC or ENDOTHERMIC

(ii) Which step is the rate determining step (RDS) ? B or D

(iii) Which product is most stable ? E or F

(iv) In accordance with Hammonds postulate, exothermic reactions tend to have

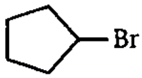
(a) early transition states that are reactant - like

(b) late transition states that are reactant-like

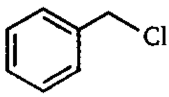
(c) early transition states that are product-like

(d) late transition states that are product-like.

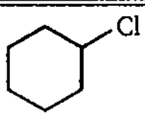
11. Select whether the following combinations of reactants will react by substitution (S_{N^1} or S_{N^2} mechanism), elimination (E_1 or E_2 mechanism)

A.  $\xrightarrow[25°C]{\text{NaI in acetone}}$

(a) S_{N^1} (b) S_{N^2} (c) E_1 (d) E_2

B.  $\xrightarrow[50°C]{\text{NaOCH}_3\text{ in methanol}}$

(a) S_{N^1} (b) S_{N^2} (c) E_1 (d) E_2

C.  $\xrightarrow[25°C]{\text{NaOCH}_3\text{ in methanol}}$

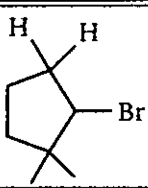
(a) S_{N^1} (b) S_{N^2} (c) E_1 (d) E_2

D. $(CH_3)_3C-OH$ $\xrightarrow[25°C]{\text{HBr 48\% in H}_2\text{O}}$

(a) S_{N^1} (b) S_{N^2} (c) E_1 (d) E_2

E. $(CH_3)_2CH-Br$ $\xrightarrow[25°C]{\text{NaCN in ethanol}}$

(a) S_{N^1} (b) S_{N^2} (c) E_1 (d) E_2

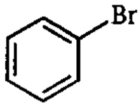
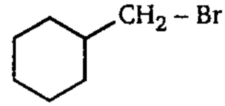
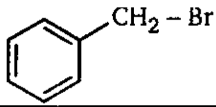
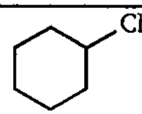
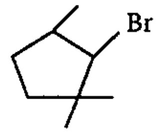
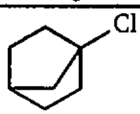
F.  $\xrightarrow[25°C]{\text{NaCN in ethanol}}$

(a) S_{N^1} (b) S_{N^2} (c) E_1 (d) E_2

G. $(CH_3)_2CHCH_2CH_2-OH$ $\xrightarrow[50°C]{\text{HBr 48\% in H}_2\text{O}}$

(a) S_{N^1} (b) S_{N^2} (c) E_1 (d) E_2

12. Examine the ten structural formulas shown in fig. & select that satisfy each of the following conditions. Write one or more (a through j) in each answer box.

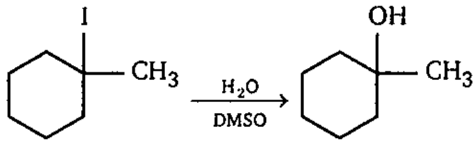
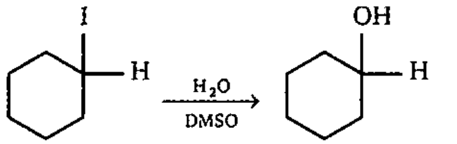
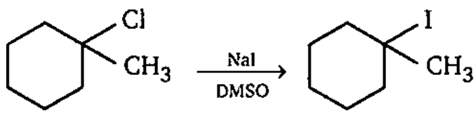
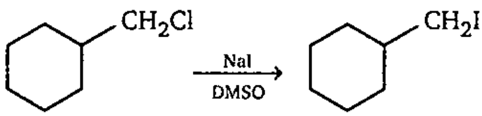
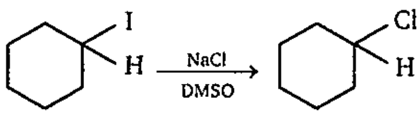
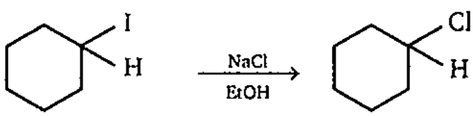
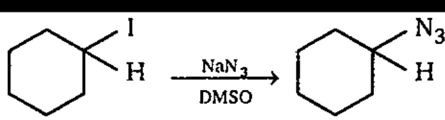
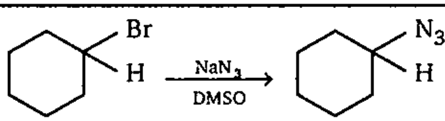
(a)		**(b)**	CH_3 $H_3C-C-Cl$ CH_3	**(c)**	
(d)	CH_3-I	**(e)**		**(f)**	
(g)	CH_3 $H_3C-C-CH_2-Cl$ CH_3	**(h)**	$H_2C=C-CH_2-Cl$ CH_3	**(i)**	
(j)					

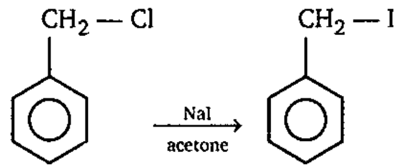
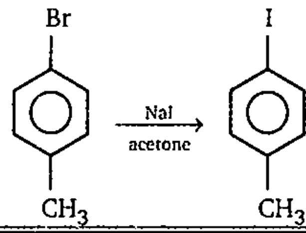
A. Which compounds give an S_{N^2} substitution reaction on treatment with alcoholic NaSH ?

B. Which compounds give an E_2 elimination reaction on treatment with alcoholic KOH ?

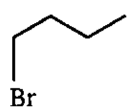
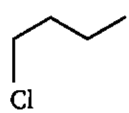
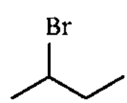
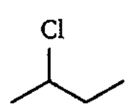
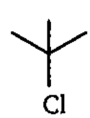
C. Which compounds do not react under either of the previous reaction conditions ?

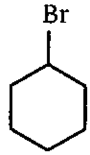
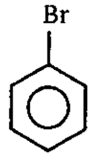
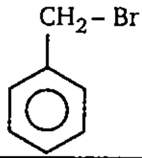
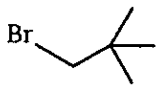
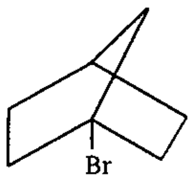
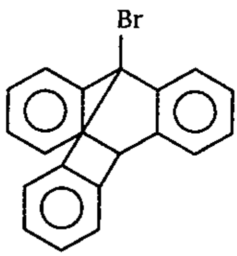
13. Select which reaction from the following reaction pairs will occur faster.

PART - 1	
Reaction A	
Reaction B	
PART - 2	
Reaction C	
Reaction D	
PART - 3	
Reaction E	
Reaction F	
PART - 4	
Reaction G	
Reaction H	

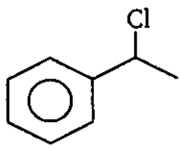
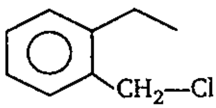
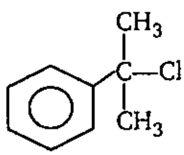
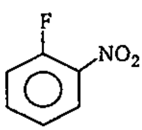
PART - 5	
Reaction I	
Reaction J	

14. Tick your answer in the given box.

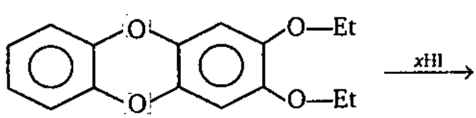
	Alkyl Halide	2-D Structure	Expect S_{N^2} (at a reasonable rate)	
(a)	1-Bromobutane			Yes
				No
(b)	1- Chlorobutane			Yes
				No
(c)	2-Bromobutane			Yes
				No
(d)	2-Chlorobutane			Yes
				No
(e)	2-Chloro-2-methyl propane			Yes
				No

(f)	Bromocyclohexane			Yes
				No
(g)	Bromobenzene			Yes
				No
(h)	Benzyl bromide			Yes
				No
(i)	1-Bromo-2,2-dimethyl propane			Yes
				No
(j)	Bicyclo compound			Yes
				No
(k)	1-bromotriptycene			Yes
				No

15. Match the column

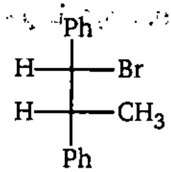
	Column-I		Column-II
(a)		**(p)**	It will undergo Nucleophilic Substitution reaction
(b)		**(q)**	It will undergo E_2 reaction
(c)		**(r)**	It will undergo E_1 reaction
(d)		**(s)**	It will undergo S_{N^2} reaction
		(t)	It will undergo S_{N^1} reaction

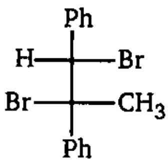
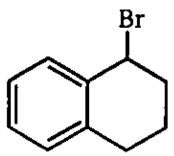
16.

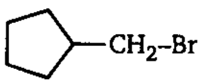
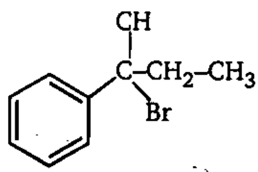
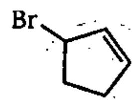


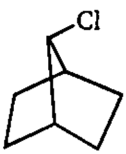
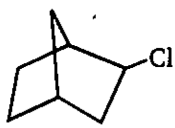
How many (x) moles of HI consumed?

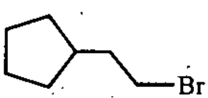
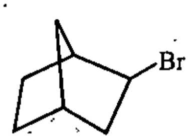
ANSWERS — LEVEL 2

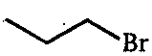
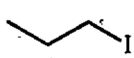
1. d
2. c The reaction is Finkelstein reaction.
3. (a) F^-; (b) I^-; (c) F^-; (d) NH_2-NH_2; (e) $CH_3SO_3^-$
4. (a) CH_3-Br (b) $CH_3-\overset{Br}{\overset{|}{C}}H-CH_3$ (c) 

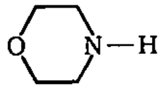
(d)  (e) 

5. (a)  (b)  (c) 

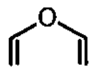
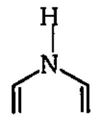
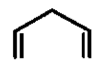
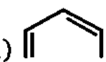
(d)  (e) 

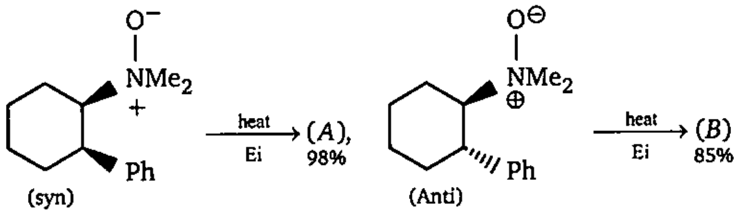
6. a – p, w; b – q, x ; c – r, y; d – s, z
7. a – r, s; b – p, q; c – r, s; d – r, s
8. (a)  (b) $(CH_3)_3C-I$ (c) 

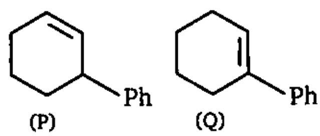
9. (1)  (2)  (3) 
10. (X) A- reactants, B-transition state, C-Inter mediate, D- transition state
(Y) (i) exothermic (ii) B (iii) F (iv) a

3.  (P)

when (P) undergoes Hoffmann exhaustive methylation (twice) then the product obtained will be :

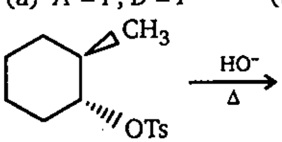
(a) 
(b) 
(c) 
(d) 

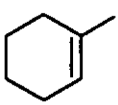
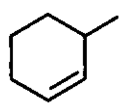
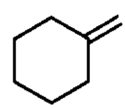
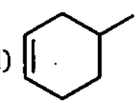
4. 



Product (A) & (B) of the above reaction is :

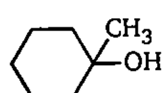
(a) $A = P, B = P$ (b) $A = Q, B = Q$ (c) $A = P, B = Q$ (d) $A = Q, B = P$

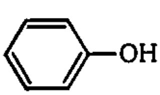
5.  Major product of the reaction is :

(a) 
(b) 
(c) 
(d) 

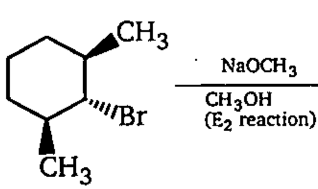
6. Which of these dehydrates most easily ?

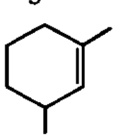
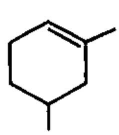
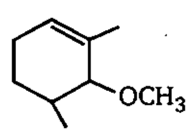
(a) $CH_3-CH_2-CH_2-OH$

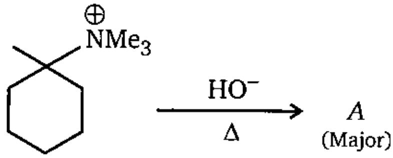
(b) 

(c) 

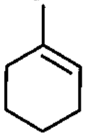
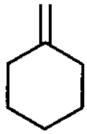
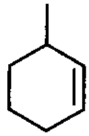
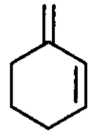
(d) $CH_3-C(CH_3)_2-CH_2-OH$

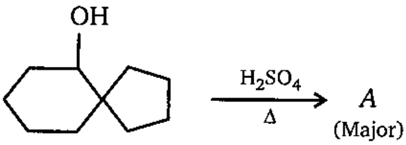
7.  Product; Product of the reaction is :

(a) 
(b) 
(c) 
(d) No reaction

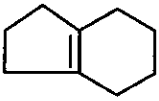
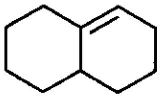
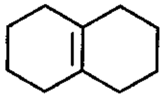
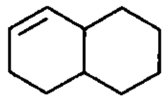
8. 

Major product A is :

(a)  (b)  (c)  (d) 

9. 

Major product A is :

(a)  (b)  (c)  (d) 

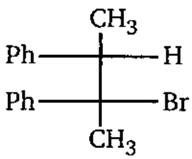
10. In which of the following reaction Saytzeff alkene is major product ?

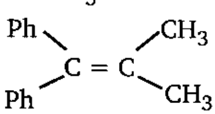
(a) $CH_3-CH_2-C(CH_3)_2-\overset{\oplus}{N}Me_3 \xrightarrow[\Delta]{HO^-}$

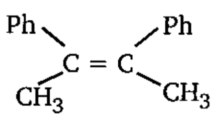
(b) $CH_3-CH_2-CH_2-CH(F)-CH_3 \xrightarrow[\Delta]{EtO^-}$

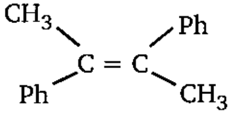
(c) $CH_3-CH_2-C(CH_3)(Br)-CH_3 \xrightarrow[\Delta]{t\text{-BuOK}}$

(d) $CH_3-CH_2-CH_2-C(Br)(CH_3)-CH_3 \xrightarrow[\Delta]{CH_3OK}$

11.  $\xrightarrow[\text{(E}_2\text{ reaction)}]{\text{alc. KOH}}$ Major product of the reaction is :

(a) 

(b) 

(c) 

(d) $Ph-CH(CH_3)-CH(OH)-Ph$

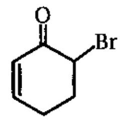
12. The conversion of 2, 3-dibromobutane to 2-butene with Zn is :

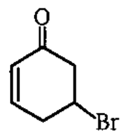
(a) Redox reaction
(b) α-Elimination
(c) β-Elimination
(d) Both α-elimination and redox reaction

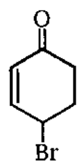
13. 1, 3-Dibromopropane is heated with zinc dust in ether. The product formed is :

(a) propene (b) propane

(c) cyclopropane (d) 3-bromopropane

14. Reaction (1)  $\xrightarrow{\text{alc. KOH}}$ (A) (major)

Reaction (2)  $\xrightarrow{\text{alc. KOH}}$ (B) (major)

Reaction (3)  $\xrightarrow{\text{alc. KOH}}$ (C) (major)

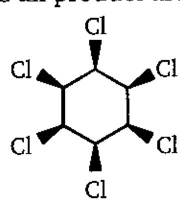
Product obtained in above reactions (1), (2) & (3) is :

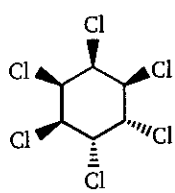
(a) A = B but C is different

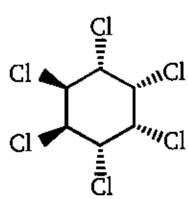
(b) A = C, but B is different

(c) B = C, but A is different

(d) A = B = C all product are identical

15. Reaction (1)  $\xrightarrow{\text{3 mole alc. KOH}}$ (A)

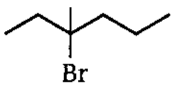
Reaction (2)  $\xrightarrow{\text{3 mole alc. KOH}}$ (B)

Reaction (3)  $\xrightarrow{\text{3 mole alc. KOH}}$ (C)

Product obtained in above reactions (1), (2) & (3) is :

(a) $A = B$, C is different (b) $A = C$, B is different

(c) $B = C$, A is different (d) $A = B = C$ is same

16.  $\xrightarrow{\text{alc. KOH}}$ (x)

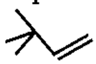
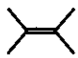
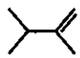
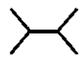
x is number of E_2 product obtained (including stereoisomers)

Find (x).

(a) 3 (b) 4 (c) 5 (d) 6

17. $CH_3-C(CH_3)_2-CH(Br)-CH_3 \xrightarrow[\Delta]{\text{EtOH}} (A)$

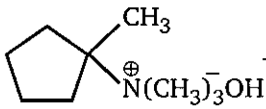
Major product (A) is :

(a)  (b)  (c)  (d) 

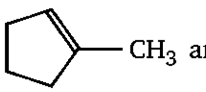
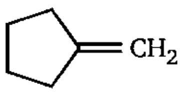
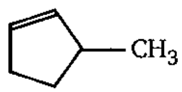
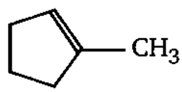
18. Which one of the following compound will be least susceptible to elimination of hydrogen bromide ?

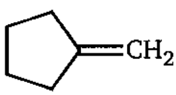
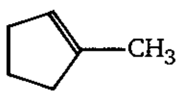
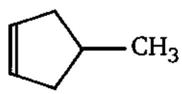
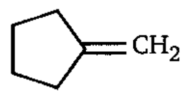
(a) $Br-CH_2-CH_2-NO_2$ (b) $Br-CH_2-CH_2-CH_3$
(c) $Br-CH_2-CH_2-CN$ (d) $Br-CH_2-CH_2-CO_2Et$

19. Two alkenes, X(91% yield) and Y(9% yield) are formed when the following compound is heated.

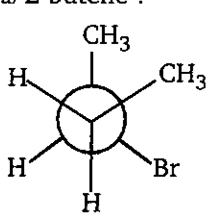
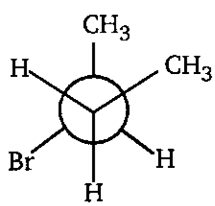
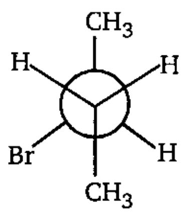
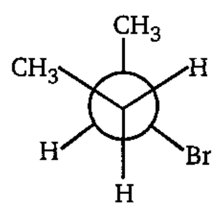
 $\xrightarrow{\Delta}$ $\underset{91\%}{X} + \underset{9\%}{Y}$

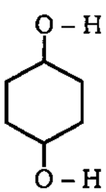
The structures of X and Y, respectively are :

(a)  and  (b)  and 

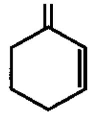
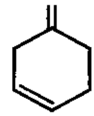
(c)  and  (d)  and 

20. In the dehydrohalogenation of 2-bromobutane; which conformation leads to the formation of *cis*-2-butene ?

(a)  (b)  (c)  (d) 

21.  $\xrightarrow[\text{Pyridine}]{CH_3-\overset{O}{\overset{\|}{C}}-Cl \text{ (2 mole)}}$ (A) $\xrightarrow[\Delta]{(Ei)}$ (B) + CH_3CO_2H

Product (*B*) of given reaction is:

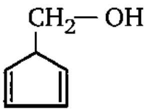
(a)  (b)  (c)  (d) 

22. What product will be formed from Hoffmann exhaustive methylation of following compound?

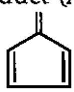
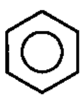
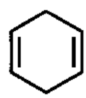
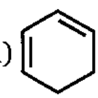
$$Me_2CHCH_2NHCH_2CH_2Me \xrightarrow[\text{(ii) } Ag_2O \text{ (iii) } \Delta]{\text{(i) } CH_3\text{–I (excess)}} \text{Product}$$

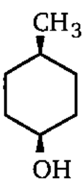
(a) $Me—CH=CH_2$ (b) $H_2C=CH_2$

(c) $CH_3—\underset{\displaystyle CH_3}{\underset{|}{C}}=CH_2$ (d) $CH_3—\underset{\displaystyle Me}{\underset{|}{CH}}—CH=CH_2$

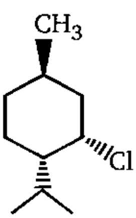
23.  $\xrightarrow[\Delta]{H^{\oplus}}$ (*A*)

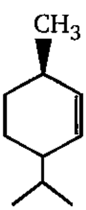
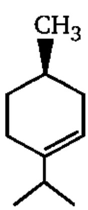
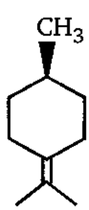
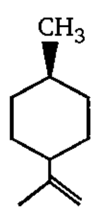
Product (*A*) is :

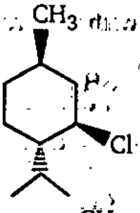
(a)  (b)  (c)  (d) 

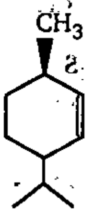
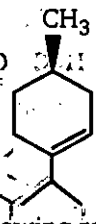
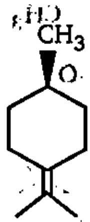
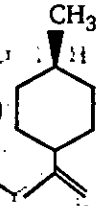
24.  $\xrightarrow[\Delta]{H^{\oplus}}$; Products obtained are :

(a) Racemic (b) Diastereomers (c) G.I (d) Positional isomers

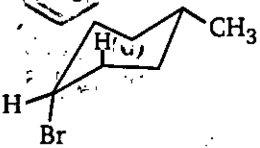
25.  $\xrightarrow[\text{(E}_2\text{reaction)}]{\text{NaOEt}}$; Major product of the reaction is :

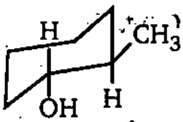
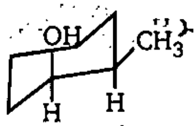
(a)  (b)  (c)  (d) 

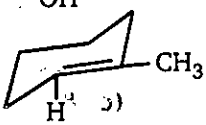
26.  $\xrightarrow{NaOEt}$; Major product of the reaction is :

(a)  (b)  (c)  (d) 

27. The E_2 product of the following reaction will be ?



(a)  (b) 

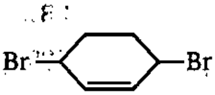
(c)  (d) 

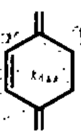
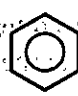
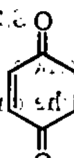
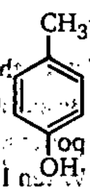
28. An halide $C_5H_{11}Br$ on treatment with alc. KOH give 2-pentene only. The halide will be :

(a) $CH_3-CH_2-CH_2-CH_2-CH_2-Br$ (b) $CH_3-CH_2-CH_2-\underset{Br}{\underset{|}{CH}}-CH_3$

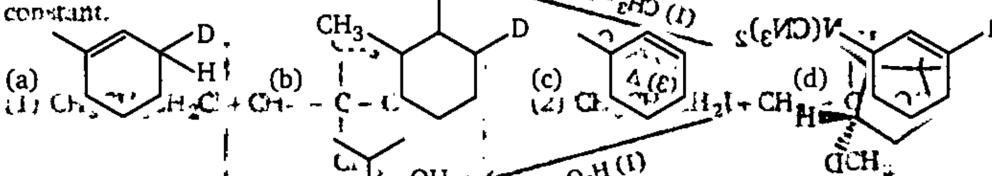
(c) $CH_3-CH_2-\underset{Br}{\underset{|}{CH}}-CH_2-CH_3$ (d) $CH_3-\overset{CH_3}{\overset{|}{CH}}-\underset{Br}{\underset{|}{C}}-CH_3$

29. End product (*D*) in the given sequence is:

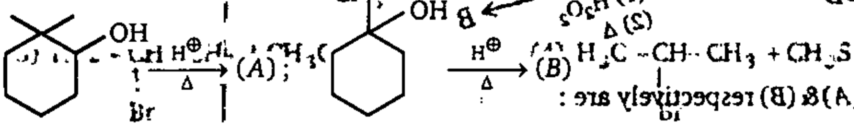
 $\xrightarrow[\text{2 molar equivalent}]{CH_3NHCH_3} (A) \xrightarrow{BaO} (B) \xrightarrow[\text{(2molar equivalent)}]{CH_3I} (C) \xrightarrow{Ag_2O/H_2O} (D) + (CH_3)_3N$

(a)  (b)  (c)  (d) 

30. For each of the following pairs of E_2 reaction, select the one that occurs with the greater rate constant.



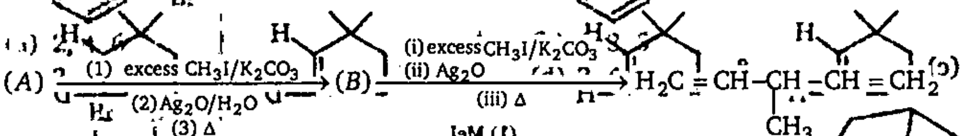
38.



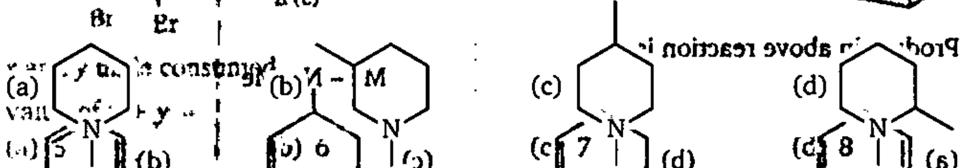
Sum of number of α-hydrogen present is compound $A + B$ is :

(a) 18 (b) 19 (c) 20 (d) 21

39.

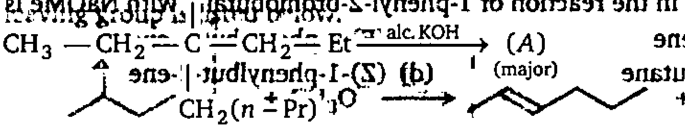


Identify A :



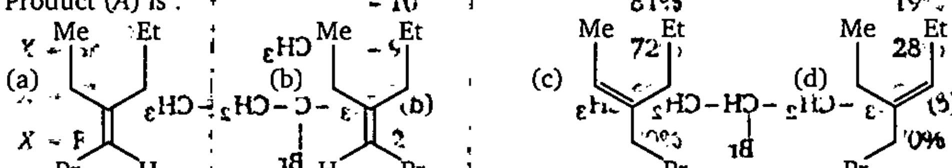
32. The following bimolecular elimination reaction is carried out with different halogen leaving groups. The per cent yield of the two products (2-hexene and 1-hexene) for each leaving group is given below.

40.



n-Pr = n-propyl

Product (A) is :

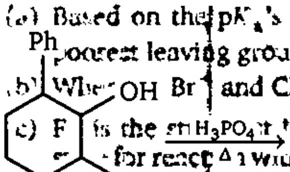


Which of the following statement is (are) true concerning this series of E_2 reactions ?

(a) Based on the pK_a's of the conjugate acid, I^- is the best leaving group and F^- is the poorest leaving group

(b) When Br and Cl are used as leaving groups, Zaitsev's rule is followed

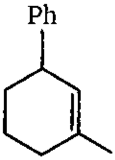
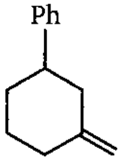
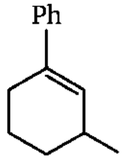
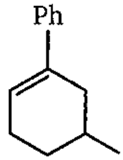
41.

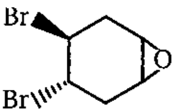


Major product obtained by dehydration of given alcohol is :

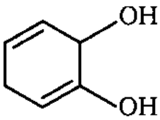
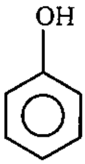
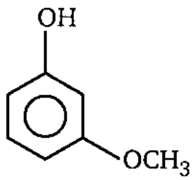
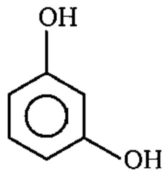
(c) F is the ... transition ... for reaction with fluoride as the leaving group has the least double bond character

(d) a, b, c are true

(a)  (b)  (c)  (d) 

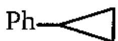
42.  $\xrightarrow[CH_3OH]{NaOCH_3\,(2mole)} (A) \xrightarrow{H_3O^{\oplus}} (B)$

Product (B) of above reaction is :

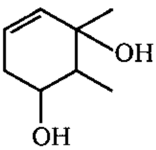
(a)  (b)  (c)  (d) 

43. $Ph-\underset{\underset{Br}{|}}{CH}-CH_2-\underset{\underset{Br}{|}}{CH_2} \xrightarrow[\Delta]{Zn-Cu}$ Product

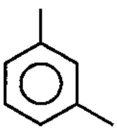
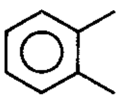
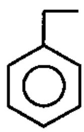
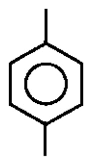
Product of the above reaction is :

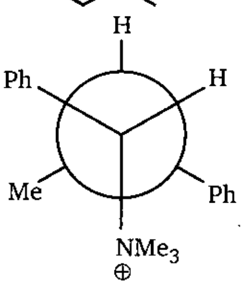
(a) $Ph-CH=CH-CH_2-Br$ (b) 

(c) $PH-CHBr-CH=CH_2$ (d) $Ph-C\equiv C-CH_3$

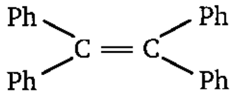
44.  $\xrightarrow[\Delta]{H^{\oplus}} (A)$

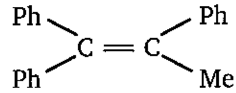
Product (A) is :

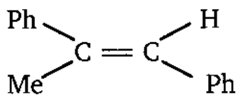
(a)  (b)  (c)  (d) 

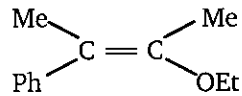
45.  $\xrightarrow[\Delta]{NaOEt}$

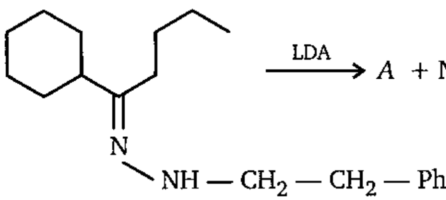
Major product of the above reaction is :

(a) 

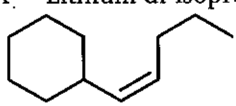
(b) 

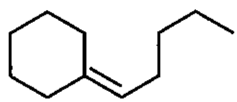
(c) 

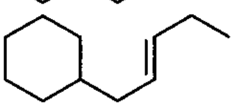
(d) 

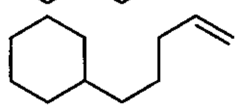
46.  $\xrightarrow{\text{LDA}}$ $A + N_2 + Ph-CH=CH_2$, Product A is:

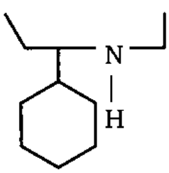
LDA = Lithium di-isopropyl amide

(a) 

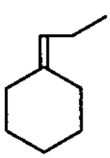
(b) 

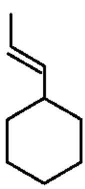
(c) 

(d) 

47. 

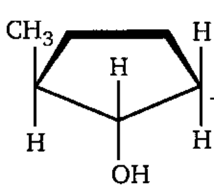
Major product of the reaction, when the given compound undergoes Hoffmann exhaustive methylation is :

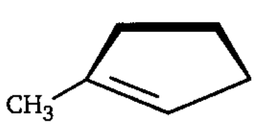
(a) 

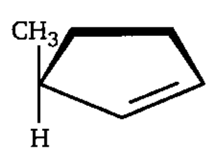
(b) 

(c) 

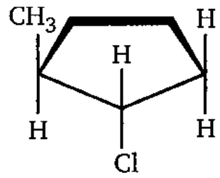
(d) $H_2C=CH_2$

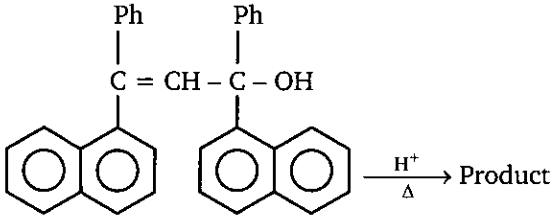
48.  $\xrightarrow[\text{Pyridine}]{POCl_3}$ Major product of the reaction is :

(a) 

(b) 

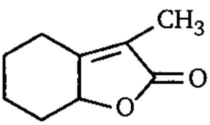
(c) 

(d) 

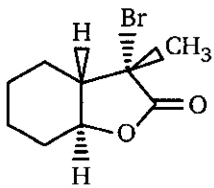
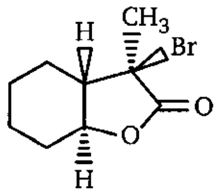
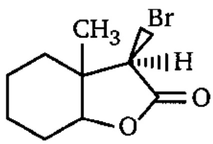
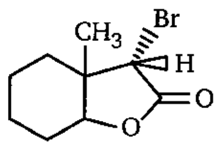
49. 

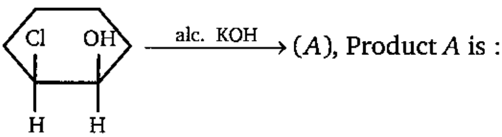
Stereochemistry of the product is :

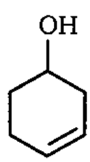
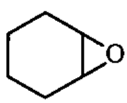
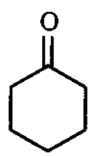
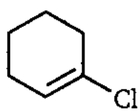
(a) Meso compound
(b) Racemic mixture
(c) Diastereomer
(d) Optically pure enantiomers

50. 

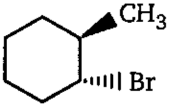
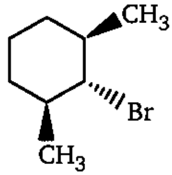
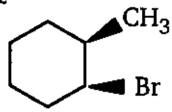
Which of the following reactant is used to obtain above compound (A). (Assume that EtO^- is used in all the reaction)

(a)  (b)  (c)  (d) 

51. 

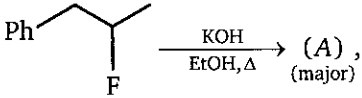
(a)  (b)  (c)  (d) 

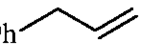
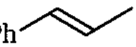
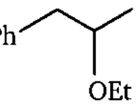
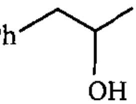
52. Rank the following in order of decreasing rate in an E_2 reaction:

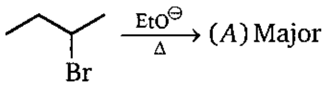
  

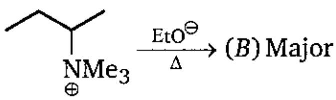
(a) (b) (c)

(a) a > b >c
(b) c > a > b
(c) c > b > a
(d) b > a > c

53.  Product (A) is :

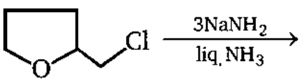
(a)  (b)  (c)  (d) 

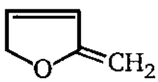
54. 



Relation between (A) and (B) is :

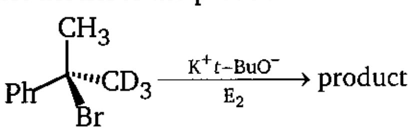
(a) G.I. (b) Positional isomer
(c) Enantiomer (d) Chain isomer

55.  Product ; The Product is :

(a)  (b) $HC\equiv C-(CH_2)_3ONa$

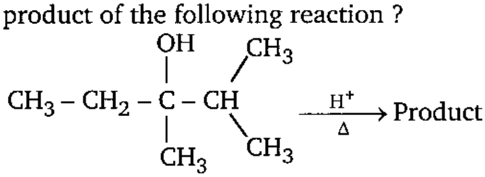
(c) $NaC\equiv C-(CH_2)_3ONa$ (d) $H-C\equiv C-(CH_2)_3OH$

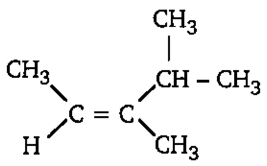
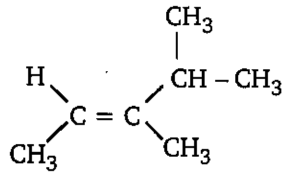
56. Which best describes the product of the following reaction ?

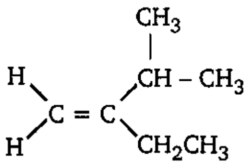
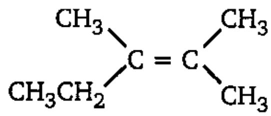


(a) Absolute configuration has been inverted
(b) Absolute configuration has been retained
(c) Racemization (loss of absolute configuration) has occurred
(d) Loss of chirality has occurred (the product is achiral)

57. What is the major product of the following reaction ?



(a) 
(b) 

(c) 
(d) 

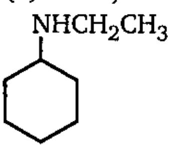
58. What will be the major product of each of the two reaction shown below ?

1. $CH_3CH_2\underset{\substack{| \\ ^{+}N(CH_3)_3\,^{-}OH}}{C}HCH_3 \xrightarrow{\text{heat}}$

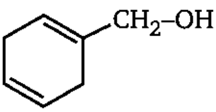
2. $CH_3CH_2\underset{\substack{| \\ Br}}{C}HCH_3 + CH_3CH_2ONa \xrightarrow{\text{heat}}$

$\longrightarrow \underset{X}{CH_3CH{=}CHCH_3} + \underset{Y}{CH_3CH_2CH{=}CH_2}$

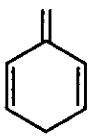
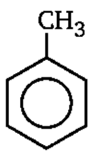
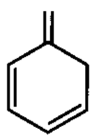
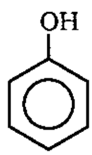
(a) 1 – X, 2 – X (b) 1 – Y, 2 – X (c) 1 – X, 2 – Y (d) 1 – Y, 2 – Y

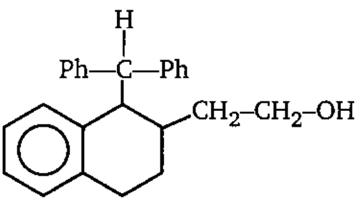
59.  + CH_3I (excess) $\longrightarrow$ product; The product is :

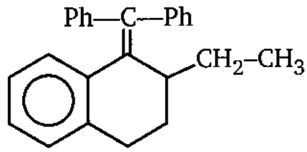
(a) a primary amine (b) a tertiary amine
(c) a secondary amine (d) a quaternary ammonium salt

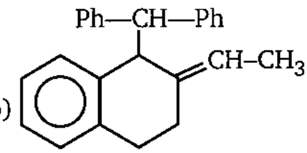
60.  $\xrightarrow[\Delta]{H^+} (A) \xrightarrow{\text{Isomerisation}} (B)$

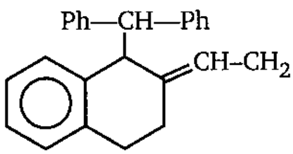
(A) on heating isomerizes to (B). What is the structure of (B) ?

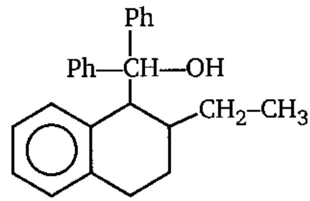
(a)  (b)  (c)  (d) 

61.  $\xrightarrow[\Delta]{H^+}$ $\underset{\text{(major)}}{(A)}$, major product (A) is :

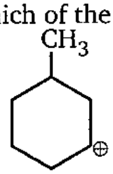
(a) 

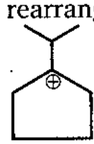
(b) 

(c) 

(d) 

62. Which of the following carbocation will undergo rearrangement ?

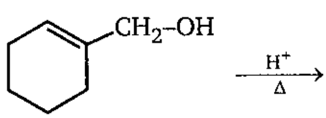
(a) 

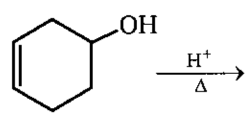
(b) 

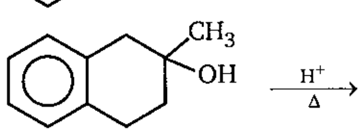
(c) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\overset{\oplus}{C}=O$

(d) $CH_3-NH-\overset{\oplus}{CH}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$

63. In which of the following reaction resonance stabilized product will form ?

(a) 

(b) 

(c) 

(d) All of these

64. In which of following reaction rearrangement take place with change in carbon skeleton ?

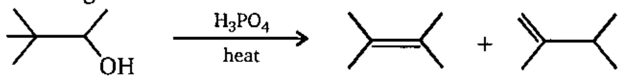
(a) $CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-\overset{\oplus}{CH_2}$

(b) $CH_3-CH_2CH_2^{\oplus}$

(c) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-\overset{\oplus}{CH_2}$

(d) $CH_3-CH^{\oplus}-CH_3$

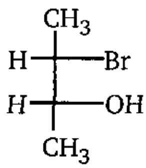
65. Consider the following reaction :



Which response contains all the correct statement about this process ?

(1) Dehydration
(2) E_2 mechanism
(3) Carbon skeleton migration
(4) Most stable alkene will form
(5) Single-step reaction

(a) 1, 3 (b) 1, 2, 3 (c) 1, 2, 5 (d) 1, 3, 4

66. 

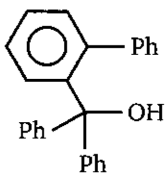
$\xrightarrow{HBr} (X) \xrightarrow[\text{acetone}]{NaI} (Y)$ (Major); Product (Y) is:

(a) *cis*-2-butene
(b) *trans*-2-butene
(c) 1-butene
(d) Iso-butene

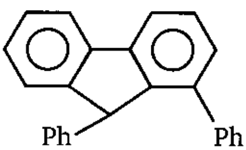
67. $\underset{\substack{| \\ Br}}{CH_2}-CH=CH-\underset{\substack{| \\ Br}}{CH_2} \xrightarrow{\text{Zn (dust)}} (A)$

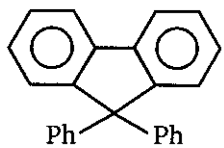
Above reaction is an example of 1,4-elimination. Predict the product.

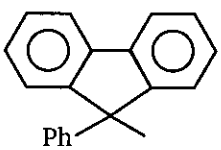
(a) $CH_3-CH=C=CH_2$
(b) $CH_3-C\equiv C-CH_3$
(c) $CH_3-CH_2-C\equiv CH$
(d) $H_2C=CH-CH=CH_2$

68. 

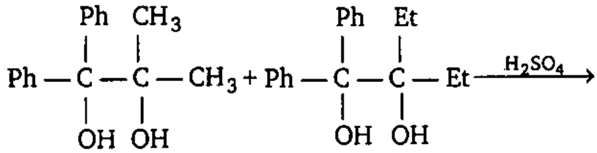
$\xrightarrow{\text{conc. } H_2SO_4}$ Major product of the reaction is:

(a) 

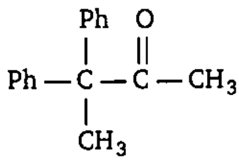
(b) 

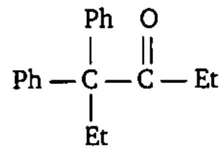
(c) 

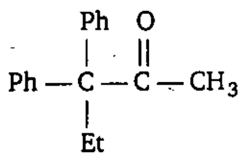
(d) None of these

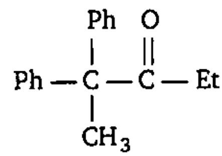
69. 

(A) (B)

(p) 

(q) 

(r) 

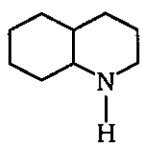
(s) 

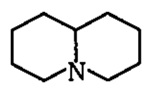
When (A) and (B) reacts with H_2SO_4 products obtained are :

(a) p, q, r, s (b) p, q (c) p, q, r (d) p, q, s

70. Which of the following compound gives even number of Hoffmann's exhaustive methylation and elimination?

(a) 

(b) 

(c) 

(d) 

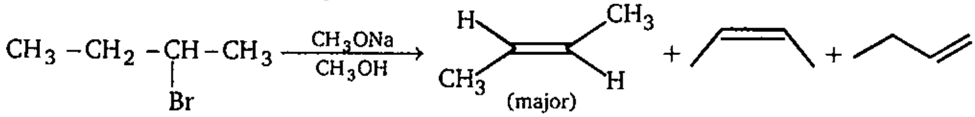
ANSWERS — LEVEL 1															
1.	(d)	2.	A – a B – d	3.	(a)	4.	(c)	5.	(b)	6.	(b)	7.	(d)	8.	(b)
9.	(c)	10.	(d)	11.	(c)	12.	(c)	13.	(c)	14.	(d)	15.	(d)	16.	(c)
17.	(b)	18.	(b)	19.	(c)	20.	(a)	21.	(b)	22.	(a)	23.	(b)	24.	(a)
25.	(b)	26.	(a)	27.	(d)	28.	(c)	29.	(b)	30.	(c)	31.	(d)	32.	(d)
33.	(a)	34.	(a)	35.	(a)	36.	(b)	37.	(c)	38.	(c)	39.	(c)	40.	(c)
41.	(c)	42.	(b)	43.	(b)	44.	(b)	45.	(c)	46.	(a)	47.	(d)	48.	(b)
49.	(b)	50.	(a)	51.	(c)	52.	(b)	53.	(b)	54.	(b)	55.	(c)	56.	(d)
57.	(d)	58.	(b)	59.	(d)	60.	(b)	61.	(a)	62.	(b)	63.	(d)	64.	(a)
65.	(d)	66.	(b)	67.	(d)	68.	(b)	69.	(b)	70.	(a,b)				

LEVEL-2

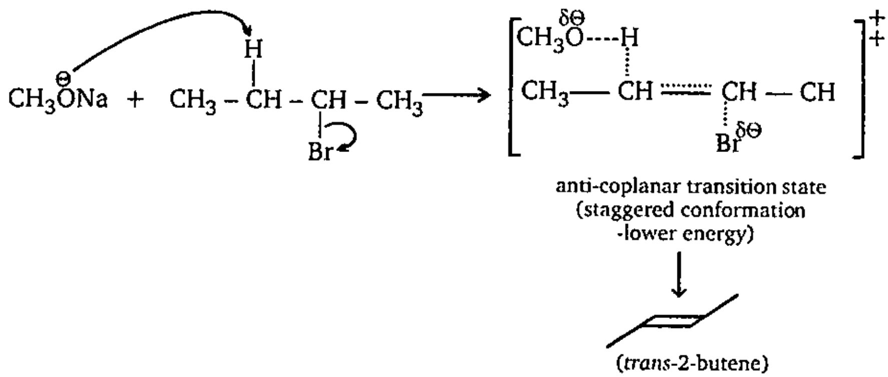
1. Comprehension

E_2 reaction → Elimination bimolecular

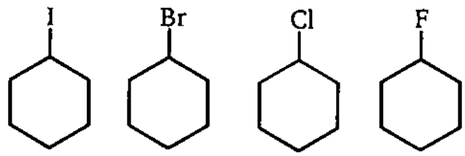
In the general mechanism of the E_2 reaction a strong base abstract a proton on a carbon atom adjacent to the one of the leaving group. As the base abstracts a proton, a double bond forms and the leaving group leaves.



Mechanism :



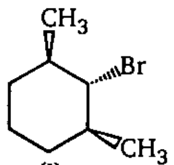
A. Identify the rate of reaction of given compounds in E_2 reaction:



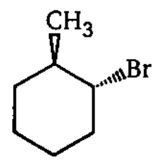
(a) (b) (c) (d)

(a) $a > b > c > d$ (b) $a > c > b > d$ (c) $b > a > c > d$ (d) $b > d > a > c$

B. In given pairs, which compound is more reactive toward E_2 reaction:

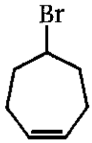
(P) 

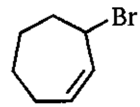
(I)



(II)

(Q) $CH_3-\underset{\displaystyle Br}{CH}-CH_3$ (III) $\qquad CH_3-\underset{\displaystyle Br}{CH}-CD_3$ (IV)

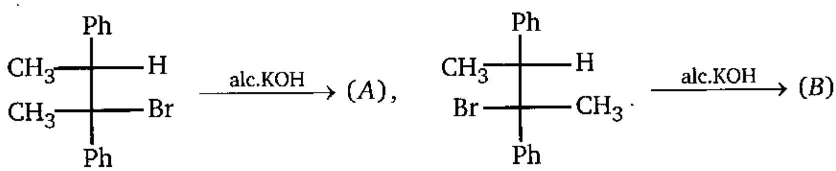
(R) 
(V)


(VI)

(S) Ph—CH_2—CH_2—Br
(VII)

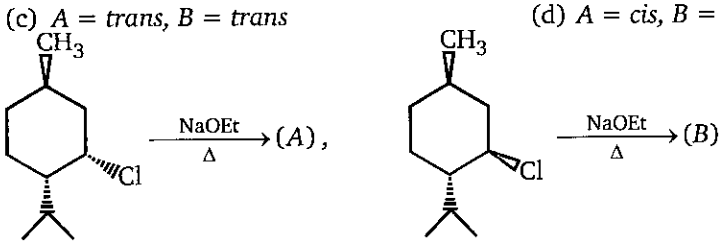
Ph — CH(Br) — CH_3
(VIII)

(a) P – II, Q – III, R – VI, S – VII
(b) P – II, Q – III, R – VI, S – VI
(c) P – I, Q – III, R – VI, S – VII
(d) P – I, Q – II, R – V, S – VIII

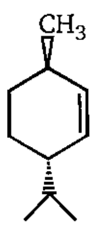
C. 

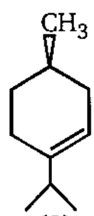
Product (*A*) and (*B*) are :

(a) *A* = *cis*, *B* = *cis*
(b) *A* = *trans*, *B* = *cis*
(c) *A* = *trans*, *B* = *trans*
(d) *A* = *cis*, *B* = *trans*

D. 

Select the products (*A*) and (*B*) from the compounds (*P*) and (*Q*) given below:

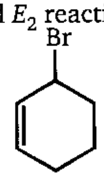

(P)


(Q)

(a) *A* = P, *B* = P
(b) *A* = Q, *B* = Q
(c) *A* = Q, *B* = P
(d) *A* = P, *B* = Q

E. Which of the following compound is inert toward E_2 reaction.

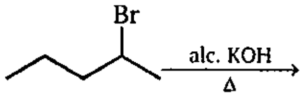
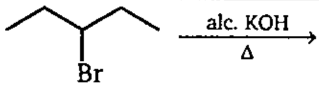
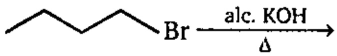
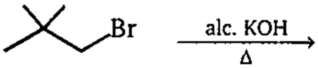
(a) $CH_3 - CH(Br) - CH_2 - CH_3$

(b) 

(c) $CH_3 - C(CH_3)_2 - CH_2 - Br$

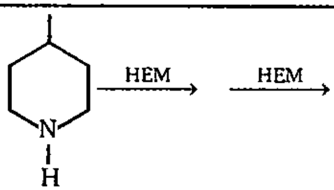
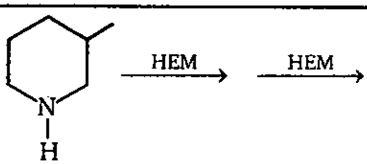
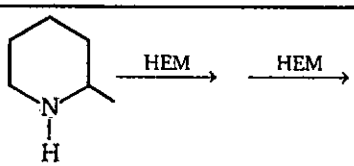
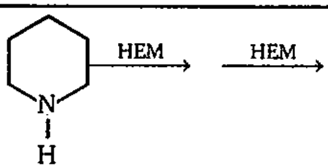
(d) $CH_3 - C(CH_3)_2 - CH(Br) - CH_3$

2. Match the column :

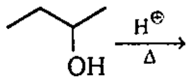
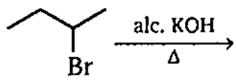
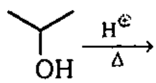
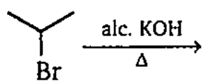
Column (I)		Column (II)	
E_2 reaction (elimination bimolecular)		No. of possible products. (including stereoisomerism)	
(a)		(p)	0
(b)		(q)	1
(c)		(r)	2
(d)		(s)	3

3. Match the Column :

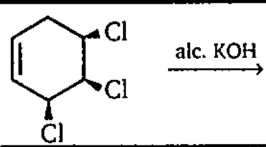
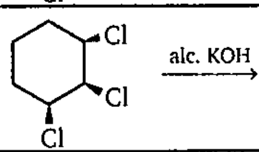
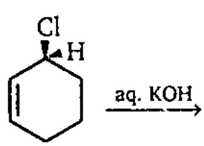
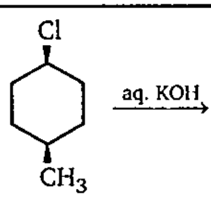
HEM = Hoffmann exhaustive methylation followed by elimination.

Column (I)		Column (II)	
Reaction		Product	
(a)		(p)	$H_2C=CH-CH_2-CH=CH_2$
(b)		(q)	$H_2C=CH-CH_2-CH_2-CH=CH_2$
(c)		(r)	$H_2C=CH-CH_2-\underset{}{C}(CH_3)=CH_2$
(d)		(s)	$H_2C=CH-CH(CH_3)-CH=CH_2$

4. Match the column :

	Column (I)		Column (II)
(a)		(p)	Product are Diastereomers
(b)		(q)	Carbocation is intermediate
(c)		(r)	2nd order reaction
(d)		(s)	Ist order reaction

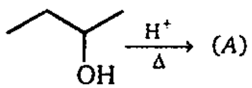
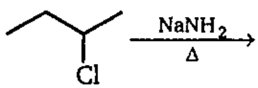
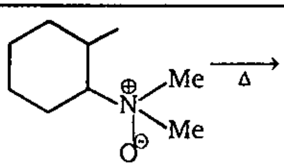
5. Match the column :

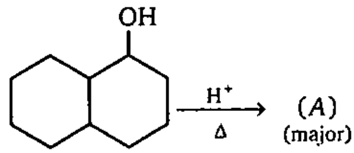
	Column (I)		Column (II)
(a)		(p)	Optically active product
(b)		(q)	Optically inactive product
(c)		(r)	2nd order reaction
(d)		(s)	unimolecular reaction

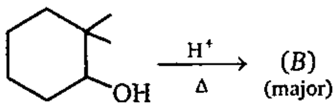
6. Match the column :

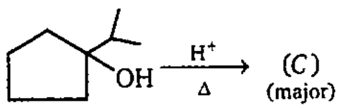
Column (I)		Column (II)	
E_2 reactions (elimination bimolecular)		Number of products (including stereoisomerism)	
(a)	$CH_3-CH_2-CH_2-CH_2-Br \xrightarrow{\text{alc. KOH}}$	(p)	1
(b)	$CH_3-CH(Br)-CH_2-CH_3 \xrightarrow{\text{alc. KOH}}$	(q)	2
(c)	$CH_3-C(CH_3)(Br)-CH_2-CH_3 \xrightarrow{\text{alc. KOH}}$	(r)	3
(d)	$Ph-CH_2-CH(Br)-CH_2-CH_3$	(s)	4

7. Match the column :

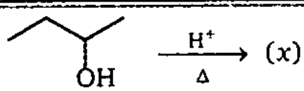
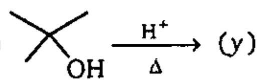
Column (I)		Column (II)	
(a)		(p)	E_1
(b)		(q)	E_2
(c)	$CH_3-\overset{\overset{O}{\parallel}}{C}-CH_2-CH(Br)-CH_3 \xrightarrow[\Delta]{\text{EtONa}}$	(r)	Ei (elimination intramolecular)
(d)		(s)	E_{1CB}

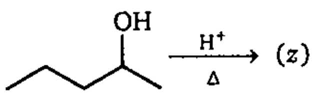
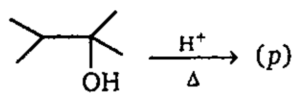
13. Reaction-1 

Reaction-2 

Reaction-3 

Sum of α-hydrogen $(A + B + C) =$

14. (a)  (b) 

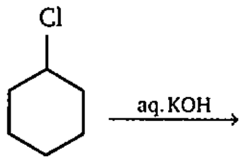
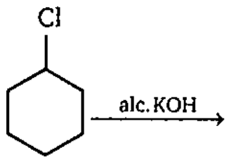
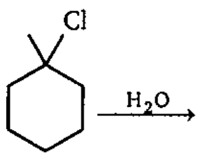
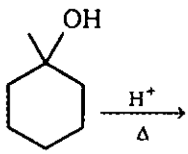
(c)  (d) 

Total number of products obtained in above reactions including minor products is (including stereoisomer)

15. Match the column (I) and (II).

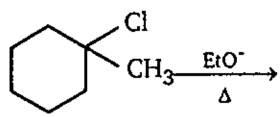
Column (I)		Column (II)	
Reaction		**Type of Reaction**	
(a)	R -2 -chlorobutane $\xrightarrow[\text{acetone}]{\text{KSH}}$	**(p)**	S_N1
(b)	R - 2- chlorobutane $\xrightarrow[\text{EtOH}]{\text{EtO}^- \overset{\ominus}{\text{Na}}}$	**(q)**	S_N2
(c)	2 - bromo- 2- methyl propane $\xrightarrow{H_2O}$	**(r)**	E_1
(d)	2- butanol $\xrightarrow[\Delta]{H_2SO_4}$	**(s)**	E_2

16. Match the column (I) and (II).

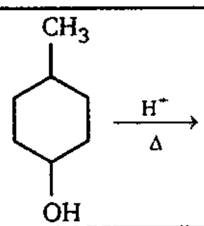
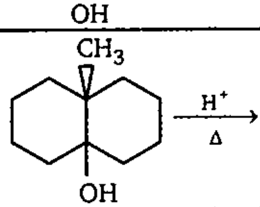
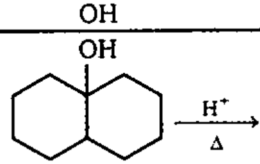
Column (I)		Column (II)	
Reaction		Type of Reaction	
(a)		(p)	S_N1
(b)		(q)	S_N2
(c)		(r)	E_1
(d)		(s)	E_2

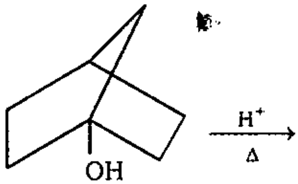
17. Select whether the following reagent combination will result in elimination or substitution reactions leading to the major product.

Reaction		Substitution	Elimination
(a)	$CH_3-\underset{\displaystyle H}{\overset{\displaystyle CH_3}{C}}-Cl \xrightarrow[H_2O]{K^{\oplus}\,\bar{O}C(CH_3)_3}$		
(b)	$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{C}}-OH \xrightarrow[\Delta]{H_2SO_4}$		

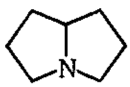
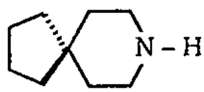
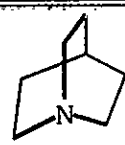
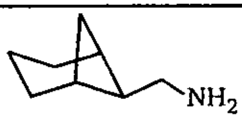
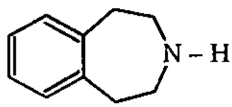
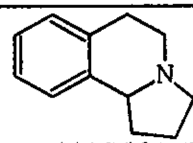
(c)	$CH_3-\underset{}{\overset{Cl}{\overset{\vert}{C}H}}-CH_2-CH_3 \xrightarrow{\text{alc-KOH}}$		
(d)	$CH_3-\underset{H}{\underset{\vert}{\overset{CH_3}{\overset{\vert}{C}}}}-I \xrightarrow{\overset{\oplus}{Na}\overset{-}{N_3}}$		
(e)			
(f)	$CH_3-\underset{CH_3}{\underset{\vert}{\overset{CH_3}{\overset{\vert}{C}}}}-Cl \xrightarrow{H_2O}$		

18. **Match the Column (I) and (II) (Matrix).**

Column (I)		**Column (II)**	
Reaction		**Comment on product**	
(a)		**(p)**	Racemic mixture
(b)		**(q)**	Major product consist of even number of α-hydrogen
(c)		**(r)**	Will not undergo dehydration

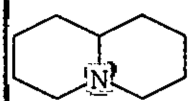
(d)		(s)	Major product consist of odd number of α-hydrogen

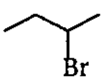
19. For each of the following amines (A through D), exhaustive methylation (treatment with excess methyl iodide), followed by Hoffmann elimination (heating with AgOH), repeated as necessary, removes the nitrogen atom in the form of trimethylamine. Indicate the number of repetitive Hoffmann eliminations required to remove the nitrogen by a number (1 to 4) in the designated answer sheet.

A.		B.		C.	
D.		E.		F.	

a.		b.		c.	
d.		e.		f.	

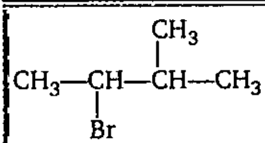
20.

 $\longrightarrow$ x is total number of HEM (Hoffman Exhaustive Methylation and eliminations) to remove nitrogen from given compound.

 $\xrightarrow{\text{alc.KOH}}$ y is total number of possible E_2 product (including stereoisomer)

Sum of $x+y=$?

21.

 $\xrightarrow{\text{EtOH}}$ (x) $(S_{N^1}+E_1)$ products. (including stereoisomer)

consider all products

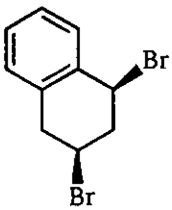
Total number of products are :

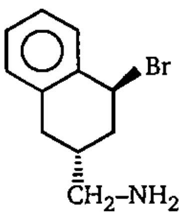
ANSWERS — LEVEL 2

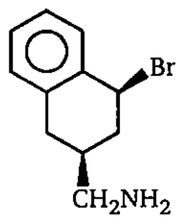
1. A – a; B – a; C – b; D – c; E – c;
2. a – s; b – r; c – q; d – p
3. a – s; b – r; c – q; d – p
4. a – p, q, s; b – p, r; c – q, s; d – r
5. a – p, r; b – p, r; c – p, r; d – q, r
6. a – p; b – r; c – q; d – s
7. a – p; b – q; c – s; d – r
8. a – p; b – q; c – r; d – s
9. $X = 3,\ Y = 3,\ Z = 2,\ P = 0 \Rightarrow 3 + 3 + 2 + 0 = 8$
10. $x = 3,\ y = 2,\ z = 3 \Rightarrow 3 + 2 + 3 = 8$
11. 32
12. 33
13. 28
14. $x = 3,\ y = 1,\ z = 3,\ p = 2$
    Sum = 9
15. (a – q), (b – s), (c – p), (d – r)
16. (a – q), (b – s), (c – p), (d – r)
17. Substitution – d, f
    Elimination – a, b, c, e
18. a – p, q; b – p, q; c – q; d – r
19. a – 3; b – 2; c – 3; d – 1; e – 2; f – 3
20. 6
21. 6

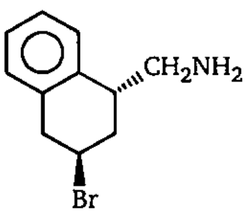
5C ALKYL HALIDES

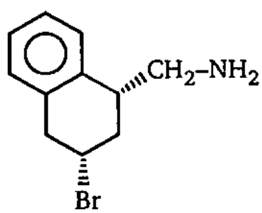
LEVEL-1

1.  $\xrightarrow[\text{2 LiAlH}_4]{\text{1. One eq. NaCN}}$ (*A*); Product (*A*) is :

(a) 

(b) 

(c) 

(d) 

2. In the reactions given below,

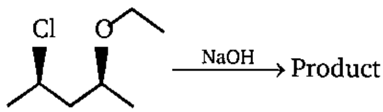
$$R - Cl \xrightarrow{\text{(i) KCN, (ii) LiAlH}_4} \text{Product } A$$

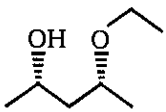
$$R - Cl \xrightarrow{\text{(i) AgCN, (ii) LiAlH}_4} \text{Product } B$$

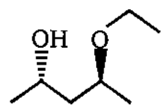
the compounds A and B are :

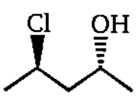
(a) chain isomers
(b) position isomers
(c) functional isomers
(d) metamers

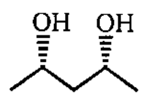
3. Which is the major product expected from the following S_{N^2} reaction ?



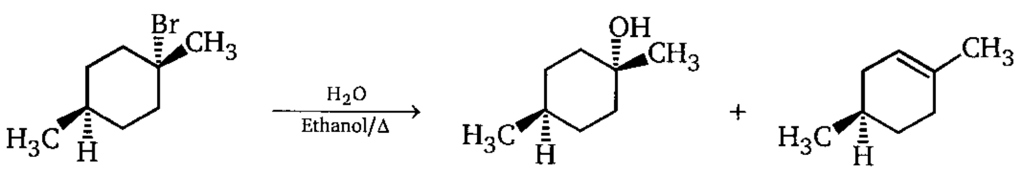
(a) 

(b) 

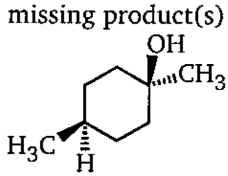
(c) 

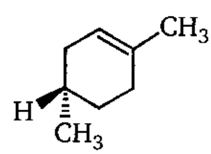
(d) 

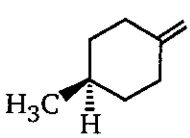
4. Consider the following E_1/S_{N^1} reaction :

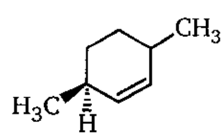


The missing product(s) is(are) :

(1) 

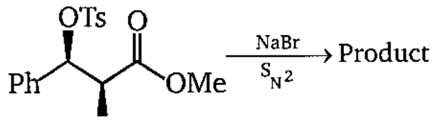
(2) 

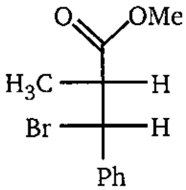
(3) 

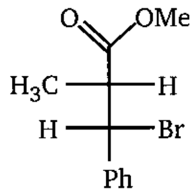
(4) 

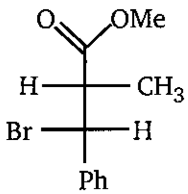
(a) 1 and 3
(b) 3 and 4
(c) 2 and 3
(d) 1, 2, 3 and 4

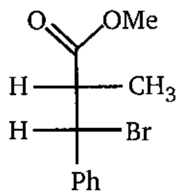
5. What is the product of the following S_N2 reaction ?



(a) 

(b) 

(c) 

(d) 

6. Select the reagent that will yield the greater amount of substitution on reaction with CH_3-CH_2-Br :

(a) CH_3CH_2OK in dimethyl sulfoxide (DMSO)

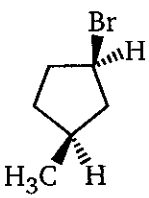
(b) $(CH_3)_3COK$ in dimethyl sulfoxide (DMSO)

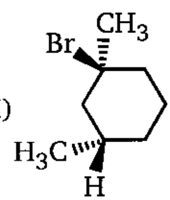
(c) Both (a) and (b) will give comparable amounts of substitution

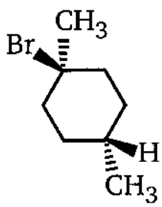
(d) Neither (a) nor (b) will give any amount of substitution

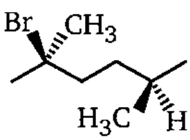
7. Under the specified conditions, substrate X undergoes substitution and elimination reactions to give products $A-D$. A and B are stereoisomers, but not enantiomers. C and D are enantiomers. A is not an isomer of C. Which of the following could be the starting material X ?

$$X \xrightarrow[\Delta]{H_2O} A + B + C + D$$

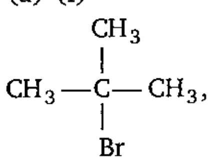
(I) 

(II) 

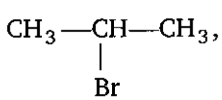
(III) 

(IV) 

(a) (I) (b) (II) (c) (III) (d) (IV)

8. 

(a)



(b)

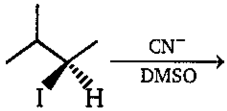
$CH_3-CH-Br$

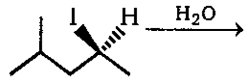
(c)

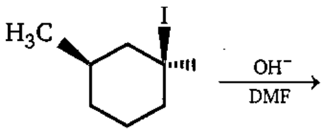
Compare rate of E_2 reaction :

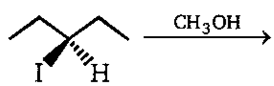
(a) $c > b > a$ (b) $a > b > c$ (c) $b > a > c$ (d) $c > a > b$

9. Which reaction results in the formation of a pair of enantiomers ?

(a) 

(b) 

(c) 

(d) 

10. Rate limiting S_{N^1} follows the sequence

$$\overset{\delta\oplus\ \delta\ominus}{R\text{–}Br} \rightleftharpoons \underset{(a)}{\boxed{R^{\oplus}Br^{\ominus}}} \rightleftharpoons \underset{(b)}{\boxed{R^{\oplus}\,|\,Br^{\ominus}}} \rightleftharpoons \boxed{R^{\oplus}} \rightleftharpoons \underset{(c)}{\boxed{Br^{\ominus}}}$$

True statement about sequence on the basis of assumption that R contains 3 different groups is :

(a) more stable carbocation, greater is in the proportion of racemization

(b) the more nucleophilic the solvent greater in the proportion of inversion

(c) In above sequence (b) represent separately solvated, pair of ions

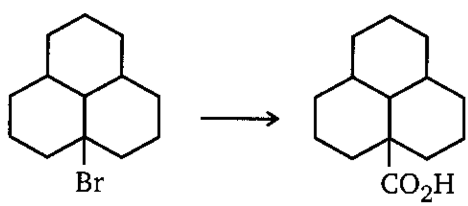
(d) All of these

11. Compare the two methods shown for the preparation of carboxylic acids :

Method 1 : $RBr \xrightarrow[\text{diethyl ether}]{Mg} RMgBr \xrightarrow[2.\ H_3O^+]{1.\ CO_2} RCO_2H$

Method 2 : $RBr \xrightarrow{NaCN} RCN \xrightarrow[\text{heat}]{H_2O,\ HCl} RCO_2H$

Which one of the following statements correctly describes this conversion ?



(a) Both method 1 and method 2 are appropriate for carrying out this conversion

(b) Neither method 1 nor method 2 is appropriate for carrying out this conversion

(c) Method 1 will work well, but method 2 is not appropriate

(d) Method 2 will work well, but method 1 is not appropriate

12. Which of the following statements is true ?

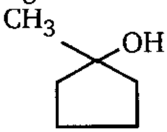
(a) $CH_3CH_2S^-$ is both a stronger base and more nucleophilic than $CH_3CH_2O^-$

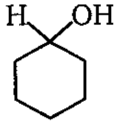
(b) $CH_3CH_2S^-$ is a stronger base but is less nucleophilic than $CH_3CH_2O^-$

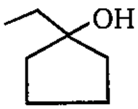
(c) $CH_3CH_2S^-$ is a weaker base but is more nucleophilic than $CH_3CH_2O^-$

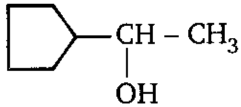
(d) $CH_3CH_2S^-$ is both a weaker base and less nucleophilic than $CH_3CH_2O^-$

13. In the given pair of alcohols, in which pair second alcohol is more reactive than first towards hydrogen bromide ?

(a) 

and 

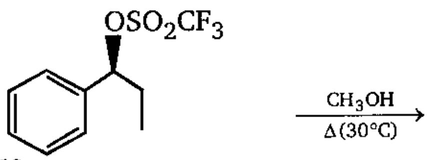
(b) 

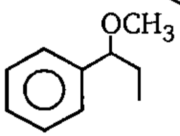
and 

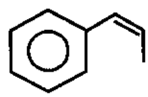
(c) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_3$ and $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-OH$

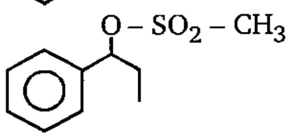
(d) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CH_3$ and $(CH_3)_2\underset{\displaystyle OH}{\underset{|}{C}}-CH_2-CH_3$

14. Which product would be expected to predominate in the given reaction ?



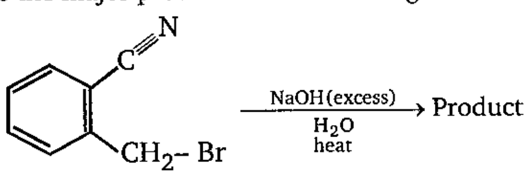
(a) 

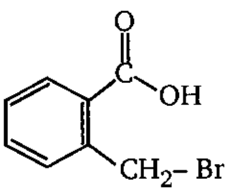
(b) 

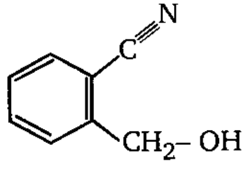
(c) 

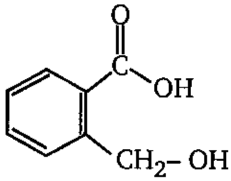
(d) None of these

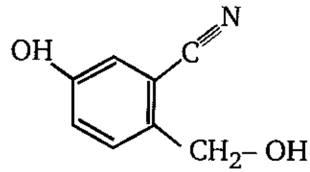
15. Which is the major product of the following reaction ?

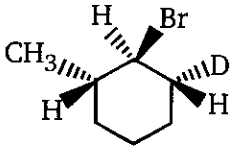


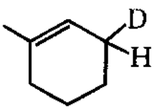
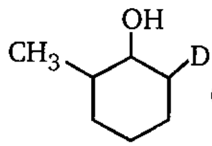
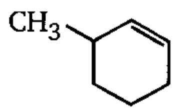
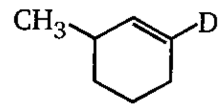
(a) 

(b) 

(c) 

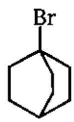
(d) 

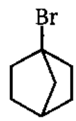
16.  $\xrightarrow{\text{Alc. KOH}}$ (A) ; Major product of this reaction is :

(a)  (b)  (c)  (d) 

17. Rate of S_{N^2} reaction is :


(A)

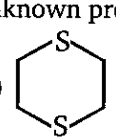

(B)

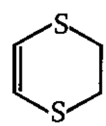

(C)

(a) $(B) > (A) > (C)$
(b) $(C) > (A) > (B)$
(c) $(A) > (B) > (C)$
(d) $(A) > (C) > (B)$

18. 1-2-dichloro ethane + $NaSCH_2CH_2SNa \longrightarrow C_4H_8S_2 + (P)$

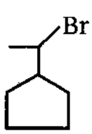
Unknown product (P) of the above reaction is :

(a) 

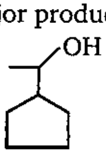
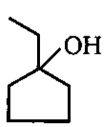
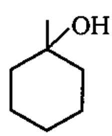
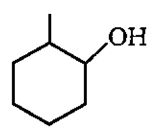
(b) 

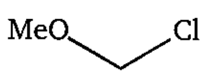
(c) $H-S-\underset{|}{\underset{H}{C}}=\underset{|}{\underset{H}{C}}-CH=CH-S-H$

(d) $H-\underset{|}{\underset{H}{C}}=\underset{|}{\underset{H}{C}}-CH=CH-S-H$

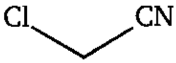
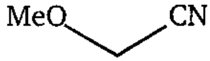
19.  $\xrightarrow{\text{Moist } Ag_2O}$ (A) product

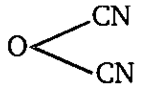
Major product (A) is :

(a)  (b)  (c)  (d) 

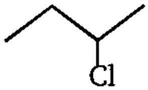
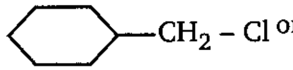
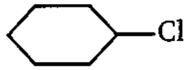
20.  $\xrightarrow{\text{KCN}}$ Product of reaction is :

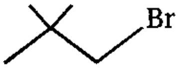
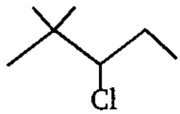
(MOM chloride)
(Methoxy methyl chloride)

(a) 
(b) 

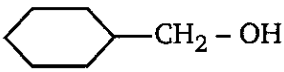
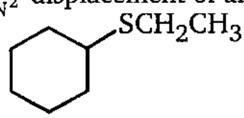
(c) $Me-O-CH_2-CH_2-CN$
(d) 

21. In the given pair of compound, in which pair the second compound is more reactive than first toward S_{N^2} reaction ?

(a)  or 
(b)  or 

(c)  or 
(d)  or 

22. Which compound might be synthesized by the S_{N^2} displacement of an alkyl-halide ?

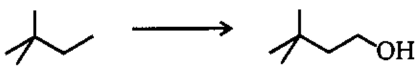
(a) 
(b) 

(c) Me_3C-OCH_3
(d) All of these

23. Identify C in the following series $C_3H_7I \xrightarrow[\text{alc.}]{\text{KOH}} A \xrightarrow[\Delta]{\text{NBS}} B \xrightarrow[\text{alc.}]{\text{KCN}} C$.

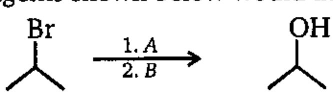
(a) $(CH_3)_2CH-CN$
(b) $CH_2=CH-CH_2CN$
(c) $Br-CH=CH-CN$
(d) $CH_2=CH-\underset{\underset{Br}{|}}{CH}CN$

24. What sequence of reagents is required to accomplish the following transformation ?



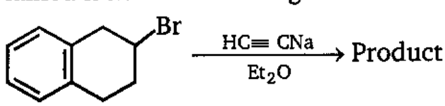
(a) (1) NBS, $ROOR$ (2) $CH_3CH_2O^-$ (3) 2HBr (4) NH_2^- (5) disiamyl borane (6) H_2O_2, OH^-
(b) (1) Cl_2 $h\nu$ (2) OH^-, heat; (3) 2HCl (4) OH^-, heat (5) $HgSO_4$, H_2SO_4
(c) (1) NBS, $ROOR$; OH^-, DMSO
(d) (1) Br_2, $h\nu$ (2) t-butoxide (3) BH_3, THF (4) H_2O_2, OH^-

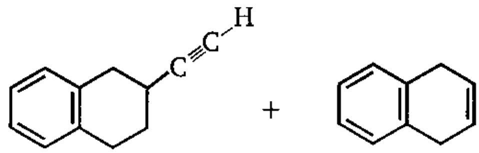
25. Which of the reagents shown below would accomplish the following transformations?



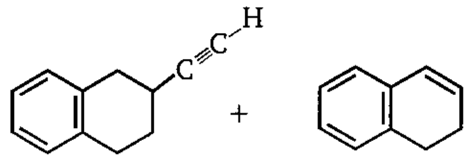
	A	*B*
(a)	H_3O^+	BH_3-THF; $H_2O_2/NaOH$
(b)	$NaOH$	BH_3-THF; $H_2O_2/NaOH$
(c)	HBr in ether	$Hg(OAc)_2/H_2O$; $NaBH_4$
(d)	$NaNH_2$	$Hg(OAc)_2/H_2O$; $NaBH_4$

26. What are the products obtained from the following reaction ?

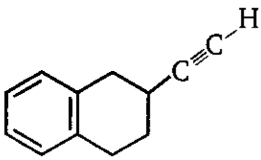


(a) 

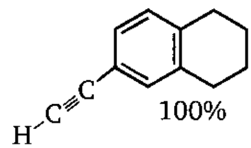
20% 80%

(b) 

20% 80%

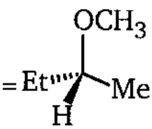
(c) 

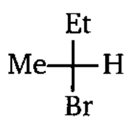
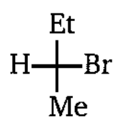
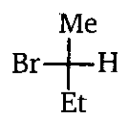
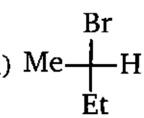
100%

(d) 

100%

27. The back-side attack on 2-bromobutane by methoxide (CH_3O^-) gives the product shown below. Which Fischer projection represents 2-bromobutane used as the reactant in this reaction ?

product = 

(a)  (b)  (c)  (d) 

28. Consider the following statements :

(1) Bridgehead halides are inert towards both S_{N^1} and S_{N^2} reactions (till one of the ring size is eight member ring)

(2) The first step in both S_{N^1} and E_1 reactions is the same

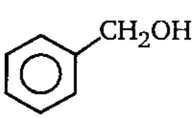
(3) S_{N^2} reactions proceed with total retention of configuration

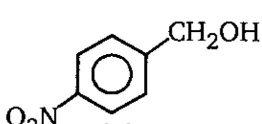
(4) E_2 eliminations are by the use of a solvent of low polarity and high concentration of a strong base

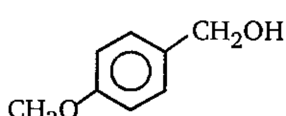
Which of the above statements are correct?

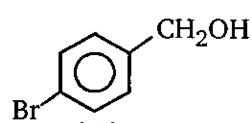
(a) 1, 2 and 4
(b) 1 and 3
(c) 2, 3 and 4
(d) 1, 2, 3 and 4

29. Consider the following alcohols :


(I)


(II)


(III)


(IV)

The order of decreasing reactivities of these alcohols towards substitution with HBr is :

(a) III > I > IV > II
(b) III > I > II > IV
(c) I > III > IV > II
(d) I > III > II > IV

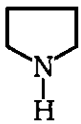
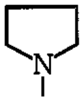
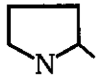
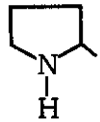
30. In solvolysis of 1,2-dimethyl propyl *p*-toluene sulfonate in acetic acid at 75°C, how many (alkene + substitution) products will be formed ?

(a) 2 (b) 3 (c) 4 (d) 5

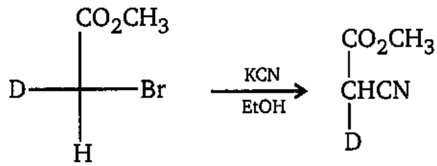
31. Benzotrichloride reacts with milk of lime to form :

(a) Benzal (b) Benzoic acid (c) Benzyl alcohol (d) Phenol

32. $Br-CH_2-(CH_2)_2-CH_2-Br+CH_3NH_2 \longrightarrow$ Product of the reaction is :

(a) 
(b) 
(c) 
(d) 

33. The configurations of the reactant and the product in the following reaction, respectively, are:



(a) R, R (b) R, S (c) S, R (d) S, S

34. 1-4-dichlorohexane (1 mole) + NaI (1 mole) $\xrightarrow{\text{Acetone}}$ Product of the reaction is :

(a) $Cl-CH_2-CH_2-\underset{\underset{I}{|}}{CH}-CH_2-CH_3$

(b) $I-CH_2-CH_2-\underset{\underset{Cl}{|}}{CH}-CH_2-CH_3$

(c) $H_2C=CH-\underset{\underset{Cl}{|}}{CH}-CH_2-CH_3$

(d) $I-CH_2-CH_2-CH_2-\underset{\underset{Cl}{|}}{CH}-CH_2-CH_3$

35. Alkyl halides can be obtained by all methods except :

(a) $CH_3CH_2OH+HCl/ZnCl_2 \longrightarrow$

(b) $CH_3-CH_2-CH_3-CH_2 \xrightarrow{\text{UV light}}$

(c) $C_2H_5OH+NaCl \longrightarrow$

(d) $CH_3COOAg+Br_2/CCl_4 \longrightarrow$

36. In order to prepare 1-chloropropane, which of the following reactants can be employed ?

(a) Propene and HCl in the presence of peroxide

(b) Propene and Cl_2 followed by treatment with aq. KOH

(c) Propanol-1 and $SOCl_2$/pyridine

(d) Any of the above can be used

37. Which alkyl halide has maximum density ?

(a) C_3H_7I (b) C_2H_5I (c) CH_3I (d) CH_3Br

38. Which of the following molecules would have a carbon-halogen bond most susceptible to nucleophilic substitution ?

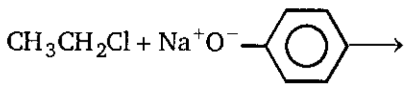
(a) 2-fluorobutane (b) 2-chlorobutane

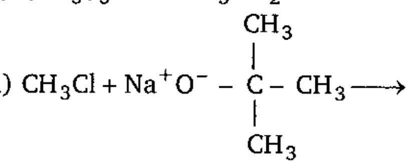
(c) 2-bromobutane (d) 2-iodobutane

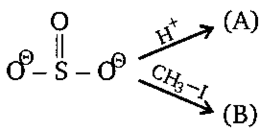
39. When benzyl chloride is treated with ethanolic KCN, the major product formed is :
(a) benzyl ethyl ether (b) benzyl alcohol (c) benzyl cyanide (d) benzyl isocyanide

40. Which of the following is most reactive towards nucleophilic substitution reaction ?
(a) $CH_2=CH-Cl$ (b) C_6H_5Cl
(c) $CH_3CH=CHCl$ (d) $ClCH_2-CH=CH_2$

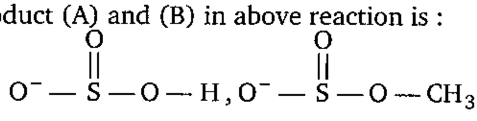
41. Which of the following reaction will not give ether as a major product ?
(a) $CH_3CH_2Cl + Ag_2O(\text{dry}) \longrightarrow$ (b) $(CH_3)_3CCl + CH_3CH_2O^-Na^+ \longrightarrow$

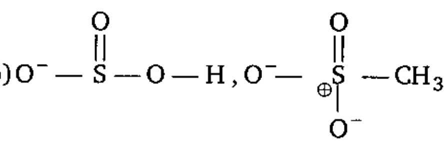
(c) 

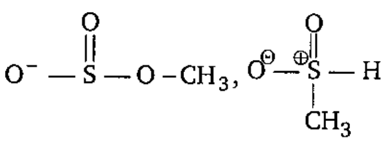
(d) 

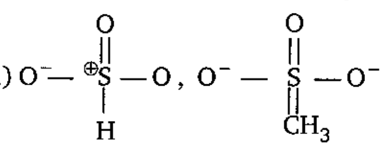
42. 

Product (A) and (B) in above reaction is :

(a) 

(b) 

(c) 

(d) 

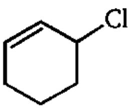
ANSWERS — LEVEL 1

1.	(c)	**2.**	(c)	**3.**	(b)	**4.**	(a)	**5.**	(a)	**6.**	(a)	**7.**	(c)	**8.**	(b)
9.	(b)	**10.**	(d)	**11.**	(c)	**12.**	(c)	**13.**	(d)	**14.**	(a)	**15.**	(c)	**16.**	(c)
17.	(c)	**18.**	(a)	**19.**	(c)	**20.**	(b)	**21.**	(d)	**22.**	(d)	**23.**	(b)	**24.**	(d)
25.	(d)	**26.**	(b)	**27.**	(d)	**28.**	(a)	**29.**	(a)	**30.**	(d)	**31.**	(b)	**32.**	(b)
33.	(d)	**34.**	(d)	**35.**	(c)	**36.**	(c)	**37.**	(a)	**38.**	(d)	**39.**	(c)	**40.**	(d)
41.	(b)	**42.**	(b)												

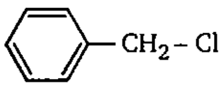
LEVEL-2

1. The following organic halide derivatives (*A* to *J*) are reacted in ethanol solution with each of the nucleophiles : acetate, methylthiolate, cyanide and hydroxide anions. Six possible results from these combinations of reactants are designated (1) through (6) below :

Write the number corresponding to your best estimate of the outcome of each reaction in the appropriate answer box below.



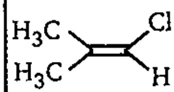
A



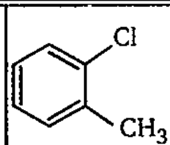
B

$CH_3 - I$

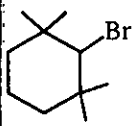
C



D



E



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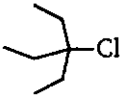
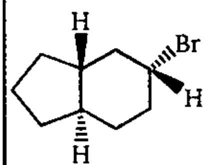
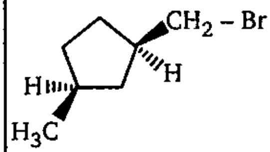


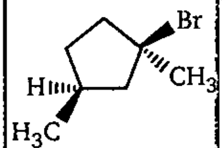
G



H



I



J

Possible Outcome :

(1) No reaction
(2) Substitution
(3) Elimination
(4) Substitution and elimination
(5) No reaction or slow substitution
(6) No reaction or slow elimination

	Compound	A	B	C	D	E	F	G	H	I	J
(i)	CH_3CO_2Na										
(ii)	CH_3SNa										
(iii)	NaCN										
(iv)	NaOH										

2. In each of the following sections three organic halogen compounds are listed. In the box given enter a number (1 to 3) indicating the order of reactivity of the designated (1 is most reactive and 3 is least).

(a) S_{N^2} substitution by $NaOCOCH_3$ in methanol:
1. $CH_3CH_2CH_2Br$ ☐ 2. $(CH_3)_2CHBr$ ☐ 3. $CH_2=CHCH_2Br$ ☐

(b) S_{N^2} substitution by NaI in acetone:
1. C_6H_5Cl ☐ 2. $C_6H_5CH_2Cl$ ☐ 3. $C_6H_5CHClCH_3$ ☐

(c) S_{N^2} substitution by NaCN in methanol:
1. CH_3CH_2Cl ☐ 2. CH_3CH_2F ☐ 3. CH_3CH_2I ☐

(d) S_{N^2} substitution by $NaSCH_3$ in methanol:
1. $(CH_3)_2CHCH_2CH_2Br$ ☐ 2. $CH_3CH_2CHBrCH_2CH_3$ ☐ 3. $(CH_3)_3CCH_2Br$ ☐

3. Isobutyl alcohol (2-methyl-1-propanol), $(CH_3)_2CHCH_2OH$, can be transformed to each of the compounds (a through l) listed in the left-hand column. In each case the number of steps needed to accomplish the change is noted, and an answer box is provided for your reagent selections. Fourteen reagents (designated A through N) are listed in the right-hand column.

Write letters designating the reagent or reagents you believe will achieve the desired transformation in the box to the right of the product formula. In the case of a multi-step sequence write the reagents in the order they are to be used. In some cases you may wish to use a previously prepared compound as a reactant. If so, write the number (a to l) corresponding to the desired compound.

	Desired product	No. of Steps	Write Options		Reagent List
a.	$(CH_3)_2CHCH_2Br$	one		**A.**	$Hg(OAc)_2$ in H_2O
b.	$(CH_3)_2C=CH_2$	one		**B.**	PBr_3 & heat
c.	$(CH_3)_2CHCH=O$	one		**C.**	$NaBH_4$ in alcohol
d.	$(CH_3)_2CHCO_2H$	one		**D.**	$LiAlH_4$ in THF (aqueous workup)
e.	$(CH_3)_3CBr$	two		**E.**	NaCN in alcohol
f.	$(CH_3)_2CHCH_2C\equiv N$	two		**F.**	PCC in CH_2Cl_2
g.	$(CH_3)_2CHCH_2OCOCH_3$	one		**G.**	Jones' reagent (CrO_3 in H_3O^+)
h.	$(CH_3)_2CHCO_2C_2H_5$	two		**H.**	HBr in CH_2Cl_2
i.	$(CH_3)_2CHCH_2OCH_2(CH_3)_2$	two		**I.**	H_3PO_4 and heat
j.	$(CH_3)_2COH$	three		**J.**	$(CH_3CO)_2O$ + pyridine
k.	$(CH_3)_2CHCH_2NH_2$	three		**K.**	NaN_3 in aqueous alcohol
l.	$(CH_3)_2CHCH_2CH_2NH_2$	two		**L.**	$C_6H_5CO_3H$ in CH_2Cl_2 (peracid)
				M.	NaH in ether and heat
				N.	C_2H_5OH + acid catalyst & heat

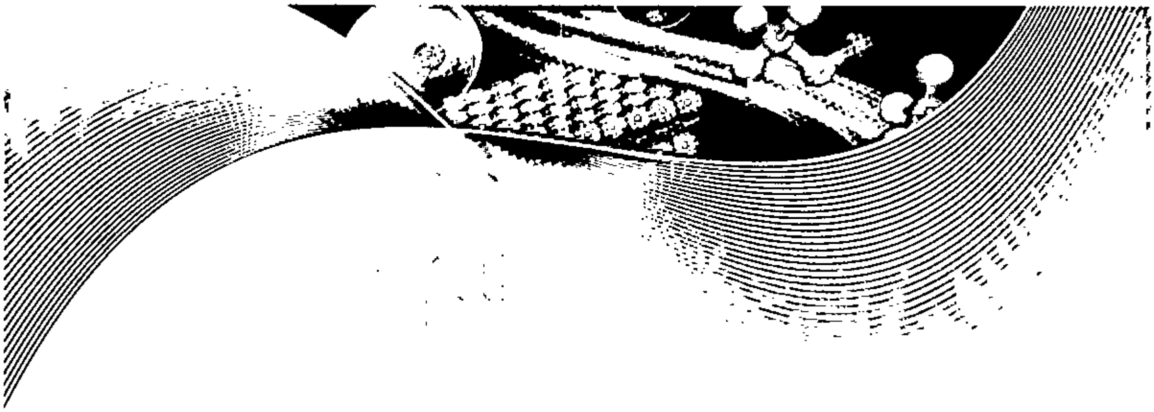
ANSWERS — LEVEL 2

1.

	A	B	C	D	E	F	G	H	I	J
(i)	2	2	2	1	1	1	6	2	2	6
(ii)	2	2	2	1	1	5	6	2	2	6
(iii)	2	2	2	1	1	1	3	3	2	3
(iv)	4	2	2	1	1	5	3	3	4	3

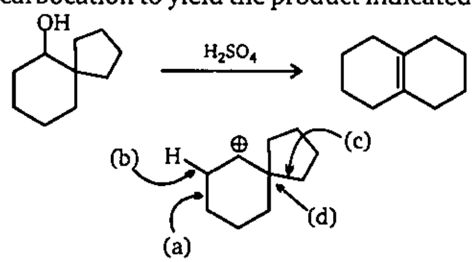
2. a – 3 > 1 > 2; b – 2 > 3 > 1; c – 3 > 1 > 2; d – 1 > 2 > 3

3. a – B; b – I; c – F; d – G; e – I, H or 2 H; f – B, E or I, E; g – J; h – G, N or 4N
i – N,I; j – I, A, C or 2AC or ILD or 2LD; k – B, K, D or 1KD; l – B, E, D or 1ED or 6D



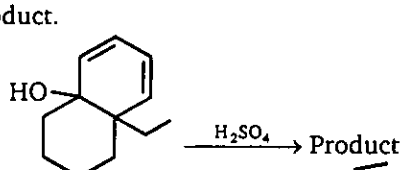
6 ALCOHOL, ETHERS AND EPOXIDES

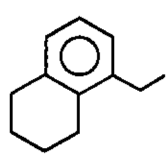
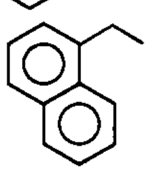
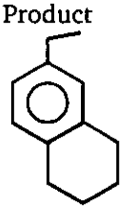
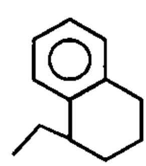
1. The following transformation involves a carbocation rearrangement. The carbocation is generated by protonation of the hydroxyl group, followed by the loss of water. Which bond has to migrate in the carbocation to yield the product indicated (after the deprotonation) ?

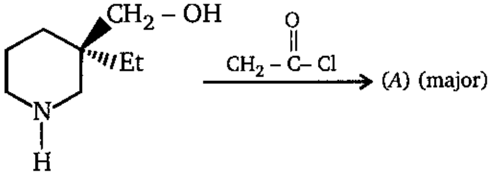


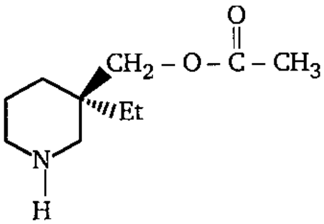
(a) a (b) b (c) c (d) d

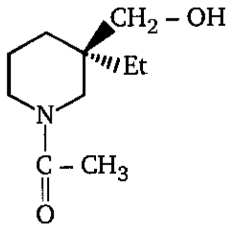
2. Identify the major product.

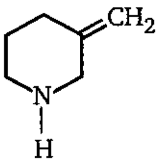


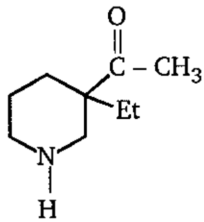
(a)  (b)  (c)  (d) 

3. 

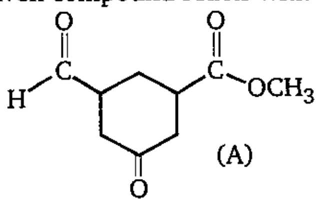
(a) 

(b) 

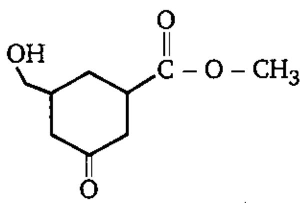
(c) 

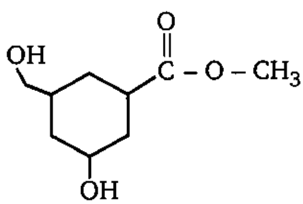
(d) 

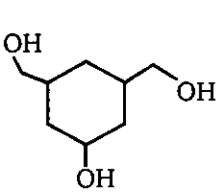
4. Predict the product when given compound reacts with $LiAlH_4$:

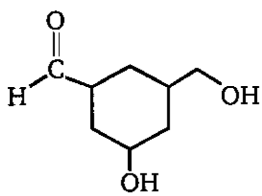


(A)

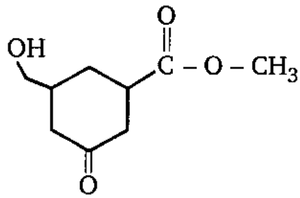
(a) 

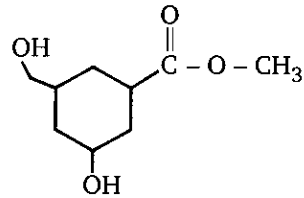
(b) 

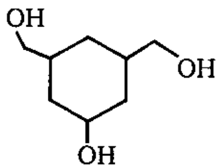
(c) 

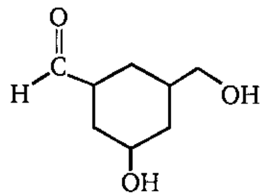
(d) 

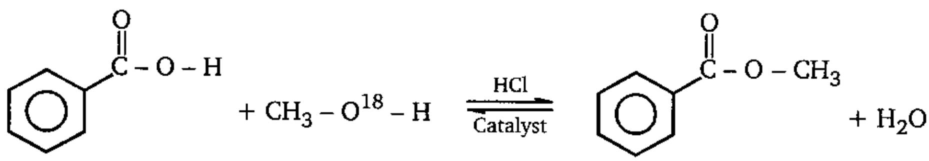
5. Predict the product when given compound (A, in the above question 4) reacts with $NaBH_4$.

(a) 

(b) 

(c) 

(d) 

6. 

Methyl benzoate

The labelled $-O^{18}$ will be in :

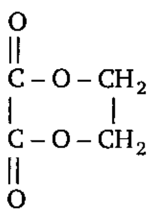
(a) H_2O

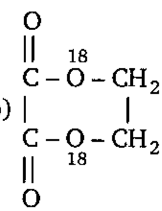
(b) Methyl benzoate

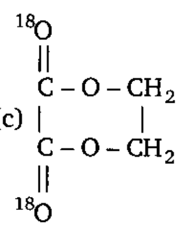
(c) Both (a) and (b)

(d) Benzoic acid

7. $\begin{array}{l} CO_2H \\ | \\ CO_2H \end{array} + \begin{array}{l} CH_2-\overset{18}{O}H \\ | \\ CH_2-\overset{18}{O}H \end{array} \xrightarrow[\Delta]{H^+} (A)$; Product (A) is :

(a) 

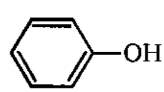
(b) 

(c) 

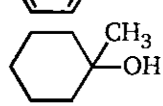
(d) $H-O-\overset{O}{\overset{||}{C}}-\overset{O}{\overset{||}{C}}-O-CH_2-CH_2-OH$

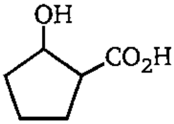
8. Which is oxidized most easily ?

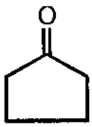
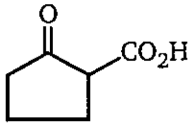
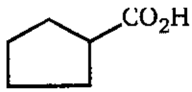
(a) $CH_3-CHOH-CH_3$

(b) 

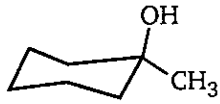
(c) $CH_3-CH_2-O-CH_2-CH_3$

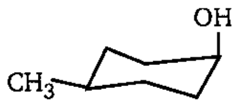
(d) 

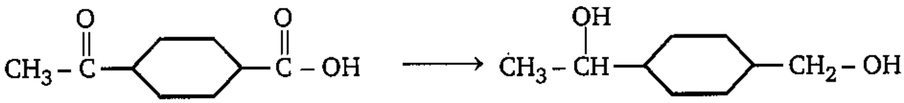
9.  $\xrightarrow[\Delta]{K_2Cr_2O_7}$ (*P*); Product (*P*) is :

(a)  (b)  (c)  (d) 

10. Which of the following react with HBr at faster rate ?

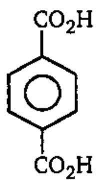
(a)  (b) 

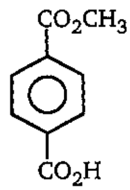
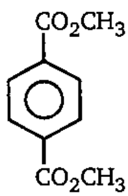
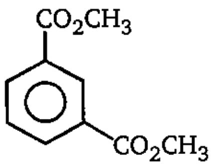
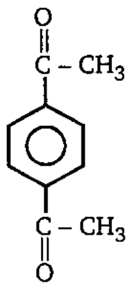
(c)  (d) 

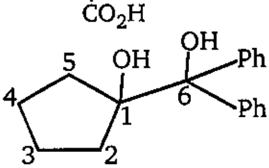
11. 

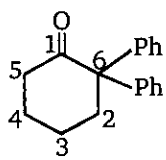
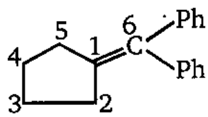
Above conversion can be done by :

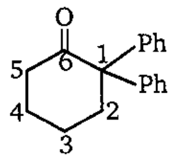
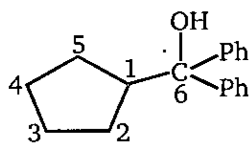
(a) $NaBH_4$ (b) $LiAlH_4$ (c) PCC (d) $KMnO_4$

12.  $\xrightarrow[H_2SO_4, \Delta]{2\ CH_3OH}$ (*A*) ; Product (*A*) is :

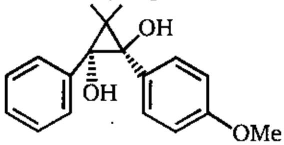
(a)  (b)  (c)  (d) 

13.  $\xrightarrow{H_2SO_4}$ (*P*) ; Unknown (*P*) of the reaction is :
99% yield

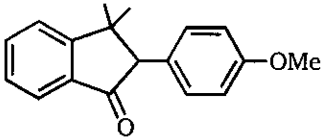
(a)  (b) 

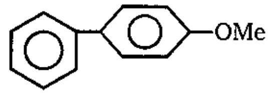
(c)  (d) 

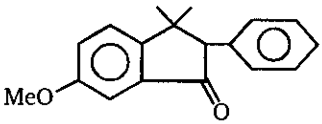
14. Predict the major product of the given reaction.

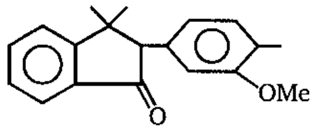


$\xrightarrow{H^+}$ (A); Product (A) is :

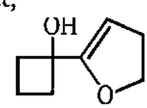
(a) 

(b) 

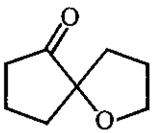
(c) 

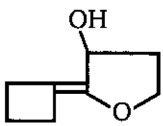
(d) 

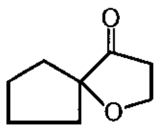
15. Identify the major product,

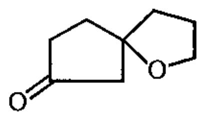


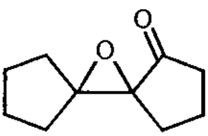
$\xrightarrow{H^+}$ Product

(a) 

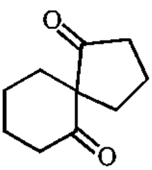
(b) 

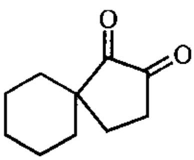
(c) 

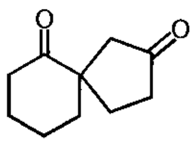
(d) 

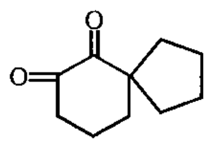
16. 

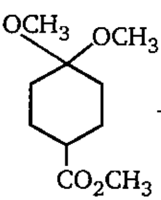
$\xrightarrow{H^+}$ (A); Product (A) is :

(a) 

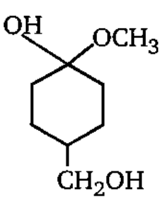
(b) 

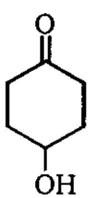
(c) 

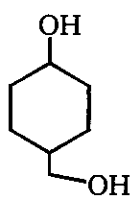
(d) 

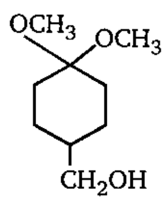
17. 

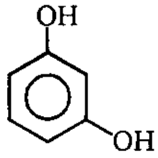
$\xrightarrow{LiAlH_4}$ (A) Major; product (A) is :

(a) 

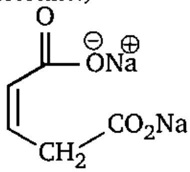
(b) 

(c) 

(d) 

18.  $\xrightarrow{I_2+NaOH}$ $\underset{\text{(Iodoform)}}{CHI_3}$ $+ (A)$; Compound (A) is :

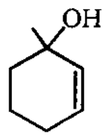
(Resorcinol)

(a) 

(b) $H-O-\overset{O}{\overset{\|}{C}}-(CH_2)_2-\overset{O}{\overset{\|}{C}}-OH$

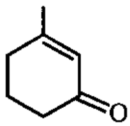
(c) $CH_3-CH_2-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-OH$

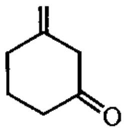
(d) $CH_3-(CH_2)_3-\overset{O}{\overset{\|}{C}}-ONa$

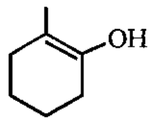
19.  $\xrightarrow{H_2CrO_4}$ (A). Product (A) is :

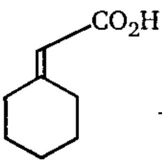
(3° alcohol)

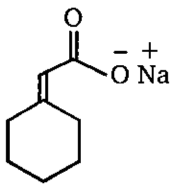
(a) No reaction

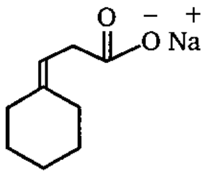
(b) 

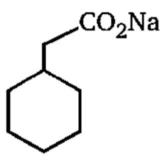
(c) 

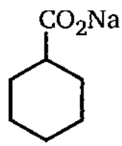
(d) 

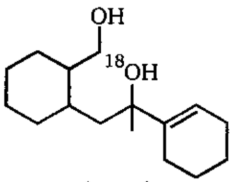
20.  $\xrightarrow[(2)\ H^{\oplus}]{(1) CH_3-Li(\text{excess})}$ (A) $\xrightarrow[NaOH]{I_2}$ $(B) + CHI_3\downarrow$; Compound (B) is :

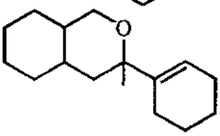
(a) 

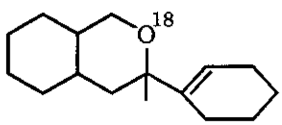
(b) 

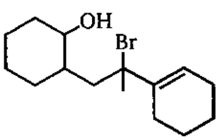
(c) 

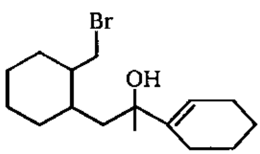
(d) 

21.  $\xrightarrow[CCl_4]{H-Br}$ Major product obtained in the reaction is :

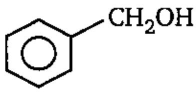
(a) 

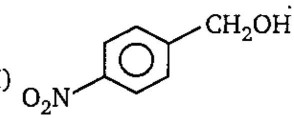
(b) 

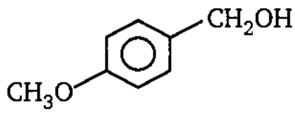
(c) 

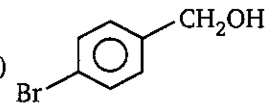
(d) 

22. Consider the following alcohols,

(I) 

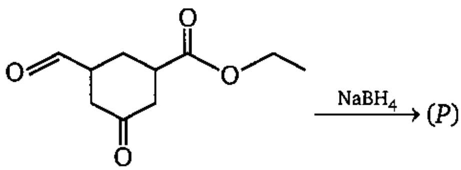
(II) 

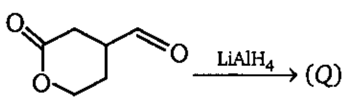
(III) 

(IV) 

The order of decreasing reactivities of these alcohols towards nucleophilic substitution with HBr is:

(a) III > I > IV > II (b) III > I > II > IV (c) I > III > IV > II (d) I > III > II > IV

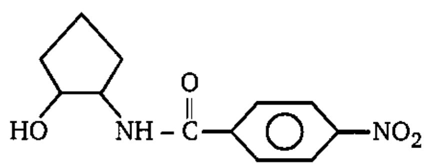
23. 

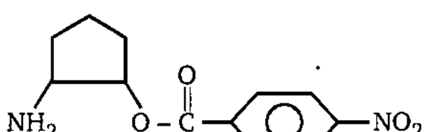


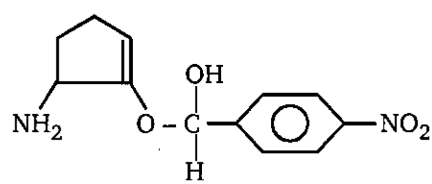
Sum of number of 1° alcoholic groups in product (P) and (Q) is:

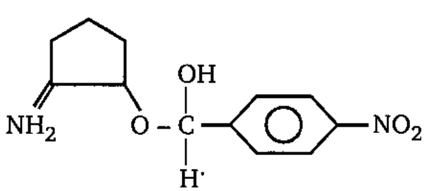
(a) 1 (b) 2 (c) 3 (d) 5

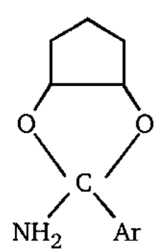
24. In presence of dil. HCl, compound A is converted to a constitutional isomer (B), compound B is:

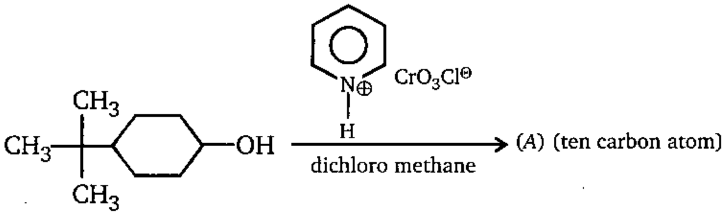


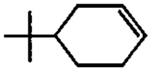
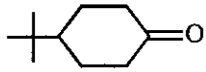
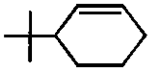
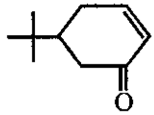
(a) 

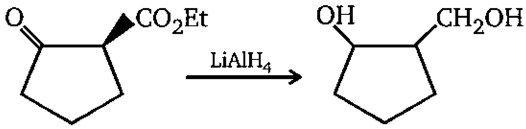
(b) 

(c) 

(d) 

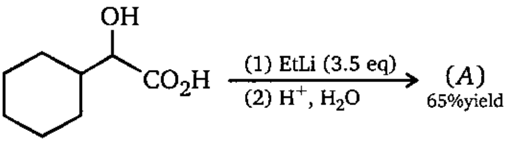
25. 

(a) 
(b) 
(c) 
(d) 

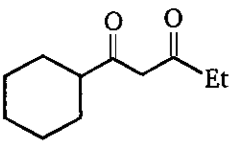
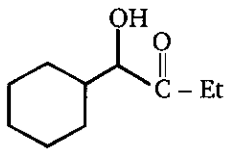
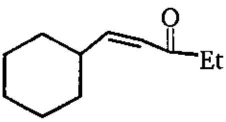
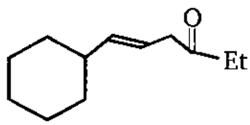
26. 

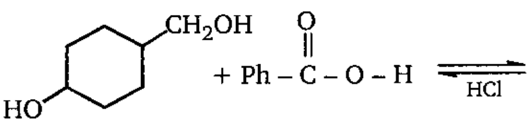
; Product of the reaction is:

(a) Racemic
(b) Diastereomer
(c) Meso
(d) Optically pure

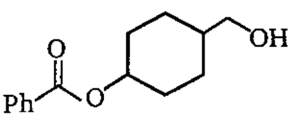
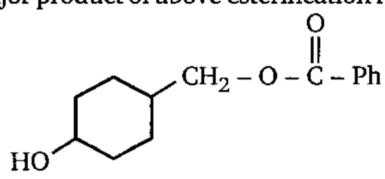
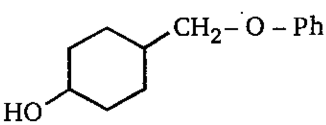
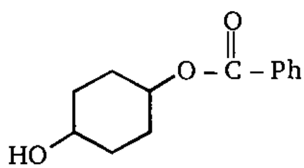
27. 

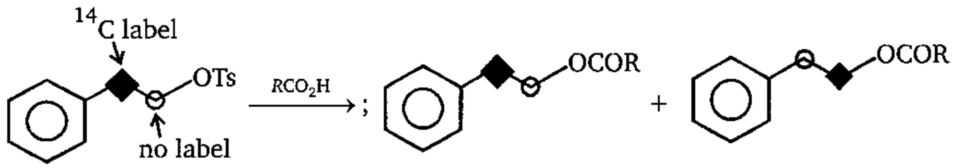
; Chemist added extra 0.5 mole of Et-Li in above reaction to obtain product (A), which is?

(a) 
(b) 
(c) 
(d) 

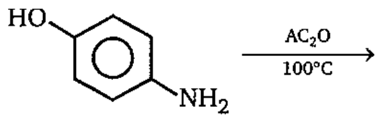
28. 

Major product of above esterification reaction is:

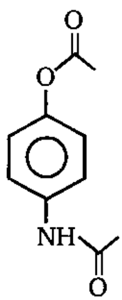
(a) 
(b) 
(c) 
(d) 

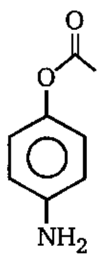
29. 

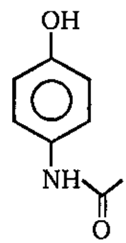
(a) S_{N^1} (b) S_{N^2} (c) SN — NGP (d) SN — Ar

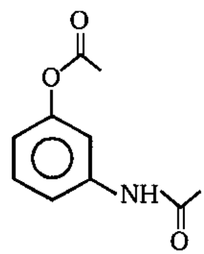
30. 

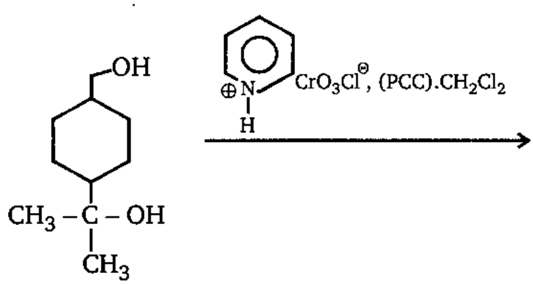
(A); Product (A) of reaction is :

(a) 

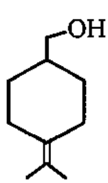
(b) 

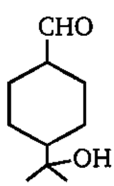
(c) 

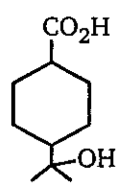
(d) 

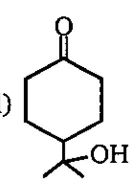
31. 

Product of the reaction is :

(a) 

(b) 

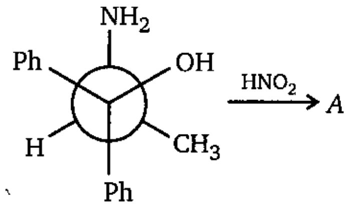
(c) 

(d) 

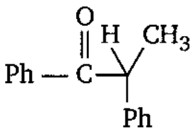
32. Which is the best reagent to convert isopropyl alcohol to isopropyl bromide ?

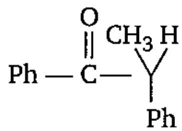
$$CH_3-\underset{}{\overset{CH_3}{\overset{|}{C}H}}-OH \xrightarrow{?} CH_3-\overset{CH_3}{\overset{|}{C}H}-Br$$

(a) HBr (b) $SOBr_2$ (c) Br_2 (d) CH_3MgBr

33. 

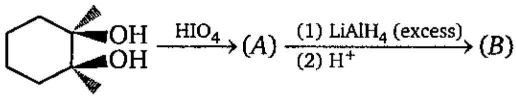
Major product obtained in the above reaction is :

(a) 

(b) 

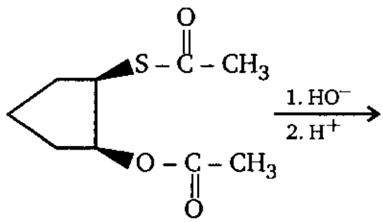
(c) Racemic

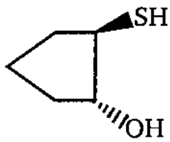
(d) Diastereomers

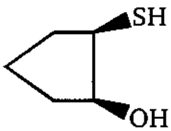
34. 

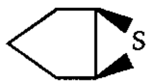
Total number of stereoisomers of product (B) will be:

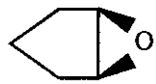
(a) 2 (b) 3 (c) 4 (d) 5

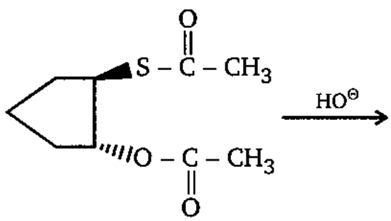
35.  Major product of the reaction is :

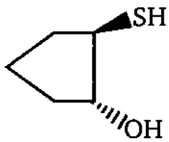
(a) 

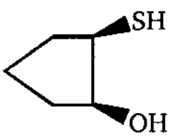
(b) 

(c) 

(d) 

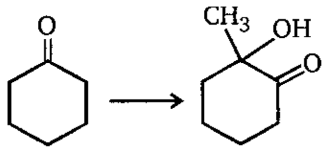
36. 

(a) 

(b) 

(c) 

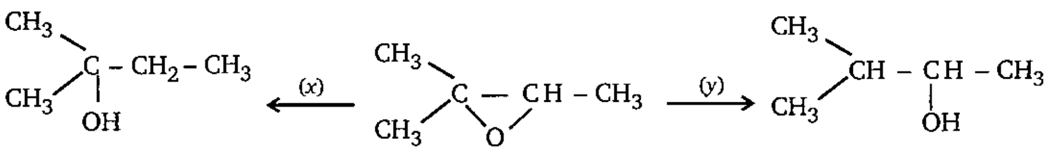
(d) 

37. 

CH_3MgBr/H^+	$KMnO_4$ (cold dil.)	CrO_3	H^+/Δ
(1)	(2)	(3)	(4)

For the above conversion the correct order of reagents used is :

(a) $1 \to 2 \to 3 \to 4$
(b) $1 \to 4 \to 3 \to 2$
(c) $1 \to 4 \to 2 \to 3$
(d) $2 \to 3 \to 4 \to 1$

38. 

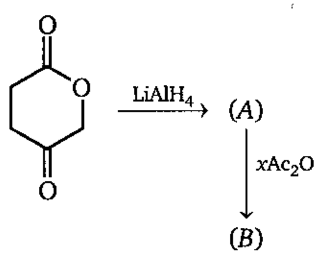
(3° alcohol) (2° alcohol)

Find missing reagents.

(a) $x = LiAlH_4, y = NaBH_4$
(b) $x = LiAlH_4/AlCl_3, y = LiAlH_4$
(c) $x = LiAlH_4, y = LiAlH_4/AlCl_3$
(d) $x = H_2/Ni, y = H_2/Pt$

39. In solvolysis of 1, 2-dimethyl propyl p-toluene sulfonate in acetic acid at 75°C, (alkene + substitution products) will be formed by mechanism ?

(a) S_{N^2}, E_2
(b) S_{N^2}, E_1
(c) S_{N^1}, E_2
(d) S_{N^1}, E_1

40. 

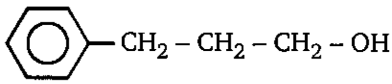
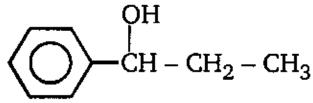
x = moles of anhydride consumed

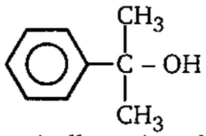
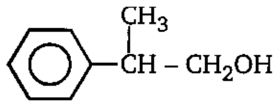
(a) 1
(b) 2
(c) 3
(d) 4

41. Identify product when (*R*) – and (*S*) – 2 – butanol reacts with (*R,R*) tartaric acid in acidic medium.

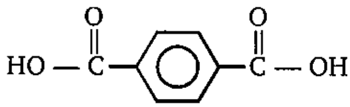
(a) Racemic
(b) Diastereomer
(c) Meso
(d) Pure enantiomer

42. An alcohol of formula $C_9H_{12}O$ reacts with $Na_2Cr_2O_7$ to form a compound having formula $C_9H_{10}O$. The original alcohol might be :

(a) 
(b) 

(c) 
(d) 

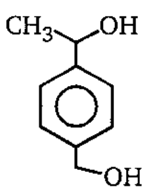
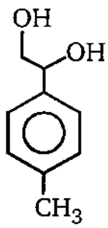
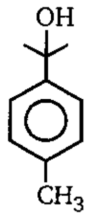
43. An optically active alcohol of formula $C_9H_{12}O_2$ produced the following compound when refluxed with $KMnO_4$.



The original compound showed these properties also :

$$\underset{(A)}{C_9H_{12}O_2} \xrightarrow{Na} H_2 \text{ liberated}$$
$$\xrightarrow{Br_2} \text{no rapid reaction}$$
$$\xrightarrow[\text{cool}]{CrO_3/H^+} C_9H_8O_3$$

What is structure of (*A*)?

(a) 
(b) 
(c) 
(d) both (a) and (b)

44. Which are not cleaved by HIO_4?

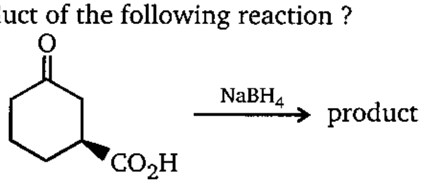
I : glycerol
II : glycol
III : 1, 3-propenediol
IV : methoxy-2-propanol

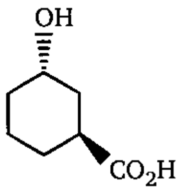
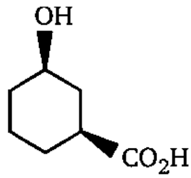
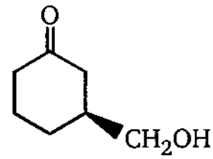
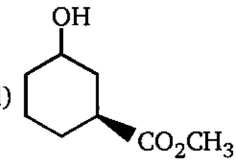
(a) I, II, III, IV
(b) I, II
(c) II, III
(d) III, IV

45. Which of the following reactions require an oxidising agent ?

(a) $CH_3-CH=CH_2 \longrightarrow CH_3-CH_2-CH_3$
(b) $CH_3-CH_2OH \longrightarrow CH_3CHO$
(c) $CH_3-CH_2Cl \longrightarrow CH_3-CH_3$
(d) $CH_3-CH_2OH \longrightarrow CH_3-CH_2Cl$

46. What is the major product of the following reaction ?



(a)  (b)  (c)  (d) 

47. Which of the esters shown, after reduction with $LiAlH_4$ and aqueous workup, will yield two molecules of only a single alcohol ?

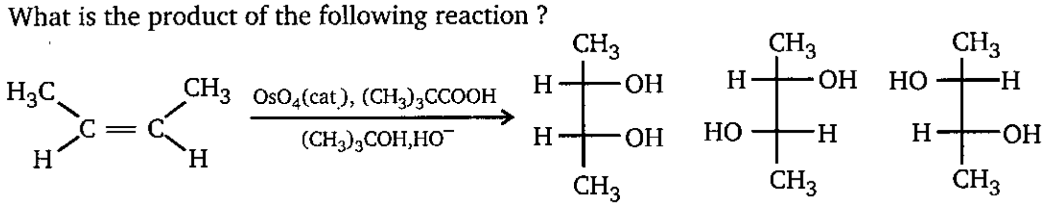
(a) $CH_3CH_2CO_2CH_2CH_3$ (b) $C_6H_5CO_2CH_2C_6H_5$
(c) $C_6H_5CO_2C_6H_5$ (d) None of these

48. For the following reaction, select the statement that best describes the change.

$$RCH_2OH + PCC\ [C_5H_5NH^+ClCrO_3^-] \longrightarrow$$

(a) The alcohol is oxidized to an acid, and the Cr(VI) is reduced
(b) The alcohol is oxidized to an aldehyde, and the Cr(VI) is reduced
(c) The alcohol is reduced to an aldehyde, and the Cr(III) is oxidized
(d) The alcohol is oxidized to a ketone, and the Cr(VI) is reduced

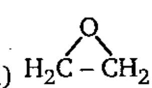
49. What is the product of the following reaction ?



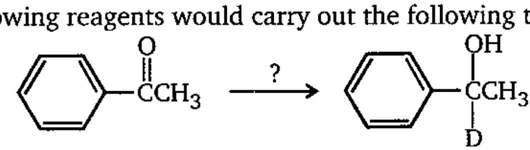
1 2 3

(a) Only 1 (b) 1 : 1 mixture of 2 and 3
(c) Only 2 (d) 1 : 1 : 1 mixture of 1, 2, and 3

50. An organic compound *B* is formed by the reaction of ethylmagnesium iodide (CH_3CH_2MgI) with a substance *A*, followed by treatment with dilute aqueous acid. Compound B does not react with PCC in dichloromethane. Identify *A* ?

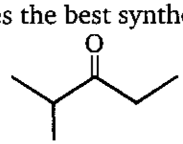
(a) $CH_3-\overset{O}{\overset{||}{C}}-H$ (b) $CH_3CH_2\overset{O}{\overset{||}{C}}CH_3$ (c) $H_2C=O$ (d) 

51. Which of the following reagents would carry out the following transformation ? (D = ^2H)



(a) $NaBD_4$ in CH_3OH (b) $LiAlH_4$, then D_2O
(c) $NaBD_4$ in CH_3OD (d) $LiAlD_4$, then D_2O

52. Which sequence of steps describes the best synthesis of 2-methyl-3-pentanone ?



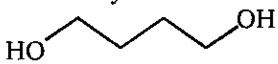
(a) (1) 1-Propanol + $(CH_3)_2CHMgBr$, diethyl ether
(2) H_3O^+
(3) PCC, CH_2Cl_2

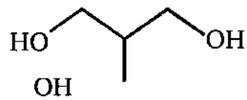
(b) (1) 1-Propanol + $Na_2Cr_2O_7$, H_2SO_4, H_2O, heat
(2) $SOCl_2$
(3) $(CH_3)_2CHCl$, $AlCl_3$

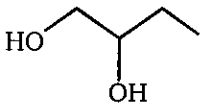
(c) (1) 1-Propanol + PCC, CH_2Cl_2
(2) $(CH_3)_2CHLi$, diethyl ether
(3) H_3O^+
(4) $Na_2Cr_2O_7, H_2SO_4, H_2O$, heat

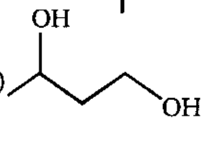
(d) (1) 2-Propanol + $Na_2Cr_2O_7$, H_2SO_4, H_2O, heat
(2) $CH_3CH_2CH_2Li$, diethyl ether
(3) H_3O^+
(4) PCC, CH_2Cl_2

53. Diols (I-IV) which react with CrO_3 in aqueous H_2SO_4 and yield products that readily under go dercarboxylation on heating, are :

(I) 

(II) 

(III) 

(IV) 

(a) I and II (b) II and III (c) II and IV (d) I and IV

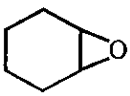
54. Which of following compounds are not oxidized by HIO_4?

(1) $CH_3-CH(-OH)-CH_2-OH$ (i.e. $CH_3-CH-OH$ with CH_2-OH)

(2) $CH_3-C{=}O$ | $H-C{=}O$

(3) $CH_3-C{=}O$ | $CH_3-C{=}O$

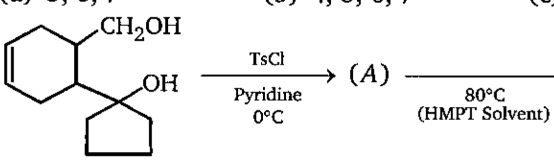
(4) $CH_3-C{=}O$ | $CH_3-CH-NH_2$

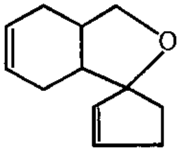
(5) 

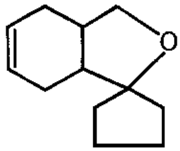
(6) CH_2-OCH_3 | CH_2-OH

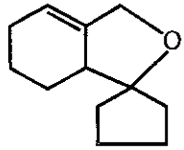
(7) $\overset{O}{\overset{\|}{C}}-OH$ | CH_2-OH

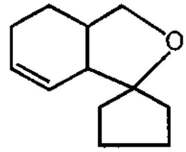
(a) 5, 6, 7 (b) 4, 5, 6, 7 (c) 6, 7 (d) 3, 4, 5, 6, 7

55.  (B) 84%; Final product (B) will be :

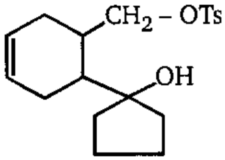
(a) 

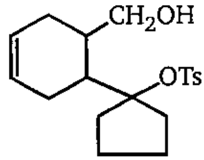
(b) 

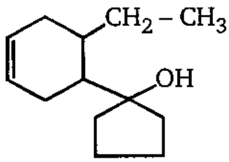
(c) 

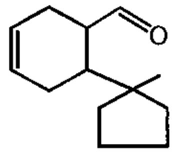
(d) 

56. Unknown (A) in the reaction (given in Q. 55) is :

(a) 

(b) 

(c) 

(d) 

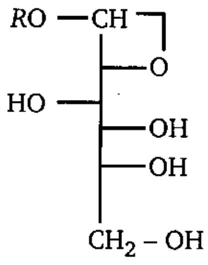
57. In the given table, identify the incorrect option. The digit in box indicate the moles of that substance.

	Reactant	HIO_4 consumed	HCO_2H formed	HCHO formed
(a)	$HO-CH_2-\overset{\overset{OH}{\vert}}{C}H-CH_2-OH$	$\boxed{2}$	$\boxed{1}$	$\boxed{2}$
(b)	$R-\overset{\overset{OH}{\vert}}{C}H-\overset{\overset{OH}{\vert}}{C}H-\overset{\overset{OH}{\vert}}{C}H-CH_2-OH$	$\boxed{3}$	$\boxed{2}$	$\boxed{1}$
(c)	$HO-CH_2-\overset{\overset{OCH_3}{\vert}}{C}H-CH_2OH$	$\boxed{0}$	$\boxed{0}$	$\boxed{0}$
(d)	$HO-CH_2-\overset{\overset{OH}{\vert}}{C}H-\overset{\overset{OCH_3}{\vert}}{C}H_2$	$\boxed{1}$	$\boxed{1}$	$\boxed{1}$

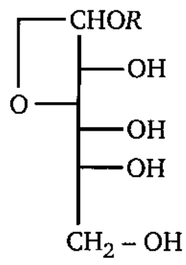
58. Succinic acid $\xrightarrow{\Delta} (A) \xrightarrow[\Delta]{NH_3} (B) \xrightarrow[KOH]{Br_2} (C)$; Product ($C$) will be :

(a) $\begin{array}{l} CH_2-CO_2H \\ \vert \\ CH_2-CH_2-NH_2 \end{array}$ (b) $\begin{array}{l} CH_2-CO_2H \\ \vert \\ CH_2-NH_2 \end{array}$ (c) $\begin{array}{l} CH_2-CO_2^-K^+ \\ \vert \\ CH_2-NH_2 \end{array}$ (d) $\begin{array}{l} CH_2-CO_2H \\ \vert \\ CH_2-CH_2-Br \end{array}$

59A. Given are the structures of cyclic D-glucoside. Moles of HIO_4 consumed with X and Y are .... respectively:



(X)



(Y)

(a) 2, 2
(b) 3, 3
(c) 2, 3
(d) 3, 2

B. Moles of formic acid formed in X and Y respectively are:

(a) 1, 2
(b) 2, 1
(c) 2, 3
(d) 3, 2

C. Moles of HCHO formed are:

(a) 1, 1
(b) 2, 2
(c) 1, 2
(d) 2, 1

60. In which of the following group, each member gives positive iodoform test ?

(a) methanol, ethanol, propanone
(b) ethanol, isopropanal, methanal
(c) ethanol, ethanal, isopropyl alcohol
(d) propanal, propanol-2, propanone

61. $H_2O^{18} + Na \longrightarrow \underset{\text{(base)}}{(A)} + (B)$

$$CH_3-\overset{\overset{\displaystyle O}{||}}{C}-O-CH_2-CH_3 + (A) \longrightarrow (C) + (D)\text{ alcohol}$$

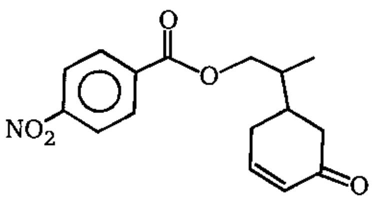
Product (C) of the reactions is:

(a) $CH_3-\overset{\overset{\displaystyle O}{||}}{C}-\underset{18}{O}-H$

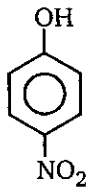
(b) $CH_3-\overset{\overset{\displaystyle O^{18}}{||}}{C}-O-H$

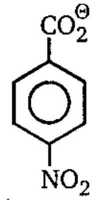
(c) $CH_3-\overset{\overset{\displaystyle O}{||}}{C}-\overset{18}{O^-}$

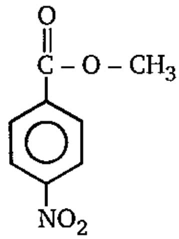
(d) $CH_3-\overset{\overset{\displaystyle O}{||}}{C}-O^{\ominus}\overset{\oplus}{Na}$

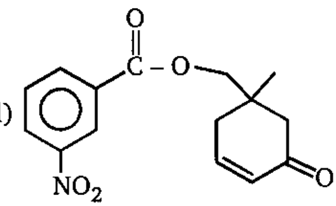
62A.  $\xrightarrow[(Ph_3P)_3\text{ RhCl}]{H_2} (A) \xrightarrow[\substack{H_2O\\(\text{Methanol})}]{0.1\text{ M NaOH}} (B) + \underset{\text{(Contains no nitrogen)}}{(C)}$

Product (B) of the reaction is :

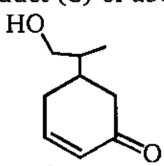
(a) 

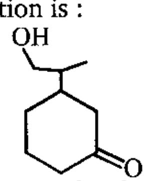
(b) 

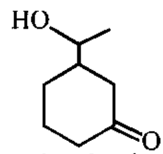
(c) 

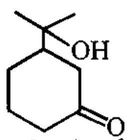
(d) 

B. Product (*C*) of above reaction is :

(a) 

(b) 

(c) 

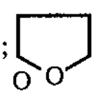
(d) 

63. Two unknown compounds *X* and *Y*, both having molecular formula C_4H_8O, give following results with four chemical tests.

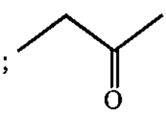
	Bromine	Na metal	Chromic acid	Lucas reagent
Compound *X*	decolourises	bubbles	Orange to Green	No reaction
Compound *Y*	No reaction	No reaction	No reaction	No reaction

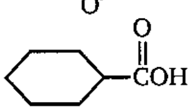
Compound *X* and *Y* respectively are :

(a) $CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$; 

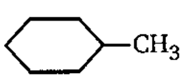
(b)  ; 

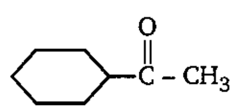
(c)  ; 

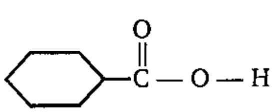
(d) $CH_3-CH_2-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-H$; 

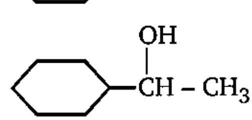
64.  $\xrightarrow[\text{dimethoxy ethane}]{\text{LiH}} L \xrightarrow{CH_3Li} M \xrightarrow{H_3O^+} N + CH_3OH$

Product (*N*) is :

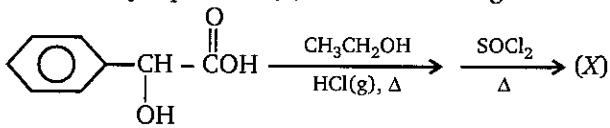
(a) 

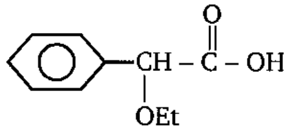
(b) 

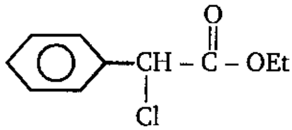
(c) 

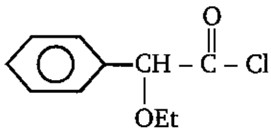
(d) 

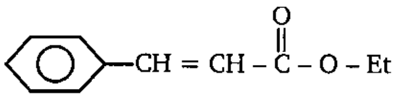
65. Assign the structure of major product (X) of the reaction given below.

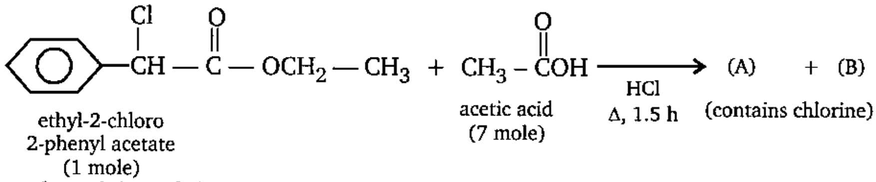


(a) 

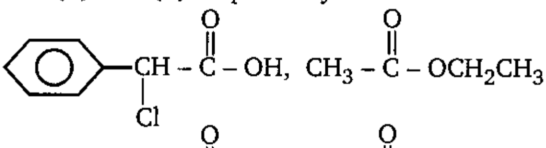
(b) 

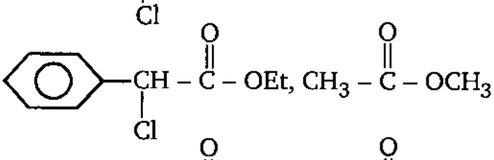
(c) 

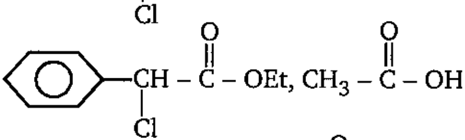
(d) 

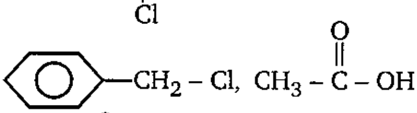
66. 

Product (A) and (B) respectively in the above reaction are :

(a) 

(b) 

(c) 

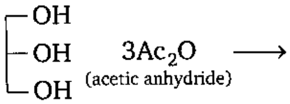
(d) 

67. $$\underset{\substack{\text{methylacrylate}\\ \text{bpt } 81^\circ\text{C}}}{H_2C=CH-\overset{\overset{\Large O}{||}}{C}-OCH_3} + \underset{\substack{n\text{-butyl alcohol}\\ \text{bpt } 117^\circ\text{C}}}{CH_3CH_2CH_2OH} \xrightarrow[\text{TsOH, }\Delta]{} \underset{\text{bpt,}145^\circ\text{C}}{(A)} + \underset{\text{bpt } 65^\circ\text{C}}{CH_3OH}$$

Product (A) of above reaction is :

(a) $H_2C=CH-\overset{\overset{O}{||}}{C}-OCH_2CH_2CH_3$ (b) $H_2C=CH-\overset{\overset{O}{||}}{C}-O-CH(Me)_2$

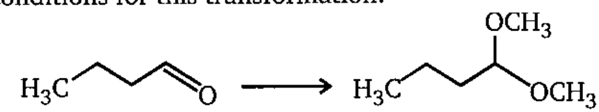
(c) $H_2\underset{\underset{OCH_3}{|}}{C}-CH_2\overset{\overset{O}{||}}{C}-OCH_3$ (d) $H_3C-(CH_2)_4-\overset{\overset{O}{||}}{C}-O-CH_3$

68. 

In above reaction molecular formula of glycerol increases by :

(a) $C_4H_4O_2$ (b) $C_6H_6O_6$ (c) $C_6H_6O_2$ (d) $C_6H_6O_3$

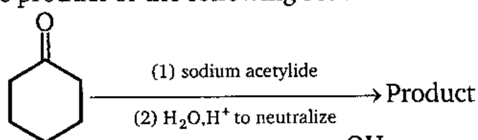
69. Give the best conditions for this transformation:

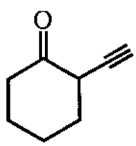


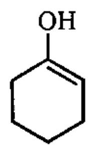
(a) CH_3OH, H^+ (cat.), heat (b) H_2O, H^+ (cat.), heat

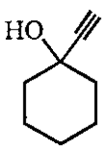
(c) Mg, ether, CH_3OH (d) $SOCl_2, CH_3OH$

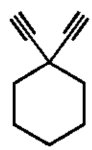
70. Give the major organic product of the following reaction.

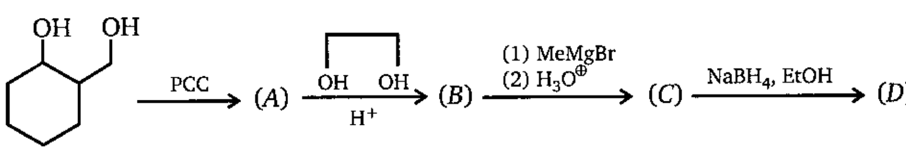


(a) 

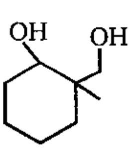
(b) 

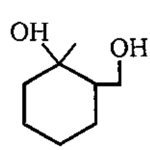
(c) 

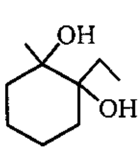
(d) 

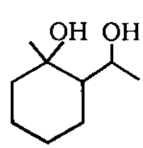
71. 

Product (*D*) in above reaction is :

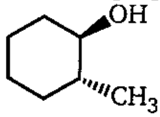
(a) 

(b) 

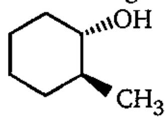
(c) 

(d) 

72. Select the best method for the preparation of the following compounds :



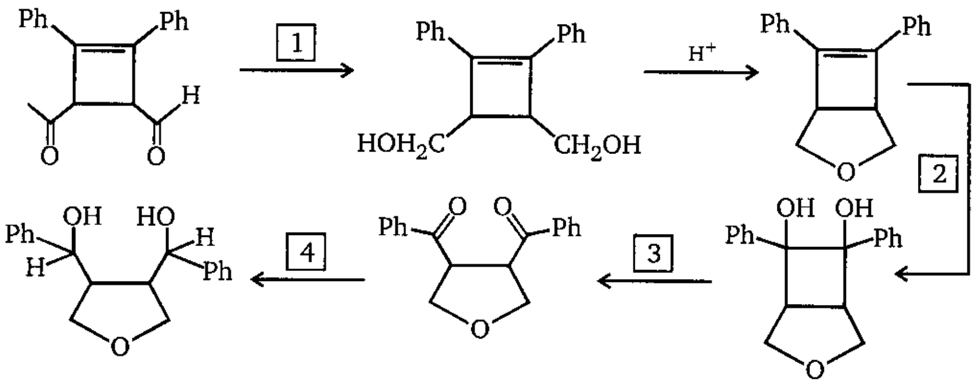
and



(MCPBA = Metachloro per benzoic acid)

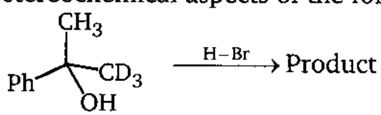
(a) reaction of cyclohexanone with CH_3Li
(b) reaction of 1-methylcyclohexene with $Hg(OAc)_2$ followed by $NaBH_4$
(c) reaction of cyclohexene with BH_3; $NaOH/H_2O_2$, following by CH_3Br
(d) reaction of cyclohexene with MCPBA, followed by CH_3MgBr

73. Identify the reagents (1-4), required for the transformations shown and arrange them in correct order.



(1) LAH ($LiAlH_4$) (2) OsO_4
(3) $NaIO_4$ (4) $NaBH_4$
(a) $1 \rightarrow 3 \rightarrow 4 \rightarrow 2$ (b) $2 \rightarrow 3 \rightarrow 1 \rightarrow 4$
(c) $2 \rightarrow 1 \rightarrow 3 \rightarrow 4$ (d) $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

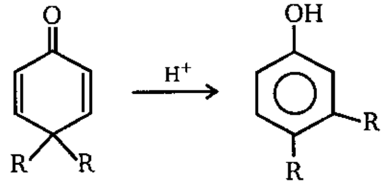
74. Which describes the best stereochemical aspects of the following reaction ?



(a) Inversion of configuration occurs at the carbon undergoing substitution.
(b) Retention of configuration occurs at the carbon undergoing substitution.
(c) Racemization (loss of configuration) occurs at the carbon undergoing substitution.
(d) The carbon undergoing substitution is not stereogenic

75. Which of following is an example of Pinacol-Diazotization ?

(a) $\underset{\substack{| \\ OH}}{Me_2C}-\underset{\substack{| \\ Br}}{CMe_2} \xrightarrow{Ag^+} Me-\overset{\substack{O \\ ||}}{C}-CMe_3$ (b) $\underset{\substack{| \\ OH}}{Me_2C}-\underset{\substack{| \\ NH_2}}{CMe_2} \xrightarrow[HCl]{NaNO_2} Me-\overset{\substack{O \\ ||}}{C}-CMe_3$

(c) $Me_2\underset{OH}{\underset{|}{C}}-\underset{OH}{\underset{|}{C}}Me_2 \xrightarrow{H^{\oplus}} Me-\overset{O}{\overset{||}{C}}-CMe_3$ (d) 

76. $\underset{C_5H_{10}O}{(A)} \xrightarrow{H_3O^{\oplus}} B + C$; (*B*) and (*C*) both give +ve iodoform test. Compound (*A*) is :

(a) $CH_3-CH=CH-O-CH_2-CH_3$

(b) $CH_3-\overset{H}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-O-CH_2-CH_3$

(c) $CH_3-\underset{CH_2}{\underset{||}{C}}-O-CH_2-CH_3$

(d) both (b) and (c)

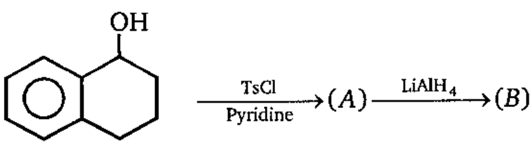
77. A solution of Ph_3CCO_2H in conc. H_2SO_4 gives (*X*) when poured into methanol *X* is :

(a) $Ph_3C-\overset{O}{\overset{||}{C}}-O-CH_3$

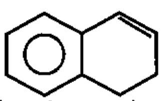
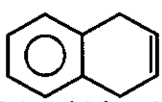
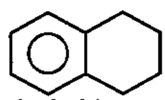
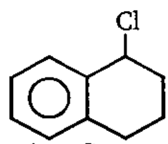
(b) $Ph_2CH-\overset{O}{\overset{||}{C}}-O-CH_3$

(c) Ph_3C-OCH_3

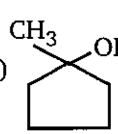
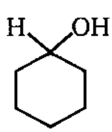
(d) Ph_3C-CH_3

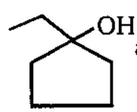
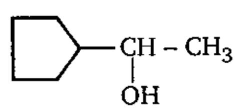
78. 

Product (*B*) of the above reaction is :

(a)  (b)  (c)  (d) 

79. In the given pair of alcohol, in which pair second alcohol is more reactive than first towards hydrogen bromide?

(a)  and 

(b)  and 

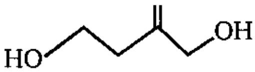
(c) $CH_3-\underset{OH}{\underset{|}{CH}}-CH_2-CH_3$ and $CH_3-CH_2-\underset{CH_3}{\underset{|}{CH}}-CH_2-OH$

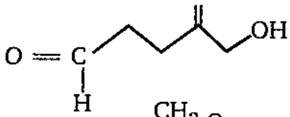
(d) $CH_3-\underset{OH}{\underset{|}{CH}}-CH_2-CH_3$ and $(CH_3)_2\underset{OH}{\underset{|}{C}}-CH_2-CH_3$

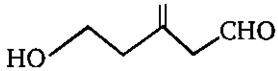
80. Rank the transition states that occur during the following reaction steps in order of increasing stability (least → most stable)

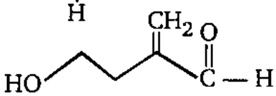
1. $H_3C-\overset{+}{O}H_2 \longrightarrow CH_3^+ + H_2O$
2. $(CH_3)_3C-\overset{+}{O}H_2 \longrightarrow (CH_3)_3C^+ + H_2O$
3. $(CH_3)_2CH-\overset{+}{O}H_2 \longrightarrow (CH_3)_2CH^+ + H_2O$

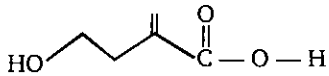
(a) $1 < 2 < 3$ (b) $2 < 3 < 1$ (c) $1 < 3 < 2$ (d) $2 < 1 < 3$

81.  $\xrightarrow{MnO_2}$ (*A*), Product (*A*) is :

(a) 

(b) 

(c) 

(d) 

82. In which of the following reactions hydrogen gas will not be evolved ?

(a) $CH_3-CH_2-OH \xrightarrow{Na}$

(b) $CH_3-CH_2-OH \xrightarrow{K}$

(c) $CH_3-\underset{\large CH_3}{\underset{|}{C}H}-OH \xrightarrow{Al}$

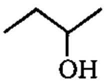
(d) $CH_3-\underset{\large CH_3}{\underset{|}{C}H}-OH \xrightarrow{CH_3MgBr}$

83. $(A) \xrightarrow{PBr_3} (C) \xrightarrow{Mg,\ ether}$ Grignard reagent

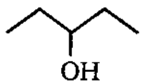
$(A) \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} (B)$

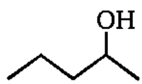
Grignard reagent + $(B) \longrightarrow (D) \xrightarrow{H_3O^{\oplus}}$ (3, 4-dimethyl 3-hexanol)

When Grignard reagent reacts with (*B*) product (*D*) will obtained.
Reactant (*A*) of the above reaction is :

(a) 

(b) 

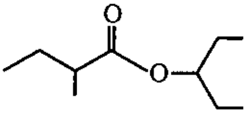
(c) 

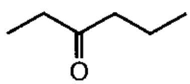
(d) 

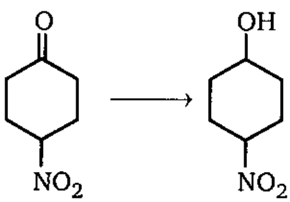
84. $(A) \xrightarrow{LiAlH_4} 2(B)$ (Chiral alcohol only) ; structure of (*A*) is :

(a) $CH_3-\underset{\large Et}{\underset{|}{C}H}-\overset{\large O}{\overset{\|}{C}}-O-\underset{\large Et}{\underset{|}{C}H}-CH_3$

(b) $CH_3-\underset{\large Et}{\underset{|}{C}H}-\overset{\large O}{\overset{\|}{C}}-O-CH_2-\underset{\large Et}{\underset{|}{C}H}-CH_3$

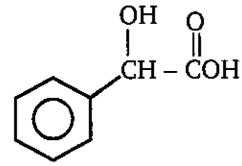
(c) 

(d) 

85. 

Above conversion can be acheived by :

(a) $LiAlH_4$ (b) $NaBH_4$ (c) H_2/Ni (d) CrO_3

86.  + EtOH $\xrightarrow[\text{HCl}]{}$ (86%)

(Mandelic acid)

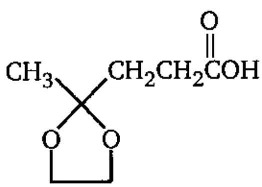
Identify product of above Fischer esterification reaction :

(a) $Ph-\underset{}{\overset{O-Et}{\overset{|}{C}H}}-CO_2H$

(b) $Ph-\overset{\frown O \frown}{CH-C}=O$

(c) $Ph-\underset{\underset{OH}{|}}{CH}-CO_2Et$

(d) $Ph-\underset{\underset{OH}{|}}{CH}-\overset{\overset{O}{||}}{C}-Et$

87.  $\xrightarrow{CH_3Li}(A)\xrightarrow{CH_3Li}(B)\xrightarrow{H_3O^{\oplus}}(C)$

Product (C) of the above reaction is :

(a) $CH_3-\overset{\overset{O}{||}}{C}-CH_2-CH_2-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$

(b) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_2-CH_2-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$

(c) $CH_3-\overset{\overset{O}{||}}{C}-CH_2-CH_2-\overset{\overset{O}{||}}{C}-CH_3$

(d) $CH_3-\overset{\overset{O}{||}}{C}-CH_2-\overset{\overset{O}{||}}{C}-CH_3$

88. What is the major product of the following reaction ?

$$CH_3-\overset{\overset{OH}{|}}{C}H-CH_2-CH_2-OH\xrightarrow[\text{Pyridine cold}]{CrO_3}\text{Product}$$

(a) $CH_3-\overset{\overset{OH}{|}}{C}H-CH_2-\overset{\overset{O}{||}}{C}-H$

(b) $CH_3-\overset{\overset{O}{||}}{C}-CH_2-\overset{\overset{O}{||}}{C}-H$

(c) $CH_3-\overset{\overset{O}{||}}{C}-CH_2-\overset{\overset{O}{||}}{C}-OH$

(d) $CH_3-\overset{\overset{OH}{|}}{C}H-CH_2-\overset{\overset{O}{||}}{C}-OH$

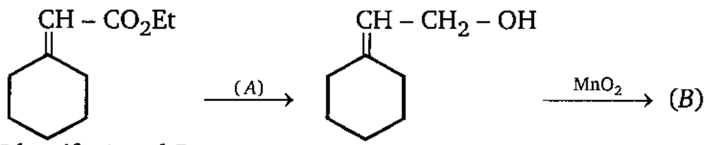
89. The major reason that phenol is a better Bronsted acid than cyclohexanol is that :

(a) it is a better proton donor.
(b) the cyclohexyl group is an electron donating group by induction, which destabilizes the anion formed in the reaction by resonance.
(c) phenol is able to stabilize the anion formed in the reaction.
(d) the phenyl group is an electron withdrawing group by induction, which stabilizes the anion formed in the reaction.

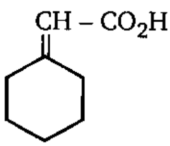
90. Which of these reagents would accomplish the following reduction ?

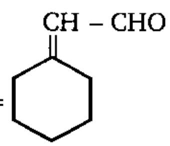
$$N\equiv C-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH=CH_2 \longrightarrow N\equiv C-CH_2-\underset{\displaystyle H}{\overset{\overset{\displaystyle OH}{|}}{C}}-CH_2-CH=CH_2$$

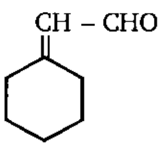
(a) $NaBH_4$ (b) $LiAlH_4$
(c) 1 mole H_2, poisoned catalyst, low pressure (d) H_3O^+

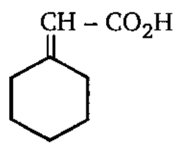
91. 

Identify A and B :

(a) $A = NaBH_4, B =$ 

(b) $A = NaBH_4, B =$ 

(c) $A = LiAlH_4, B =$ 

(d) $A = LiAlH_4, B =$ 

92. $Ph-CH_2-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3 \xrightarrow{K} \xrightarrow{C_2H_5Br} (A)$

Product (A) in above reaction is:

(a) $Ph-CH_2-\underset{\displaystyle OEt}{\underset{|}{CH}}-CH_3$, (inversion) (b) $Ph-CH_2-\underset{\displaystyle OEt}{\underset{|}{CH}}-CH_3$, (retention)

(c) $Ph-CH_2-\underset{\displaystyle OEt}{\underset{|}{CH}}-CH_3$, (racemic) (d) $Ph-CH=CH-CH_3$

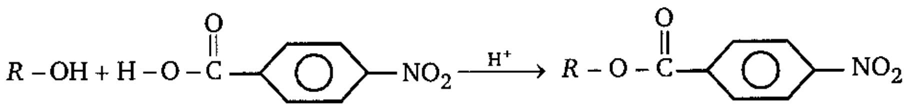
93. $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-O-H+CH_3-O^{18}-H \overset{H^+}{\rightleftharpoons} (X)+H_2O$; Identify X:

(a) $X = Ph-\overset{\overset{\displaystyle O}{\|}}{C}-O^{18}-CH_3$ (Trans esterification)

(b) $X = Ph-\overset{\overset{\displaystyle O}{\|}}{C}-O^{18}-CH_3$ (Esterification reaction)

(c) $X = Ph-\overset{\overset{\displaystyle O}{\|}}{C}-O^{18}-CH_3$ (Saponification)

(d) $X = Ph-\overset{\overset{\displaystyle O}{\|}}{C}-O-CH_3$ (Hydrolysis)

94. 

Fastest rate of reaction will be when R is :

(a) CH_3- (b) CH_3-CH_2 (c) $CH_3-\underset{\underset{\displaystyle CH_3}{|}}{CH}-$ (d) $CH_3-\underset{\underset{\displaystyle CH_3}{|}}{\overset{\overset{\displaystyle CH_3}{|}}{C}}-$

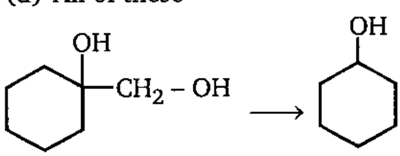
95. Select the correct statement.

(a) Solvolysis of $(CH_3)_2C=CH-CH_2-Cl$ in ethanol is over 6000 times greater than alkyl chloride (25°C)

(b) $CH_3-CH=CH-CH_2-OH$ when reacts with HBr give a mixture of 1-bromo-2-butene and 3-bromo 1-butene

(c) When solution of 3-buten-2-ol in aqueous sulphuric acid is allowed to stand for one week, it was found to contain both 3-buten-2-ol and 2-buten-1-ol

(d) All of these

96. 

; Above transformation can be carried out by :

(a) H^+/Δ, Zn(Hg), HCl (b) $HIO_4, LiAlH_4$

(c) $HIO_4, H^+/\Delta$ (d) H^+/Δ, HIO_4

97. $H_2C=CH-CH_2-CH_2-\underset{\underset{\displaystyle OH}{|}}{CH}-CH_3 \xrightarrow[\text{Pyridine}]{SOCl_2} (A) \xrightarrow[(H_2O)]{O_3/Zn} \underset{C_5H_9ClO}{(B)} \xrightarrow{NaBH_4} (C)$

Compound (C) is :

(a) $CH_3-\overset{\overset{\displaystyle OH}{|}}{CH}-CH_2-\underset{\underset{\displaystyle Cl}{|}}{CH}-CH_3$

(b) $HOCH_2-CH_2-CH_2-CH_2-CH_2-CH_2-Cl$

(c) $HO-CH_2-CH_2-CH_2-\overset{\overset{\displaystyle Cl}{|}}{CH}-CH_3$

(d) $HO-CH_2-CH_2-\underset{\underset{\displaystyle Cl}{|}}{CH}-CH_2-CH_3$

98. Iodoform can be obtained on warming NaOH and iodine with :

(a) $CH_3CH_2CH(OH)CH_3$

(b) $(CH_3)_2CH\overset{\overset{O}{\|}}{C}C_2H_5$

(c) $CH_3-\underset{\underset{O}{\|}}{C}-OCH_3$

(d) $(CH_3)_2CHCH_2OH$

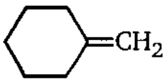
99. Which of these is a reducing agent ?

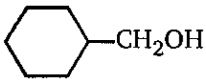
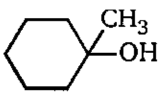
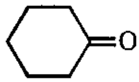
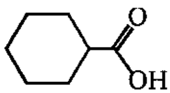
(a) CrO_3/H^+

(b) $KMnO_4$

(c) $LiAlH_4$

(d) O_3

100.  $\xrightarrow[\text{(ii). } H_2O_2/OH^-]{\text{(i). } (BH_3)_2}$ (P); Product (P) in the reaction is:

(a)  (b)  (c)  (d) 

101. $CH_3-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3 \xrightarrow[\text{cool}]{Na_2Cr_2O_7} (P)$; Product (P) in the reaction is:

(a) $CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2$

(b) $CH_3-\overset{\overset{CH_3}{|}}{CH}-CH_3$

(c) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-O-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$

(d) No reaction

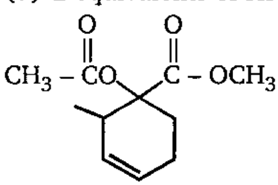
102. 1, 2, 3 – butanetriol undergoes oxidative cleavage of HIO_4. During this process

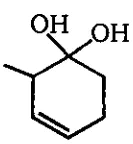
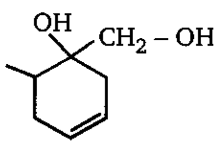
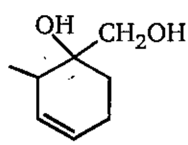
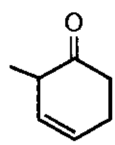
(a) 1 equivalent of HIO_4 consumed & HCO_2H & $H_3C-\underset{\underset{O}{\|}}{C}-CO_2H$ are formed

(b) 2 equivalents of HIO_4 consumed & HCO_2H, $HCH=O$ & $CH_3-CH=O$ are formed

(c) 3 equivalents of HIO_4 consumed & HCO_2H (2 eq.) & 1 eq. of CH_3CO_2H are formed

(d) 2 equivalents of HIO_4 consumed & 2 eq. of HCO_2H & 1 eq. of $CH_3CH=O$ is formed

103.  $\xrightarrow[\text{(ii)} H_2O]{\text{(i)} LiAlH_4}$ (A); Product (A) of the reaction is :
(96%)

(a)  (b)  (c)  (d) 

104. $R-\overset{O}{\overset{\|}{C}}-O-R'+R''OH \xrightleftharpoons{H^{\oplus}} R-\overset{O}{\overset{\|}{C}}-O-R''+R'OH$

Above reaction is/an example of :

(a) esterification (b) saponification

(c) *trans*-esterification (d) hydrolysis

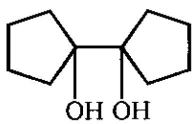
105. What is the major organic product of the following sequence of reactions ?

$$(CH_3)_2CHCH_2OH \xrightarrow{PBr_3} \xrightarrow{Mg} \xrightarrow{H_2C\overset{O}{\frown}CH_2} \xrightarrow{H_3O^+} ?$$

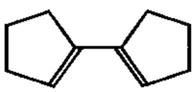
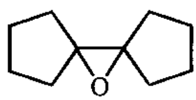
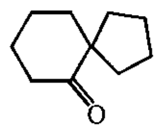
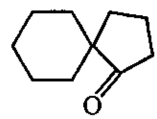
(a) $(CH_3)_2CH\overset{OH}{\overset{|}{C}}HCH_2CH_3$ (b) $(CH_3)_2CHCH_2CH_2OH$

(c) $(CH_3)_2CHCH_2\overset{OH}{\overset{|}{C}}HCH_3$ (d) $(CH_3)_2CHCH_2CH_2CH_2OH$

106. The structure of the product formed in the reaction given below is :



$\xrightarrow[\Delta]{H^+}$

(a)  (b)  (c)  (d) 

107. $\begin{array}{l} CHO \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array} \xrightarrow{2HIO_4}$ Products obtained in the above reaction are :

(a) $HCHO, HCO_2H$ (b) $HCHO, 2HCO_2H$

(c) $CO_2, 2HCO_2H$ (d) $CO_2, HCHO, HCO_2H$

108. $\begin{array}{l} CHO \\ | \\ (CH-OH)_3 \\ | \\ CH_2-OH \end{array} + 4HIO_4 \longrightarrow$ Products obtained are :

Aldo pentose

(a) $4HCO_2H$, $HCHO$ (b) $4CH_2O$, HCO_2H

(c) CO_2, $4HCHO$ (d) $CO_2, 3HCO_2H$, $HCHO$

109. (i) $\begin{array}{l} CHO \\ | \\ (CH-OH)_3 \\ | \\ CH_2-OH \end{array} \xrightarrow{4HIO_4}$ Product (ii) $\begin{array}{l} CH_2OH \\ | \\ (CH-OH)_4 \\ | \\ CH_2-OH \end{array} \xrightarrow{5HIO_4}$ Product

Ratio of moles of formic acid obtained in reaction (i) and reaction (ii) is :
(a) 3/4 (b) 4/5 (c) 1 (d) 5/4

110. Which of the following compound gives 2HCHO, CO_2, HCO_2H when oxidised by periodic acid?

(a) CH_2-OH / $(CH-OH)_2$ / CH_2-OH
(b) CHO / $(CH-OH)_2$ / CH_2-OH
(c) CH_2-OH / $C=O$ / $(CH-OH)_2$ / CH_2-OH
(d) CHO / $C=O$ / $CH-OH$ / CH_2-OH

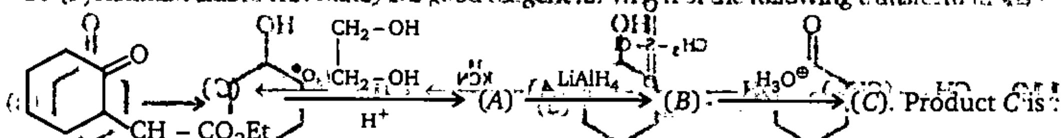
111. Hydration of 3-phenylbut-1-ene in dil. H_2SO_4 will give mainly :
(a) 3-Phenylbutan-1-ol (b) 3-Phenylbutan-2-ol
(c) 2-Phenylbutan-2-ol (d) 2-Phenylbutan-1-ol

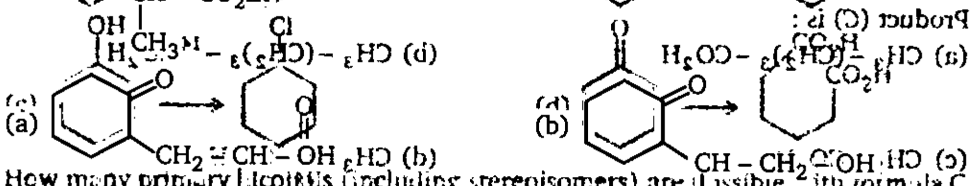
112. Decarboxylation of sodium salicylate with soda lime forms
(a) Salicylic acid (b) Phenol (c) Benzene (d) None of these

113. CH_2-OH / $CH-OH$ / $CH-OH$ / CH_2-OH $+ \ xHIO_4 \longrightarrow$ What is the maximum value of (x) ?
(a) 1 (b) 2 (c) 3 (d) 4

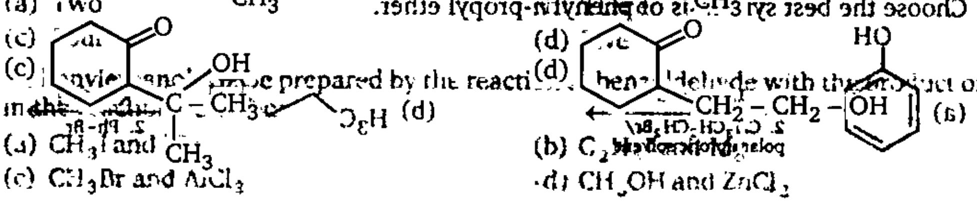
123. PCC (Pyridinium chlorochromate) is a good reagent for which of the following transformations ?

114.





124. How many primary alcohols (including stereoisomers) are possible with formula $C_5H_{12}O$?
(a) Two

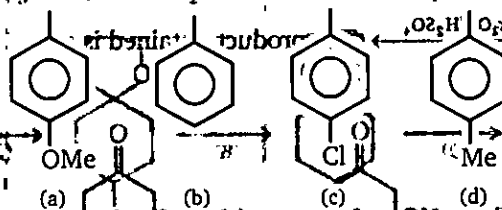


125. ... can be prepared by the reaction of ... with the product obtained in the ...
(a) CH_3I and ... (b) C_2H_5...
(c) CH_3Br and $AlCl_3$ (d) CH_3OH and $ZnCl_2$

126. 0.092 g of a compound with the molecular formula $C_3H_8O_3$ on reaction with an excess of CH_3MgI gives 67.00 mL of methane at STP. The number of active hydrogen atoms present in a molecule of the compound is :

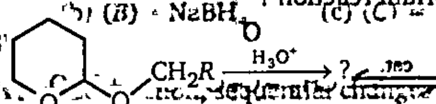
(a) one (b) two
(c) three (d) four

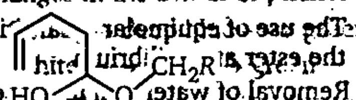
127. Migratory aptitude of the following in decreasing order is :

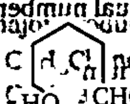
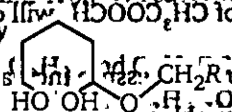


(a) a > c > b > d (b) a > d > b > c
(c) a > d > c > b (d) b > c > a > b

128. The major product formed in the reaction is :



(a)  $+ RCH_2OH$ (b) 

(c)  $+ RCH_2OH$ (d) 

129. Reaction of *R*-2-butanol with *p*-toluenesulphonyl chloride in pyridine then LiBr gives :

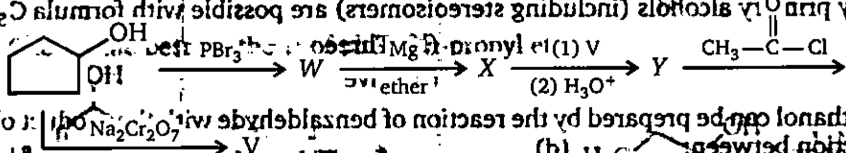
(a) *R*-2-butyl bromide (b) *S*-2-butyl tosylate
(c) *R*-2-butyl tosylate (d) *S*-2-butyl bromide

130. Optically active 2-octanol rapidly loses its optical activity when exposed to :

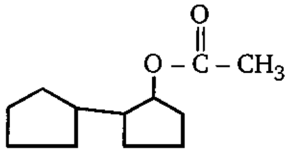
(a) dilute acid (b) dilute base (c) light (d) humidity

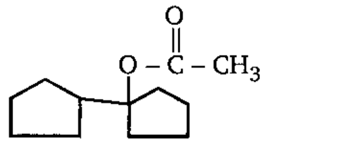
131. If (±) 2-methyl butanoic acid were esterified by reaction with (±) 2-butanol, how many optically active compounds would be present in the final equilibrium reaction mixture ?

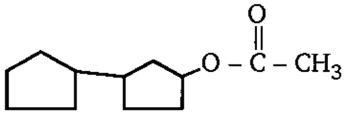
(a) 2 (b) 3 (c) 4 (d) 6

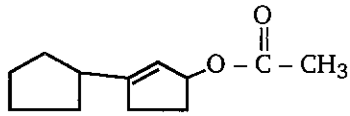
132. 

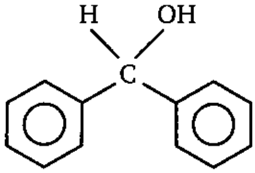
Product *Z* of above reaction is :

(a) 

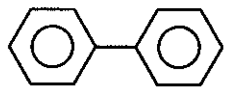
(b) 

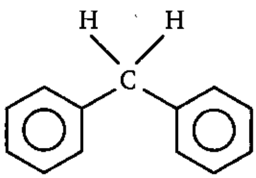
(c) 

(d) 

133.  $\xrightarrow[AlCl_3]{LiAlH_4}$ (*A*) ; Identify the product :

(a) No reaction

(b) 

(c) 

(d) $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-Ph$

134. $(EtO)_2CHCHO + CH_3MgI \xrightarrow{H_3O^{\oplus}} (A)$

Product obtained in the above reaction is :

(a) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle O}{\|}}{C}-H$

(b) $CH_3-\overset{\overset{\displaystyle OH}{|}}{CH}-CHO$

(c) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-OH$

(d) $CH_3-\underset{\underset{\displaystyle OH}{|}}{CH}-CH_2-OH$

135. **Reaction - (1):** $CH_3-CH=CH-CH_3 \xrightarrow[Cold]{KMnO_4} (A) \xrightarrow{NaIO_4} (B)$ 2 mole

Reaction - (2): $CH_3-CH=CH-CH_3 \xrightarrow{KMnO_4/NaIO_4} (C)$ 2 mole

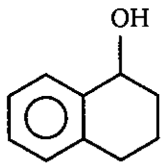
Product (*B*) and (*C*) respectively are :

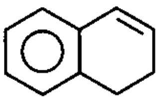
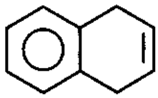
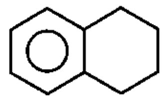
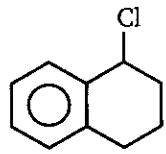
(a) CH_3CHO, CH_3CO_2H

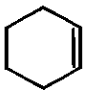
(b) CH_3CO_2H, CH_3CHO

(c) CH_3CHO in both reaction

(d) CH_3CO_2H in both reaction

136.  $\xrightarrow[\text{Pyridine, 25°C}]{\text{TsCl}} A \xrightarrow[\text{Pyridine, 25°C}]{LiAlH_4} B$; Product (B) is :

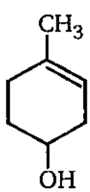
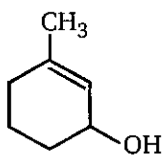
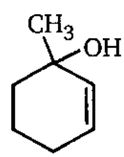
(a)  (b)  (c)  (d) 

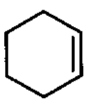
137.  $\longrightarrow$ HO – $(CH_2)_6$ – OH, this conversion can be achieved by

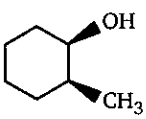
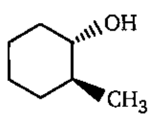
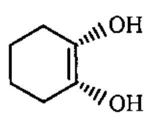
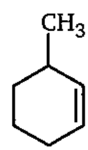
(a) O_3, Zn, then $LiAlH_4$ (b) O_3/H_2O_2, then $LiAlH_4$

(c) cold dil. $KMnO_4$, HIO_4, then $LiAlH_4$ (d) All of these

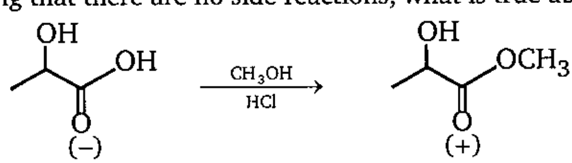
138. Which of the following alcohol on treatment with HCl give 3-chloro-3-methyl cyclohexene as a product ?

(a)  (b)  (c)  (d) All of these

139.  $\xrightarrow[\text{(b) } CH_3MgBr \text{ (c) } H^+, H_2O]{\text{(a) } RCO_3H}$ (A); Product of the reaction is :

(a)  (b)  (c)  (d) 

140. Esterification (shown below) is a reaction converting a carboxylic acid to its ester. It involves only the carbonyl carbon. Esterification of (–) -lactic acid with methanol yields (+)-methyl lactate. Assuming that there are no side reactions, what is true about this reaction ?



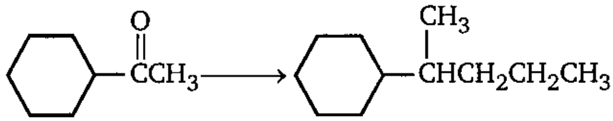
(a) An S_{N^2} process has occurred, inverting the absolute configuration of the chiral center

(b) An S_{N^1} reaction at the chiral center has inverted the optical rotation

(c) A diastereomer has been produced; diastereomers have different physical properties including optical rotation

(d) Optical rotation is not directly related to absolute configuration, so the change in sign of rotation is merely a coincidence

141. Which of the following sets of reagents, used in the order shown, would successfully accomplish the conversion shown ?

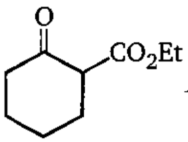


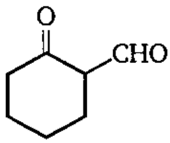
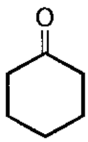
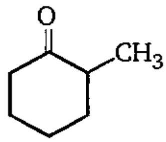
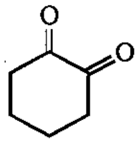
(a) $CH_3CH_2CH_2MgBr$; H_3O^+; PCC, CH_2Cl_2

(b) $CH_3CH_2CH_2MgBr$; H_3O^+; H_2SO_4, heat PCC, CH_2Cl_2

(c) $(C_6H_5)_3\overset{+}{P}-\overset{-}{\ddot{C}}HCH_2CH_3, B_2H_6$; CH_3CO_2H

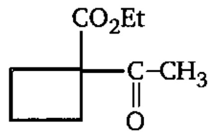
(d) $(C_6H_5)_3\overset{+}{P}-\overset{-}{\ddot{C}}HCH_2CH_3$; H_2O

142.  $\xrightarrow[(2)\ \Delta]{(1)\ H_3O^+}$ Product ; Product of the reaction is :

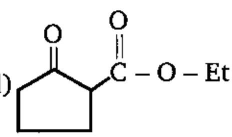
(a)  (b)  (c)  (d) 

143. Which of the following compound on hydrolysis followed by heating gives a product, which gives positive iodoform test?

(a) $CH_3-\underset{CO_2Et}{\underset{|}{CH}}-\overset{O}{\overset{||}{C}}-CH_2-CH_3$

(b) 

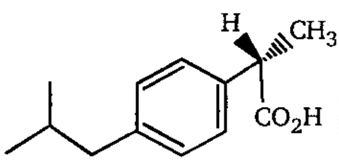
(c) $CH_3-\underset{CO_2Et}{\underset{|}{CH}}-CO_2Et$

(d) 

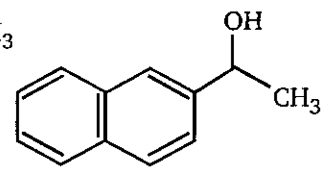
144. Treatment of a 2° OH with CrO_3/H_2SO_4 yields an/a :

(a) aldehyde (b) carboxylic acid (c) ester (d) ketone

145. Esterification of the acid **P** with the alcohols **Q** will give :



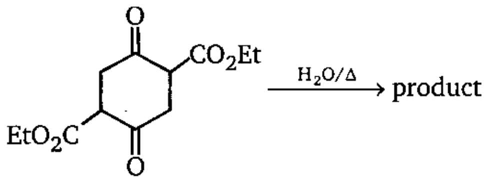
(S)-P



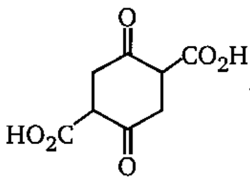
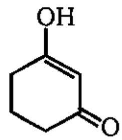
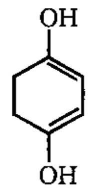
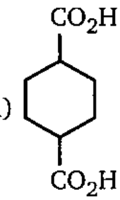
(±)-Q

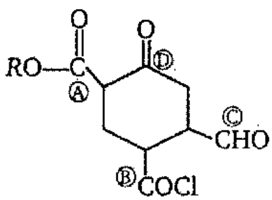
(a) only one enantiomer (b) a mixture of diastereomers

(c) a mixture of enantiomers (d) only one diastereomer

146. 

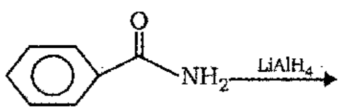
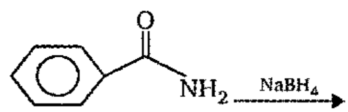
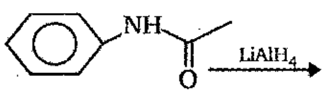
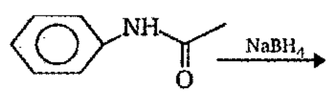
Identify major product of the reaction, when the given compound is hydrolysed and heated strongly:

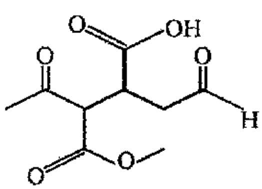
(a)  (b)  (c)  (d) 

147.  find out the reactivity order with $LiAlH_4$:

(a) $A > B > C > D$
(b) $B > C > D > A$
(c) $D > C > B > A$
(d) $B > D > C > A$

148. Find out the reaction in which obtained product give positive isocyanide test:

(a) 
(b) 
(c) 
(d) 

149. 

In the above given compound how many functional group reduced by LAH (Lithium aluminium hydride) and SBH (sodium borohydride) respectively ?

(a) 4, 4
(b) 4, 3
(c) 3, 4
(d) 4, 2

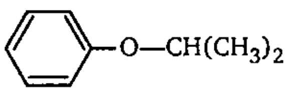
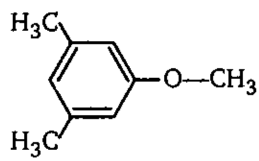
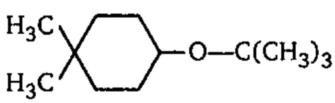
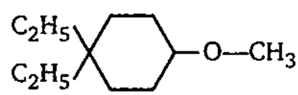
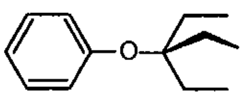
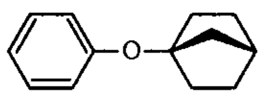
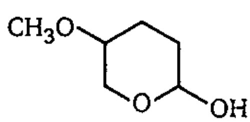
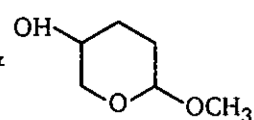
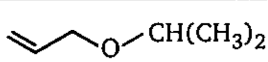
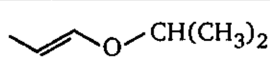
ANSWERS — LEVEL 1

1.	(c)	**2.**	(a)	**3.**	(b)	**4.**	(c)	**5.**	(b)	**6.**	(b)	**7.**	(b)	**8.**	(a)
9.	(b)	**10.**	(b)	**11.**	(b)	**12.**	(b)	**13.**	(a)	**14.**	(a)	**15.**	(a)	**16.**	(a)
17.	(d)	**18.**	(a)	**19.**	(b)	**20.**	(a)	**21.**	(a)	**22.**	(a)	**23.**	(d)	**24.**	(a)
25.	(b)	**26.**	(b)	**27.**	(b)	**28.**	(b)	**29.**	(c)	**30.**	(c)	**31.**	(b)	**32.**	(b)
33.	(a)	**34.**	(b)	**35.**	(b)	**36.**	(c)	**37.**	(c)	**38.**	(c)	**39.**	(d)	**40.**	(c)
41.	(b)	**42.**	(b)	**43.**	(d)	**44.**	(d)	**45.**	(b)	**46.**	(a)	**47.**	(b)	**48.**	(b)
49.	(a)	**50.**	(b)	**51.**	(a)	**52.**	(c)	**53.**	(c)	**54.**	(c)	**55.**	(b)	**56.**	(a)
57.	(d)	**58.**	(c)	**59.**	A-d	**59.**	B-b	**59.**	C-a	**60.**	(c)	**61.**	(c)	**62.**	A-b
62.	B-b	**63.**	(b)	**64.**	(c)	**65.**	(b)	**66.**	(a)	**67.**	(a)	**68.**	(d)	**69.**	(a)
70.	(c)	**71.**	(b)	**72.**	(d)	**73.**	(d)	**74.**	(c)	**75.**	(b)	**76.**	(d)	**77.**	(c)
78.	(c)	**79.**	(d)	**80.**	(c)	**81.**	(c)	**82.**	(d)	**83.**	(a)	**84.**	(b)	**85.**	(b)
86.	(c)	**87.**	(c)	**88.**	(b)	**89.**	(d)	**90.**	(a)	**91.**	(c)	**92.**	(b)	**93.**	(b)
94.	(a)	**95.**	(d)	**96.**	(b)	**97.**	(c)	**98.**	(a)	**99.**	(c)	**100.**	(a)	**101.**	(d)
102.	(b)	**103.**	(c)	**104.**	(c)	**105.**	(d)	**106.**	(c)	**107.**	(b)	**108.**	(a)	**109.**	(c)
110.	(d)	**111.**	(c)	**112.**	(b)	**113.**	(b)	**114.**	(b)	**115.**	(b)	**116.**	(d)	**117.**	(b)
118.	(a)	**119.**	(b)	**120.**	(a)	**121.**	(a)	**122.**	(b)	**123.**	(b)	**124.**	(d)	**125.**	(a)
126.	(c)	**127.**	(b)	**128.**	(c)	**129.**	(d)	**130.**	(a)	**131.**	(c)	**132.**	(b)	**133.**	(c)
134.	(b)	**135.**	(a)	**136.**	(c)	**137.**	(d)	**138.**	(d)	**139.**	(b)	**140.**	(d)	**141.**	(c)
142.	(b)	**143.**	(b)	**144.**	(d)	**145.**	(b)	**146.**	(c)	**147.**	(b)	**148.**	(a)	**149.**	(b)

1. Consider the pairs of ethers, numbered I through V, shown below. To the right of each pair is a description of reaction conditions to be applied to each. One compound of the pair will react more rapidly than the other.

Which ether of the two will be more rapidly cleaved?

Write your answer in box.

	(A) Ether Pairs	(B)	Cleavage Conditions
I.	 &		Treated with HBr in CH_3CN, 40°C
II.	 &		Treated with H_2SO_4 in CH_3CN, 40°C
III.	 &		Treated with H_2SO_4 in CH_3CN, 40°C
IV.	 &		Treated with 5% aqueous H_2SO_4, 25°C
V.	 &		Treated with 5% aqueous H_2SO_4, 25°C

2. Comprehension

(a) $CH_3-CH_2-CH_2-CH_2-CH_2-OH$

(b) $CH_3-CH_2-CH_2-CH(OH)-CH_3$

(c) $CH_3-CH_2-CH(OH)-CH_2-CH_3$

(d) $CH_3-CH_2-C(CH_3)_2-OH$

(e) $CH_3-CH(CH_3)-CH_2-CH_2-OH$

(f) $CH_3-CH(CH_3)-CH(OH)-CH_3$

(g) $HO-CH_2-CH(CH_3)-CH_2-CH_3$

(h) $CH_3-C(CH_3)_2-CH_2-OH$

Above compounds (a) to (h) are isomers of $C_5H_{12}O$.

Based on the above isomer answer the following (A to F).

A. Which isomer is most reactive towards dehydration by conc. H_2SO_4?

B. Which isomer will undergo rearrangement when treated with conc. H_2SO_4?

C. Which isomers on dehydration with conc. H_2SO_4 give alkene which is capable to show geometrical isomerism ?

D. Which isomer is least acidic ?

E. Which isomers on dehydration give most stable alkene ?

F. Which isomer on dehydration with conc. H_3PO_4 undergo maximum rearrangement ?

3. Comprehension

$$\underset{\text{(alkane lowest oxidation no.)}}{R-CH_3} \underset{[H]}{\overset{[O]}{\rightleftharpoons}} \underset{\text{alcohol}}{R-CH_2-OH} \underset{[H]}{\overset{[O]}{\rightleftharpoons}} \underset{\text{aldehyde}}{RCHO} \underset{[H]}{\overset{[O]}{\rightleftharpoons}} \underset{\text{(acid highest oxidation no.)}}{RCO_2H}$$

[O] = Oxidation [H] = Reduction

Consider the above sequence and answer *A* to *F*.

A. Conversion $(CH_3-CH_3 \longrightarrow CH_3-CH_2-OH)$ alkane $\longrightarrow$ alcohol is achieved by:

(a) $Br_2/h\nu$, alc. KOH (b) $Br_2/h\nu$, aq. KOH
(c) Br_2/CCl_4, $LiAlH_4$ (d) Br_2/CCl_4, $NaBH_4$

B. Conversion $R-CH_2-OH \longrightarrow R-CHO$ can be done by:

(a) PCC/CH_2Cl_2 (b) Cu, 300°C
(c) CrO_3 (d) All of these

C. Conversion $R-CHO \longrightarrow R-CO_2H$ can be done by:

(a) $KMnO_4$ (b) H_2CrO_4
(c) $K_2Cr_2O_7$ (d) All of these

D. Conversion $R-CO_2H \longrightarrow R-CHO$ can be done by:

(a) $LiAlH_4$ (b) $NaBH_4$
(c) DIBAL – H (d) All of these

E. Conversion $R-CHO \longrightarrow R-CH_2-OH$ can be done by:

(a) $LiAlH_4$ (b) $NaBH_4$
(c) H_2/Ni (d) All of these

F. Reduction $R-CH_2-OH \longrightarrow R-CH_3$ can be done by:

(a) $LiAlH_4$ (b) $NaBH_4-AlCl_3$
(c) H_2-Ni (d) Red P + HI

4. Which of the following is true for 3-methylbutanal ?

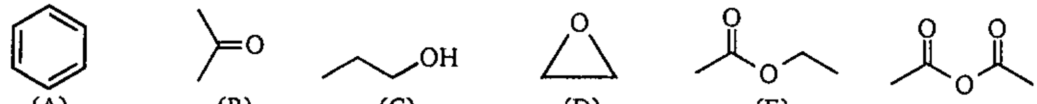
a.	This compound may be classified as an aldehyde.	
b.	This compound may be classified as a ketone	
c.	An aldol reaction takes place on treatment with NaOH solution.	
d.	There is no reaction with $LiAlH_4$ in ether solution.	
e.	An excess of CH_3MgBr in ether reacts to give 4-methyl-2-pentanol.	
f.	Wolff-Kishner reduction gives butane.	
g.	This compound is an isomer of 3-pentanone.	

5. This problem is an introduction to the planning of multistep syntheses.

For use, you have six reactant compounds (**A** through **F**) ; and eight reagents (**1** through **8**), shown below.

Following these lists, five multistep syntheses are outlined. For each of these, certain reactants or reagents must be identified by writing an appropriate letter or number in designated answer boxes. Write a single letter or number, indicating your choice of the best reactant or reagent, in each answer box.

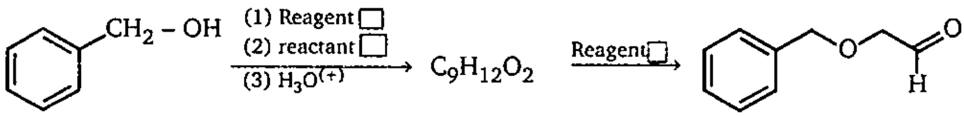
Reactant Compounds :

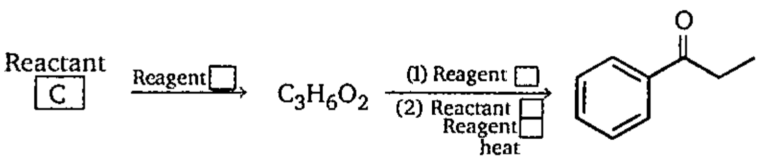


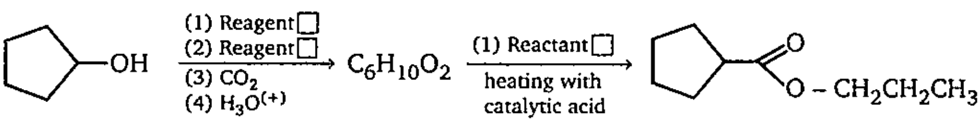
(A) (B) (C) (D) (E) (F)

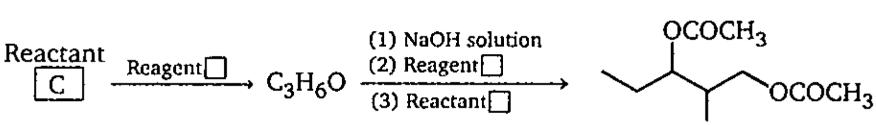
Reagents :

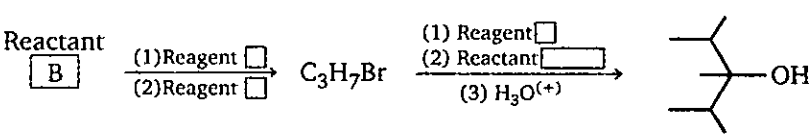
(1) Jones' reagent [$Na_2Cr_2O_7$ in H_3O^+]
(2) PCC [CrO_3 in pyridine + HCl]
(3) Sodium hydride NaH
(4) Sodium borohydride $NaBH_4$
(5) Thionyl chloride $SOCl_2$
(6) Phosphorus tribromide PBr_3
(7) Aluminium trichloride $AlCl_3$
(8) Magnesium turnings in ether

1.


2.


3.


4.


5.


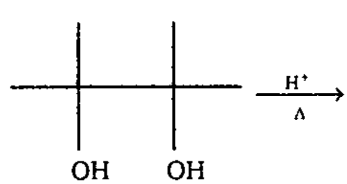
6. Which of the following is true for 3-methyl-2-butanone?

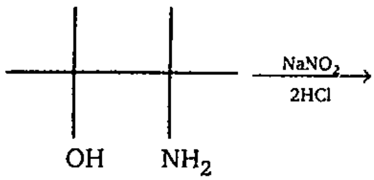
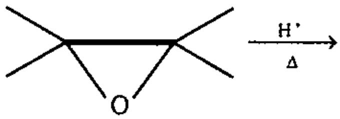
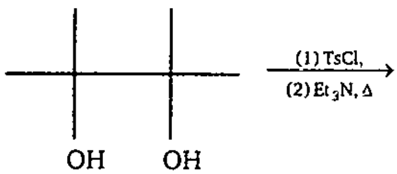
a.	It may be prepared by CrO_3 oxidation of 2-methyl-2-butanol.	
b.	Its reaction with $NaBH_4$ gives a secondary alcohol.	
c.	It may be prepared by acidic Hg^{2+} catalyzed hydration of 3-methyl-1-butyne.	
d.	It forms a silver mirror on treatment with $[Ag(NH_3)_2]^+$.	
e.	This compound is an isomer of 4-penten-1-ol.	

7. Which of these methods would serve to prepare 1-phenyl-2-propanol?

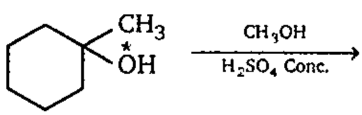
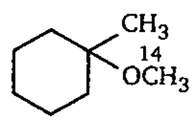
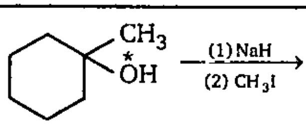
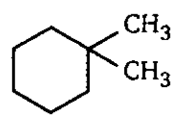
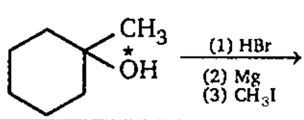
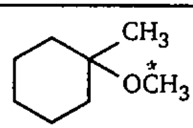
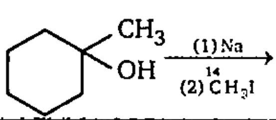
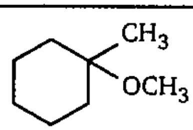
a.	Addition of benzyl Grignard reagent to acetaldehyde (ethanal).	
b.	Addition of phenyl lithium to propylene oxide (methyloxirane).	
c.	Addition of phenyl Grignard reagent to acetone (2-propanone).	
d.	Acid-catalyzed hydration (addition of water to) of 2-phenyl-1-propene.	
e.	Addition of methyl Grignard reagent to acetophenone (methyl phenyl ketone).	
f.	Addition of methyl Grignard reagent to phenylacetaldehyde.	

8. Match the Column (I) and (II).

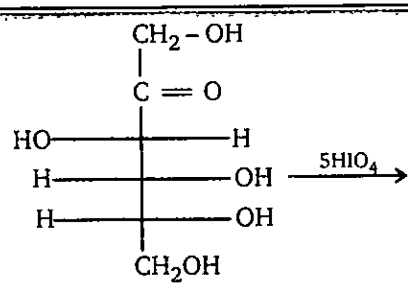
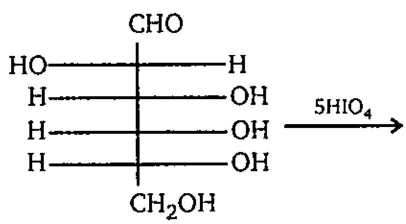
Column (I)		Column (II)	
Reaction		**Name of Reaction**	
(a)		(p)	Pinacol-Pinacolone rearrangement

(b)		(q)	Semi-Pinacol reaction
(c)		(r)	Pinacolic-Diazotization
(d)		(s)	Pinacol fashion reaction

9. Match the Column (I) and (II).

Column (I)		Column (II)	
Reactant		**Products**	
(a)		(p)	
(b)		(q)	
(c)		(r)	
(d)		(s)	

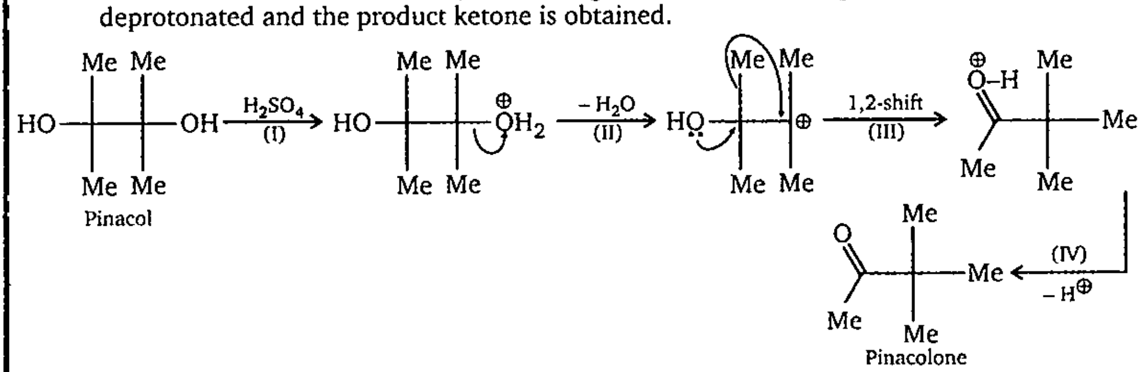
10.

Reaction 1.	
Reaction 2.	

Ratio of moles of formaldehyde obtained in the reaction (1) and reaction (2) ?

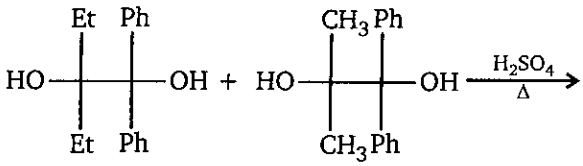
11. Comprehension

Di-tert-glycols rearrange in the presence of acid to give α-tertiary ketones. The trivial name of the simplest glycol of this type is pinacol, and this type of reaction therefore is named pinacol rearrangement (in this specific case, the reaction is called a pinacol-pinacolone rearrangement). The rearrangement involves 4 steps. one of the hydroxyl groups is protonated in the first step. A molecule of water is eliminated in the second step and a tertiary carbocation is formed. The carbocation rearranges in the third step into a more stable carboxonium ion *via* a [1, 2] rearrangement. In the last step, the carboxonium ion is deprotonated and the product ketone is obtained.



A. What is R.D.S. of pinacol-pinacolone rearrangement ?

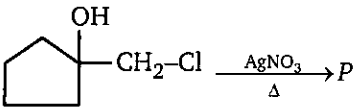
(a) I step
(b) II step
(c) III step
(d) IV step

B. 

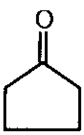
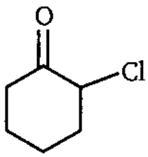
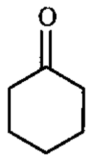
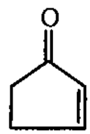
How many products obtained in above reaction ?

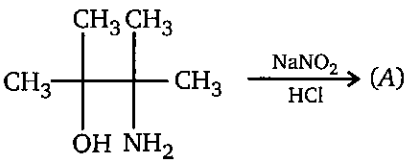
(a) 1 (b) 2

(c) 3 (d) 4

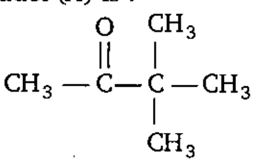
C. 

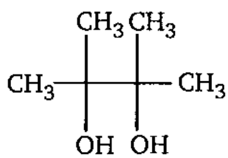
Product '*P*' is :

(a)  (b)  (c)  (d) 

D. 

Product (*A*) is :

(a) 

(b) 

(c) 

(d) None of these

ANSWERS — LEVEL 2

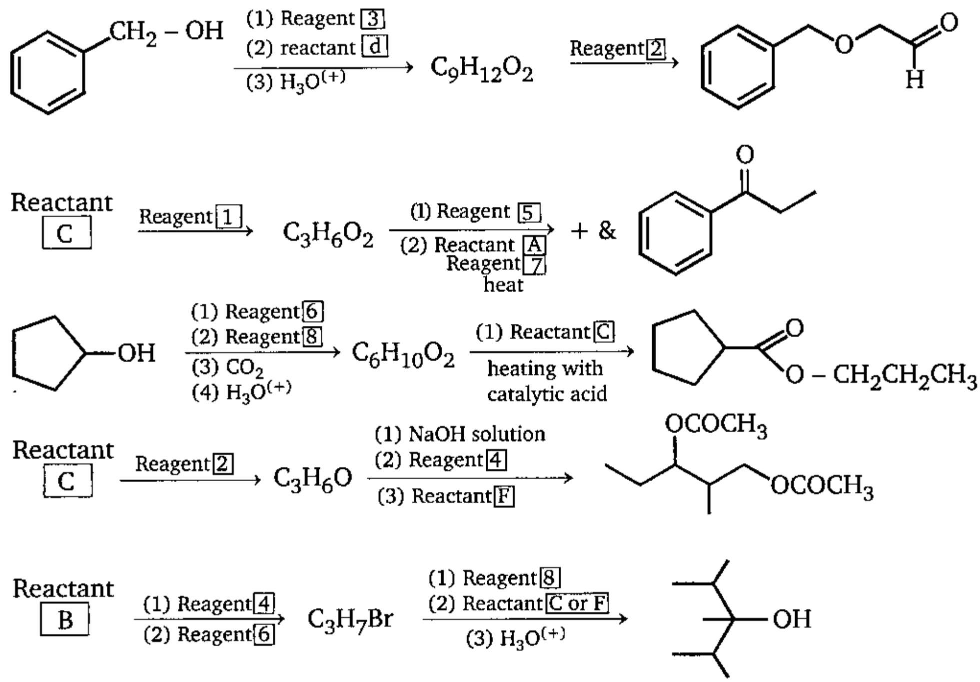
1. I – B; II – A; III – A; IV – B; V – B

2. A – d; B – a, c, e, f, g, h; C – a, b, c; D – d; E – d, e, f, g, h; F – e

3. A – b; B – d, C – d, D – c, E – d; F – d

4. a, c, e, g

5.



6. b, c, e

7. a, b, f

8. a – p, b – r, c – s, d – q

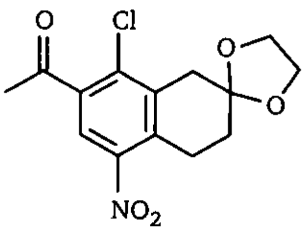
9. a – s, b – r, c – q, d – p

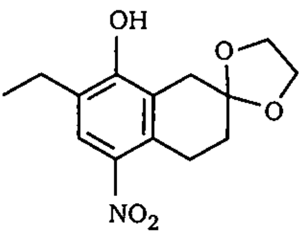
10. Ratio of reaction I and II = 2

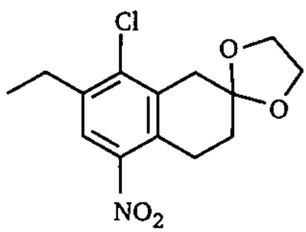
11. A – b; B – b; C – c; D – a

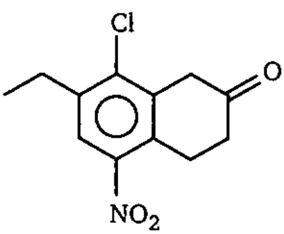
7 ALDEHYDES AND KETONES

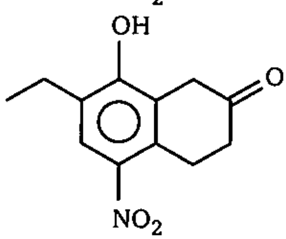
LEVEL-1

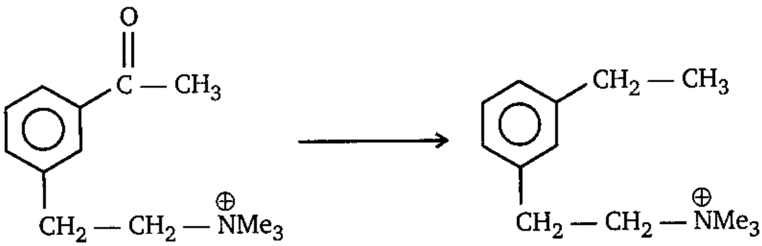
1.  $\xrightarrow[\text{(Wolff-Kishner reduction)}]{N_2H_4/KOH/H_2O}$ $\underset{\text{major}}{(A)}$; Product A is :

(a) 

(b) 

(c) 

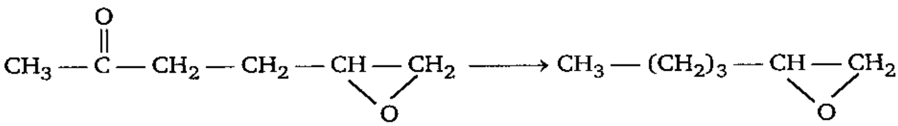
(d) 

2. 

Above conversion can be achieved by :

(a) Wolf-Kishner reduction (b) Clemmensen reduction

(c) $LiAlH_4$ (d) $NaBH_4$

3. 

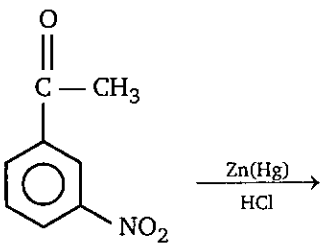
Above conversion can be achieved by :

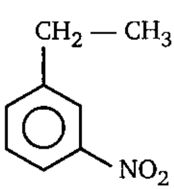
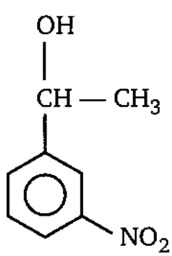
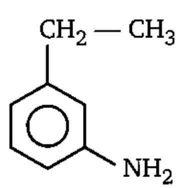
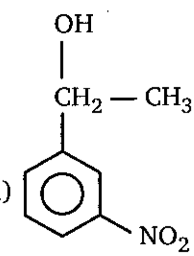
(a) Wolff- Kishner reduction

(b) Clemmensen reduction

(c) $HS-CH_2-CH_2-SH$, following by Raney Ni

(d) None of these

4.  ; Product of the Clemmensen reduction is :

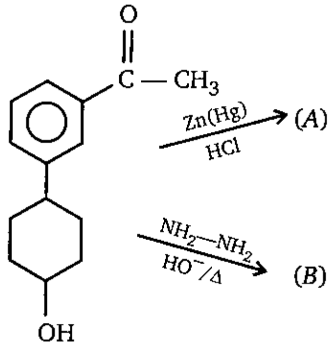
(a)  (b)  (c)  (d) 

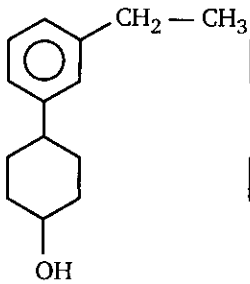
5. $CH_3-\overset{OH}{\overset{|}{C}H}-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-CH_3 \longrightarrow CH_3-\overset{OH}{\overset{|}{C}H}-(CH_2)_3-CH_3$

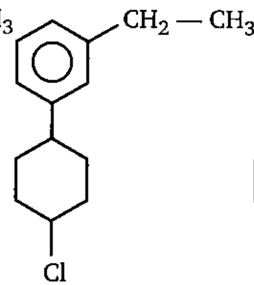
Above conversion can be achieved by :

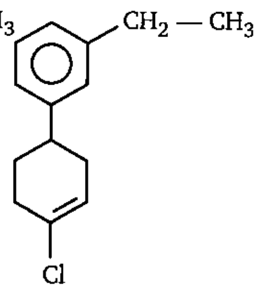
(a) Wolff-Kishner reduction (b) Clemmensen reduction

(c) $LiAlH_4$ (d) $NaBH_4$

6. 

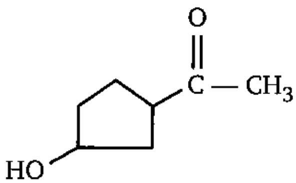

(P)

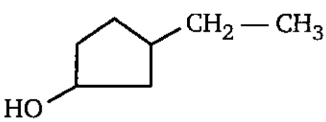

(Q)

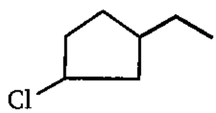

(R)

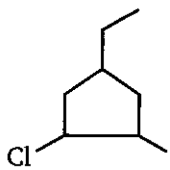
Identify product (A) & (B) from the given product P, Q, R:

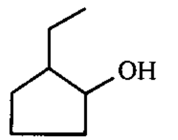
(a) $A = P$, $B = Q$ (b) $A = Q$, $B = R$ (c) $A = Q$, $B = P$ (d) $A = R$, $B = P$

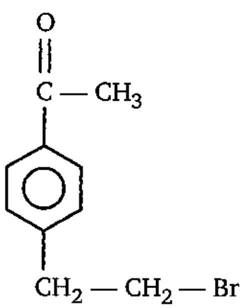
7.  $\xrightarrow[\text{HCl}]{\text{Zn(Hg)}}$ (A) ; Identify the A.

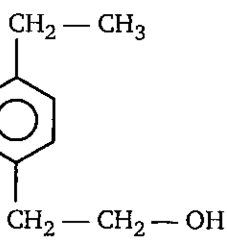
(a) 

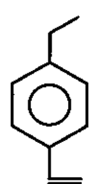
(b) 

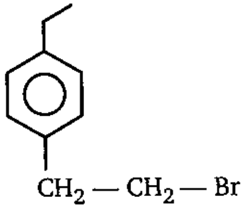
(c) 

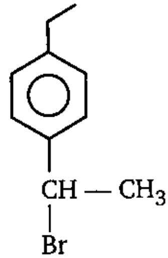
(d) 

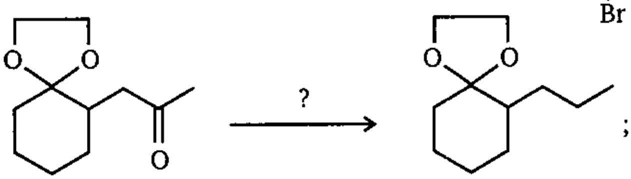
8.  $\xrightarrow[\text{HO}^-,\Delta \text{ (Wolff-Kishner reduction)}]{N_2H_4}$ (A) ; Product (A) is :

(a) 

(b) 

(c) 

(d) 

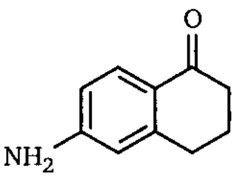
9. 

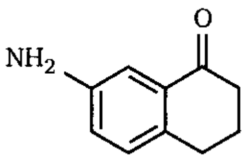
Above conversion can be carried out by :

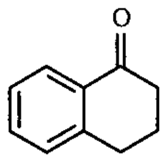
(a) Clemmensen reduction (b) Wolff-Kishner reduction

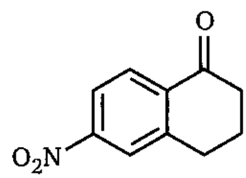
(c) $LiAlH_4$ (d) $NaBH_4$

10. Increasing order of equilibrium constants for the formation of a hydrate:


(I)

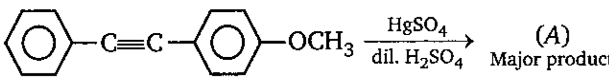

(II)

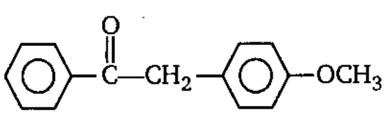

(III)

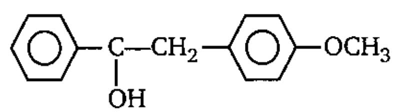

(IV)

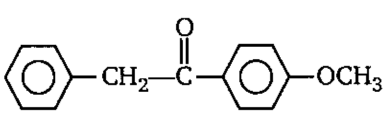
(a) IV < III < II < I (b) IV < III < I < II

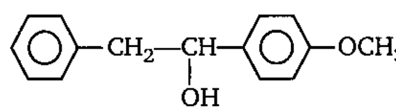
(c) I < II < III < IV (d) II <III < I < IV

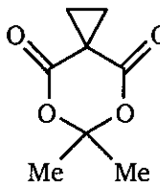
11.  Product (A) is:

(a) 

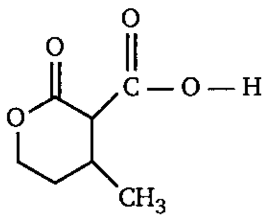
(b) 

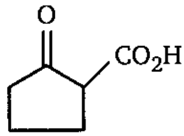
(c) 

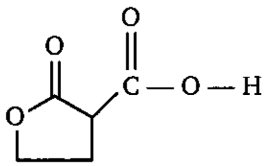
(d) 

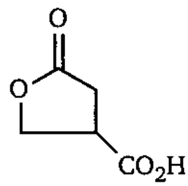
12.  $\xrightarrow{H_2O}$ (*A*)

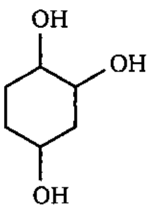
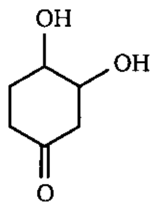
Predict the product of hydrolysis of the above molecule.

(a) 

(b) 

(c) 

(d) 

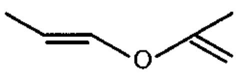
13.  $\longrightarrow$  , This conversion can be achieved by :

(a) $Me_2CO/H^+, H_3O^{\oplus}, KMnO_4/HO^-$

(b) $Me_2CO/H^+, KMnO_4, H_3O^+$

(c) $KMnO_4/NaO_4$, Me_2CO/H^+, H_3O^+

(d) $KMnO_4/NaIO_4$, H_3O^+, Me_2CO/H^+

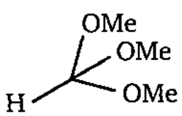
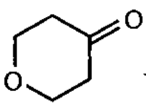
14.  $\xrightarrow{H_3O^{\oplus}}$ *A* + *B*. Compound (*A*) & (*B*) can be differentiated by:

(a) 2-4-DNP

(b) Fehling solution

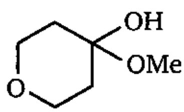
(c) Lucas reagent

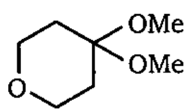
(d) $NaHSO_3$

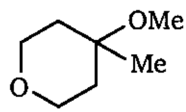
15.  +  $\xrightarrow[20°C, 15 min]{HOH, H^+/catalyst}$ (*A*) + $H-\overset{O}{\overset{\|}{C}}-OMe$; Product (*A*) is :

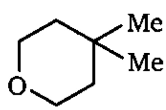
trimethyl orthoformate

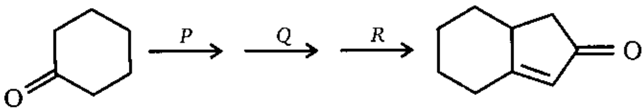
Methyl formate

(a) 

(b) 

(c) 

(d) 

16. 

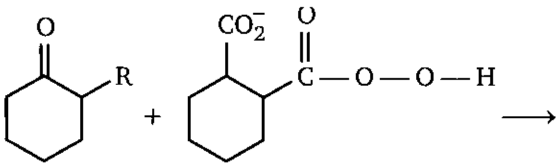
Reagents to carry out above conversion, P, Q, R respectively are :

(a) $H_2C=CH-CH_2-Br, (HO^{\ominus}), [HO^{\ominus}, \Delta]$, Wacker-process

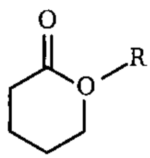
(b) $H_2C=CH-CH_2-Br(HO^{\ominus})$, Wacker-process, $HO^{\ominus}, \Delta$

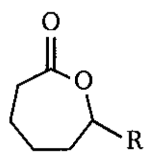
(c) Wacker process, $H_2C=CH-CH_2-Br(HO^{\ominus}), HO^{\ominus}(\Delta)$

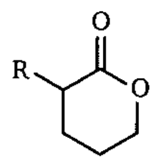
(d) Wacker process, $HO^{\ominus}(\Delta), H_2C=CH-CH_2-Br(HO^{\ominus})$

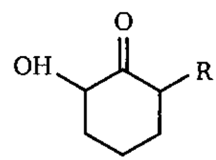
17. 

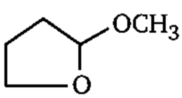
Above reaction is a Baeyer Villiger rearrangement of an asymmetric ketone with magnesium mono peroxo pthalate hexahydrate (in the drawing, Mg^{+2} is omitted for clearity) Identify major product.

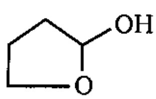
(a) 

(b) 

(c) 

(d) 

18. 

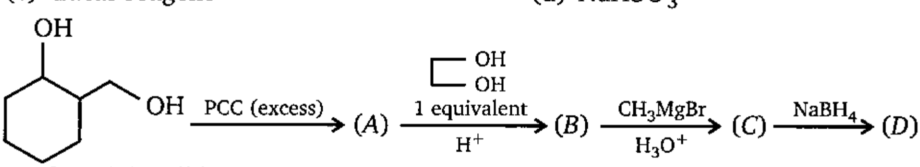
and 

,

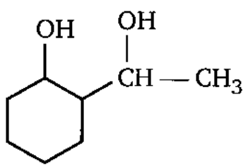
Above compounds can be differentiated by following reagent:

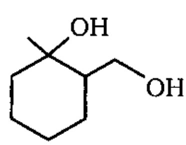
(a) 2-4 DNP (Brady reagent) (b) Tollen's reagent

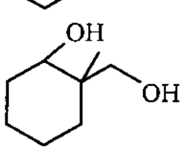
(c) Lucas reagent (d) $NaHSO_3$

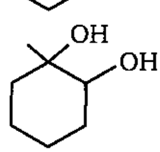
19. 

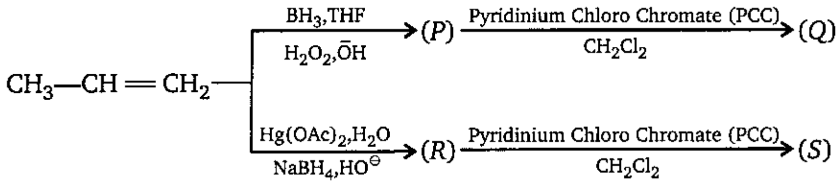
Product (D) will be :

(a) 

(b) 

(c) 

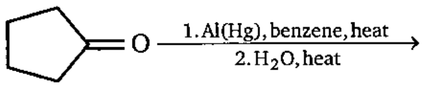
(d) 

20. 

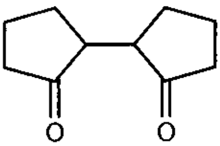
Relationship between products (Q) and (S) is:

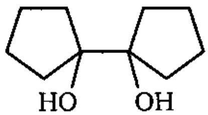
(a) Positional isomer (b) Chain isomer

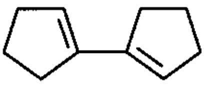
(c) Stereoisomer (d) Functional isomer

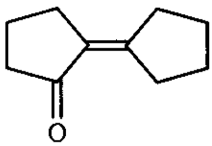
21. In the reaction, 

X, the product (X) is :

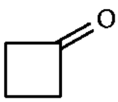
(a) 

(b) 

(c) 

(d) 

22. Rank the following in order of increasing value of the equilibrium constant for hydration, $K_{\text{hyd.}}$ (smallest value first).

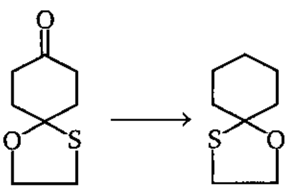


1

2

$(CH_3)_3C\overset{O}{\overset{\|}{C}}C(CH_3)_3$
3

(a) 1 < 2 <3 (b) 3 < 1 < 2 (c) 2 < 1 < 3 (d) 2 < 3 < 1

23. 

Above conversion can be achieved by:

(a) $Zn(Hg), HCl$ (b) $NH_2 - NH_2/KOH/\Delta$

(c) $LiAlH_4$ (d) H_2/Ni

24. Which sequence represents the best synthesis of hexanal ?

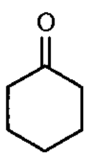
$$\underset{\text{Hexanal}}{CH_3CH_2CH_2CH_2CH_2CH=O}$$

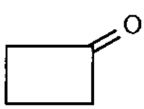
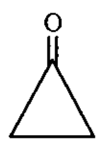
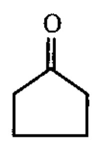
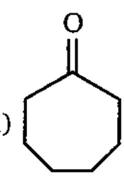
(a) 1. $CH_3CH_2CH_2\ CH_2Br + NaC \equiv CH$
   2. $H_2O,\ H_2SO_4, HgSO_4$

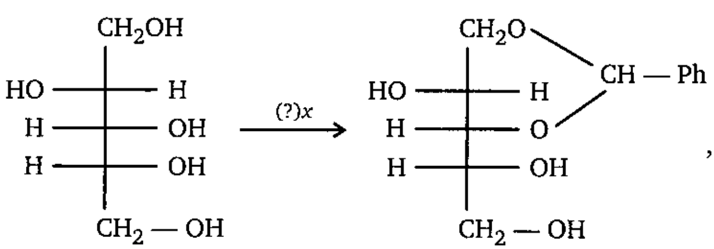
(b) 1. $CH_3CH_2CH_2CH = CH_2 + CH_3\overset{O}{\overset{\|}{C}}OOH$
   2. CH_3MgBr, diethyl ether
   3. H_3O^+
   4. PCC, CH_2Cl_2

(c) 1. $CH_3CH_2CH_2CH_2\overset{O}{\overset{\|}{C}}CH_3$
   2. $CH_3\overset{O}{\overset{\|}{C}}OOH$ 3. $LiAlH_4$
   4. H_2O 5. PCC, CH_2Cl_2

(d) 1. $CH_3CH_2CH_2CH_2MgBr + H_2C \underset{O}{—} CH_2$
   2. H_3O^+ 3. PCC, CH_2Cl_2

25.  $\xrightarrow{HNO_3} (A) \xrightarrow{Ca(OH)_2} (B)$, Product (B) in this reaction is :

(a)    (b)    (c)    (d) 

26. 

Compound (x) in the above reaction is :

(a) $Ph-\overset{O}{\overset{\|}{C}}-CH_3$ (b) $Ph-\overset{O}{\overset{\|}{C}}-H$

(c) $Ph-CH_2-\overset{O}{\overset{\|}{C}}-H$ (d) $Ph-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

27. $Ph-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[HCl]{NaNO_2} (A) \xrightarrow[heat]{AC_2O} (B) \xrightarrow{H_3O^+} (C)$

Product (C) of the above reaction is :

(a) $Ph-CO_2H$

(b) $Ph-\overset{\overset{O}{\|}}{C}-CO_2H$

(c) $Ph-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-H$

(d) $Ph-\overset{\overset{O}{\|}}{C}-CH_2OH$

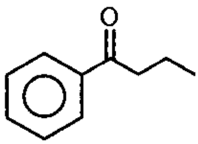
28.  $\xrightarrow[2HCl]{H-\overset{\overset{O}{\|}}{C}-H} (A) \xrightarrow{AgNO_2} (B)$; Product (B) of the reaction is :

(a) $Ph-CH_2-NO_2$

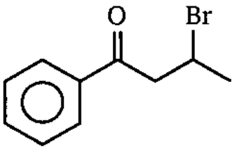
(b) $Ph-CH_2-ONO$

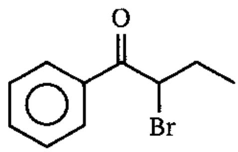
(c) $Ph-CHO$

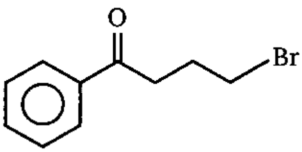
(d) $Ph-O-N=O$

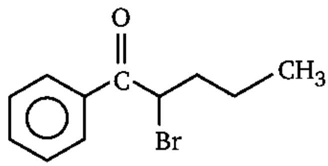
29.  $\xrightarrow[\text{0.75 mole \%, } AlCl_3\ Et_2O]{Br_2} (A)$; (100%)

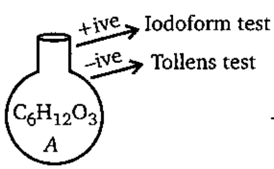
Product (A) of the above reaction is (bromination occur not in the benzene ring) :

(a) 

(b) 

(c) 

(d) 

30. 

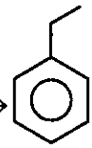
$\xrightarrow[\text{drop of } H_2SO_4]{H_2O}$ Positive Tollens test

Compound (A) is :

(a) $CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{OCH_3}{|}}{CH}-\underset{\underset{OCH_3}{|}}{CH_2}$

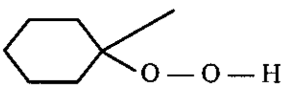
(b) $CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{OCH_3}{|}}{\overset{\overset{OCH_3}{|}}{C}}-CH_3$

(c) $CH_3-\overset{\overset{\large O}{||}}{C}-CH_2-\underset{\underset{\large OCH_3}{|}}{CH}-OCH_3$ (d) $H-\overset{\overset{\large O}{||}}{C}-CH_2-CH_2-\underset{\underset{\large OCH_3}{|}}{CH}-OCH_3$

31. $\underset{(A)}{C_{16}H_{16}} \xrightarrow{O_3} \underset{C_8H_8O}{(B)} \xrightarrow[HO^-/\Delta]{NH_2-NH_2}$  ; Reactant (*A*) in this reaction is :

(a) $\begin{matrix} Ph \\ Ph \end{matrix}\!\!>C=C<\!\!\begin{matrix} CH_3 \\ CH_3 \end{matrix}$ (b) $\begin{matrix} Ph \\ CH_3 \end{matrix}\!\!>C=C<\!\!\begin{matrix} CH_3 \\ Ph \end{matrix}$

(c) $\begin{matrix} Ph \\ CH_3 \end{matrix}\!\!>C=C<\!\!\begin{matrix} Ph \\ CH_3 \end{matrix}$ (d) both (b) and (c)

32.  $\xrightarrow{H_3O^{\oplus}}$ (P) $C_7H_{14}O_2$

1-methyl 1-cyclohexyl hydrogen peroxide

(P) → +ive Iodoform test; +ive 2-4 DNP test; +ive test with CrO_3

Compound (*P*) is :

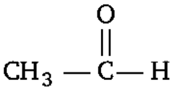
(a) $CH_3-\overset{\overset{\large O}{||}}{C}-CH_2-CH_2-CH_2-\underset{\underset{\large OH}{|}}{CH}-CH_3$

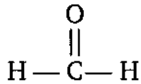
(b) $CH_3-\overset{\overset{\large O}{||}}{C}-CH_2-\overset{\overset{\large OH}{|}}{CH}-CH_2-CH_2-CH_3$

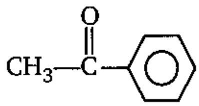
(c) $CH_3-\overset{\overset{\large O}{||}}{C}-CH_2-CH_2-CH_2-CH_2-CH_2-OH$

(d) $CH_3-\overset{\overset{\large O}{||}}{C}-\underset{\underset{\large CH_3}{|}}{CH}-\overset{\overset{\large OH}{|}}{\underset{\underset{\large CH_3}{|}}{C}}-CH_3$

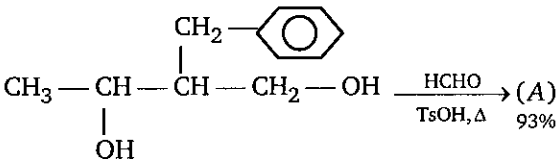
33. Correct order of reactivity of following compounds towards Grignard reagent?

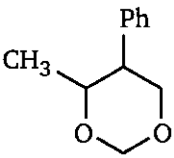

(I)

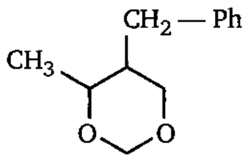

(II)

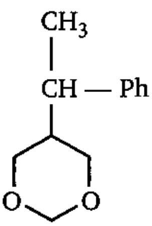

(III)

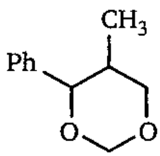
(a) I > II > III (b) II > I > III (c) II > III > I (d) I > III > II

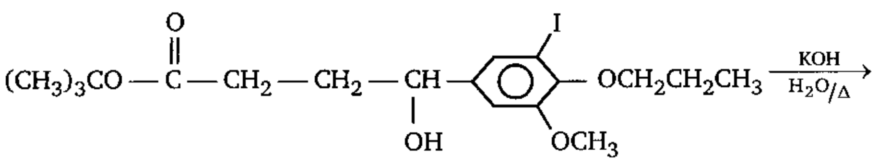
34.  ; Product (A) is :

(a) 

(b) 

(c) 

(d) 

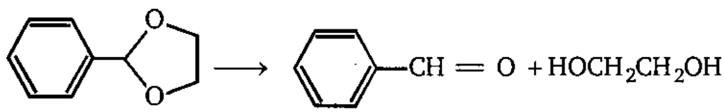
35. 

Total number of products obtained in above reaction is :

(a) 2 (b) 3

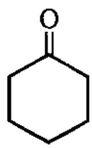
(c) 4 (d) 5

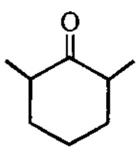
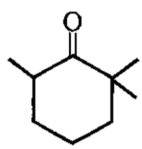
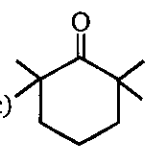
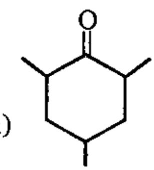
36. What reagent and/or reaction conditions would you choose to bring about the following conversion?

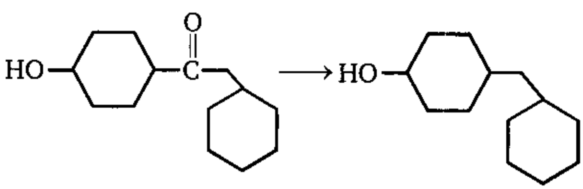


(a) 1. $LiAlH_4$, 2. H_2O (b) H_2O, H_2SO_4, heat

(c) H_2O, NaOH, heat (d) PCC, CH_2Cl_2

37.  $\xrightarrow[\text{KH excess}]{\text{MeI excess}}$ 81% yield ; Product of the reaction is :

(a)  (b)  (c)  (d) 

38. 

The above reduction can be best carried out by :

(a) Clemmensen reduction (b) Wolff-Kishner reduction

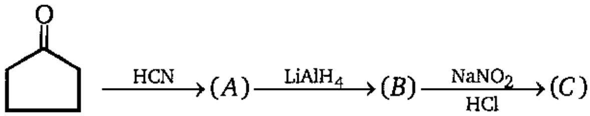
(c) $NaBH_4$ (d) None of these

39. $CH_3-C\equiv CH \xrightarrow[\text{dil. } H_2SO_4]{HgSO_4} (A)$

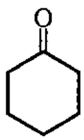
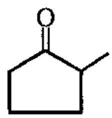
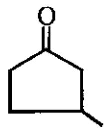
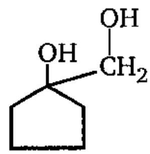
$CH_3-C\equiv CH \xrightarrow[(2) H_2O_2/HO^-]{(1) BH_3\cdot THF} (B)$

Product (A) and (B) is differentiated by:

(a) 2-4-DNP (b) NaOI (c) Na-metal (d) $NaHSO_3$

40. 

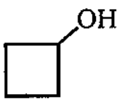
End product (C) in above reaction is :

(a)  (b)  (c)  (d) 

41. Compound (X) C_4H_8O, which reacts with 2, 4-DNP derivative and gives negative haloform test is :

(a) $CH_3-\overset{\overset{O}{||}}{C}-CH_2-CH_3$

(b) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CHO$

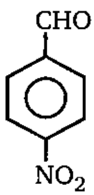
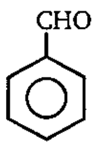
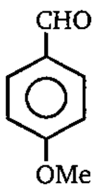
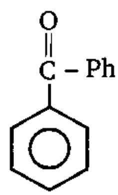
(c) 

(d) $CH_3-CH_2-\overset{\overset{OH}{|}}{CH}-CH_3$

42. When a nucleophile encounters a ketone, the site of attack is :

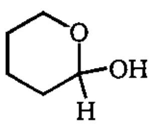
(a) the carbon atom of the carbonyl
(b) the oxygen atom of the carbonyl
(c) both the carbon and oxygen atoms, with equal probability
(d) no attack occurs as ketones do not react with nucleophiles

43. The correct order of rate of reaction toward nucleophilic addition reaction:

   $CH_3-\overset{\overset{O}{||}}{C}-Et$ 

(a) (b) (c) (d) (e)

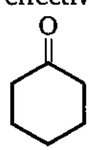
(a) $a > b > c > d > e$
(b) $a > b > d > c > e$
(c) $a > d > e > b > c$
(d) $a > b > e > d > c$

44. The structure  would be best classified as a(an) :

(a) Acetal (b) Hemiacetal (c) Hydrate (d) Cyanohydrin

45. Which of the following pairs of reactants is most effective in forming an enamine ?

(a) $CH_3CH_2\overset{\overset{O}{||}}{C}H + [(CH_3)_2CH]_2NH$

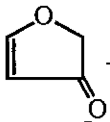
(b)  $+ CH_3-NH-CH_3$

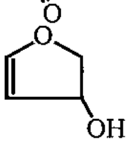
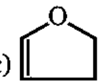
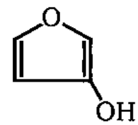
(c) $(CH_3)_3\overset{\overset{O}{\|}}{C}H + (CH_3)_2NH$ (d) None of these form an enamine.

46. The reaction of $C_6H_5CH=CHCHO$ with $LiAlH_4$ gives :

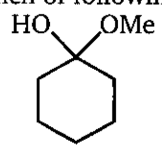
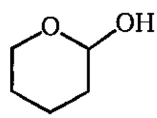
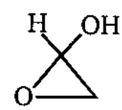
(a) $C_6H_5CH_2CH_2CH_2OH$ (b) $C_6H_5CH=CHCH_2OH$

(c) $C_6H_5CH_2CH_2CHO$ (d) $C_6H_5CH_2CHOHCH_3$

47.  $\xrightarrow{NaBH_4} (A) \xrightarrow[\Delta]{H^+} (B)$; Product (*B*) of the reaction is :

(a)  (b)  (c)  (d) 

48. Which of following compound is hemiacetal ?

(a)  (b)  (c)  (d) all of these

49. $Ph-CH_2-C\equiv N \xrightarrow[THF]{LDA} \xrightarrow{CH_3I} 71\%$; End product of the reaction will be :

(a) $Ph-CH_2-CH_2-NH_2$ (b) $Ph-CH_2-NH_2$

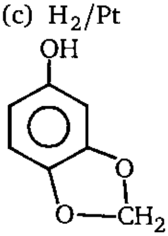
(c) $Ph-\underset{\underset{CH_3}{|}}{CH}-C\equiv N$ (d) $Ph-CH=C=N-CH_3$

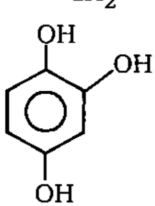
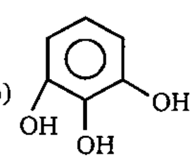
50. $Ph-CH=CH-\overset{\overset{O}{\|}}{C}-CH_3 \longrightarrow Ph-CH=CH-CO_2H$

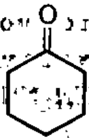
Above conversion can be achieved by :

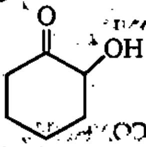
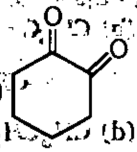
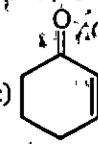
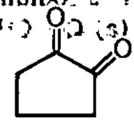
(a) $KMnO_4, \Delta$ followed by H^+ (b) $I_2/NaOH$ followed by H^+

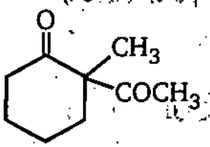
(c) H_2/Pt (d) $LiAlH_4$

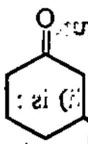
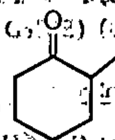
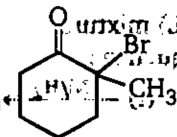
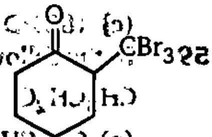
51.  $\xrightarrow{H_3O^{\oplus}}$ Products ; Product of the reaction is/are :

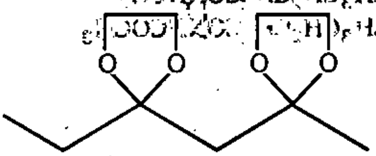
(a)  (b)  (c) HCHO (d) Both (a) and (c)

52.  $\xrightarrow{SeO_2}$ (*A*); Product (*A*) of the reaction is :

(a)  (b)  (c)  (d) 

53.  $\xrightarrow{Br_2 + NaOH}$ (*A*) + $CHBr_3$; (*A*) $\xrightarrow[\Delta]{H^+}$ (*C*); Product (*C*) of the reaction is :

(a)  (b)  (c)  (d) 

54.  $\xrightarrow{H_3O^{\oplus}}$ (*A*) + 2 Glycol

Product (*A*) of the reaction will be :

(a) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-CH_3$

(b) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

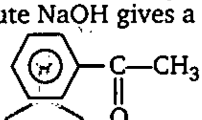
(c) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

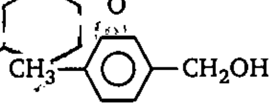
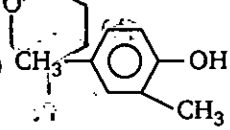
(d) $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

55. $R-\overset{O}{\overset{\|}{C}}-H \xrightarrow{R-NH_2} R'-CH=N-R$. This reaction gives best yield at :

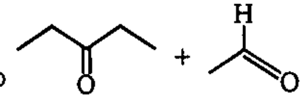
(a) pH 1 - 2 (b) pH 4 - 5 (c) pH 10 - 11 (d) pH 13 - 14

56. An aromatic compound *A* of the molecular formula $C_8H_{10}O$ on reaction with iodine and dilute NaOH gives a yellow precipitate. The structure of the compound is expected to be:

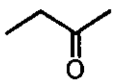
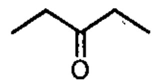
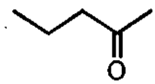
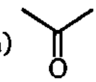
(a)  (b) $C_6H_5CHOHCH_3$

(c)  (d) 

69. Consider the following sequence of reactions.

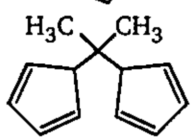
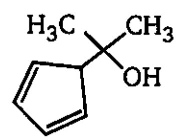
Ketone $A \xrightarrow[2.\ H_2O]{1.\ C_2H_5MgBr} B \xrightarrow[-H_2O]{H_2SO_4,\ heat} C \xrightarrow[2.\ Zn,\ H_2O]{1.\ O_3}$ 

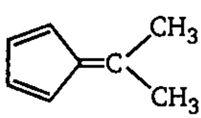
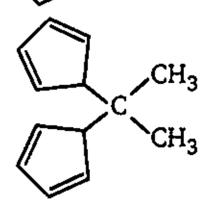
The ketone (A) is :

(a)  (b)  (c)  (d) 

70. In the reaction,

 $+\ CH_3COCH_3 \xrightarrow[heat]{EtONa/EtOH} X$, the product ($X$) is :

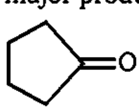
(a)  (b) 

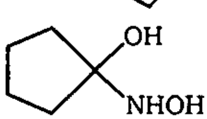
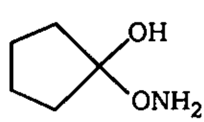
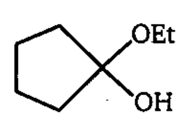
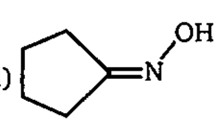
(c)  (d) 

71. The conversion of acetophenone into benzoic acid can be achieved by its reaction with :
(a) sodium hydroxide followed by acidification
(b) iodine and sodium hydroxide, followed by acidification
(c) hydroxylamine followed by reaction with H_2SO_4
(d) m-chloroperoxobenzoic acid

72. In which of the following compounds the methylenic hydrogens are the most acidic ?
(a) $CH_3COCH_2CH_3$ (b) $CH_3CH_2COOC_2H_5$
(c) $CH_3CH_2CH(COOC_2H_5)_2$ (d) CH_3COCH_2CN

73. Which is the major product of the following reaction ?

 $\xrightarrow[H^{\oplus}]{NH_2OH}$

(a)  (b)  (c)  (d) 

74. $Ph-\overset{\overset{O}{||}}{C}-OH \xrightarrow{SOCl_2} (A) \xrightarrow[Pd\text{-}BaSO_4]{H_2} (B)$

Product (B) is :

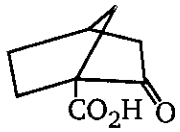
(a) $\mathrm{Ph-\overset{\overset{O}{||}}{C}-H}$ (b) $\mathrm{Ph-CH_2-OH}$

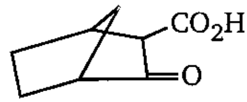
(c) $\mathrm{Ph-CH_2-Cl}$ (d) $\mathrm{Ph-CH=CH_2}$

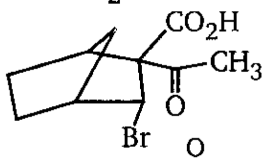
75. The presence of unsaturation in organic compounds can be tested with :
(a) Schiff's reagent (b) Tollens' reagent (c) Fehling's reagent (d) Baeyer's reagent

76. Which of the following gives iodoform test ?
(a) CH_3CH_2OH (b) C_2H_5CHO (c) $(CH_2OH)_2$ (d) None of these

77. Which of the following β-keto carboxylic acid does not undergo decarboxylation on heating ?

(a) 

(b) 

(c) 

(d) None of these

78. $\mathrm{HOCH_2CH_2CH_2-\overset{\overset{O}{||}}{C}-OCH_2CH_3 \xrightarrow{PCC} (\mathit{A}) \xrightarrow[\text{(1 molar equivalent)}]{H_2C=CHMgBr} (\mathit{B}) \xrightarrow{NH_4Cl/H_2O} (\mathit{C})}$

$\mathrm{\xrightarrow[H_2O]{KOH} \xrightarrow{H_3O^{\oplus}} \xrightarrow[\text{Pyridine}]{(CH_3-\overset{\overset{O}{||}}{C})_2O} (\mathit{D})}$

Product (*D*) is :

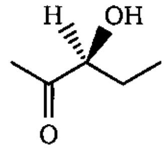
(a) $\mathrm{H_2C=CH-\overset{O-\overset{\overset{O}{||}}{C}-CH_3}{\overset{|}{CH}}-CH_2-CH_2-\overset{\overset{O}{||}}{C}-OH}$

(b) $\mathrm{H_2C=CH-CH_2-\underset{\underset{OH}{|}}{C}-CO_2H}$

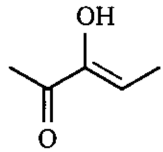
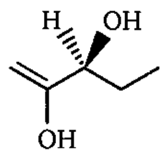
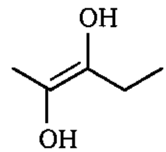
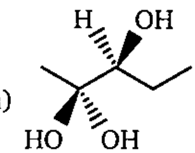
(c) $\mathrm{H_2C=CH-\underset{\underset{OH}{|}}{C}-CH_2-CH_2-\overset{\overset{O}{||}}{C}-O-\overset{\overset{O}{||}}{C}-CH_3}$

(d) $\mathrm{H_2C=CH-CH_2-\underset{\underset{OH}{|}}{CH}-CH_2-\overset{\overset{O}{||}}{C}-O-H}$

79. The compound shown in the below undergoes racemization on reaction with aqueous acid.



Which of the following structures best represents the intermediate responsible for this process?

(a) 
(b) 
(c) 
(d) 

80. The final product of the following sequence of reaction is :

$$(CH_3O)_2CHCH_2CH_2CH_2Br \xrightarrow{Mg} \xrightarrow{H_2C=O} \xrightarrow[\text{heat}]{H_3O^+}$$

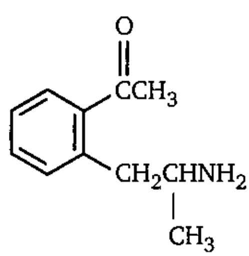
(a) $CH_3O\overset{O}{\overset{\|}{C}}CH_2CH_2CH_2CH_2OH$

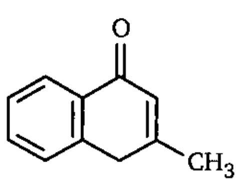
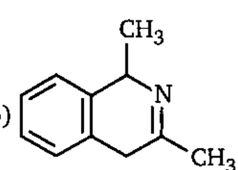
(b) $CH_3\overset{O}{\overset{\|}{C}}CH_2CH_2CH_2CH_2OH$

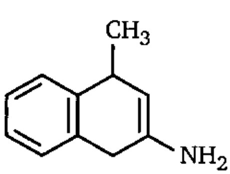
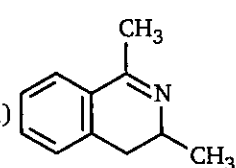
(c) $H\overset{O}{\overset{\|}{C}}CH_2CH_2CH_2CH_2OH$

(d) $H\overset{O}{\overset{\|}{C}}CH_2CH_2CH_2\overset{O}{\overset{\|}{C}}H$

81. The amino ketone shown below undergoes a spontaneous cyclization on standing. What is the major product of this intramolecular reaction ?



(a) 
(b) 

(c) 
(d) 

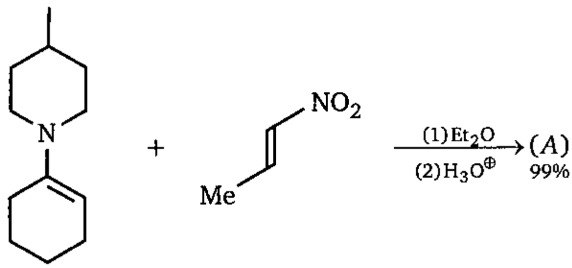
82. Compound (A) $C_6H_{12}O$ is optically active. Compound (A) give negative Tollens test and positive test with 2-4-di-nitro phenyl hydrazine. Identify A.

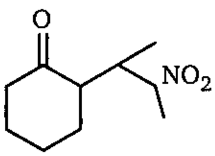
(a) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-\underset{\underset{CH_3}{|}}{CH}-CH_3$

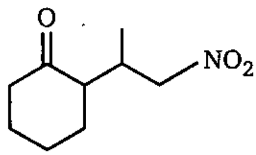
(b) $CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_2-CH_3}{|}}{CH}-CH_3$

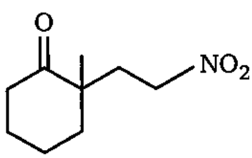
(c) $H-\overset{\overset{O}{\|}}{C}-CH_2-\underset{\underset{CH_2-CH_3}{|}}{CH}-CH_3$

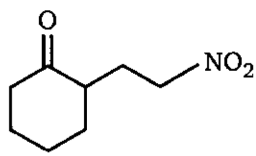
(d) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_2-CH_3$

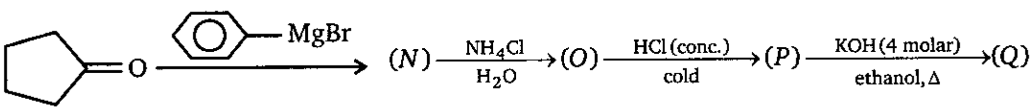
83.  ; Product (A) of the reaction is :

(a) 

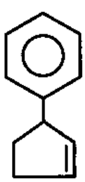
(b) 

(c) 

(d) 

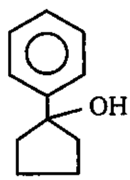
84. 

Product (Q) will be :

(a) 

(b) 

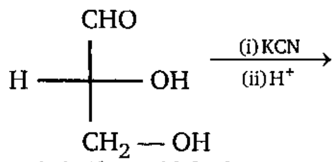
(c) 

(d) 

85. $Ph-CH_3 \xrightarrow{CrO_2Cl_2} (A) \xrightarrow{\text{conc.KOH}} Ph-CH_2OH + (B)$

Product (B) of above the reaction is :

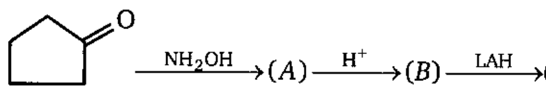
(a) $Ph-CO_2H$ (b) $Ph-CO_2^-$ (c) $Ph-CHO$ (d) $Ph-CH_3$

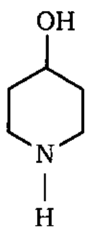
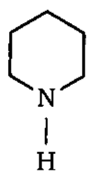
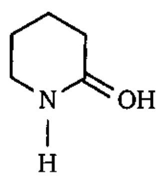
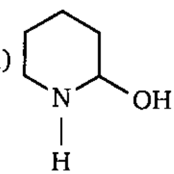
86.  Product ; Product obtained in the reaction is :

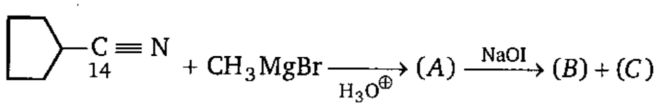
D-(+)-Glyceraldehyde

(a) Diastereomer (b) Racemic

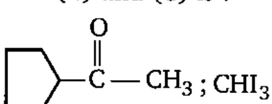
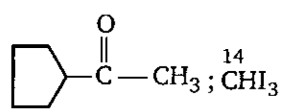
(c) Meso (d) Optically pure enantiomer

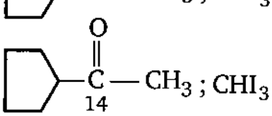
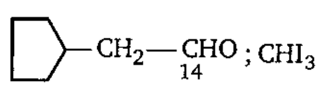
87.  Product (C) of the reaction is :

(a)  (b)  (c)  (d) 

88. 

Product (A) and (C) is :

(a)  (b) 

(c)  (d) 

89. $Ph-CH(OH)-CH_3 \xrightarrow{PCC} (A) \xrightarrow{NH_2-NH-\overset{O}{\overset{\|}{C}}-NH_2} (B)$

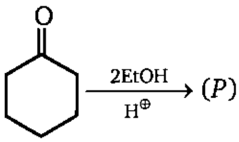
Product (B) is :

(a) $Ph-\underset{}{\overset{CH_3}{\overset{|}{C}}}=N-\overset{O}{\overset{\|}{C}}-NH-NH_2$

(b) $Ph-\underset{CH_3}{\underset{|}{C}}=N-NH-\overset{O}{\overset{\|}{C}}-NH_2$

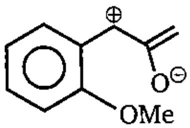
(c) $Ph-CH=N-\underset{CH_3}{\underset{|}{N}}-\overset{O}{\overset{\|}{C}}-NH_2$

(d) $Ph-CH=N-\overset{O}{\overset{\|}{C}}-NH_2$

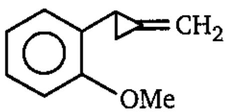
90. 

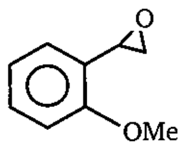
Product (P) is :

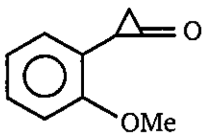
(a) Hemiacetal (b) Acetal (c) Alcohol (d) Alkane

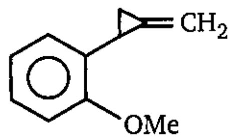
91.  ; Product of rearrangement is :

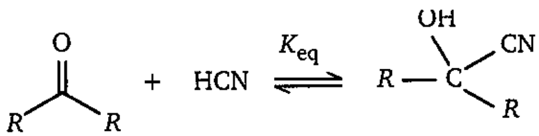
(Oxyallyl cation)

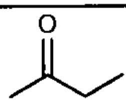
(a) 

(b) 

(c) 

(d) 

92. 

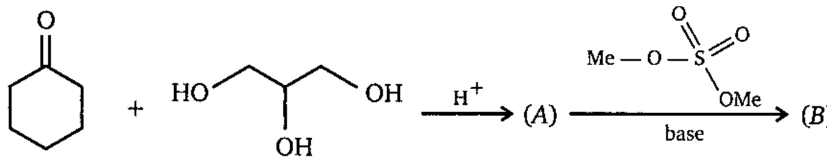
Reactant	$K_{eq.}$
PhCHO	a
	b
$Ph-\overset{O}{\overset{\parallel}{C}}-CH_3$	c
$CH_3-\overset{O}{\overset{\parallel}{C}}-H$	d

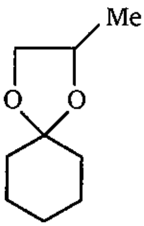
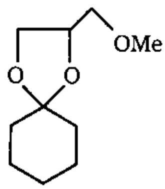
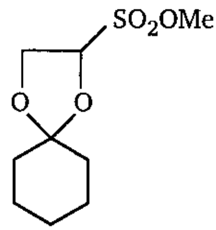
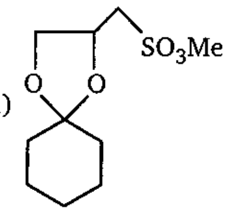
The correct order of decreasing value of $K_{eq.}$ is :

(a) $a > b > c > d$ (b) $d > a > b > c$

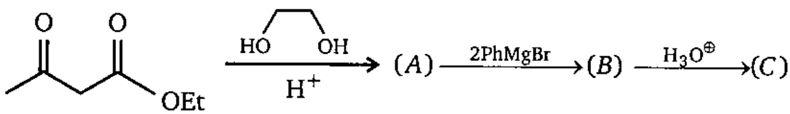
(c) $d > b > a > c$ (d) $d > a > c > d$

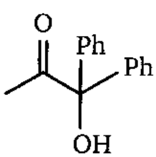
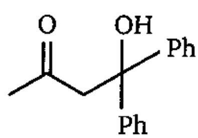
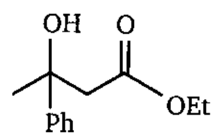
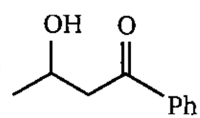
93. Product (*B*) of the given reaction is :



(a)  (b)  (c)  (d) 

94. End product (*C*) of the reaction is :



(a)  (b)  (c)  (d) 

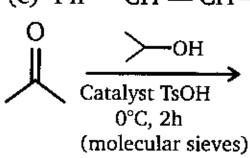
95. (*A*) $C_{11}H_8O$ → does not undergo self aldol condensation

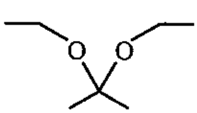
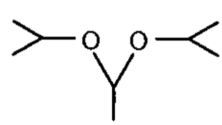
(*A*) $\xrightarrow{O_3}$ Ph — CHO + 2b $\xrightarrow{Ag^+}$ oxalic acid

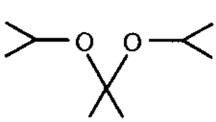
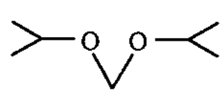
Compound (*A*) will be :

(a) Ph — C ≡ C — C ≡ C — CHO (b) Ph — C ≡ C — CH = CH — CHO

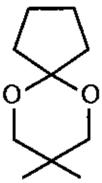
(c) Ph — CH = CH — C ≡ C — CHO (d) Ph — CH = CH — C = CH — CO_2H

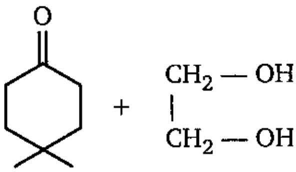
96.  Product ; Product of the reaction is :
(62% yield)

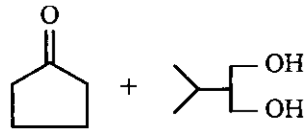
(a)  (b) 

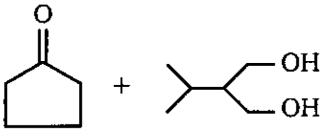
(c)  (d) 

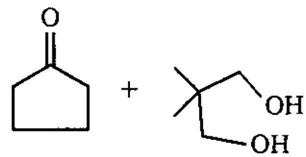
97. Which pair of reactants compounds may be used to make given acetal ?

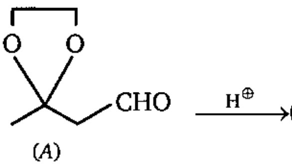


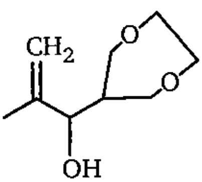
(a) 

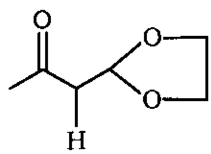
(b) 

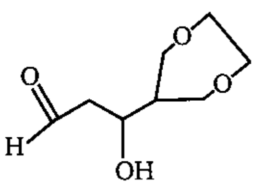
(c) 

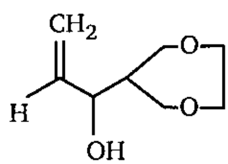
(d) 

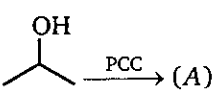
98.  (B) ; (A) & (B) are isomers ; Isomer (B) is :

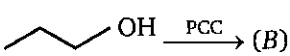
(a) 

(b) 

(c) 

(d) 

99. 



(A) and (B) is differentiated by :

(a) NaH (b) 2-4 DNA (c) Tollen's reagent (d) $NaHSO_3$

100. Which of the following pairs cannot be differentiated by Tollens' reagent ?

(a) Benzaldehyde and benzyl alcohol
(b) Hexanal and 2-hexanone
(c) 2-Hexanol and 2-hexanone
(d) Pentanal and diethyl ether

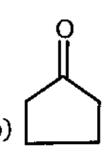
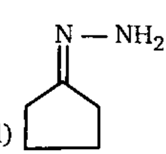
101. An optically active compound $C_6H_{12}O$ gives positive test with 2, 4-dinitrophenyl hydrazine, but negative with Tollens' reagent, what is the structure of the compound ?

(a) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_2-CH_3$
(b) $H-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-CH_3$
(c) $CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3$
(d) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-CH_3$

102. Compound (A) $C_6H_{12}O_3$, when treated with I_2 in aqueous sodium hydroxide gives yellow precipitate. When A is treated with Tollens reagent no reaction occur. When A is hydrolysed and then treated with Tollens reagent, a silver mirror is formed in test tube. Compound (A) will be :

(a) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-\underset{\underset{OCH_3}{|}}{CH}-OH$
(b) $CH_3-\overset{\overset{O}{\|}}{C}-\overset{\overset{OCH_3}{|}}{\underset{\underset{OCH_3}{|}}{C}}-CH_3$
(c) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH(OCH_3)_2$
(d) $H-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH(OCH_3)_2$

103. $\begin{array}{l} CH_2-CH_2-CO_2H \\ | \\ CH_2-CH_2-CO_2H \end{array} \xrightarrow[BaCO_3]{\Delta} A \xrightarrow{NH_2-NH_2} B \xrightarrow[KOH]{heat} (C)$, Product (C) obtained is :

(a) $CH_3-CH=CH-CH_2$
(b) 
(c) 
(d) 

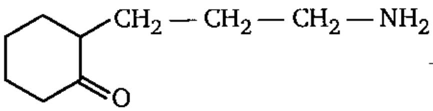
104. Which of following does not react with $NaHSO_3$ (sodium bisulphite)?

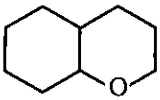
(a) $CH_3-\overset{\overset{O}{\|}}{C}-H$

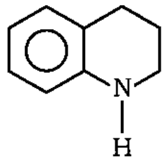
(b) $CH_3-\overset{\overset{O}{\|}}{C}-Et$

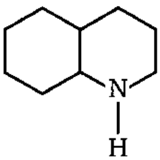
(c) $Et-\overset{\overset{O}{\|}}{C}-Et$

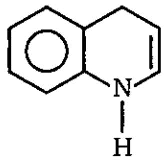
(d) $Ph-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$

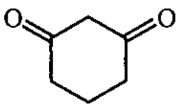
105.  $\xrightarrow[\text{Raney Ni}]{H_2}$ (A) ; Product (A) is :

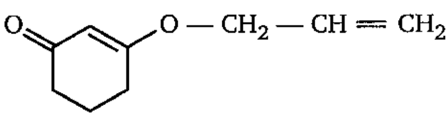
(a) 

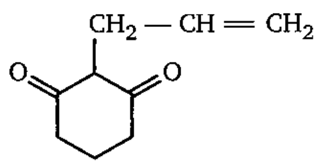
(b) 

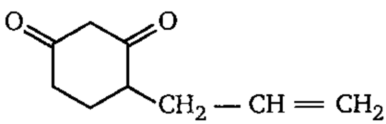
(c) 

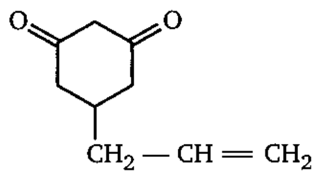
(d) 

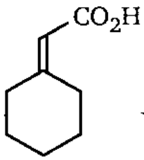
106.  $+CH_2=CH-CH_2-Br \xrightarrow[(75\%)]{KOH} (A)$; Product (A) is :

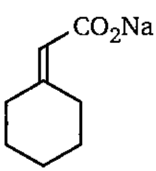
(a) 

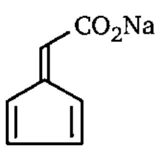
(b) 

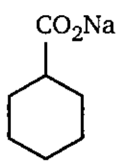
(c) 

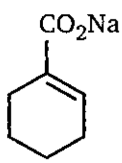
(d) 

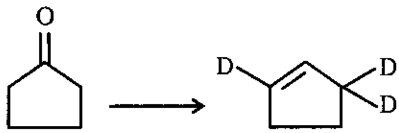
107.  $\xrightarrow[(2)\,HCl/H_2O]{(1)\,Me\text{-}Li(\text{excess})} (A) \xrightarrow[NaOH]{I_2} (B) + CHI_3$; Product (B) in this reaction is :

(a) 

(b) 

(c) 

(d) 

108. 

Arrange the following reagent in the correct order in which above transformation is carried out :

(a) $KOD/D_2O, H^+/\Delta, LiAlH_4$
(b) $H^+/\Delta, KOD/D_2O, LiAlH_4$
(c) $KOD/D_2O, LiAlH_4, H^+/\Delta$
(d) $LiAlH_4, H^+/\Delta, KOD/D_2O$

109. $CH_3-\overset{\overset{\large O}{\|}}{C}-H \xrightarrow{HCN} (A) \xrightarrow{H_3O^{\oplus}} (B) \xrightarrow[\Delta]{} (C) \xrightarrow{LiAlH_4} (D) \xrightarrow{HIO_4} HCHO + (E)$

Compound (C) can show geometrical isomerism. Product (E) of the reaction will be :

(a) $CH_3-\overset{\overset{\large O}{\|}}{C}-CH_3$
(b) $CH_3-CH_2-\overset{\overset{\large O}{\|}}{C}-H$
(c) CH_3-CHO
(d) HCHO

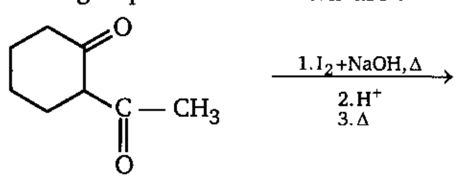
110. Arrange in their increasing order of equilibrium constants for hydration ?

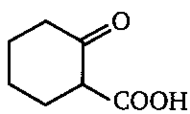
$\underset{(A)}{CH_3-\overset{\overset{\large O}{\|}}{C}-CH_3}$, $\underset{(B)}{CH_3-\overset{\overset{\large O}{\|}}{C}-H}$, $\underset{(C)}{CH_3-\overset{\overset{\large O}{\|}}{C}-CH_2-Cl}$, $\underset{(D)}{H-\overset{\overset{\large O}{\|}}{C}-H}$,

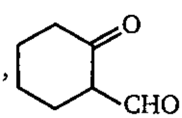
$\underset{(E)}{Cl-CH_2-\overset{\overset{\large O}{\|}}{C}-H}$

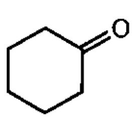
(a) $A < B < C < D < E$
(b) $A < C < B < E < D$
(c) $A < C < E < B < D$
(d) $C < A < B < E < D$

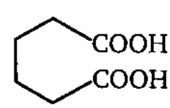
111. End products of the following sequence of reactions are :



(a) yellow ppt. of CHI_3, 

(b) yellow ppt. of CHI_3, 

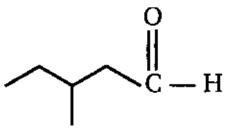
(c) yellow ppt. of CHI_3, 

(d) yellow ppt. of CHI_3, 

112. $Ph-CH_2-CN \xrightarrow[\substack{(2)\, CH_3-\overset{O}{\overset{\|}{C}}-Cl \\ (3)\, H_3O^{\oplus}/\Delta}]{(1)\, EtONa} (P)$; Product (*P*) of the reaction will be :

(a) $Ph-CH_2-\overset{O}{\overset{\|}{C}}-H$ (b) $Ph-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

(c) $Ph-\underset{CH_3}{\underset{|}{CH}}-\overset{O}{\overset{\|}{C}}-H$ (d) $Ph-\underset{CH_3}{\underset{|}{CH}}-\overset{O}{\overset{\|}{C}}-CH_3$

113.  $\xrightarrow[\text{(ii)}\, H_2SO_4]{\text{(i)}\, NaCN}$ Products. Products of the reaction are :

(a) Racemic mixture
(b) Diastereomers
(c) Meso
(d) Mixture of meso compound and optically active compound

114. $(A) \xrightarrow[\text{dil. } H_2SO_4]{HgSO_4} (B) \xrightarrow{LiAlH_4} \underset{\text{recemic mixture}}{(C)}$

∴ reactant (*A*) is :

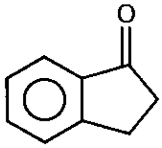
(a) $CH_3-C\equiv CH$ (b) $HC\equiv CH$

(c) $CH_3-C\equiv C-CH_3$ (d) $Ph-CH=CH_2$

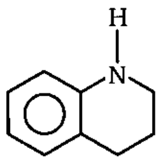
115. $CH_3CH_2-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow[HCl]{NaNO_2}$; Major product of this reaction is :

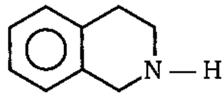
(a) $CH_3\underset{NO}{\underset{|}{CH}}-\overset{O}{\overset{\|}{C}}-CH_3$ (b) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-CH=N-OH$

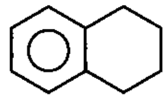
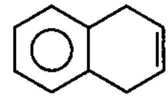
(c) $CH_3-\underset{N-OH}{\underset{\|}{C}}-\overset{O}{\overset{\|}{C}}-CH_3$ (d) $CH_3-CH_2-\underset{N-OH}{\underset{\|}{C}}-CH_3$

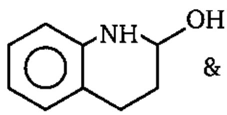
116. 

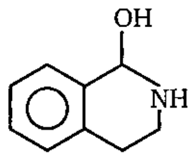
$\xrightarrow[\substack{(2)\,H^+,\Delta \\ (3)\,LiAlH_4}]{(1)\,NH_2OH}(A) + (B)$. Product (A) & (B) are :

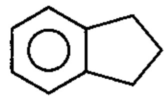
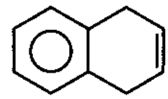
(a) 

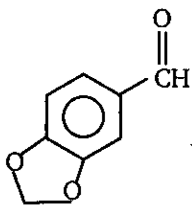
& 

(b)  & 

(c) 

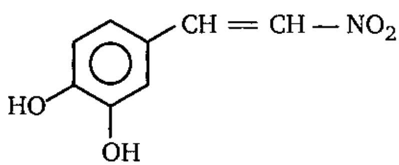
& 

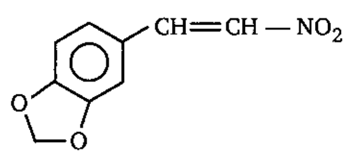
(d)  & 

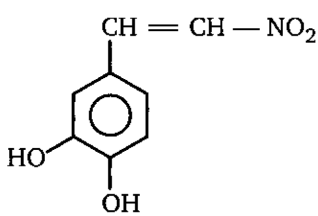
117. 

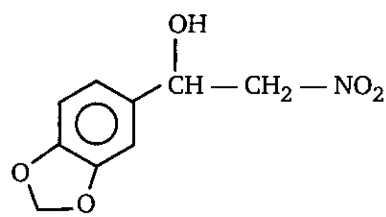
3, 4-Methylene dioxybenzaldehyde

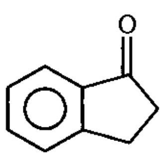
$+ \underset{\text{nitromethane}}{CH_3NO_2} \xrightarrow{NaOH} A \xrightarrow[\Delta]{HCl} \underset{93\%}{(B)}$. Product (B) is :

(a) 

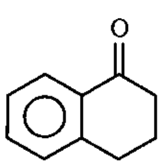
(b) 

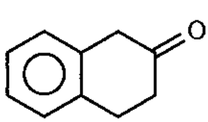
(c) 

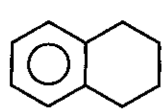
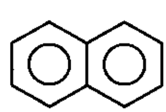
(d) 

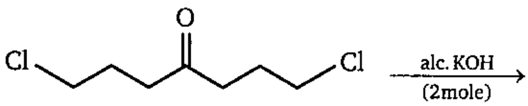
118. 

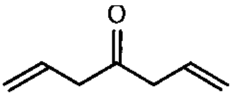
$\xrightarrow[\substack{(2)\,LiAlH_4 \\ (3)\,NaNO_2/H^+}]{(1)\,HCN} \underset{\text{major}}{(A)}$. Product (A) is :

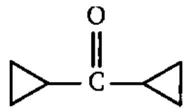
(a) 

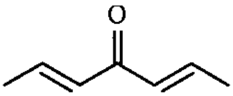
(b) 

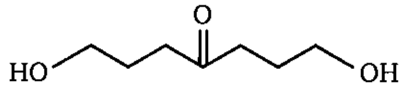
(c)  (d) 

119.  (A). Product (A) is :

(a) 

(b) 

(c) 

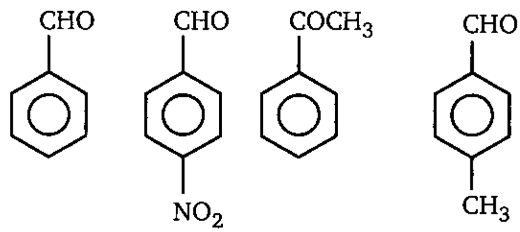
(d) 

120. $$R-\overset{\overset{\displaystyle O}{\|}}{C}-R \underset{\text{(catalyst)}}{\overset{\text{HCN}}{\rightleftharpoons}} R-\underset{\underset{\displaystyle CN}{|}}{\overset{\overset{\displaystyle OH}{|}}{C}}-R$$

Which of following can be used as a catalyst in the above reaction?

(a) Cl^- (b) $CH_3-\overset{\overset{O}{\|}}{C}-O^-$ (c) $Et-O^-$ (d) HSO_4^-

121. Arrange the following carbonyl compounds in decreasing order of their reactivity in nucleophilic addition reaciton.

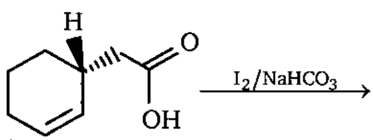


(i) (ii) (iii) (iv)

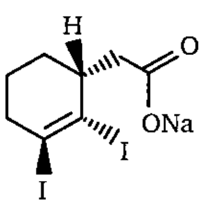
(a) ii > iii > i > iv (b) ii > i > iv > iii

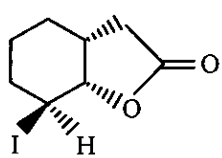
(c) iii > ii > i > iv (d) iii > i > iv > ii

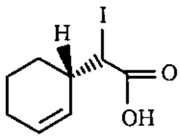
122. The following reaction were carried out.

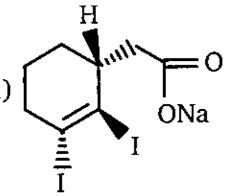


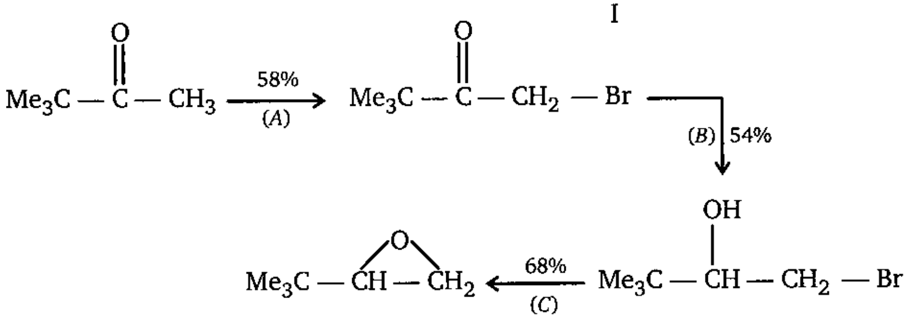
The final product formed in the above reaction sequence is :

(a) 

(b) 

(c) 

(d) 

123. 

A. Yield of each step as actually carried out in the laboratory is given above. What is overall yield of reaction?

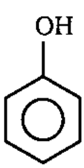
(a) 42% (b) 31%

(c) 21% (d) 60%

B. What is the appropriate reagent to carry out above synthesis, *i.e.*, *A*, *B*, *C* respectively are :

(a) Br_2/H^+, $LiAlH_4, H^{\oplus}$ (b) $Br_2/H^+, NaBH_4, HO^-$

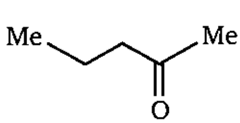
(c) NBS, $AlCl_3, HO^-$ (d) $Br_2/HO^-, BF_3, HO^-$

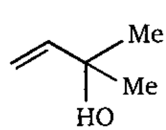
124.  $\xrightarrow[\substack{3H_2 \\ \text{(High temp} \\ \text{\& pressure)}}]{Ni} (A) \xrightarrow{Cu} (B) \xrightarrow{NH_2OH} (C) \xrightarrow{H^{\oplus}} (D) \xrightarrow{HO^-} (E)$;

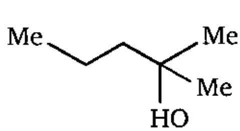
Product (*E*) is :

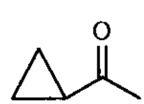
(a) Nylon 66 (b) Nylon 6 (c) Styrene (d) Polystyrene

125. Methyl vinyl ketone on reaction with $LiCuMe_2$ gives a major product, whose structure is :

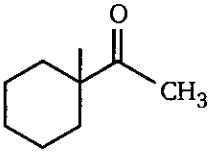
(a) 

(b) 

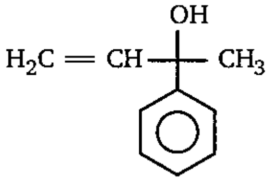
(c) 

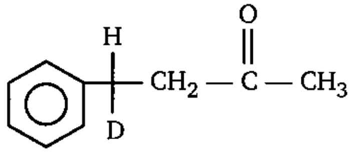
(d) 

126. Which of following is in capable to show iodoform test ?

(a) 

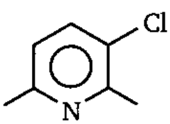
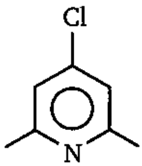
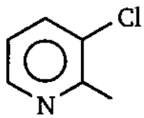
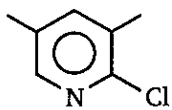
(b) $Ph-CH=CH-\underset{}{\overset{OH}{\overset{|}{C}H}}-CH_3$

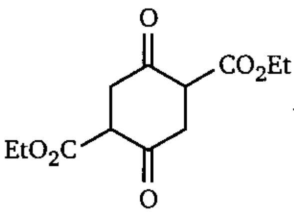
(c) 

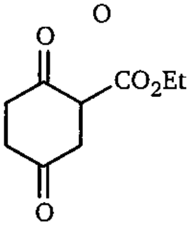
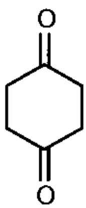
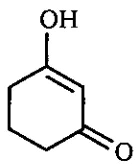
(d) 

127. $CH_3-\overset{O}{\overset{||}{C}}-CH_2-CH_2-\overset{O}{\overset{||}{C}}-CH_3 \xrightarrow[\Delta]{(NH_4)_2CO_3} (A) \xrightarrow[\Delta]{CCl_3CO_2Na} \underset{\text{(major)}}{(B)}$

Product (*B*) of above reaction is :

(a)  (b)  (c)  (d) 

128.  $\xrightarrow[\Delta]{H_3O^+}$ *A* ; Product obtained is :

(a)  (b)  (c)  (d) None of these

129. $\underset{\substack{\text{Symmetrical}\\ \text{Ketone}}}{(A)} \xrightarrow{LiAlH_4} (B) \xrightarrow[\Delta]{H^{\oplus}}$ Diastereomers

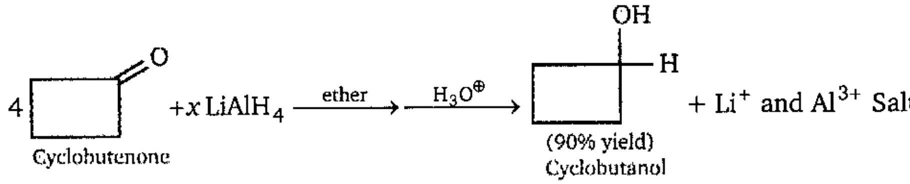
Reactent (*A*) is :

(a) $CH_3-\overset{O}{\overset{||}{C}}-CH_3$

(b) $CH_3-\overset{O}{\overset{||}{C}}-CH_2-CH_3$

(c) $CH_3-CH_2-\overset{O}{\overset{||}{C}}-CH_2-CH_3$

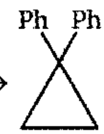
(d) $CH_3-CH_2-CH_2-CH=O$

130. 

Value of x in above reaction is :

(a) 1 (b) 2 (c) 3 (d) 4

131. $(A) \xrightarrow[\Delta]{NH_2OH} (B) \xrightarrow{H_2SO_4} (C) \xrightarrow{H_3O^{\oplus}} (D) + (E) \xrightarrow[KOH, \Delta]{CHCl_3} CH_3 - N \overset{\rightarrow}{=} C$

$(D) \xrightarrow{SOCl_2} (F) \xrightarrow[(ii)\ H^{\oplus}]{(i)\ PhMgBr(excess)} (G) \xrightarrow[\Delta]{H^{\oplus}} (H) \xrightarrow[Zn/Cu]{CH_2I_2}$ 

Molecular weight of compound (A) is :

(a) 58 (b) 120

(c) 60 (d) 182

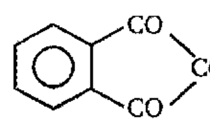
132. $Ph_2CH - \overset{O}{\overset{\|}{C}} - H \xrightarrow{\text{aqueous acid}} \underset{81\%}{(A)} + \underset{2\%}{\text{enol}} + \underset{17\%}{\text{aldehyde}}$

Product (A) of above reaction will be :

(a) $Ph - \underset{Ph}{\underset{|}{C}} = CH - O$ (b) $Ph_2CH - \overset{OH}{\overset{|}{CH_2}}$

(c) $Ph_2CH - \overset{OH}{\overset{|}{CH}} - OH$ (d) $Ph_2CH - \overset{O}{\overset{\|}{C}} - CH_3$

133. Which of the following will form stable hydrate ?

(a) CCl_3CHO (Chloral) (b)  (Ninhydrin)

(c) $(CF_3)_2CO$ (d) All of these

134. The pH at which maximum hydrate is present in an solution of oxaloacetic acid:

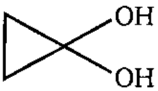
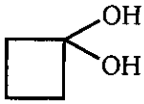
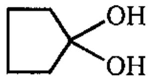
$$H - O - \overset{O}{\overset{\|}{C}} - \overset{O}{\overset{\|}{C}} - CH_2 - \overset{O}{\overset{\|}{C}} - O - H$$

$pK_a = 2.2$ $pK_a = 3.98$

(a) pH = 0 (b) pH = 12

(c) pH = 4 (d) pH = 6

135. Arrange their stabilities of given gem- diols in decreasing order.

(I)  (II)  (III) 

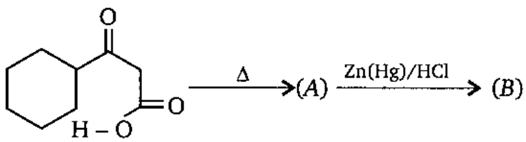
(a) I > II > III (b) III > II > I (c) I > III > II (d) III > I > II

136. Maximum hydration takes place of :

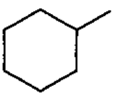
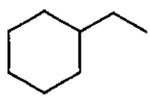
(a) CF_3COCF_3 (b) CH_3COCH_3 (c) $CH_3CH(Cl)-COCH_3$ (d) $C_6H_5COC_6H_5$

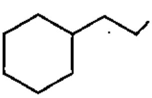
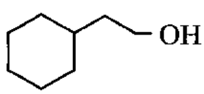
137. The conversion, $PhCN \rightarrow PhCOCH_3$, can be achieved most conveniently by reaction with:

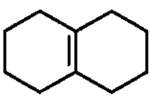
(a) CH_3MgBr followed by hydrolysis
(b) I_2 — NaOH, CH_3I
(c) dil. H_2SO_4 followed by reaction with CH_2N_2
(d) LAH followed by reaction with CH_3I

138. 

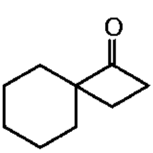
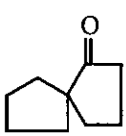
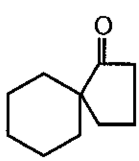
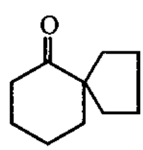
In the above reaction, product (*B*) is:

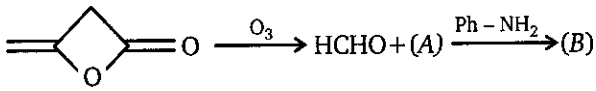
(a)  (b) 

(c)  (d) 

139. $(A) \xrightarrow{LiAlH_4} (B) \xrightarrow[\Delta]{H^{\oplus}}$ 

Structure of *A* is :

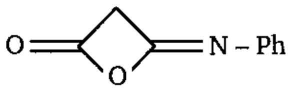
(a)  (b)  (c)  (d) 

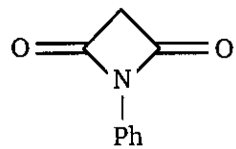
140. 

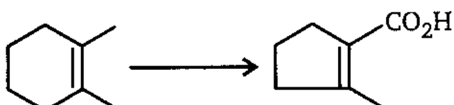
Product (*B*) is :

(a) $Ph-NH-\overset{O}{\overset{\|}{C}}-CO_2H$

(b) $Ph-NH-\overset{O}{\overset{\|}{C}}-CH_2-CO_2H$

(c) 

(d) 

141. 

To carry out above conversion, arrange the following reagents in correct order.

O_3/Zn (1) EtONa / EtOH/Δ (2) NaOCl (3) H^+ (4)

(a) $1 \to 3 \to 2 \to 4$

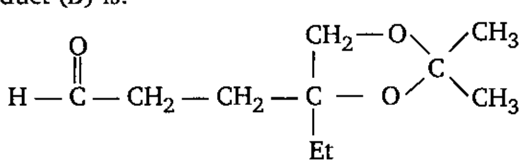
(b) $1 \to 2 \to 4 \to 3$

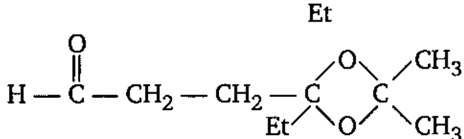
(c) $1 \to 3 \to 4 \to 2$

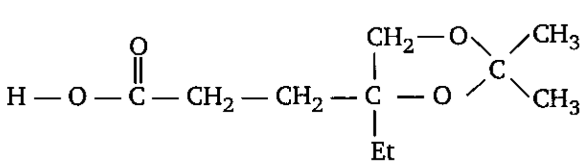
(d) $1 \to 2 \to 3 \to 4$

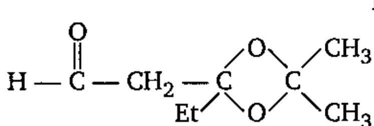
142. $$H_2C=CH-CH_2-CH_2-\underset{CH_2-CH_3}{\overset{HOCH_2}{C}}-OH \xrightarrow[TsOH]{CH_3-\overset{O}{\overset{\|}{C}}-CH_3} (A) \xrightarrow[(CH_3)_2S]{O_3} (B) + HCHO$$

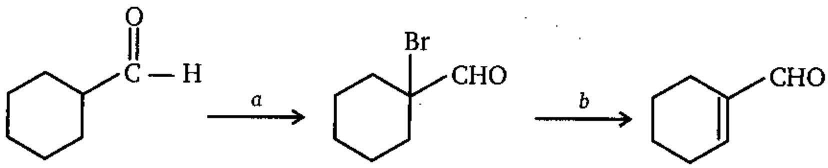
Product (*B*) is:

(a) 

(b) 

(c) 

(d) 

143. 

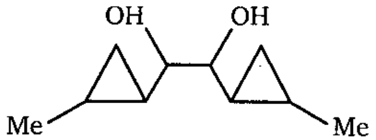
Identify appropriate reagents for the above reaction:

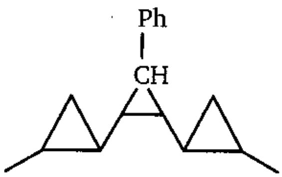
(a) $a = Br_2/CCl_4$, $b =$ aq. KOH

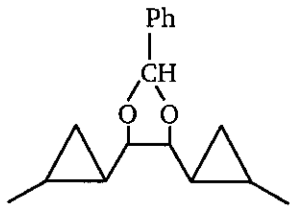
(b) $a = Br_2/H^+$, $b =$ aq. KOH

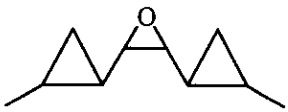
(c) $a = Br_2/H^+$, $b =$ alc. KOH

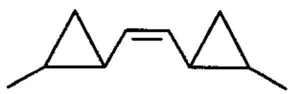
(d) $a = Br_2/HO^-$, $b =$ aq. KOH

144.  $\xrightarrow[H^+]{PhCHO}$ (X); Product (X) of this reaction is : 96%

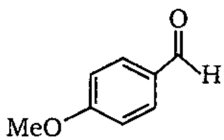
(a) 

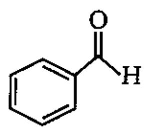
(b) 

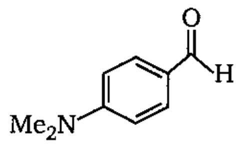
(c) 

(d) 

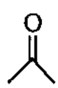
145. The $K_{eq.}$ values in HCN addition to following aldehydes are in the order :

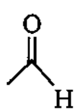

(I)


(II)


(III)

(a) I > II > III (b) II > III > I (c) III > I > II (d) II > I > III

146. (1) $CH_3-\overset{OH}{\underset{CH_3}{C}}-CN \overset{K_1}{\rightleftharpoons}$  +HCN

(2) $CH_3-\overset{OH}{\underset{H}{C}}-CN \overset{K_2}{\rightleftharpoons}$  +HCN

elation between K_1 and K_2 is :

(a) $K_1 = K_2$ (b) $K_1 > K_2$ (c) $K_2 > K_1$ (d) $K_1 = K_2 = 1$

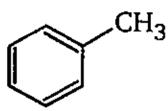
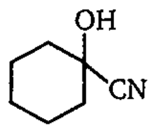
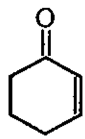
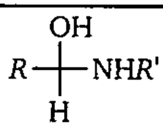
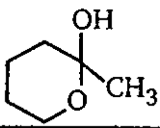
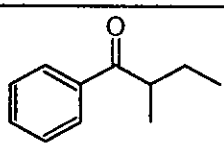
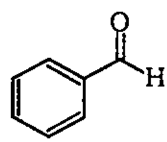
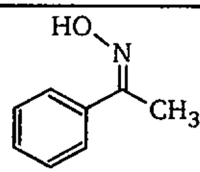
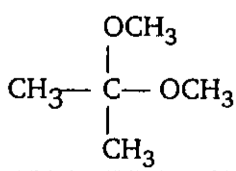
ANSWERS — LEVEL 1

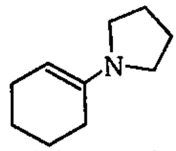
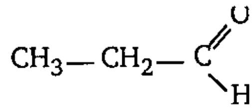
1.	(a)	2.	(b)	3.	(d)	4.	(c)	5.	(a)	6.	(c)	7.	(b)	8.	(b)
9.	(b)	10.	(c)	11.	(c)	12.	(c)	13.	(b)	14.	(b)	15.	(b)	16.	(b)
17.	(b)	18.	(b)	19.	(b)	20.	(d)	21.	(b)	22.	(b)	23.	(b)	24.	(d)
25.	(c)	26.	(b)	27.	(b)	28.	(a)	29.	(b)	30.	(c)	31.	(d)	32.	(c)
33.	(b)	34.	(b)	35.	(a)	36.	(b)	37.	(c)	38.	(d)	39.	(b)	40.	(a)
41.	(b)	42.	(a)	43.	(a)	44.	(b)	45.	(c)	46.	(c)	47.	(b)	48.	(d)
49.	(c)	50.	(b)	51.	(d)	52.	(b)	53.	(b)	54.	(c)	55.	(b)	56.	(b)
57.	(a)	58.	(d)	59.	(c)	60.	(c)	61.	(c)	62.	(a)	63.	(b)	64.	(b)
65.	(b)	66.	(d)	67.	(b)	68.	(d)	69.	(b)	70.	(b)	71.	(b)	72.	(d)
73.	(d)	74.	(a)	75.	(d)	76.	(a)	77.	(a)	78.	(c)	79.	(c)	80.	(c)
81.	(d)	82.	(b)	83.	(b)	84.	(b)	85.	(b)	86.	(a)	87.	(b)	88.	(c)
89.	(b)	90.	(b)	91.	(c)	92.	(b)	93.	(b)	94.	(b)	95.	(c)	96.	(c)
97.	(d)	98.	(b)	99.	(c)	100.	(c)	101.	(c)	102.	(c)	103.	(c)	104.	(c)
105.	(c)	106.	(b)	107.	(d)	108.	(c)	109.	(c)	110.	(b)	111.	(c)	112.	(b)
113.	(b)	114.	(c)	115.	(c)	116.	(a)	117.	(b)	118.	(a)	119.	(b)	120.	(c)
121.	(b)	122.	(b)	123.	A-c	123.	B-b	124.	(b)	125.	(a)	126.	(c)	127.	(a)
128.	(b)	129.	(c)	130.	(a)	131.	(a)	132.	(c)	133.	(d)	134.	(a)	135.	(a)
136.	(a)	137.	(a)	138.	(b)	139.	(d)	140.	(b)	141.	(d)	142.	(a)	143.	(c)
144.	(b)	145.	(d)	146.	(b)										

LEVEL-2

1. Select the best choice for example (A to L) from the examples (a to n) given below. Write your choice in the box given.

A.	An acetal derivative of a ketone.	
B.	A chiral ketone.	
C.	An aldehyde that gives a aldol condensation with itself.	
D.	An oxime derivative	
E.	A reagent that reduces aldehydes to 1°- alcohols.	
F.	An α, β-unsaturated ketone.	
G.	A reagent that oxidizes aldehydes to carboxylic acids.	
H.	A reagent that reduces ketones to alkanes.	
I.	An enamine derivative of a ketone.	
J.	An intermediate in imine formation.	
K.	A cyclic hemiacetal.	
L.	A cyanohydrin derivative.	

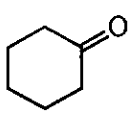
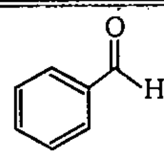
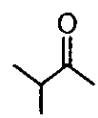
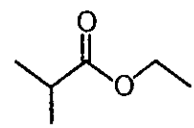
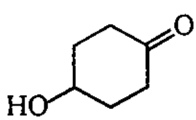
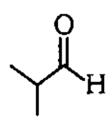
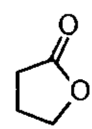
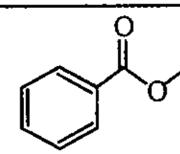
(a)		**(b)**		**(c)**	
(d)		**(e)**		**(f)**	$Zn(Hg)H_3O^{(+)}$
(g)		**(h)**	$NaBH_4$ aq. alcohol	**(i)**	
(j)	$Ag(NH_3)_2^{(+)}OH^{(-)}$	**(k)**		**(l)**	

(m)		(n)			

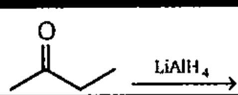
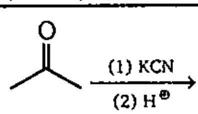
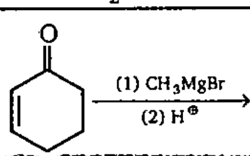
2. The following questions refer to the compounds (A to G) shown below :

i.	Which compounds are reduced by sodium borohydride ?	ii.	Which compounds are hydrolyzed by hot aqueous acid ?	iii.	Which compound are oxidisized by CrO_3/pyridine?

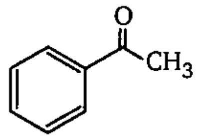
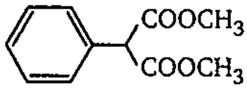
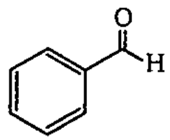
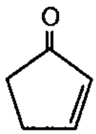
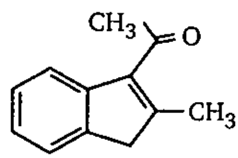
A		E		A		E		A		E	
B		F		B		F		B		F	
C		G		C		G		C		G	
D		H		D		H		D		H	

A.		B.		C.		D.	
E.		F.		G.		H.	

3. **Match the column:**

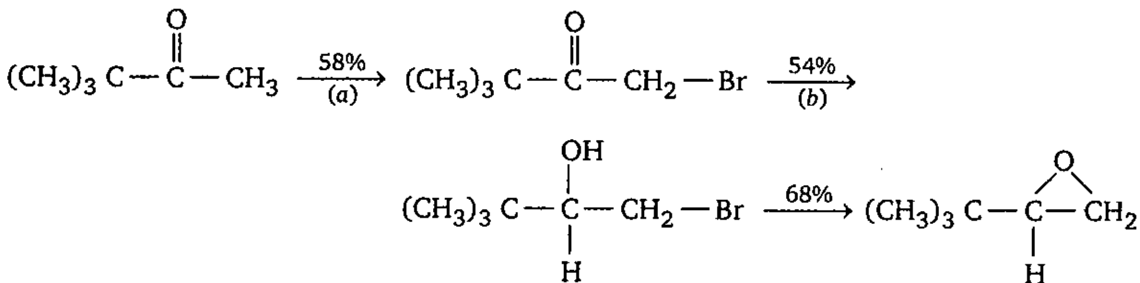
	Column (I)		Column (II)
(a)		(p)	racemic mixture
(b)		(q)	Diastereomers
(c)	$Ph-CH_2-Cl \xrightarrow{KCN}$	(r)	Nu-addition reaction
(d)		(s)	Nu-Substitutions reaction

4. Complete the following table.

	REACTANT	REAGENT(S)/ CONDITIONS	MAJOR ORGANIC PRODUCTS
a.		H_2/Pd - C in ethanol (solvent)	**A**
b.		$H^+/H_2O/\Delta$	**B**
c.		$(CH_3)_2\overset{-}{C}-\overset{+}{P}(C_6H_5)_3$	**C**
d.		1. $Li^+[(CH_3)_2Cu]^-$ in dry ether 2. H^+/H_2O	**D**
e.	**E**	OH^-/ethanol/Δ	

5. Comprehension

Consider the following reactions and answer A and B.



A. Suggest a reagent appropriate step (*a*) the synthesis.

(a) HO^-/Br_2 (1 mole)

(b) H^+/Br_2 (1 mole)

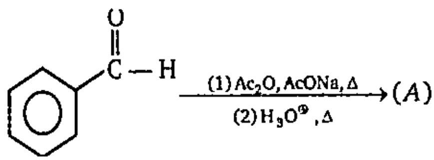
(c) both (a) and (b)

(d) None of these

B. Yield of each step as actually carried out in laboratory is given above each arrow. What is overall yield of the reaction ?

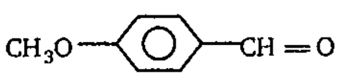
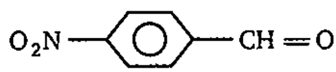
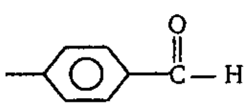
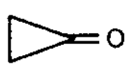
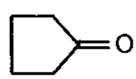
(a) 60% (b) 21% (c) 40% (d) 68%

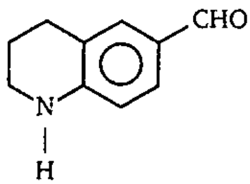
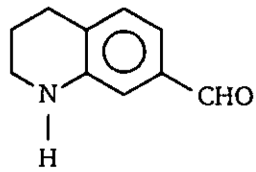
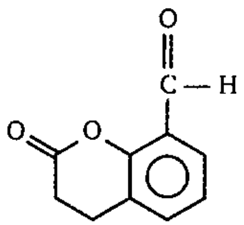
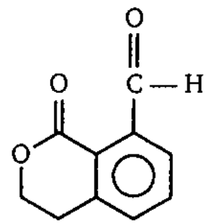
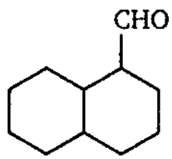
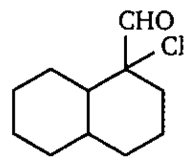
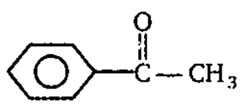
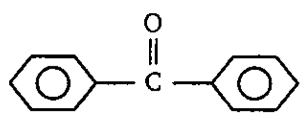
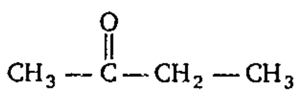
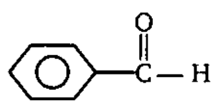
6.

Reaction 1.	
Reaction 2.	$Ph-CH=CH-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow[CH_3-\underset{CH_3}{\underset{\mid}{CH}}-OH]{Al(OCHMe_2)_3} (B)$
Reaction 3.	$Ph-CH=CH-\overset{OH}{\overset{\mid}{CH}}-CH_3 \xrightarrow[(2)\, H^{\oplus}]{(1)\, NaOI} (C)$

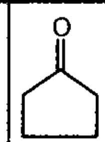
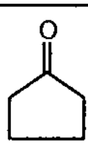
Degree of unsaturation present in compound (*A* + *B* + *C*) is ?

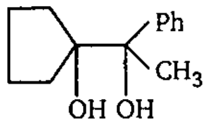
7. Within each set, which compound should be more reactive toward carbonyl addition reaction ?

	A	B
Set (1)	$CH_3-\overset{O}{\overset{\|}{C}}-CH_2-Br$	$CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-Br$
Set (2)	$CH_3-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-CH_3$	$CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_3$
Set (3)		
Set (4)		$CH_3-\overset{O}{\overset{\|}{C}}-H$
Set (5)		

Set (6)		
Set (7)		
Set (8)		
Set (9)		
Set (10)		

8. Match the Column (I) and Column (II). (Matrix)

	Column (I)		Column (II)
(A)	 $\xrightarrow[\text{traces of KOH}]{\text{HCN}} (A) \xrightarrow{\text{LiAlH}_4} (B) \xrightarrow[\text{HCl}]{\text{NaNO}_2} (C)$	**(p)**	Formation of six member ring takes place
(B)	 $\xrightarrow{\text{NH}_2\text{OH}} (A) \xrightarrow{\text{H}^+} (B) \xrightarrow{\text{LAH}} (C)$	**(q)**	Final product is Ketone

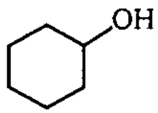
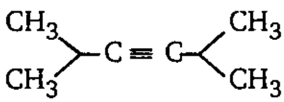
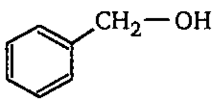
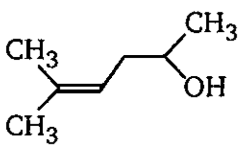
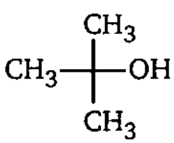
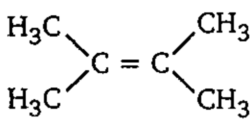
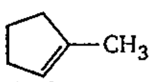
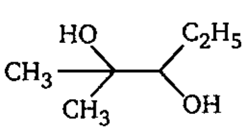
(C)	$CH_3-\overset{O}{\overset{\Vert}{C}}-CH_2-CH_2-CH_2-\overset{O}{\overset{\Vert}{C}}-H \xrightarrow[\Delta]{HO^-} (A)$	(r)	Final product formed will give positive Tollens test
(D)	 $\xrightarrow[\Delta]{H^{\oplus}} (A)$	(s)	Final product formed will react with 2,4-DNP. (2,4-di-nitrophenyl hydrazine)

9. Consider reactions A through F. Those carbon atoms undergoing change, as part of a functional group, are marked as C^{12}, C^{14} or starred. In the cases shown, each carbon atom has either been reduced or oxidized. Your job is to identify the change in oxidation state that has occurred for each of the marked carbon.

	Reaction		C^{12}		C^{14}
A.	$CH_3\underset{12}{C}H=\underset{14}{C}H_2 \xrightarrow{Br_2} CH_3CHBrCH_2Br$		Reduced		Reduced
			Oxidized		Oxidized
B.	$CH_3\underset{12}{C}H=\underset{14}{C}H_2 \xrightarrow[\text{(ii)}\ H_2O_2,\text{NaOH}]{\text{(i)}\ B_2H_6} CH_3CH_2CH_2OH$		Reduced		Reduced
			Oxidized		Oxidized
C.	$CH_3CH_2\overset{*}{C}H=O \xrightarrow{NaBH_4} CH_3CH_2CH_2OH$		Reduced		
			Oxidized		
D.	$CH_3CH_2\overset{*}{C}H=O \xrightarrow[H_2O,\ pH>8]{Ag^{(+)}} CH_3CH_2CO_2H$		Reduced		
			Oxidized		
E.	$CH_3CO\underset{12}{C}H_2\underset{14}{C}O_2H \xrightarrow{\text{Heat}} CH_3COCH_3 + O=C=O$		Reduced		Reduced
			Oxidized		Oxidized
F.	$H_2\underset{12}{C}=\underset{14}{C}(OH)C_2H_5 \xrightarrow{\text{tautomerization}} H_3CCOC_2H_5$		Reduced		Reduced
			Oxidized		Oxidized

10. Consider the possible formation of an aldehyde or ketone product when each of the ten compounds in the column on the left is treated with each of the reagents shown in the top row. Check the designated answer box if you believe an aldehyde or ketone will be formed.

Assume that the reagents may be present in excess. For each checked reaction, try to draw the structure of the major product (s).

Starting	PCC $C_5H_5NHCrO_3Cl$	Jone's Reagent CrO_3 in aq. acid	$Pb(OAc)_4$ [or HIO_4]	(i) O_3, (ii) Zn dust	$H_3O^{\oplus}$	(i) BH_3 in THF (ii) H_2O_2 + NaOH
						
						
						
						
						
						
						
						
						
						

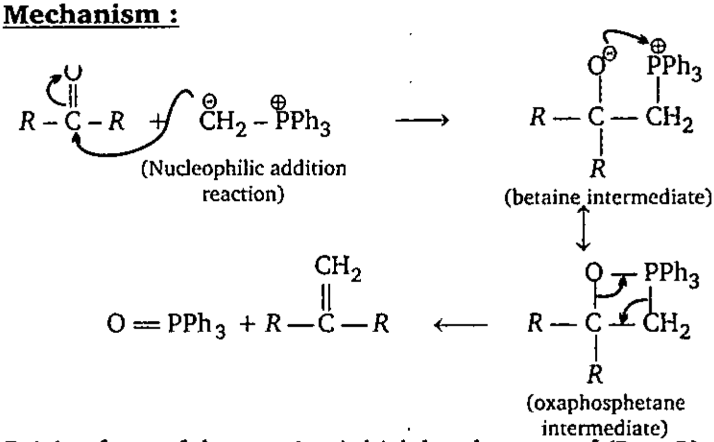
11. Comprehension

Wittig reaction :

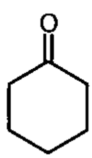
The reaction of a phosphorus ylide with an aldehyde (or) ketnoe introduces a carbon-carbon double bond is place of the carbonyl bond.

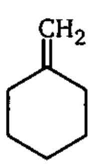
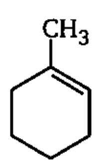
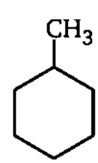
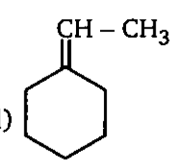
$$R-\overset{\overset{\displaystyle O}{\|}}{C}-R + Ph_3P=CH_2 \longrightarrow R-\overset{\overset{\displaystyle CH_2}{\|}}{C}-R + Ph_3P=O$$

Mechanism :

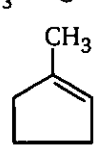
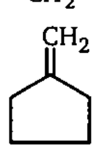
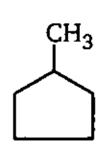
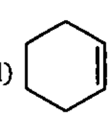


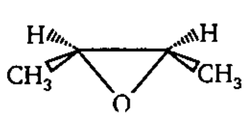
Driving force of the reaction is high bond energy of (P = O) . (ΔH = –ve)

A.  + $Ph_3P=CH_2 \longrightarrow$ (A) (major), Major product (A) is :

(a)  (b)  (c)  (d) 

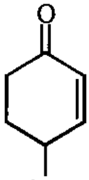
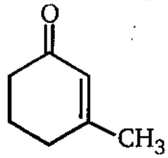
B. $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH_2-CH_2-CH_2-\overset{\oplus}{P}Ph_3 \xrightarrow[\Delta]{Ph-Li}$ (A), Major product (A) is :

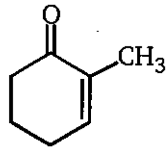
(a)  (b)  (c)  (d) 

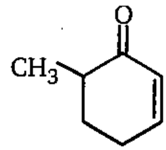
C.  $\xrightarrow{Ph_3P}$ (A) , Major product (A) is :

(a) *cis*-2-butene (b) *trans*-2-butene (c) iso-butene (d) 1-butene

D. $CH_3-\overset{O}{\overset{\|}{C}}-(CH_2)_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{P}}(OEt)_2 \xrightarrow{NaH} (A)$ (cyclic). Product (A) is :

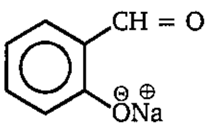
(a) 
(b) 

(c) 

(d) 

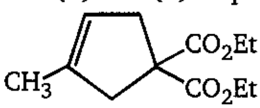
E. Identify major product in given intramolecular Wittig reaction :

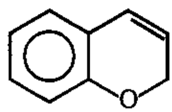
Rxn.-1 $\longrightarrow$ $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH(CO_2Et)_2 + H_2C=CH-{}^{\oplus}PPh_3 \xrightarrow{NaH} (A)$

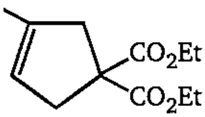
Rxn.-2 $\longrightarrow$ 

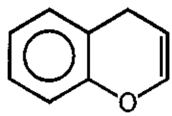
$+ H_2C=CH-{}^{\oplus}PPh_3 \longrightarrow (B)$

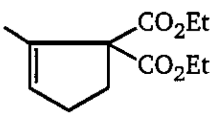
Product (A) and (B) respectively are :

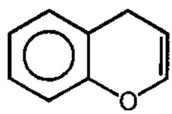
(a) 

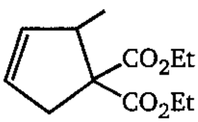
& 

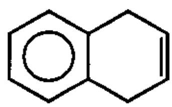
(b) 

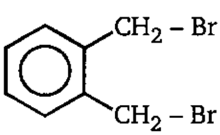
& 

(c) 

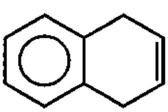
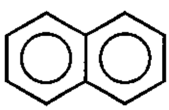
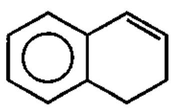
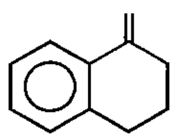
& 

(d) 

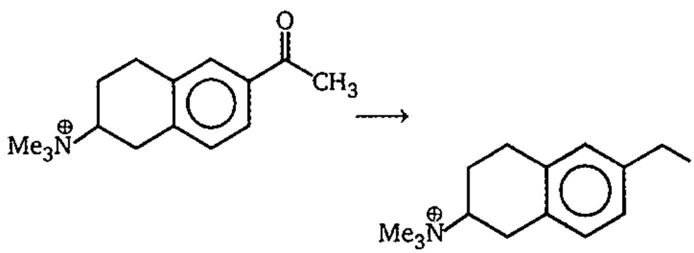
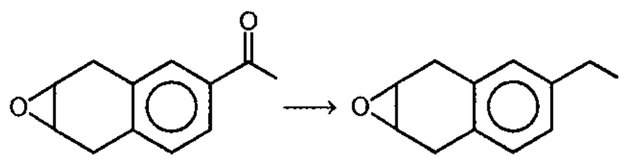
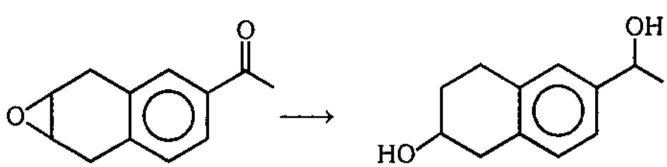
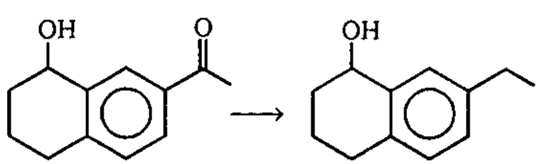
& 

F. 

$\xrightarrow[\text{(2) 2Ph–Li} \quad \text{(3) CHO–CHO}]{\text{(1) Ph}_3\text{P(2 mole)}}$ (A) ; product (A) is :

(a) 
(b) 
(c) 
(d) 

12. Match the column :

Column (I)		Column (II)	
Conversion		Reagent	
(a)		(p)	$NH_2/NH_2/HO^{\ominus}$, Δ (Wolff-Kishner reduction)
(b)		(q)	Zn(Hg), HCl (Clemmensen reduction)
(c)		(r)	$LiAlH_4$
(d)		(s)	None

13. Comprehension

$$(A) \xrightarrow[\text{dil. } H_2SO_4]{HgSO_4} (B) \xrightarrow[(2)\, H^{\oplus}/\Delta]{(1)\ NaBH_4} CH_3-\underset{\underset{\displaystyle CH-CH_3}{\|}}{C}-CH_2-CH_3$$

A. Reactant (*A*) is :

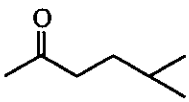
(a) $CH_3-C\equiv C-\underset{\underset{\displaystyle CH_3}{|}}{CH}-CH_3$

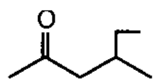
(b) $HC\equiv C-C-\underset{\underset{\displaystyle C-C}{|}}{C}-C$

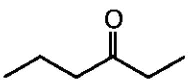
(c) $CH_3-\underset{\underset{\displaystyle CH_2-CH_3}{|}}{CH}-C\equiv CH$

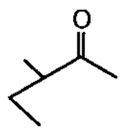
(d) $CH_3-C\equiv C-CH_2-CH_2-CH_3$

B. Product (*B*) is :

(a) 

(b) 

(c) 

(d) 

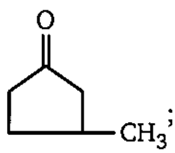
ANSWERS — LEVEL 2

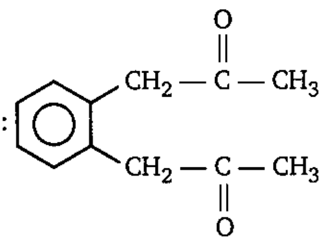
1. A – l; B – g; C – n; D – k; E – h; F – c; G – j; H – f; I – m; J – d; K – e; L – b

2. i – A, B, C, E, F; ii – D, G, H; iii – B, E, F

3. a - p,r; b - r; c - s; d - p, r

4. **A** : $Ph-CH(OH)-CH_3$; **B** : $Ph-CH_2-COOH$; **C** : $Ph-CH=C(CH_3)_2$;

D : ;

E : 

5. A – c; B – b

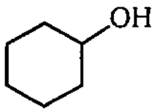
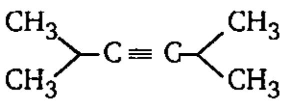
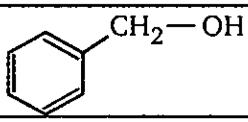
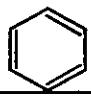
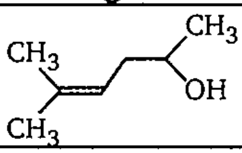
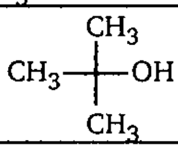
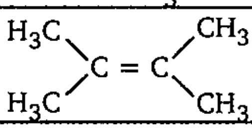
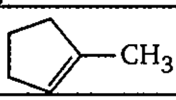
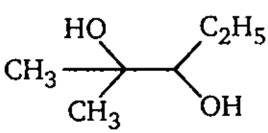
6. $A+B+C=17$

7. set 1 – A; set 2 – A; set 3 – B; set 4 – B; set 5 – A; set 6 – B; set 7 – B;
set 8 – B; set 9 – A; set 10 – B

8. A – p, q, s; B – p; C – p, q, s; D – p, q, s

9. A : both are oxidized; B : C^{12} is reduced, C^{14} is oxidized; C : reduced; D : oxidized
E : C^{12} is reduced, C^{14} is oxidized; F : C^{12} is reduced, C^{14} is oxidized

10.

Compound	PCC $C_5H_5NHCrO_3Cl$	Jone's Reagent CrO_3 in aq. acid	$Pb(OAc)_4$ [or HIO_4]	(i) O_3, (ii) Zn dust	H_3O^+	(i) BH_3 in THF (ii) H_2O_2 + NaOH
	✓	✓	✗	✗	✗	✗
	✗	✗	✗	✓	✓	✓
	✓	✓	✗	✓	✗	✗
	✗	✗	✗	✓	✗	✗
	✓	✓	✗	✓	✓	✓
	✗	✗	✗	✗	✗	✗
	✗	✗	✗	✓	✓	✓
	✗	✗	✗	✓	✓	✓
	✓	✓	✗	✗	✗	✗
	✓	✓	✓	✗	✗	✗

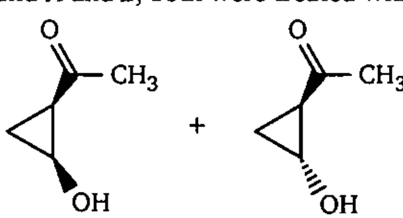
11. A – a; B – a; C – b; D – b; E – a; F – b

12. a – q; b – s; c – r; d – p **13. A.** (c) **B.** (d)

8 ALDOL AND CANNIZARO REACTION

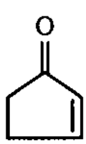
LEVEL-1

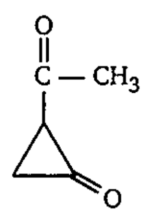
1. Compound A and B, both were treated with NaOH, producing a single compound C.

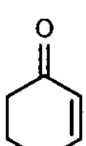


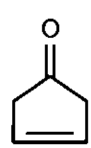
(A) (B)

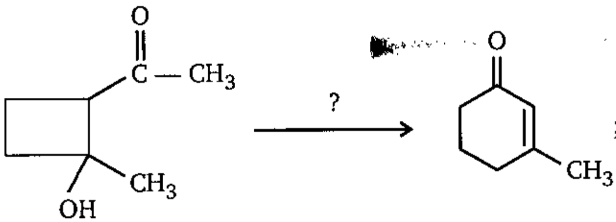
$\xrightarrow[\text{heat}]{HO^-}$ C. Compound (C) is :

(a) 

(b) 

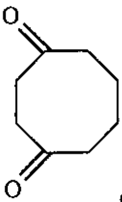
(c) 

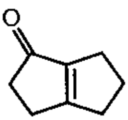
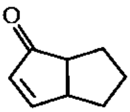
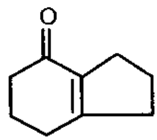
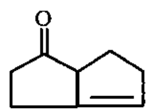
(d) 

2.  ; This conversion can be achieved by :

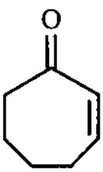
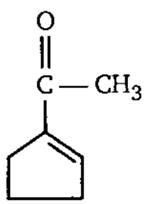
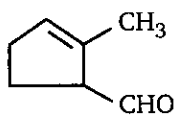
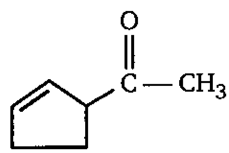
(a) Dehydration, Hydrolysis
(b) Retro aldol and further condensation
(c) Perkin condensation & Clemmensen reduction
(d) Clemmensen and Perkin condensation

3. This is an example of an intramolecular aldol reaction :

 $\xrightarrow[H_2O]{H_2SO_4}$ (*A*); Product (*A*) is :

(a)  (b)  (c)  (d) 

4. $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow[(73\%)]{HO^-/\Delta}$ (*A*) ; Product (*A*) is :

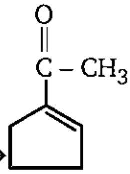
(a)  (b)  (c)  (d) 

5. $Ph-CH=CHCHO + CH_3CH=CHCHO \xrightarrow[EtOH, \Delta]{base} (A)$ 87% ; Product of this reaction is :

(a) $Ph-(CH=CH)_2-CHO$
(b) $Ph-(CH=CH)_3CHO$
(c) $Ph-(CH=CH)_4CHO$
(d) $Ph-CH=CH-CH=CH-CH_3$

6. $CH_3CHO \xrightarrow[5°C]{10\% \ NaOH} \xrightarrow[\Delta]{} \xrightarrow[Ni]{H_2} (A)$; Product (*A*) of the reaction is :

(a) propanol (b) ethanol (c) butanol (d) pentanol

7. $(A) \xrightarrow[\Delta]{NaOH}$ 

. Reactant (*A*) is :

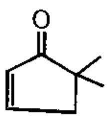
(a) $CH_3-\overset{O}{\overset{\|}{C}}-(CH_2)_5-\overset{O}{\overset{\|}{C}}-CH_3$

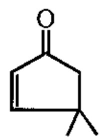
(b) $CH_3-\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-H$

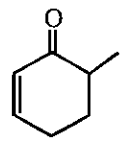
(c) $H-\overset{O}{\overset{\|}{C}}-(CH_2)_5-\overset{O}{\overset{\|}{C}}-H$

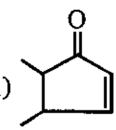
(d) $CH_3-\overset{O}{\overset{\|}{C}}-(CH_2)_4-CH_2-OH$

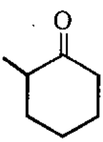
8. $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\underset{CH_3}{\overset{CH_3}{C}}-CHO \xrightarrow{KOH,\ H_2O} (A)$; Product *A* is:

(a) 

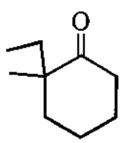
(b) 

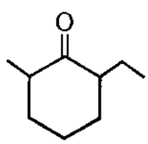
(c) 

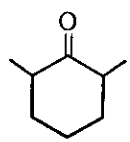
(d) 

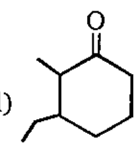
9. 

$\xrightarrow[CH_3-CH_2-I]{LDA}$ $\underset{\text{(major)}}{(A)}$; Product *A* is:

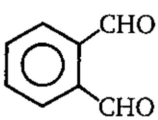
(a) 

(b) 

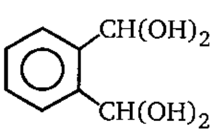
(c) 

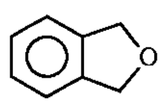
(d) 

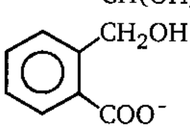
10. The reaction ,

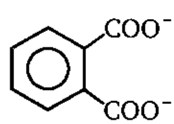


+ conc. NaOH $\xrightarrow{\text{heat}}$, products Identify the product.

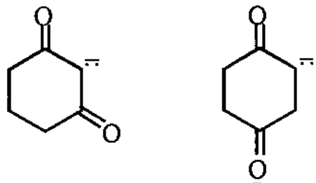
(a) 

(b) 

(c) 

(d) 

11. Compare enolate *A* with enolate *B*.



A *B*

Which of the following statements is true ?

(a) *A* is more stable than *B*

(b) *A* and *B* have the same stability

(c) *B* is more stable than *A*

(d) No comparison of stability can be made

12. Benzalacetone is the product of mixed aldol condensation between benzaldehyde ($C_6H_5CH = O$) and acetone [$(CH_3)_2C = O$]. What is its structure ?

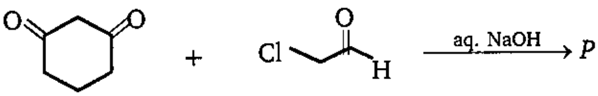
(a) $C_6H_5CH = CH\overset{\overset{O}{\|}}{C}CH_3$

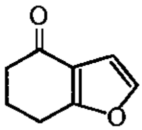
(b) $C_6H_5CH = C(CH_3)_2$

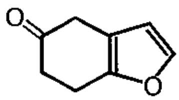
(c) $C_6H_5\overset{\overset{O}{\|}}{C}CH = CHCH_3$

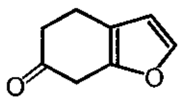
(d) $C_6H_5CH_2\overset{\overset{O}{\|}}{C}CH = CH_2$

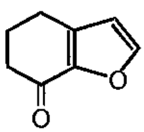
13. Identify the major product *P* in the following reaction:

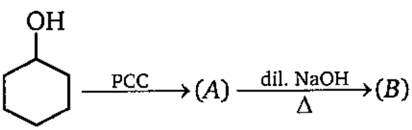


(a) 

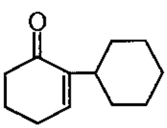
(b) 

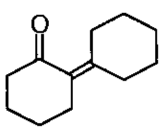
(c) 

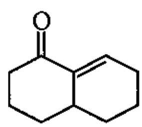
(d) 

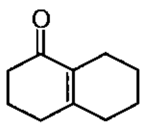
14. 

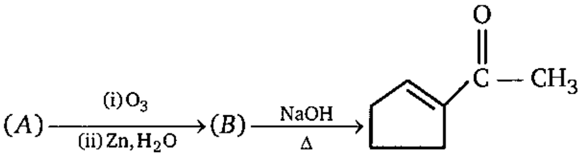
Product (*B*) is:

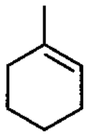
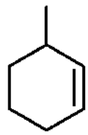
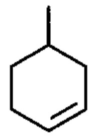
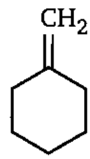
(a) 

(b) 

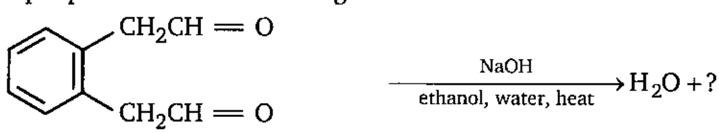
(c) 

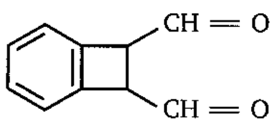
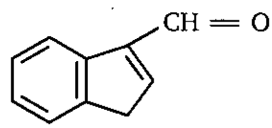
(d) 

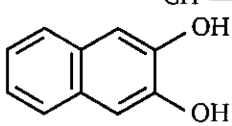
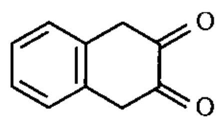
15.  the reactant (A) will be :

(a)  (b)  (c)  (d) 

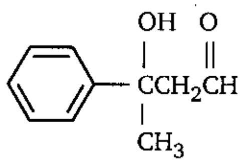
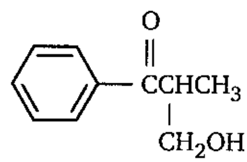
16. Identify the principal product of the following reaction?

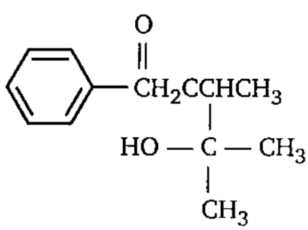
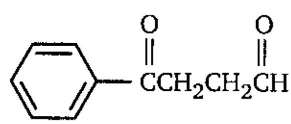


(a)  (b) 

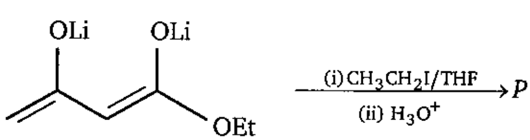
(c)  (d) 

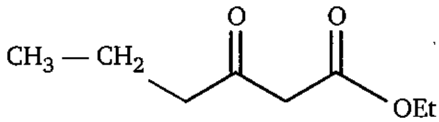
17. Which one of the following compounds is the best choice for being prepared by an efficient mixed aldol addition reaction?

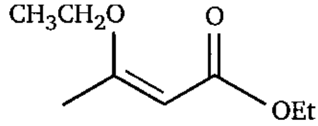
(a)  (b) 

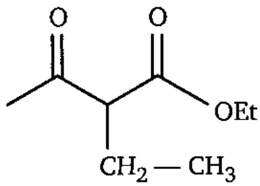
(c)  (d) 

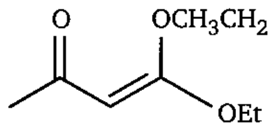
18. Identify the major product *P* in the following reaction:



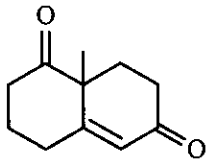
(a) 

(b) 

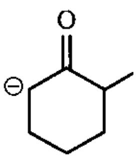
(c) 

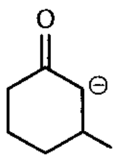
(d) 

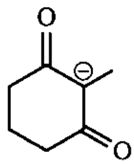
19. The enolate ion that reacts with 3-buten-2-one to form (*Y*) is :

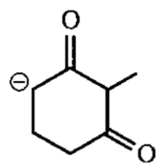


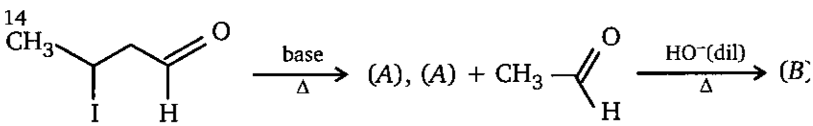
(*Y*)

(a) 

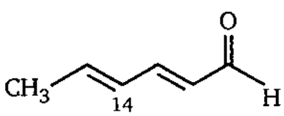
(b) 

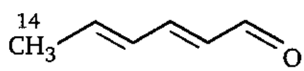
(c) 

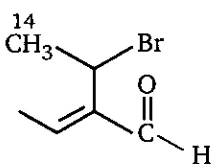
(d) 

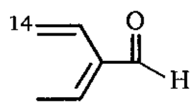
20. 

Product (*B*) in the above reaction is :

(a) 

(b) 

(c) 

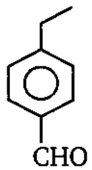
(d) 

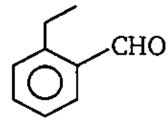
21. $H-\overset{\overset{O}{\|}}{C}-D \xrightarrow[(50\%)]{HO^-}$; Product of this Cannizaro reaction is :

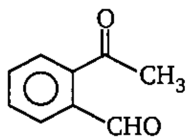
(a) $D-CO_2^- + CH_2DOD$ (b) $H-CO_2^- + D-CO_2^-$

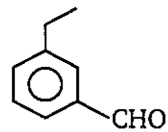
(c) $D-CO_2^- + CH_2DOH$ (d) $D-CO_2^- + CHD_2OH$

22. An organic compound with the molecular formula $C_9H_{10}O$ forms a 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizaro reaction, on vigorous oxidation it gives 1,2-benzenedicarboxylic acid. Structure of organic compound is:

(a) 

(b) 

(c) 

(d) 

23. $$CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH_2-CH_2-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-H \;\xrightarrow{KOH}$$

Number of intramolecular aldol condensation product is :

(a) 1 (b) 2 (c) 3 (d) 4

24. $$\underset{C_7H_{14}}{(A)} \xrightarrow[Zn/AcOH]{O_3} (B) + (C)$$

Compound (A) exist in geometrical isomers and (B) gives Cannizaro reaction.

(A) will be :

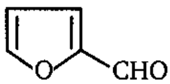
(a) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\overset{\displaystyle CH_3}{\overset{|}{C}}=CH-CH_3$

(b) $(CH_3)_3CCH_2-CH=CH_2$

(c) $(CH_3)_3C-CH=CH-CH_3$

(d) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2-CH=CH_2$

25. Which of the following compounds will not undergo Cannizaro reaction, when treated with 50% aqueous alkali?

(a) $Ph-\overset{\overset{O}{||}}{C}-H$ (b) 

(c) Me_2CHCHO (d) $Ph-CH_2-CHO$

26. $H-\overset{\overset{O}{||}}{C}-D \xrightarrow{H^{18}O^-} H-\overset{\overset{O}{||}}{C}-{}^{18}O^- + CH_2D-OH$

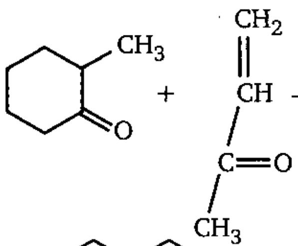
Above reaction is known as :

(a) Cannizaro reaction, Disproportionation reaction

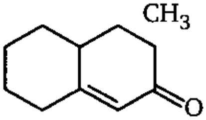
(b) Tischenko reaction, Disproportionation reaction

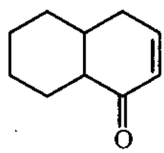
(c) Cross Cannizaro reaction, Redox reaction

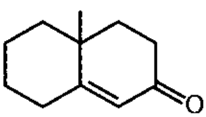
(d) Tischenko reaction, Redox reaction

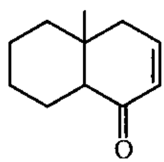
27. 

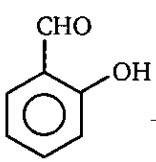
$\xrightarrow[\text{(Conjugate–addition)}]{HO^-}$ (A) ; Product (A) is :

(a) 

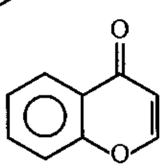
(b) 

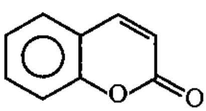
(c) 

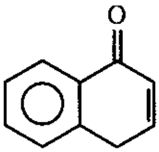
(d) 

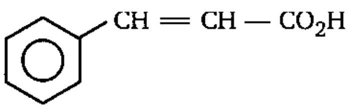
28. 

$\xrightarrow[(2)\,H_2O]{(1)\,Ac_2O,\,AcONa}$ (A) ; Identify product and name of reaction.

(a)  , Aldol condensation

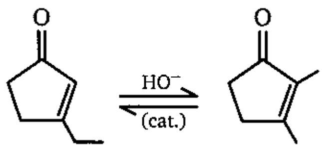
(b)  , Perkin reaction

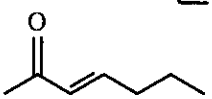
(c)  , Cannizaro reaction

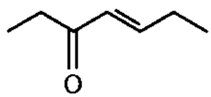
(d) 

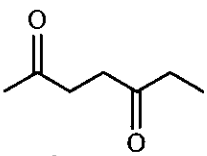
, Claisen-condensation

29. Choose the most reasonable reaction intermediate for the following reaction.



(a) 

(b) 

(c) 

(d) None of these

30. $CH_3-\underset{\displaystyle |}{\overset{OH}{CH}}-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow[\text{(Retro aldol)}]{HO^-} (A)$; $3HCHO + A \xrightarrow[40°C]{Na_2CO_3} \underset{(82\%)}{(B)}$

Product (*B*) of the above reaction is :

(a) $HO-CH_2-\overset{\overset{\displaystyle CH_2-OH}{|}}{\underset{\underset{\displaystyle CH_2-OH}{|}}{C}}-CH_2OH$

(b) $HO-CH_2-\overset{\overset{\displaystyle CHO}{|}}{\underset{\underset{\displaystyle CH_2-OH}{|}}{C}}-CHO$

(c) $HO-CH_2-\overset{\overset{\displaystyle CH_2OH}{|}}{\underset{\underset{\displaystyle CHO}{|}}{C}}-CH_2OH$

(d) $HO-CH_2-\overset{\overset{\displaystyle CHO}{|}}{\underset{\underset{\displaystyle CH_2-OH}{|}}{C}}-CH_2-CH_2-OH$

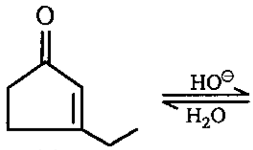
31. $CH_3CH=CHCHO \xrightarrow[\text{Aldol condensation}]{OH^-} \xrightarrow{\Delta} A$; Product *A* is :

(a) $CH_3(CH=CH)_3CHO$

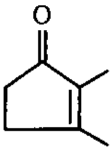
(b) $CH_3CH_2CH_2(CH=CH)_2CHO$

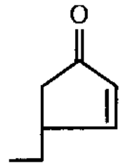
(c) $CH_3(CH_2CH_2)_3CH=CH-CHO$

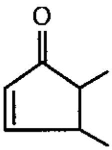
(d) none is correct

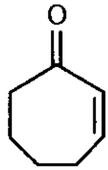
32.  B. (A) and (B) are isomer : Identify (B).

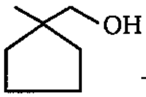
(A)

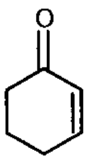
(a) 

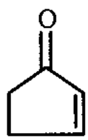
(b) 

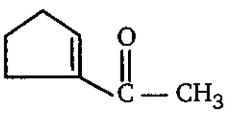
(c) 

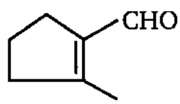
(d) 

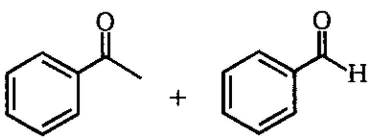
33.  $\xrightarrow[\Delta]{H^+} (A) \xrightarrow[Zn]{O_3} (B) \xrightarrow[\Delta]{HO^-} \underset{(72\%)}{(C)}$; Product (C) is :

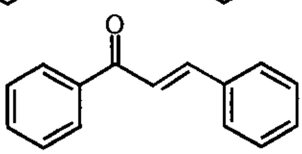
(a) 

(b) 

(c) 

(d) 

34.  $\xrightarrow{\text{HCl/heat}}$ A. Product (A) is:

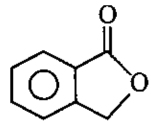
(a) 

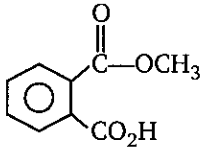
(b) $Ph-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-Ph$

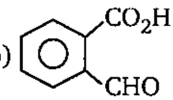
(c) $Ph-CH=CH-\underset{\underset{OH}{|}}{CH}-Ph$(d)

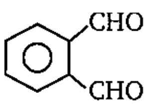
(d) $Ph-CH=C=CH-Ph$

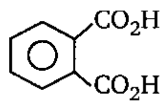
35. Which of the following reactant on reaction with conc. NaOH followed by acidification gives the following lactone as the product ?

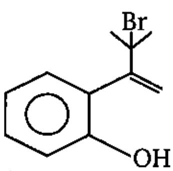


(a) 

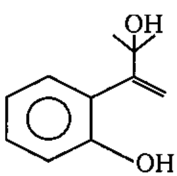
(b) 

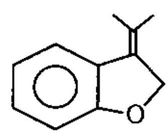
(c) 

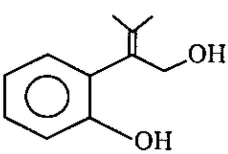
(d) 

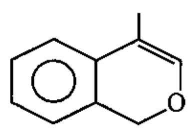
36. 

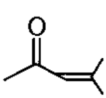
$\xrightarrow{\text{NaOH}}$ Product; Product is:

(a) 

(b) 

(c) 

(d) 

37. $(P) \xrightarrow[\Delta]{\text{KOH}}$ 

$(Q) \xrightarrow[\Delta]{\text{KOH}}$ Ph—CH_2—OH + Ph—$CO_2^{\ominus}$

$(R) \xrightarrow{O_3} P + Q$, Structure of (R) is :

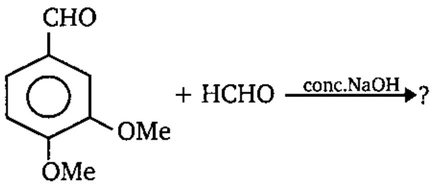
(a) Ph — CH = CH — CH_3

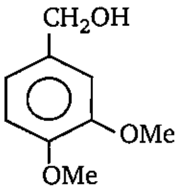
(b) Ph—CH=C(CH_3)(CH_3)

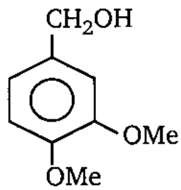
(c) Ph—C(CH_3)=CH—CH_3

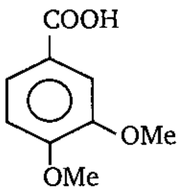
(d) CH_3—C(CH_3)=CH_2

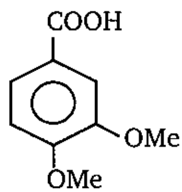
38. The following reaction gives:



(a)  + CH_3OH

(b)  + $HCO_2^{\ominus}$

(c)  + HCOOH

(d)  + CH_3OH

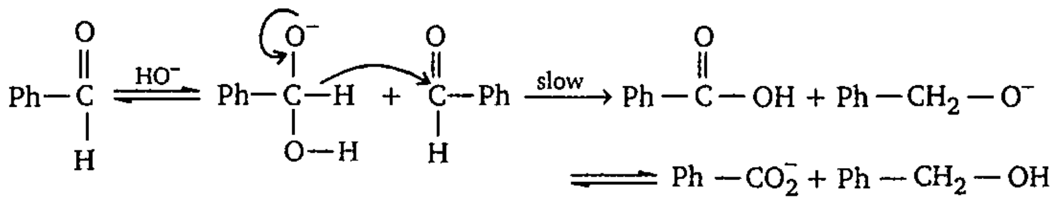
ANSWERS — LEVEL 1

1.	(a)	**2.**	(b)	**3.**	(a)	**4.**	(b)	**5.**	(b)	**6.**	(c)	**7.**	(b)	**8.**	(b)
9.	(b)	**10.**	(c)	**11.**	(a)	**12.**	(a)	**13.**	(a)	**14.**	(b)	**15.**	(a)	**16.**	(b)
17.	(b)	**18.**	(a)	**19.**	(c)	**20.**	(a)	**21.**	(c)	**22.**	(b)	**23.**	(c)	**24.**	(c)
25.	(d)	**26.**	(a)	**27.**	(c)	**28.**	(b)	**29.**	(c)	**30.**	(c)	**31.**	(a)	**32.**	(a)
33.	(c)	**34.**	(a)	**35.**	(c)	**36.**	(b)	**37.**	(b)	**38.**	(b)				

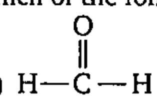
LEVEL-2

1. Comprehension

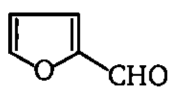
Mechanism of Cannizzaros reaction of benzaldehyde is



A. Which of the following reactants can undergo Cannizaro's reaction.?

(a) 

(b) R_3CCHO

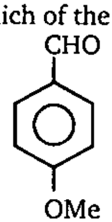
(c) 

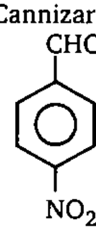
(d) All of these

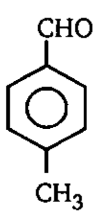
B. Order of the above reaction is:

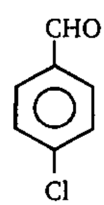
(a) 1
(b) 2
(c) 3
(d) 4

C. Which of the following is best hydride donor in Cannizaro's reaction?

(a) 

(b) 

(c) 

(d) 

D. Cannizaro's reaction is:

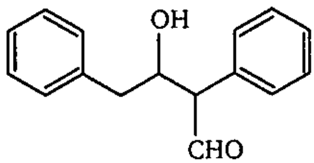
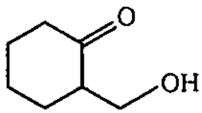
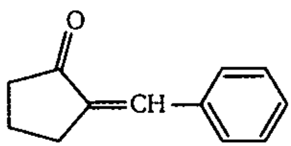
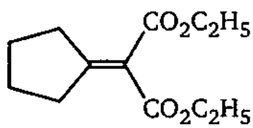
(a) Reduction
(b) Disproportionation reaction
(c) Oxidation
(d) Ion - exchange reaction

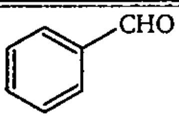
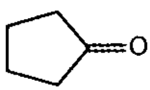
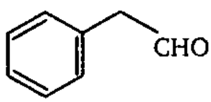
E. Which of the following cannot undergo intramolecular Cannizaro's reaction?

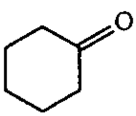
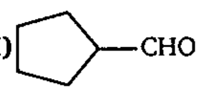
(a) $\mathrm{H-\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle O}{\|}}{C}-H}$ (b) $\mathrm{H-\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle O}{\|}}{C}-Ph}$

(c) $\mathrm{Ph-\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle O}{\|}}{C}-Ph}$ (d) $\mathrm{H-\overset{\overset{\displaystyle O}{\|}}{C}-\overset{\overset{\displaystyle O}{\|}}{C}-H}$

2. Aldol condensation proceeds by carbon-carbon bond formation between an enolate donor and a carbonyl acceptor. For each of the following aldol products (a through e) select a donor and an acceptor compound from the list at the bottom of the page (compounds A through H). Write the letter corresponding to your selection in the appropriate answer box.

	Aldol Product	Donor	Acceptor
a.			
b.			
c.			
d.	$(CH_3)_2C(OH)CH_2COCH_3$		
e.			

(A)  **(B)**  **(C)**  **(D)** $H_2C=O$

(E)  **(F)** $H_2C(CO_2C_2H_5)_2$ **(G)** $H_3C-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$ **(H)** 

3. Comprehension

During an experimental workup procedure, a chemist treated a starting material with NaOH in the solvent acetone [$(CH_3)_2C=O$]; however, the starting material was recovered unreacted. Instead, the chemist isolated a small amount of Product *A* (shown below).

Product A

The chemist determined that Product A resulted from the aldol self-condensation of acetone. Product A was identified based on the following observations.

Observations about Product A

1. Elemental analysis of Product A indicated that it consisted only of carbon, hydrogen, and oxygen.
2. product A had a molecular weight of 116 g/mol.
3. Product A was a methyl ketone because it gave a positive iodoform test.
4. When product A was treated with Br_2 in CCl_4, the red bromine colour persisted, because no carbon-carbon double bonds were present to react with the bromine.

The structure of Product A was further confirmed when treatment with hot sulfuric acid resulted in the corresponding dehydration product, Product B.

A. What is the molecular weight of a compound that undergoes an aldol self-condensation reaction to result in a β-hydroxy ketone with a molecular weight of 144 ?

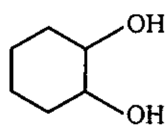
(a) 70 g/mol (b) 72 g/mol
(c) 74 g/mol (d) 76 g/mol

B. The aldol self-condensation of acetone is an equilibrium that favours acetone over its condensation product. Which of the following experimental modifications is most likely to shift the position of equilibrium toward Product A ?

(a) Using only a catalytic amount of NaOH
(b) Using only a catalytic amount of acetone
(c) Removing Product A as it is formed
(d) Increasing the reaction temperature to the boiling point of acetone

C. Based only on observation 1 and 2, which of the following compounds could have been Product A ?

(a) $CH_3\underset{\underset{\displaystyle CH_3}{|}}{C}HCH_2CH_2CH_2CH_2CH_3$ (b) $CH_3\overset{\overset{\displaystyle O}{\|}}{C}CH_2\overset{\overset{\displaystyle OH}{|}}{C}HCH_2CH_2CH_3$

(c) $CH_2=CHCH_2-O-CH_2CH_2CH_3$ (d) 

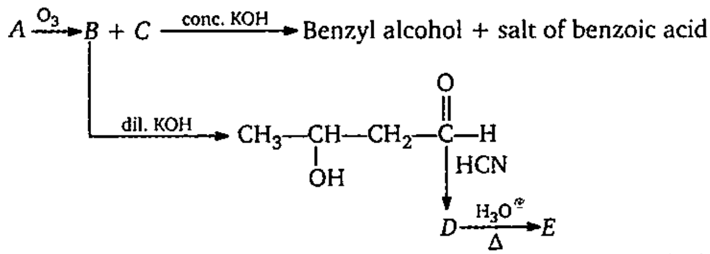
D. When a drop of Br_2 in CCl_4 is added to Product B, the resulting solution will be :

(a) colourless, because Product B does not contain a carbon-carbon double bond
(b) colourless, because Product B contains a carbon-carbon double bond
(c) red, because Product B does not contain a carbon-carbon double bond
(d) red, because Product B contains a carbon-carbon double bond

E. Which of the following compounds from the passage will give a positive iodoform test ?

(a) Product A only (b) Product A and Product B
(c) Product A and acetone only (d) Product A, Product B, and acetone

4. Comprehension



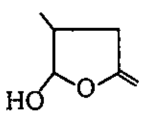
A. Structure of A is :

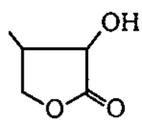
(a) $H_2C=CH-CHO$ (b) $Ph-CH=CH-CH_3$
(c) $Ph-\underset{\underset{CH_3}{|}}{C}=CH_2$ (d) $Ph-CH=\underset{\underset{CH_3}{|}}{C}-CH_3$

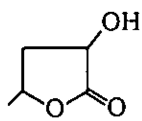
B. Structure of (B) and (C) differentiated by :

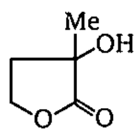
(a) Tollen's reagent (b) Fehling solution (c) 2,4-DNP (d) $NaHSO_3$

C. Structure of E is :

(a) 

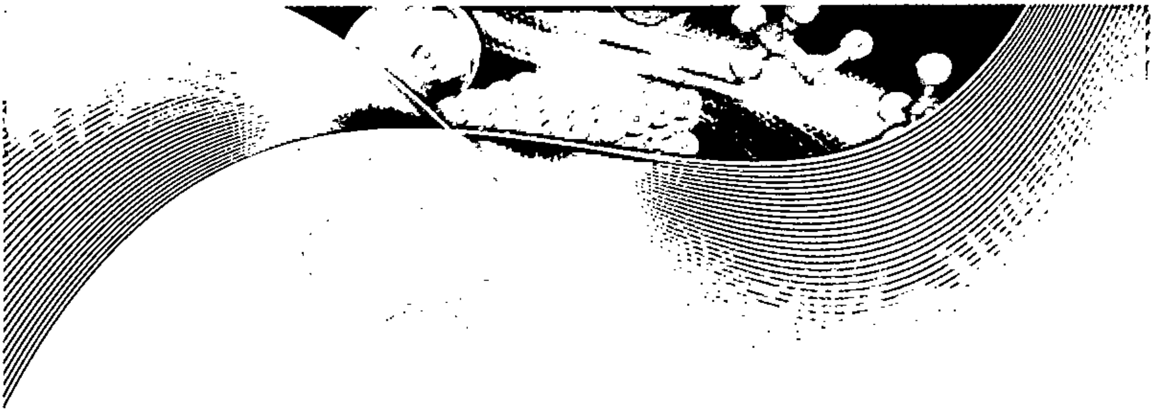
(b) 

(c) 

(d) 

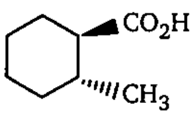
ANSWERS — LEVEL 2

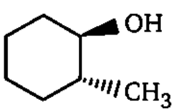
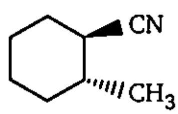
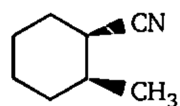
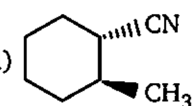
1. A – d; B – c; C – a; D – b; E – c
2. a – Donor = C, Acceptor = C; b – Donor = E, Acceptor = D;
c – Donor = B, Acceptor = A; d – Donor = G, Acceptor = G; e – Donor = F, Acceptor = B
3. A – b; B – c; C – d; D – b; E – d
4. A – b, B – b, C – c



9 CARBOXYLIC ACID AND THEIR DERIVATIVES

1. Identify C in the following sequence of reactions :

 $\xrightarrow{SOCl_2} A \xrightarrow{NH_3} B \xrightarrow[heat]{P_4O_{10}} C(C_8H_{13}N)$

(a)  (b)  (c)  (d) 

2. Saponification (basic hydrolysis) of $C_6H_5\underset{\underset{O}{\|}}{C}\boldsymbol{O}CH_3$ will yield :

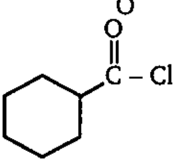
[$\boldsymbol{O}$ = mass – 18 isotope of oxygen]

(a) $C_6H_5-\overset{\overset{O}{\|}}{C}-\boldsymbol{O}^- + H\boldsymbol{O}CH_3$

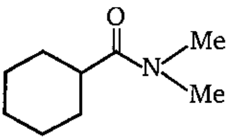
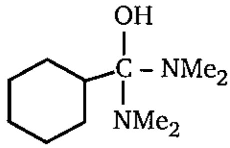
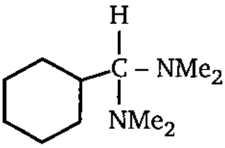
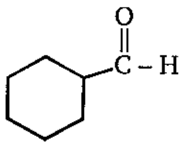
(b) $C_6H_5-\overset{\overset{O}{\|}}{C}-O^- + H\boldsymbol{O}CH_3$

(c) $C_6H_5\underset{\underset{O}{\|}}{C}O^- + H\boldsymbol{O}^-$

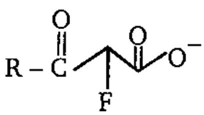
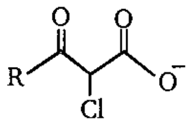
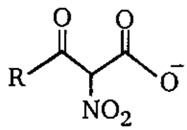
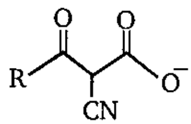
(d) $C_6H_5\underset{\underset{\boldsymbol{O}}{\|}}{C}O^- + HOCH_3$

3.  $\xrightarrow[0°C, 2h]{Me_2NH}$ (X) 86-89% (yield); (3 equivalent)

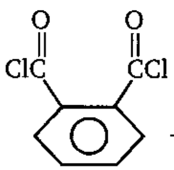
Product (*X*) of the reaction is :

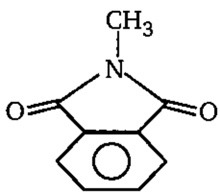
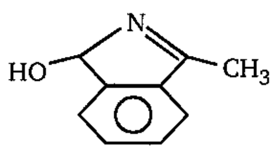
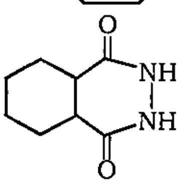
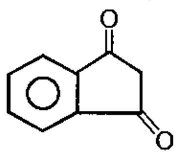
(a) 
(b) 
(c) 
(d) 

4. Which of the following is the correct order of decarboxylation of β-keto carboxylate anion ?

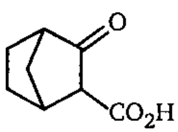
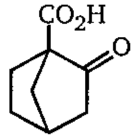

(*a*)

(*b*)

(*c*)

(*d*)

(a) $a > b > c > d$ (b) $c > d > a > b$ (c) $c > d > b > a$ (d) $d > c > a > b$

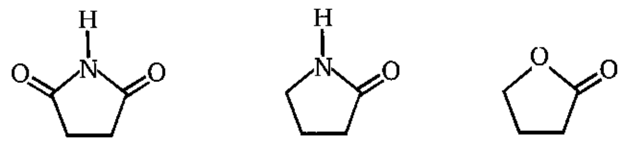
5. 
(A)
$+ CH_3-NH_2 \longrightarrow$ Product of the reaction is :

(a) 
(b) 
(c) 
(d) 

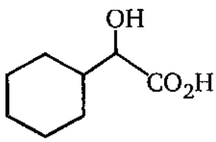
6. Which β-keto acid shown will not undergo decarboxylation ?

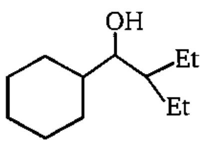
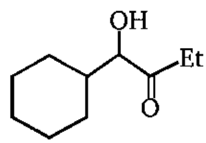
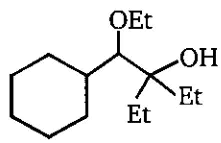
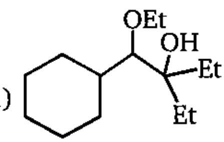
(a) 
(b) 
(c) $Ph-\overset{O}{\overset{||}{C}}-CH_2-CO_2H$ (d) $CH_3-\overset{O}{\overset{||}{C}}-CH_2-CO_2H$

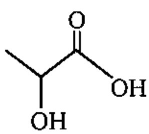
7. Choose the response that matches the correct functional group classification with the following group of structural formulas.

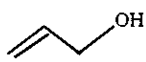


(a) Anhydride	Lactam	Lactone
(b) Lactam	Imide	Lactone
(c) Imide	Lactone	Anhydride
(d) Imide	Lactam	Lactone

8.  $\xrightarrow[\text{(2) } H^+,\ H_2O]{\text{(1) Et–Li(3–eq.)}}$ (*P*) (65% yield) ; Product (*P*) of the reaction is :

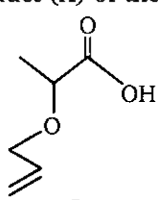
(a)  (b)  (c)  (d) 

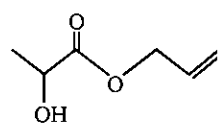
9.  $\xrightarrow[\text{conc. } H_2SO_4 \text{ 89-91\% yield}]{}$ (X) + H_2O

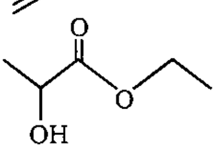


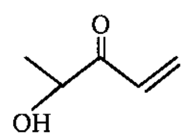
(Lactic acid)

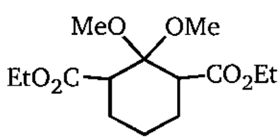
Product (X) of the reaction is :

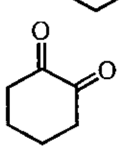
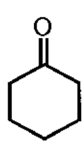
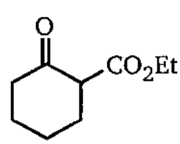
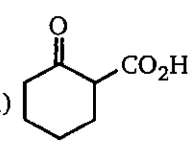
(a) 

(b) 

(c) 

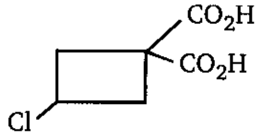
(d) 

10.  $\xrightarrow[\Delta]{H_3O^{\oplus}}$ (*A*) , Product (*A*) obtained is :

(a)  (b)  (c)  (d) 

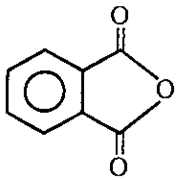
11. Which of the following acid on heating gives geometrical isomers as a product ?

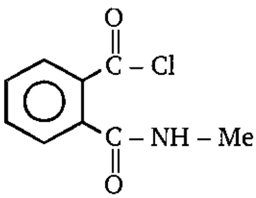
(a) $CH_3-CH(OH)-CO_2H$

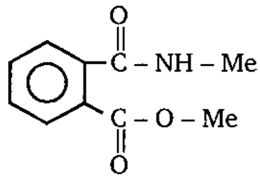
(b) 

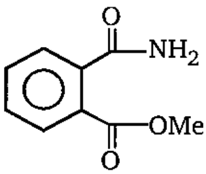
(c) $CH_3-CH(OH)-CH_2-CO_2H$

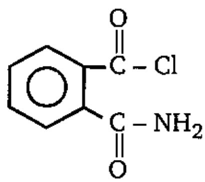
(d) All of these

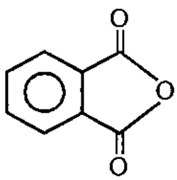
12.  $\xrightarrow{MeOH} A \xrightarrow{PCl_3} B \xrightarrow{MeNH_2} C$; Product (C) of the reaction is :

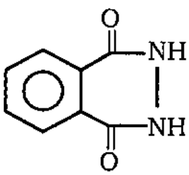
(a) 

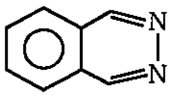
(b) 

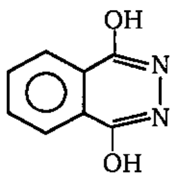
(c) 

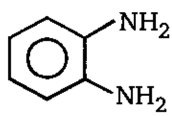
(d) 

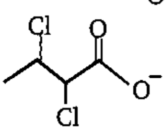
13.  $\xrightarrow{LiAlH_4} A \xrightarrow{PCC} B \xrightarrow{NH_2-NH_2} C$, Product (C) is :

(a) 

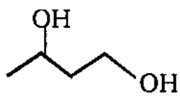
(b) 

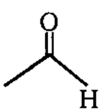
(c) 

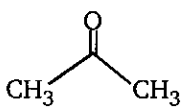
(d) 

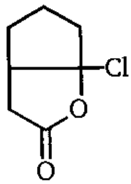
14.  $\xrightarrow{-CO_2} A \xrightarrow{HCl} B \xrightarrow{aq\ KOH} C$. Product ($C$) is :

(a) $CH_3-CH_2-\overset{O}{\overset{\|}{C}}-H$

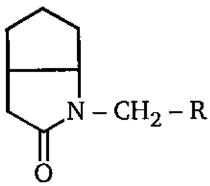
(b) 

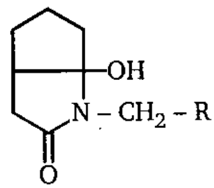
(c) 

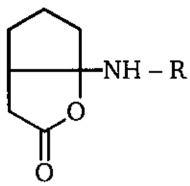
(d) 

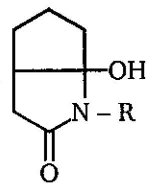
15.  $+ R-CH_2-NH_2 \xrightarrow[THF]{K_2CO_3} (A)$ (71%)

In above reaction identify major product (*A*) of the reaction:

(a) 

(b) 

(c) 

(d) 

16. An optically active compound '*X*' has molecular formula $C_4H_8O_3$. It evolves CO_2 with $NaHCO_3$. '*X*' reacts with $LiAlH_4$ to give an achiral compound. '*X*' is :

(a) $CH_3CH_2CH(OH)COOH$

(b) $CH_3CH(Me)COOH$

(c) $CH_3CH(CH_2OH)COOH$

(d) $CH_3CH(OH)CH_2COOH$

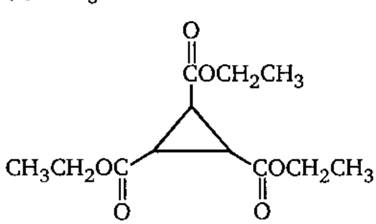
17. $CH_3-\overset{O}{\overset{\|}{C}}-O-CH_2-CH_3 + H-●^- \longrightarrow$ (● $= O^{18}$) One of the product of the reaction is :

(a) $CH_3-\overset{O}{\overset{\|}{C}}-O-H$

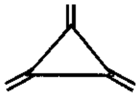
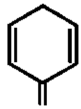
(b) $CH_3-CH_2-●-H$

(c) $CH_3-\overset{O}{\overset{\|}{C}}-●^-$

(d) $CH_3-CH_2-●^-$

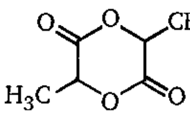
18.  $\xrightarrow{KOH} \xrightarrow{H_3O^+} \xrightarrow{PCl_5} \xrightarrow{LiAlH_4} \xrightarrow{H^+/\Delta} (X)$

Product (X) is :

(a)  (b)  (c)  (d) 

19. Identify final product in the following reaction;

$$CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCOOH \xrightarrow{\Delta} \text{Product}$$

(a)  (b) $CH_2=CHCO_2H$ (c) $CH_3-\overset{O}{\overset{\|}{C}}CO_2H$ (d) CH_3CH_2OH

20. Select the final product from this sequence of reactions.

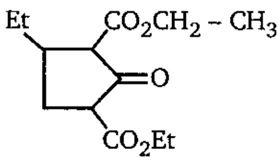
$$\text{Acetoacetic ester} \xrightarrow{NaOEt} \xrightarrow{CH_3I} \xrightarrow{NaOEt} \xrightarrow{CH_3CH_2CH_2Br}$$

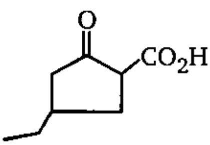
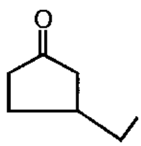
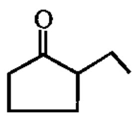
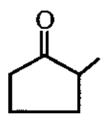
(a) $H_3C-\overset{O}{\overset{\|}{C}}-\overset{CH_3}{\overset{|}{\underset{CH_2CH_2CH_3}{\underset{|}{C}}}}-COOC_2H_5$

(b) $H_3C-\overset{CH_3}{\overset{|}{\underset{CH_2CH_2CH_3}{\underset{|}{C}}}}-CH_2COOC_2H_5$

(c) $H_3C-\overset{H}{\overset{|}{\underset{CH_2CH_2CH_3}{\underset{|}{C}}}}-CH_2COOC_2H_5$

(d) $CH_3CO-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-CH_2COOC_2H_5$

21.  $\xrightarrow[\text{heat}]{H_2O,\ H_2SO_4} (A)$; Product (A) will be :

(a)  (b)  (c)  (d) 

22. $CH_2(CO_2Me)_2 + ? \xrightarrow[\text{(ii) AcOH}]{\text{(i) Na}} CH(CO_2Me)_3$

Which of the following reactants will complete the above reaction ?

(a) $CH_2(CO_2Me)_2$ (b) $(CO_2Me)_2$

(c) $Cl-CO_2Me$ (d) $COCl_2$

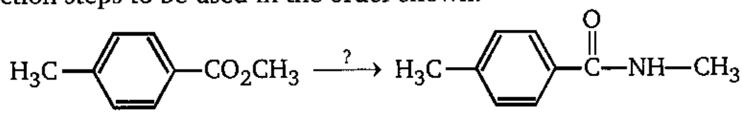
23. Arrange the following in order of increasing reactivity (least $\longrightarrow$ most) towards nucleophile

$\underset{1}{CH_3\overset{O}{\overset{\|}{C}}OCHCH_3}$ $\underset{2}{CH_3\overset{O}{\overset{\|}{C}}Cl}$ $\underset{3}{CH_3\overset{O}{\overset{\|}{C}}NHCH_3}$

(a) $1 < 2 < 3$ (b) $3 < 1 < 2$

(c) $1 < 3 < 2$ (d) $2 < 1 < 3$

24. Choose the best sequence of reactions for transformation given. Semicolons indicate separate reaction steps to be used in the order shown.



(a) H_3O^+; $SOCl_2$; CH_3NH_2

(b) HO^-/H_2O; PBr_3; Mg; CO_2; H_3O^-; $SOCl_2$; CH_3NH_2

(c) $LiAlH_4$; H_2O; HBr; Mg; CO_2; H_3O^+; $SOCl_2$; CH_3NH_2

(d) None of these would yield the desired product

25. A key step in the hydrolysis of acetamide in aqueous acid proceeds by nucleophilic addition of :

(a) H_3O^+ to $CH_3\overset{O}{\overset{\|}{C}}NH_2$

(b) H_2O to $CH_3\overset{^+OH}{\overset{\|}{C}}NH_2$

(c) H_3O^+ to $CH_3\overset{^+OH}{\overset{\|}{C}}NH_2$

(d) HO^- to $CH_3\overset{^+OH}{\overset{\|}{C}}NH_2$

26. Which reaction is not possible for acetic anhydride ?

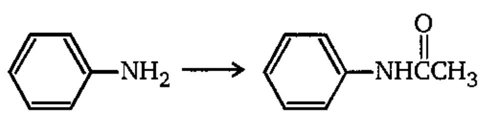
(a) $(CH_3\overset{O}{\overset{\|}{C}})_2O + 2HN(CH_3)_2 \longrightarrow CH_3\overset{O}{\overset{\|}{C}}N(CH_3)_2 + CH_3CO_2^- + H_2\overset{+}{N}(CH_3)_2$

(b) $(CH_3\overset{O}{\overset{\|}{C}})_2O + CH_3CH_2OH \longrightarrow CH_3\overset{O}{\overset{\|}{C}}OCH_2CH_3 + CH_3CO_2H$

(c) $(CH_3\overset{O}{\overset{\|}{C}})_2O + C_6H_6 \xrightarrow{AlCl_3} CH_3\overset{O}{\overset{\|}{C}}C_6H_5 + CH_3CO_2H$

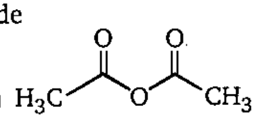
(d) $(CH_3\overset{O}{\overset{\|}{C}})_2O + NaCl \longrightarrow CH_3\overset{O}{\overset{\|}{C}}Cl + CH_3CO_2^-Na^+$

27. All but one of the following compounds react with aniline to give acetanilide. Which one does not?

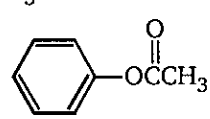


Aniline Acetanilide

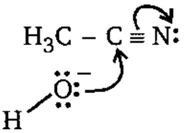
(a) $CH_3\overset{O}{\overset{\|}{C}}-Cl$

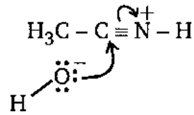
(b) 

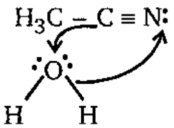
(c) $CH_3\overset{O}{\overset{\|}{C}}-H$

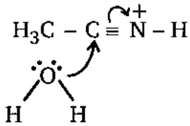
(d) 

28. Which of the following best describes the nucleophilic addition step in the acid-catalyzed hydrolysis of acetonitrile (CH_3CN) ?

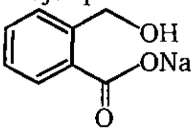
(a) 

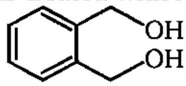
(b) 

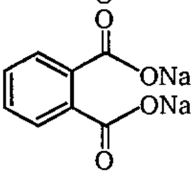
(c) 

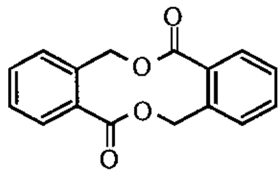
(d) 

29. The major product expected, when Phthalamide is treated with NaOH, is :

(a) 

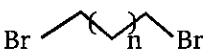
(b) 

(c) 

(d) 

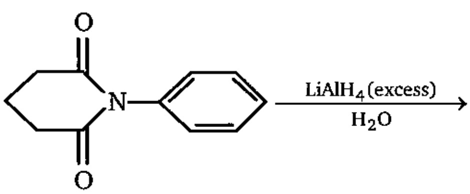
30. Which of following acid remains unaffected on heating ?

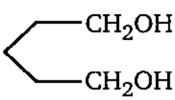
(a) malonic acid
(b) maleic acid
(c) Fumaric acid
(d) Succinic acid

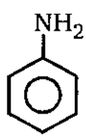
31.  $+ CH_2(CO_2Et)_2 \xrightarrow[EtOH]{NaOEt}$ cyclic product

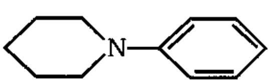
At which value of n the formation of six membered ring takes place ?

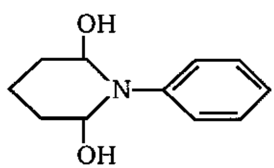
(a) $n = 2$
(b) $n = 3$
(c) $n = 5$
(d) $n = 6$

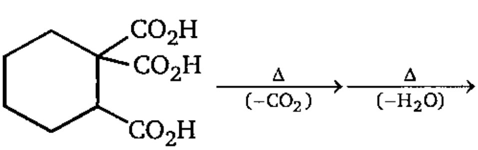
32.  Product of the reaction is :

(a) 

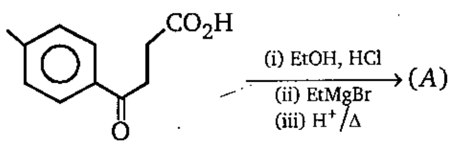
(b) 

(c) 

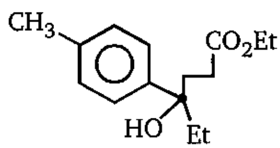
(d) 

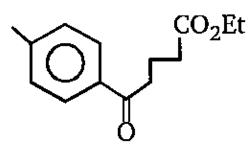
33.  , Product of the reaction is :

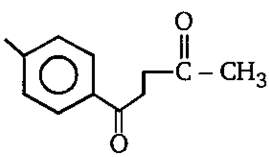
(a) *cis*-anhydride (b) *trans*--anhydride
(c) both (a) & (b) (d) mono-basic acid

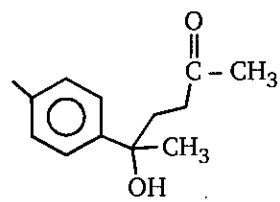
34. 

Product (A) of the reaction is :

(a) 

(b) 

(c) 

(d) 

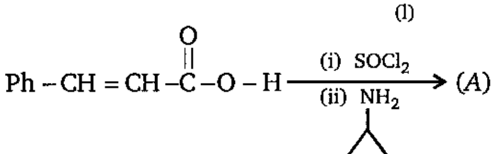
35.
$$\begin{array}{l} CH_2-O-COR \\ | \\ CH-O-COR_2 \quad + 3NaOH \longrightarrow (A) + \text{Salt of fatty acid (soap)} \\ | \\ CH_2-O-COR_3 \end{array}$$

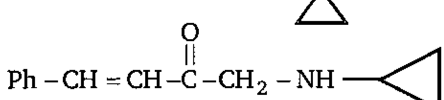
Product (*A*) of the reaction is :

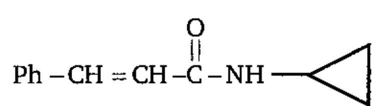
(a) Ethylene glycol (b) Glycerol
(c) Glyceryltrinitrate (explosive) (d) Cumene hydrogen peroxide

36. $\underset{(d)}{CH_3-\underset{|}{\overset{}{CH}}(Et)-OAc} \xrightarrow{HO^-}$ Product of the reaction is : (d=dextro rotatory)

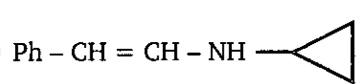
(a) $CH_3-\underset{(d)}{\overset{Et}{\overset{|}{CH}}}-OH$ (b) $CH_3-\underset{\underset{(l)}{Et}}{\underset{|}{CH}}-OH$ (c) $CH_3-\underset{\underset{(d)\ \&\ (l)}{Et}}{\underset{|}{CH}}-OH$ (d) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH_2$

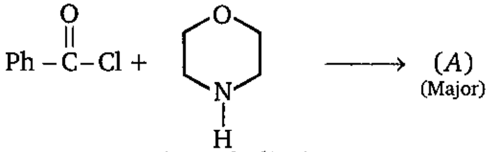
37.  Product (*A*) of the reaction is :

(a) 

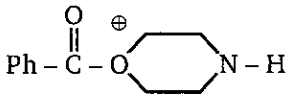
(b) 

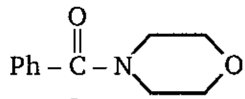
(c) $Ph-CH=CH-\overset{O}{\overset{||}{C}}-H$

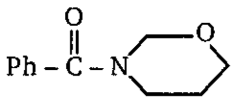
(d) 

38.  ; Identify the product (*A*).

(Morpholine)

(a) 

(b) 

(c) 

(d) $Ph-\overset{\overset{O}{||}}{C}-NH_2$

39. 

Above reaction is an example of :

(a) Esterification
(b) Saponification
(c) Hydrolysis
(d) Trans Esterification

40. Which of the following is an intermediate formed in the reaction shown below ?

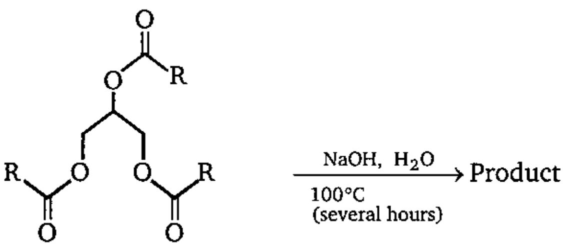
$$CH_3-\overset{\overset{O}{||}}{C}-Cl+NH_3 \longrightarrow \text{Intermediate} \longrightarrow \text{product.}$$

(a) $CH_3-\overset{\oplus}{N}H_3$

(b) $CH_3-\overset{\overset{O}{||}}{C}\oplus$

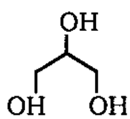
(c) $Cl-\underset{\underset{\oplus NH_3}{|}}{\overset{\overset{OH}{|}}{C}}-Cl$

(d) $CH_3-\underset{\underset{\oplus NH_3}{|}}{\overset{\overset{O^-}{|}}{C}}-Cl$

41. 

(Principal component of coconut oil.)

Product is obtained in the above reaction is :

(a) $R-CO_2Na$
(b) 
(c) Both (a) and (b)
(d) None of these

42. The reaction of sodium acetate with acetyl chloride proceeds through which of the following mechanisms ?

(a) $CH_3-\overset{\overset{O}{||}}{C}-\bar{O} \;+\; CH_3-\overset{\overset{O}{||}}{C}-Cl$

(b) $CH_3-\overset{\overset{O}{||}}{C}-\bar{O} \;+\; CH_3-\overset{\overset{O}{||}}{C}-Cl$

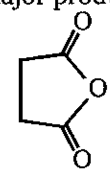
(c) $CH_3-\overset{O}{\overset{\|}{C}}-O^- \quad + \quad CH_3-\overset{O}{\overset{\|}{C}}-Cl$ (d) $CH_3-\overset{O}{\overset{\|}{C}}-O^- \quad + \quad Cl-\overset{O}{\overset{\|}{C}}-CH_3$

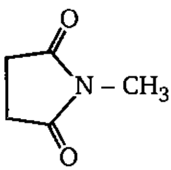
43. Which is the major product of the following reaction ?

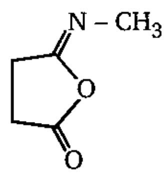
$$CH_3-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow{H_2S} \text{product}$$

(a) $CH_3-\underset{SH}{\underset{|}{\overset{OH}{\overset{|}{C}}}}-Cl$ (b) $CH_3-\overset{O}{\overset{\|}{C}}-SH$ (c) $CH_3-\overset{S}{\overset{\|}{C}}-Cl$ (d) $CH_3-\overset{O}{\overset{\|}{C}}-S-\overset{O}{\overset{\|}{C}}-CH_3$

44. Which is the major product of the following reaction ?

 $+ CH_3-NH_2 \xrightarrow{\Delta}$ product

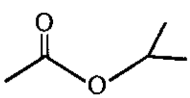
(a) 

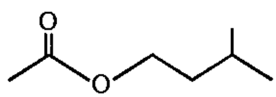
(b) 

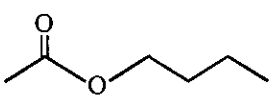
(c) $HO-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-NH-CH_3$

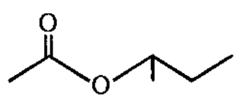
(d) $CH_3-NH-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-NH-CH_3$

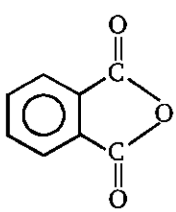
45. Ethanoic acid + 3-methyl-1-butanol $\underset{\text{traces } H_2SO_4}{\rightleftharpoons}$ (A); Compound (A) is :

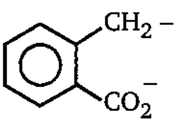
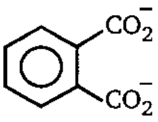
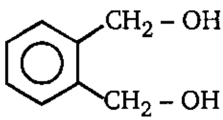
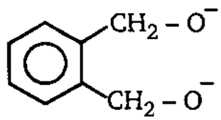
(a) 

(b) 

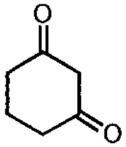
(c) 

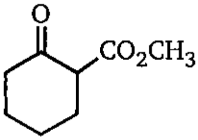
(d) 

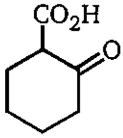
46.  $\xrightarrow{PCl_5} (A) \xrightarrow{LiAlH_4} (B) \xrightarrow{PCC} (C) \xrightarrow[\Delta]{HO^-} (D)$

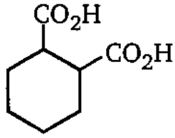
(a)  (b)  (c)  (d) 

47. Which of the following compounds will undergo decarboxylation on heating ?


1


2


3


4

(a) 2 and 3 (b) 3 and 4 (c) 3 only (d) 1 and 4

48. Which one of the following is not an intermediate in the generally accepted mechanism for the reaction shown below ?

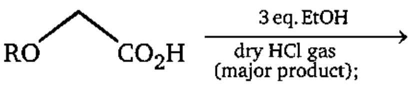
$$CF_3\overset{O}{\overset{\|}{C}}OH + CH_3\underset{OH}{\underset{|}{C}H}CH_3 \xrightarrow{H_2SO_4} CF_3\overset{O}{\overset{\|}{C}}O\underset{CH_3}{\underset{|}{C}H}\,CH_3 + H_2O$$

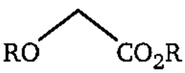
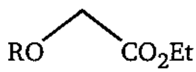
(a) $CF_3\overset{\overset{+}{\ddot{O}}H}{\overset{\|}{C}} - \ddot{O}H$

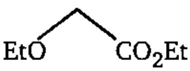
(b) $CF_3\overset{\overset{\ddot{O}:^-}{|}}{\underset{\underset{:\ddot{O}H}{|}}{C}} - \ddot{O}CH(CH_3)_2$

(c) $CF_3\overset{\overset{:\ddot{O}H}{|}}{\underset{\underset{\overset{+}{\ddot{O}}H_2}{|}}{C}} - \ddot{O}CH(CH_3)_2$

(d) $CF_3\overset{\overset{:\ddot{O}H}{|}}{\underset{\underset{:\ddot{O}H}{|}}{C}} - \ddot{O}CH(CH_3)_2$

49.  (A); Product A is :

(a)  (b) 

(c)  (d) $R - O - \overset{O}{\overset{\|}{C}} - O - Et$

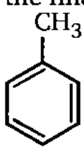
50. Identify the compound C in the following sequence :

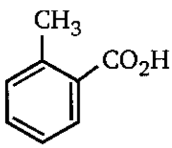
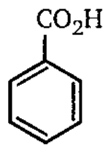
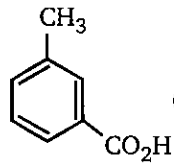
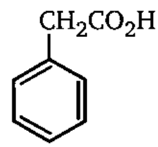
$$(CH_3)_2CHCH_2C \equiv N \xrightarrow{HCl,\ H_2O} \text{compound } A \xrightarrow[2.\ H_2O]{1.\ LiAlH_4} \text{compound } B \xrightarrow[CH_2Cl_2]{PCC} \text{compound } C$$

(a) $(CH_3)_2CH\overset{O}{\overset{||}{C}}CH_3$ (b) $(CH_3)_2CHCH_2\overset{O}{\overset{||}{C}}OH$

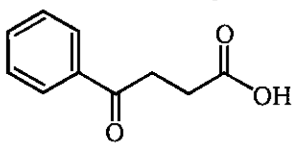
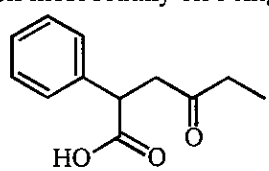
(c) $(CH_3)_2CHCH_2\overset{O}{\overset{||}{C}}H$ (d) $(CH_3)_2CH\overset{O}{\overset{||}{C}}CH_2OH$

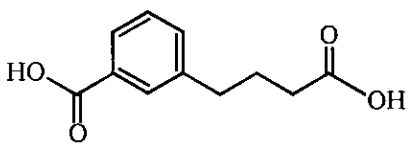
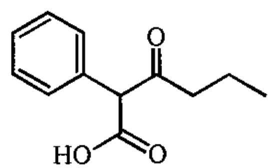
51. What is the final product (*B*) of this sequence ?

 $\xrightarrow[\text{light}]{Br_2} A \xrightarrow[2.\ H_3O^+,\ \text{heat}]{1.\ KCN} B$

(a)  (b)  (c)  (d) 

52. Which of the following undergoes decarboxylation most readily on being heated ?

(a)  (b) 

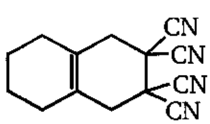
(c)  (d) 

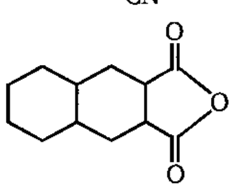
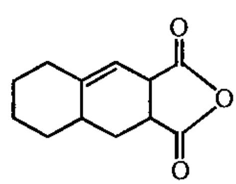
53. What is compound *Z* ?

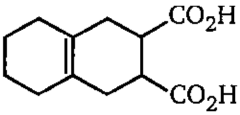
$CH_3CH_2CH_2Br \xrightarrow{NaCN} X \xrightarrow[\text{heat}]{H_3O^+} Y \xrightarrow[H^+]{CH_3CH_2OH} Z$

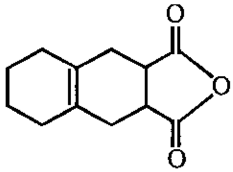
(a) $CH_3CH=CH\overset{O}{\overset{||}{C}}OH$ (b) $CH_3CH_2CH_2CH=NOCH_2CH_3$

(c) $CH_3CH_2CH_2CH(OCH_2CH_3)_2$ (d) $CH_3CH_2CH_2\overset{O}{\overset{||}{C}}OCH_2CH_3$

54.  $\xrightarrow{H_3O^{\oplus}/\Delta}$ (*A*); Product (*A*) of the reaction is :

(a)  (b) 

(c) 

(d) 

55. $CH_3-CH=CH-CH_2-CO_2H \xrightarrow[\Delta]{} (X)$ (major); Product (X) is :

(a) $CH_3-CH=CH-CH_3$

(b) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH_2$

(c) $CH_3-CH_2-CH=CH_2$

(d) $CH_3-CH=CH_2$

56. $H-O-\overset{\displaystyle O}{\overset{||}{C}}-(CH_2)_n-\overset{\displaystyle O}{\overset{||}{C}}-O-H \xrightarrow[\Delta]{}$ product, At what value of (n) given compound will not evolve CO_2 gas ?

(a) $n = 5$ (b) $n = 4$ (c) $n = 2$ (d) $n = 1$

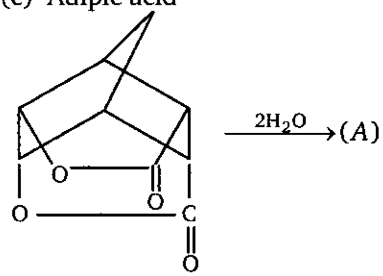
57. $\begin{array}{c} CO_2H \\ | \\ (CH_2)_n \\ | \\ CO_2H \end{array}$; If $(n = 4)$ then di-carboxylic acid would be known as :

(a) Malonic acid

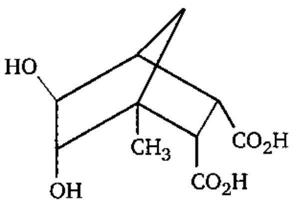
(b) Succinic acid

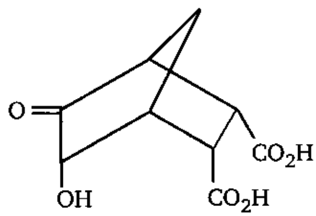
(c) Adipic acid

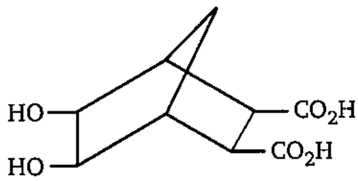
(d) Oxalic acid

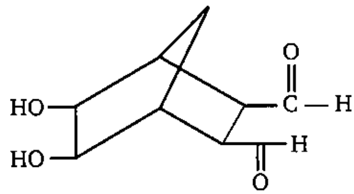
58. 

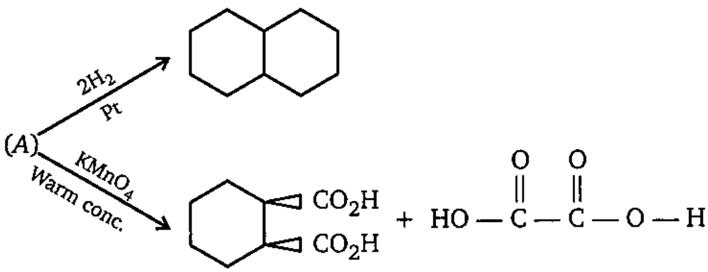
Product (A) of the above reaction is :

(a) 

(b) 

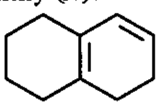
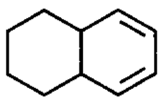
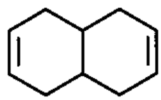
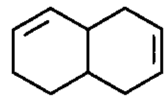
(c) 

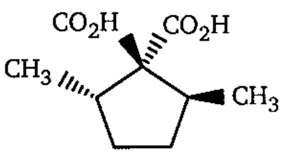
(d) 

59. 

cis-cyclo hexane 1,2-dicarboxylic acid

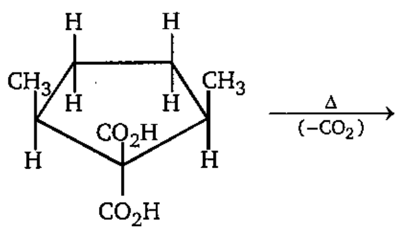
Identify (*A*).

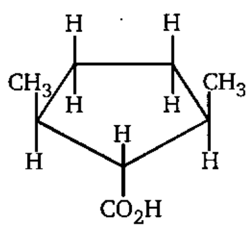
(a) 
(b) 
(c) 
(d) 

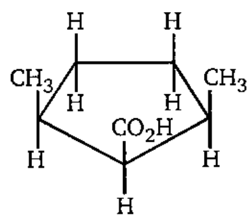
60. 

How many product will be formed when above compound undergo de-carboxylation?

(a) 0 (b) 1 (c) 2 (d) 3

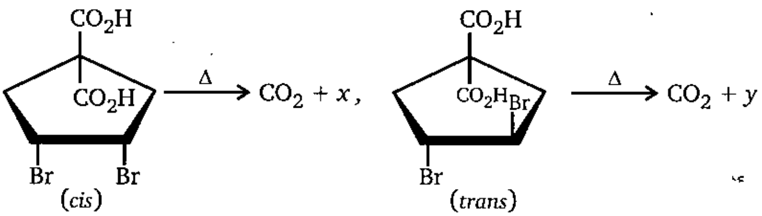
61.  Product of the reaction is :

(a) 

(b) 

(c) Both (a) and (b) (d) none of these

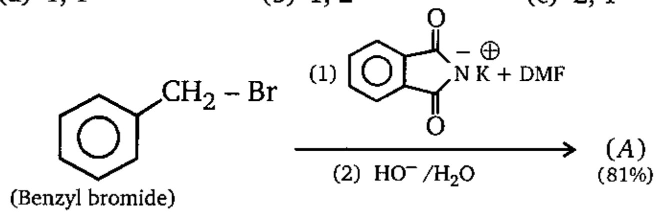
62. Products obtained in the given reactions are shown below.



The number of possible products for x and y are :

(a) 1, 1 (b) 1, 2 (c) 2, 1 (d) 2, 2

63.



Product (A) of the above reaction is :

(a) $Ph-NH_2$
(b) $Ph-CH_2-NH_2$
(c) $Ph-CH_2-NH-CO_2H$
(d) $Ph-CH_2-NH-CHO$

64. Which of the following pair is C_2-epimer ?

(a) *D*-Glucose, *D*-Maltose
(b) *D*-Glucose, *D*-Mannose
(c) *D*-Allose, *D*-Ribose
(d) *D*-Glucose, *D*-Arabinose

65. Total number of enol possible for the compound formed during given reaction will be (including stereoisomer):

$$CH_3MgBr + CH_3CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-Cl \longrightarrow$$

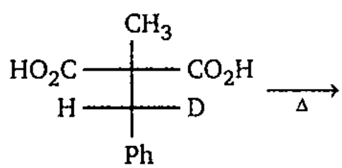
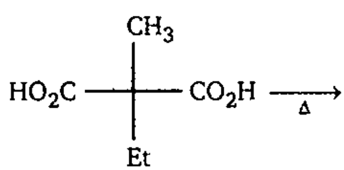
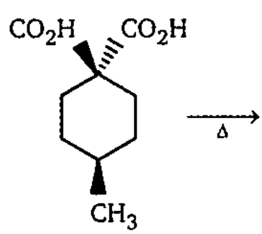
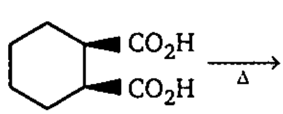
(a) 2 (b) 3 (c) 4 (d) 5

ANSWERS — LEVEL 1

1.	(b)	2.	(b)	3.	(a)	4.	(c)	5.	(a)	6.	(b)	7.	(d)	8.	(b)
9.	(b)	10.	(b)	11.	(d)	12.	(b)	13.	(b)	14.	(a)	15.	(b)	16.	(c)
17.	(c)	18.	(b)	19.	(a)	20.	(a)	21.	(b)	22.	(c)	23.	(b)	24.	(a)
25.	(b)	26.	(d)	27.	(c)	28.	(d)	29.	(c)	30.	(c)	31.	(b)	32.	(c)
33.	(a)	34.	(a)	35.	(b)	36.	(a)	37.	(b)	38.	(b)	39.	(d)	40.	(d)
41.	(c)	42.	(c)	43.	(b)	44.	(c)	45.	(b)	46.	(a)	47.	(c)	48.	(b)
49.	(b)	50.	(c)	51.	(d)	52.	(d)	53.	(d)	54.	(d)	55.	(c)	56.	(c)
57.	(c)	58.	(c)	59.	(b)	60.	(b)	61.	(c)	62.	(c)	63.	(b)	64.	(b)
65.	(b)														

LEVEL-2

1. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Reaction		**Products formed**	
(a)		**(p)**	Diastereomers
(b)		**(q)**	Racemic mixture
(c)		**(r)**	Meso compound
(d)		**(s)**	CO_2 gas will evolve

ANSWERS — LEVEL 2

1. a – p, s; b – q, s; c – p, s; d – r

10 AMINES

LEVEL-1

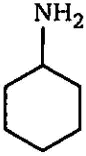
1. In which of the following reaction cyanide will be obtained as a major product ?

(a) $Ph-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[\text{(ii) } H_3O^+]{\text{(i) } LiAlH_4}$

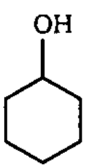
(b) $Ph-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow[Br_2]{NaOH}$

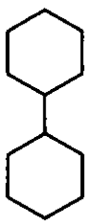
(c) $Ph-\overset{\overset{O}{\|}}{C}-NH_2 \xrightarrow{P_4O_{10}}$

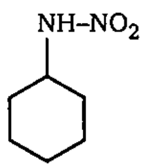
(d) $Ph-\overset{\overset{O}{\|}}{C}-O-H \xrightarrow{SOCl_2} \xrightarrow{NH_3}$

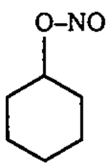
2.  $\xrightarrow{HNO_2}$ A (Major) :

Product (A) is :

(a) 

(b) 

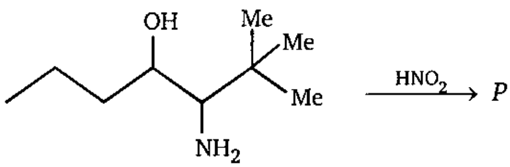
(c) 

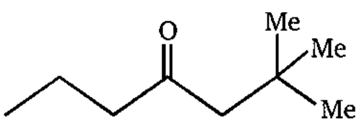
(d) 

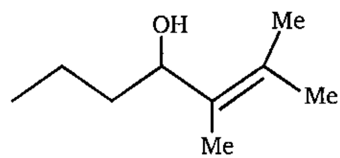
3. Which of the following alkene cannot be prepared by de-amination of n-Bu $-$ NH_2 (n-Butyl) with $NaNO_2/HCl$?

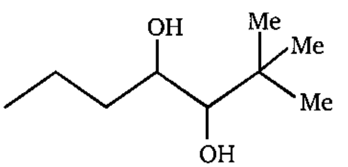
(a) 1-butene (b) *cis*-2-butene (c) *trans*-2-butene (d) Iso-butene

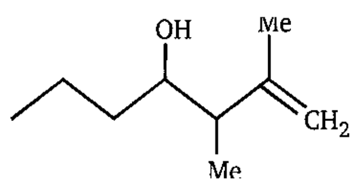
4. Predict the major product P in the following reaction.

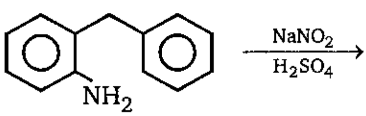


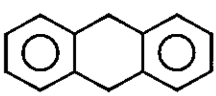
(a) 

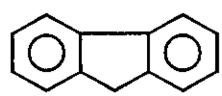
(b) 

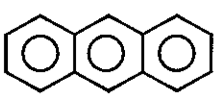
(c) 

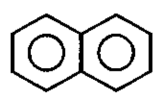
(d) 

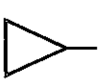
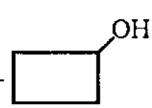
5.  (A); Product of this reaction is :

(a) 

(b) 

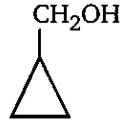
(c) 

(d) 

6.  $CH_2-NH_2 \xrightarrow{HNO_2} \underset{48\%}{(A)} +$  47% $+ CH_2=CH-CH_2-CH_2-OH$

A will be :

(a) $CH_2=CH-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$

(b) 

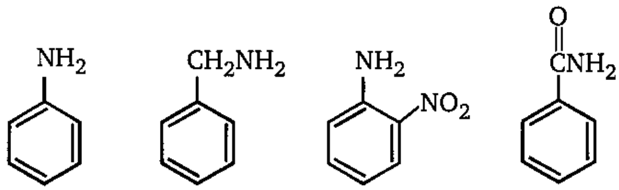
(c) 

(d) 

7. Which of the following isomers of C_8H_9NO is the weakest base ?

(a) *o*-Aminoacetophenone (b) *p*-Aminoacetophenone
(c) *m*-Aminoacetophenone (d) Acetanilide

8. Rank the following compounds in order of increasing basic strength. (weakest → strongest) :



1 2 3 4

(a) 4 < 2 < 1 < 3 (b) 4 < 3 < 1 < 2
(c) 4 < 1 < 3 < 2 (d) 2 < 1 < 3 < 4

9. Which of the following arylamines will not form a diazonium salt on reaction with sodium nitrite in hydrochloric acid ?

(a) *m*-Ethylaniline (b) *p*-Aminoacetophenone
(c) 4-Chloro-2-nitroaniline (d) *N*-Ethyl-2-methylaniline

10. Identify product *D* in the following reaction sequence :

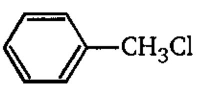
$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2CH_2OH \xrightarrow[H_2O,\ heat]{K_2Cr_2O_7;\ H_2SO_4} A \xrightarrow{SOCl_2} B \xrightarrow[(2mole)]{(CH_3)_2NH} C \xrightarrow[2.\ H_2O]{1.\ LiAlH_4 \text{ diethyl ether}} D$$

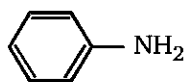
(a) $CH_3\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}CH_2C\equiv N$ (b) $CH_3\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}CH_2CH_2N(CH_3)_2$

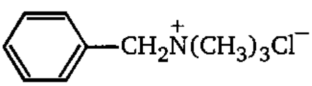
(c) $CH_3\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}CH_2\overset{\overset{N(CH_3)_2}{|}}{C}HN(CH_3)_2$ (d) $CH_3\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}CH_2\underset{\underset{OH}{|}}{C}HN(CH_3)_2$

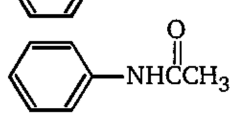
11. Which one of the following is best catalyst for the reaction shown below ?

$$CH_3(CH_2)_8CH_2Br \xrightarrow[benzene]{KCN} CH_3(CH_2)_8CH_2CN$$

(a) 

(b) 

(c) 

(d) 

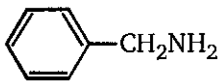
12. The major products obtained from the following sequence of reactions are :

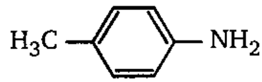
$$(CH_3)_2CHCH_2N(CH_2CH_3)_2 \xrightarrow{CH_3I} \xrightarrow[H_2O]{Ag_2O} \xrightarrow{\text{heat}} \text{products}$$

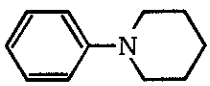
(a) $(CH_3)_2CHCH_2NH_2 + H_2C=CH_2$ (b) $(CH_3)_2NCH_2CH_3 + H_2C=C(CH_3)_2$

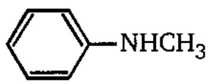
(c) $(CH_3)_2CHCH_2\overset{CH_3}{\overset{|}{N}}CH_2CH_3 + H_2C=CH_2$ (d) $(CH_3)_3\overset{+}{N}CH_2CH_3I^- + H_2C=CH_2$

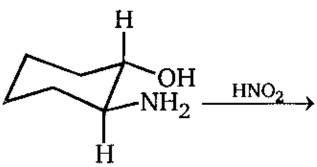
13. Which amine yields N-nitroso amine after treatment with nitrous acid ($NaNO_2$, HCl) ?

(a) 

(b) 

(c) 

(d) 

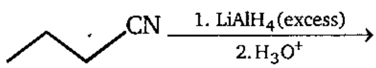
14. 

(A); Product (A) is :

(a) cyclopentane carboxyaldehyde (b) cyclohexane-1, 2-diol

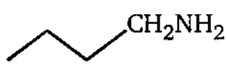
(c) 2-aminocyclohexene (d) cyclohex-2-enol

15. Choose the appropriate product for this reaction.

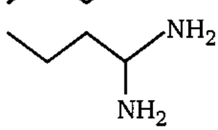


product

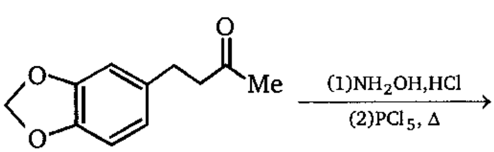
(a) 

(b) 

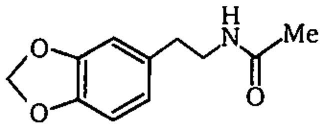
(c) 

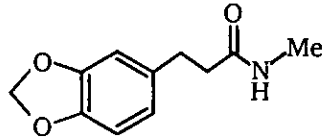
(d) 

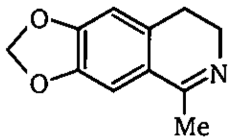
16. Which of the following product will be obtained in the given (consider minor product also) Beckmann-type rearrangement ?



product

(a) 

(b) 

(c) 

(d) all of these

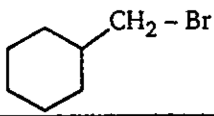
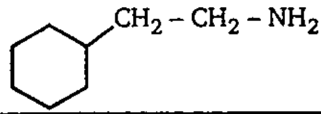
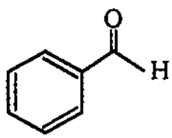
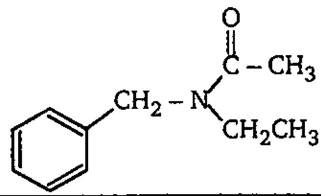
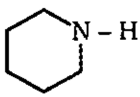
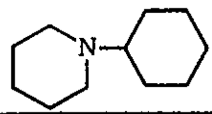
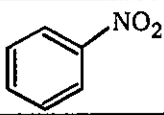
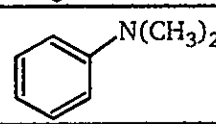
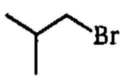
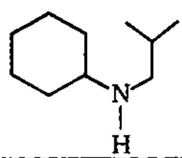
17. Deamination (or) diazotization of n-Bu–NH_2 with $NaNO_2/HCl$ gives .... isomeric butene.

(a) 2 (b) 3 (c) 4 (d) 5

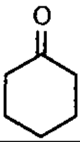
ANSWERS — LEVEL 1															
1.	(c)	2.	(a)	3.	(d)	4.	(a)	5.	(b)	6.	(b)	7.	(d)	8.	(b)
9.	(d)	10.	(b)	11.	(c)	12.	(c)	13.	(d)	14.	(a)	15.	(b)	16.	(d)
17.	(b)														

LEVEL-2

1. Five amine syntheses are outlined below. In each reaction box enter a single letter designating the best reagent and conditions selected from the list at the bottom of the page.

A.		First Step ☐ → Second Step ☐	
B.		First Step ☐ → Second Step ☐ Third Step ☐	
C.		First Step ☐ → Second Step ☐	
D.		First Step ☐ → Second Step ☐	
E.		First Step ☐ Second Step ☐ → Third Step ☐ Fourth Step ☐	

(a)	(i) $LiAlH_4$ in ether (ii) H_2O & base	
(b)	$C_2H_5NH_2$(cat. $H^{(+)}$)	
(c)	NaCN in alcohol	
(d)	H_2 & Ni catalyst or H_2 & Pd catalyst	
(e)	NaN_3 in alcohol	
(f)	$(CH_3CO)_2O$ & pyridine	
(g)	C_2H_5Br	

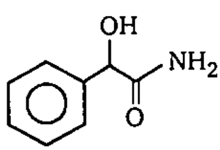
(h)	 , $H^{\oplus}$	
(i)	$2CH_3I$ & pyridine	
(j)	KOH in H_2O	

ANSWERS — LEVEL 2

1. A – c, a or c, d; B – b, d, f; C – h, d; D – d, i or a, i; E – e, a, h, a

11 CARBENE AND NITRENE

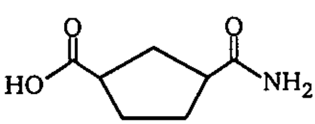
LEVEL-1

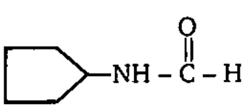
1.  $\xrightarrow{Br_2/KOH}$ product;

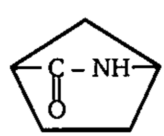
(α-hydroxy amide)

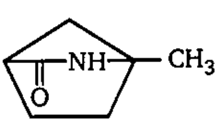
Product of this Hoffmann bromamide reaction is :

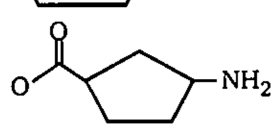
(a) $Ph-\overset{\overset{O}{\|}}{C}-CH_3$ (b) $Ph-CHO$ (c) $Ph-CH\begin{cases}OH\\NO_2\end{cases}$ (d) $Ph-CH_2-NH_2$

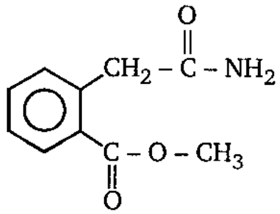
2.  $\xrightarrow{KOBr}$ (A) $\xrightarrow[\Delta]{}$ (B). Compound (B) is :

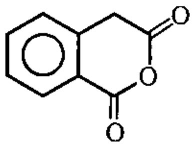
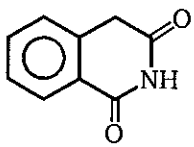
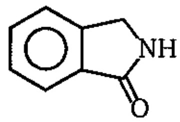
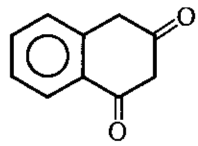
(a) 

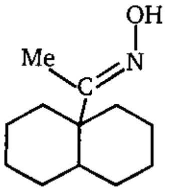
(b) 

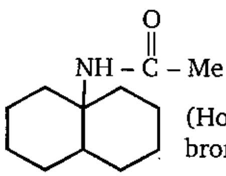
(c) 

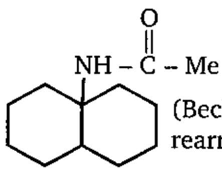
(d) 

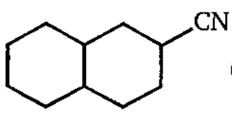
3.  $\xrightarrow{KOBr}$ (A); Product (A) is :

(a)  (b)  (c)  (d) 

4.  $\xrightarrow{H_2SO_4}$ Product and name of the reaction is :

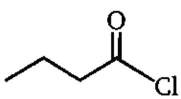
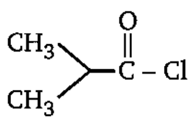
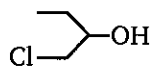
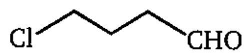
(a)  (Hoffmann bromamide reaction)

(b)  (Beckmann rearrangement)

(c)  (Curtius reaction)

(d) None of these

5. $(X)C_4H_7OCl \xrightarrow{NH_3} C_4H_9ON \xrightarrow[KOH]{Br_2} CH_3CH_2CH_2NH_2$; Compound (X) is :

(a)  (b)  (c)  (d) 

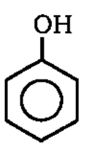
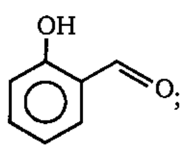
6. Which of the following will not give Hoffmann bromamide reaction ?

(a) $CH_3-\overset{\overset{\large O}{||}}{C}-NH_2$

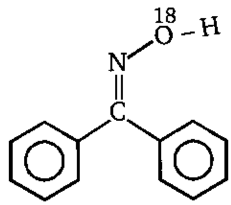
(b) $Ph-\overset{\overset{\large O}{||}}{C}-NH_2$

(c) $CH_3-\overset{\overset{\large O}{||}}{C}-NH-Br$

(d) $Ph-\overset{\overset{\large O}{||}}{C}-NH-Ph$

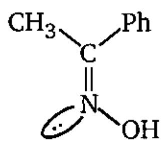
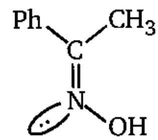
7.  $+ (x) \xrightarrow[(2)\ H^{\oplus}]{(1)\ NaOH}$ ; Reactant x is :

(a) CH_3Cl (b) CH_2Cl_2 (c) $CHCl_3$ (d) CCl_4

8.  $\xrightarrow[H_2O^{18}]{H_2SO_4}$ (A). Product (A) of the reaction is :

(a) $Ph-NH-\overset{O}{\overset{\|}{C}}-Ph$ (b) $Ph-NH-\overset{O^{18}}{\overset{\|}{C}}-Ph$

(c) $(Ph)_2-\overset{OH}{\overset{|}{C}}-NH_2$ (d) $Ph-CH_2-NH-Ph$

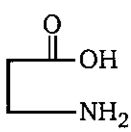
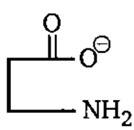
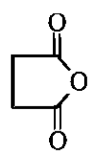
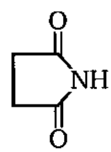
9.  $\xrightarrow{H_2SO_4}$ (A),  $\xrightarrow{H_2SO_4}$ (B)

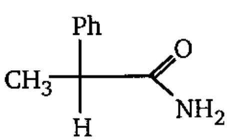
Product (A) & (B) respectively in the above reaction are :

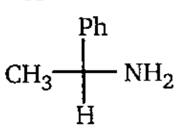
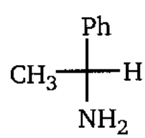
(a) $Ph-\overset{O}{\overset{\|}{C}}-NH-CH_3$, $Ph-\overset{O}{\overset{\|}{C}}-NH-CH_3$ (b) $CH_3-\overset{O}{\overset{\|}{C}}-NH-Ph$, $CH_3-\overset{O}{\overset{\|}{C}}-NH-Ph$

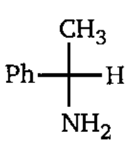
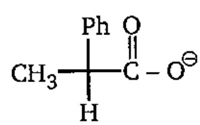
(c) $Ph-\overset{O}{\overset{\|}{C}}-NH-CH_3$, $CH_3-\overset{O}{\overset{\|}{C}}-NH-Ph$ (d) $CH_3-\overset{O}{\overset{\|}{C}}-NH-Ph$, $Ph-\overset{O}{\overset{\|}{C}}-NH-CH_3$

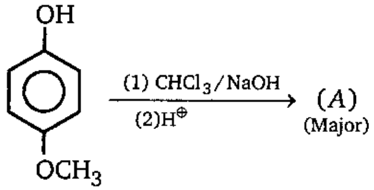
10. NBS $\xrightarrow{KOBr}$ (A) . Product (A) is :

(a)  (b)  (c)  (d) 

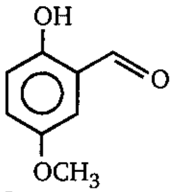
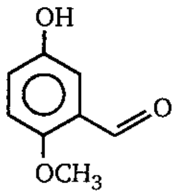
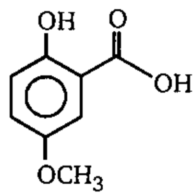
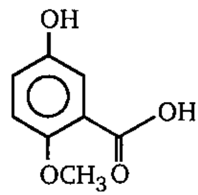
11.  $\xrightarrow{NaOBr}$ $\underset{\text{(major)}}{(A)}$; Product of the reaction is :

(a)  (b) 

(c)  (d) 

12. 

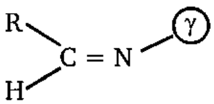
Product (A) is :

(a)  (b)  (c)  (d) 

13. $R-\overset{O}{\overset{\|}{C}}-NH_2 + xNaOH + Br_2 \longrightarrow R-NH_2 + 2NaBr + Na_2CO_3 + H_2O$

Number of moles of NaOH used in above Hoffmann bromamide reaction is :

(a) 3 (b) 4 (c) 5 (d) 6

14. , Rate of reaction toward Beckmann rearrangement

when $\gamma = \underset{(i)}{CH_3CO_2^-}$, $\underset{(ii)}{Cl-CH_2-CO_2^-}$, $\underset{(iii)}{Ph-SO_3^-}$

(a) (i) > (ii) > (iii) (b) (ii) > (i) > (iii)

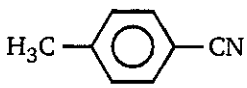
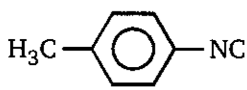
(c) (iii) > (ii) > (i) (d) (iii) > (i) > (ii)

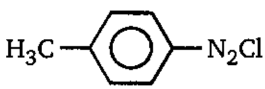
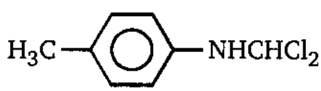
15. When primary amine reacts with chloroform in ethanolic KOH, then product is :

(a) an isocyanide (b) an aldehyde

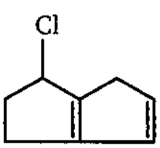
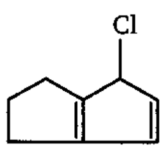
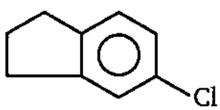
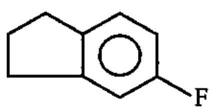
(c) a cyanide (d) an alcohol

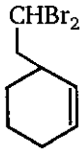
16. The reaction of chloroform with alcoholic KOH and *p*-toluidine forms :

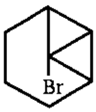
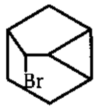
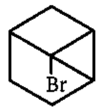
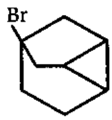
(a)  (b) 

(c)  (d) 

17. What is the product (Q) of the following reaction ?

(a)  (b)  (c)  (d) 

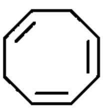
18.  $\xrightarrow[\Delta]{\text{NaOH, 50\%}}$ (A) ; Product (A) is :

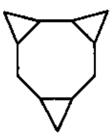
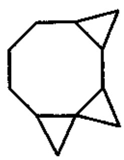
(a)  (b)  (c)  (d) 

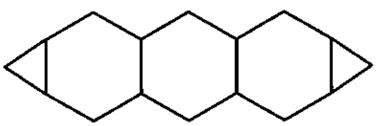
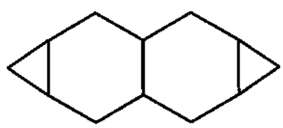
19. Which of the following reaction, does not give chloro benzene as a product ?

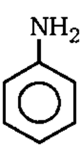
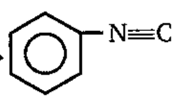
(a)  $\xrightarrow{CHCl_3,\ HO^-}$ (b)  $\xrightarrow{CHBrCl_2,\ HO^-}$

(c)  $\xrightarrow{CHBr_2Cl,\ HO^-}$ (d)  $\xrightarrow{CHFClBr,\ HO^-}$

20.  $\xrightarrow[\text{Zn/Cu}]{(3\text{ mole})\,CH_2I_2}$ (A) ; Compound (A) is :

(a)  (b) 

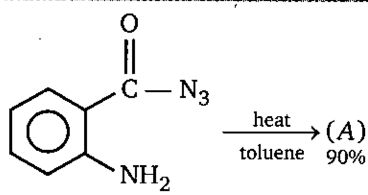
(c)  (d) 

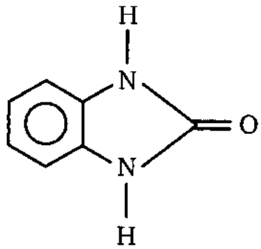
21.  $+ CHCl_3 + x$KOH $\longrightarrow$ 

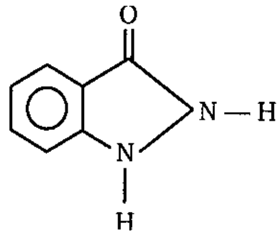
x = moles of KOH consumed is :

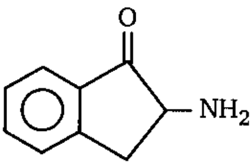
(a) 1 (b) 2 (c) 3 (d) 4

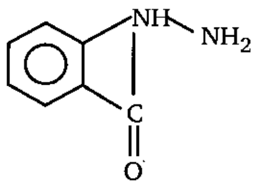
22. Heating the acyl azide in dry toluene under reflux for 3-hours give a 90% yield for a heterocyclic product. Identify the product (A).

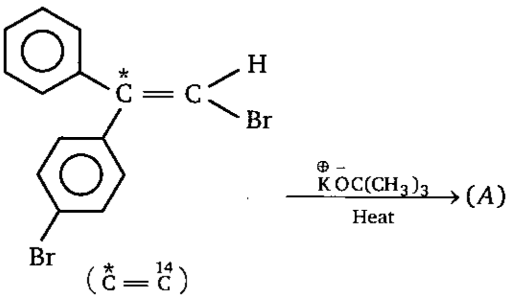


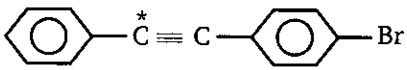
(a) 

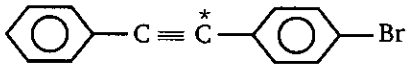
(b) 

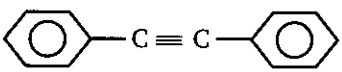
(c) 

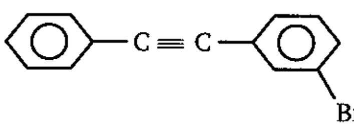
(d) 

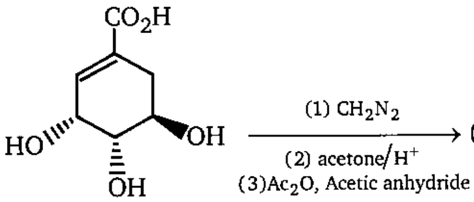
23. 

(a) 

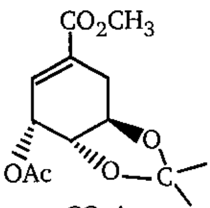
(b) 

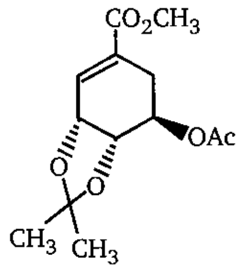
(c) 

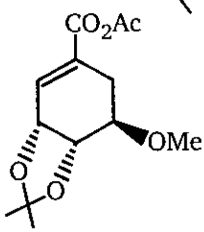
(d) 

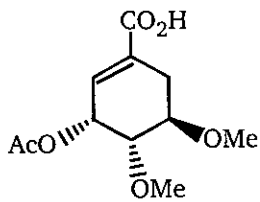
24.  (A) (de-colourises Br_2 water)

Product (A) of the above reaction is :

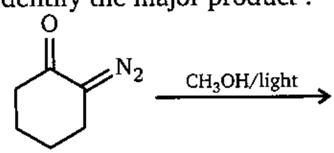
(a) 

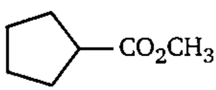
(b) 

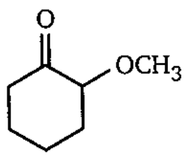
(c) 

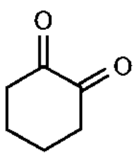
(d) 

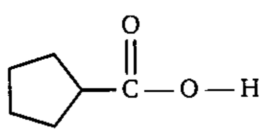
25. A rather interesting example of the Wolff rearrangement with 2-diazocyclohexanone in methanol is given below. Identify the major product :



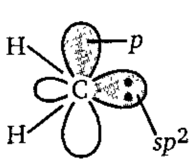
(a) 

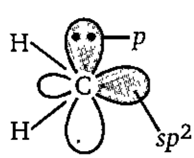
(b) 

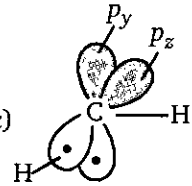
(c) 

(d) 

26. The orbital picture of a singlet carbene (:CH_2) can be drawn as :

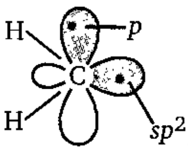
(a) 

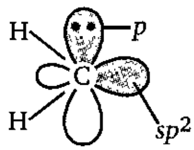
(b) 

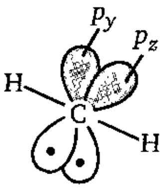
(c) 

(d) none of these

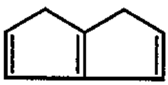
27. The orbital picture of a triplet carbene can be drawn as :

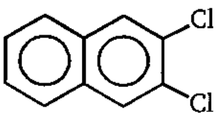
(a) 

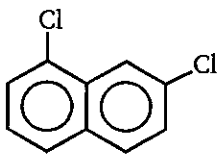
(b) 

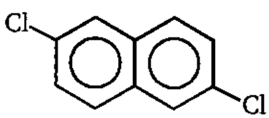
(c) 

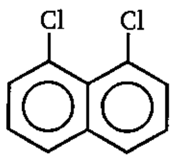
(d) none of these

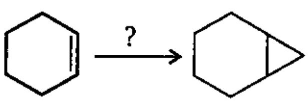
28.  $\xrightarrow[\text{KOH}]{\text{CHCl}_3} (A) \xrightarrow[\text{KOH}]{\text{CHCl}_3} (B)$; Product (B) is :

(a) 

(b) 

(c) 

(d) 

29. 

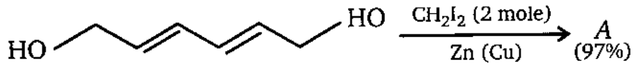
Select the suitable reagent for above conversion.

(a) CH_2N_2 / Δ

(b) CBr_4 / RLi

(c) $H_2C = CH_2$

(d) t-BuOK

30. 

Product (A) will be :

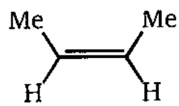
(a) 

(b) 

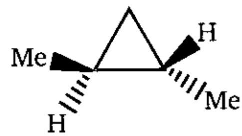
(c) 

(d) 

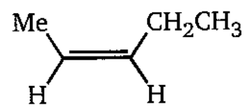
31. The major product formed in the following reaction is

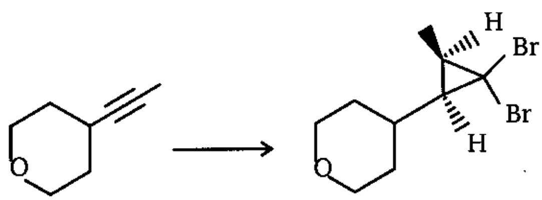
 + :CH_2 (singlet) $\longrightarrow$

(a) 

(b) 

(c) 50 : 50 mixture of above two compounds

(d) 

32. 

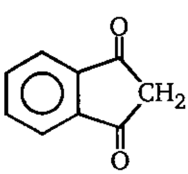
To carry out above conversion reagent used in decreasing order.

(a) Na/liq. NH_3, $CHBr_3$/NaOH (Δ)

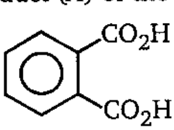
(b) H_2/Pd - $CaCO_3$, $CHBr_3$/NaOH (Δ)

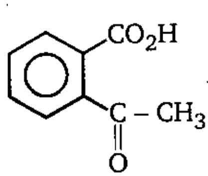
(c) Na/liq. NH_3, $CHCl_3$/NaOH

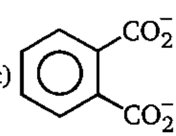
(d) H_2/Pd - $CaCO_3$, $CHCl_3$/NaOH

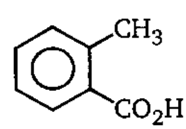
33.  $\xrightarrow[KOH]{Br_2}$ (A) + $CHBr_3 \downarrow$

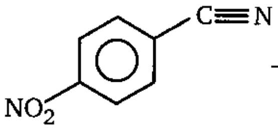
Product (A) of the reaction is :

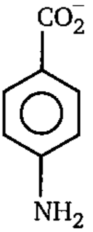
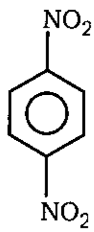
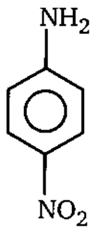
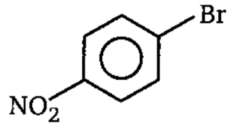
(a) 

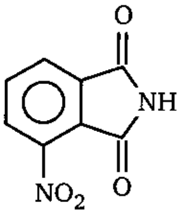
(b) 

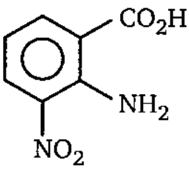
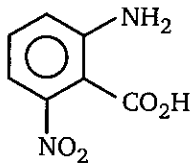
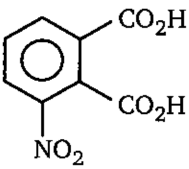
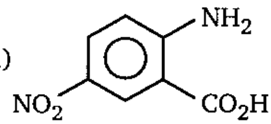
(c) 

(d) 

34.  $\xrightarrow[\text{(2) HO}^-\text{, Br}_2]{\text{(1) HO}^-\text{(1 mole)}}$ (A); Product (A) is :

(a) 
(b) 
(c) 
(d) 

35.  $\xrightarrow[\text{H}_2\text{O}]{\text{NaOCl}}$ (X) ; Product X will be :
(80%)

(a) 
(b) 
(c) 
(d) 

36. $CH_3 - CH_2 - CH_2 - CH_2 - CH_3 \xrightarrow{CH_2N_2/\Delta}$ Products

Which of the following product(s) is/are can be obtained in the above reaction.

(a) Isopentane (b) 3-Methyl hexane (c) *n*-Pentane (d) 3-Methyl pentane

ANSWERS — LEVEL 1															
1.	(b)	**2.**	(b)	**3.**	(c)	**4.**	(b)	**5.**	(a)	**6.**	(d)	**7.**	(c)	**8.**	(b)
9.	(c)	**10.**	(b)	**11.**	(a)	**12.**	(a)	**13.**	(b)	**14.**	(c)	**15.**	(a)	**16.**	(b)
17.	(d)	**18.**	(a)	**19.**	(d)	**20.**	(a)	**21.**	(c)	**22.**	(a)	**23.**	(b)	**24.**	(b)
25.	(a)	**26.**	(a)	**27.**	(c)	**28.**	(c)	**29.**	(a)	**30.**	(b)	**31.**	(a)	**32.**	(b)
33.	(c)	**34.**	(c)	**35.**	(b)	**36.**	(d)								

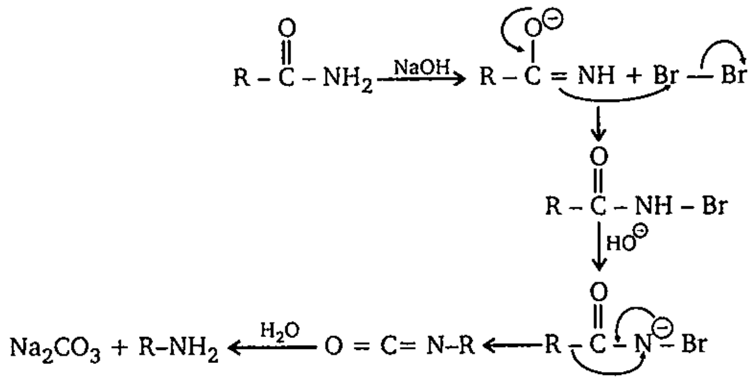
LEVEL-2

1. Comprehension

Hoffmann bromamide reaction involves conversion of a carboxylic acid amide into an amine with a loss of a carbon atom on treatment with aqueous sodium hypobromite. Thus Hoffmann result in shortening of a carbon chain.

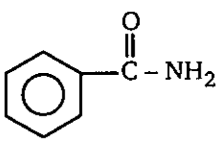
$$R-\overset{\overset{\large O}{||}}{C}-NH_2 \xrightarrow[NaOH]{Br_2} R-NH_2 + NaBr + Na_2CO_3$$

Mechanism of the reaction is :



A. Number of moles of NaOH consumed in above reaction.

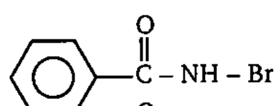
(a) 1 (b) 2 (c) 3 (d) 4

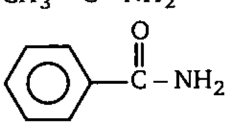
B.  $\xrightarrow[KOH]{Br_2}$ $\underset{\text{(Major)}}{(A)}$; Product (A) :

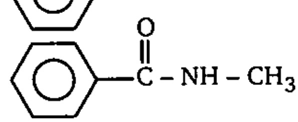
(a) $Ph-NH_2$ (b) $Ph-CH_2-NH_2$ (c) $Ph-NH-CH_3$ (d) $Ph-N\begin{matrix}\diagup CH_3\\ \diagdown CH_3\end{matrix}$

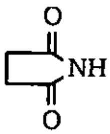
C. Which of the following will not give Hoffmann bromamide reaction.

(a) $CH_3-\overset{\overset{\large O}{||}}{C}-NH_2$

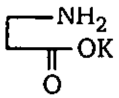
(b) 

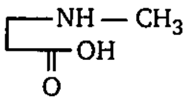
(c) 

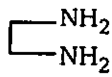
(d) 

D. 

$\xrightarrow{KOBr}$ (A), Product (A) is :

(a) 

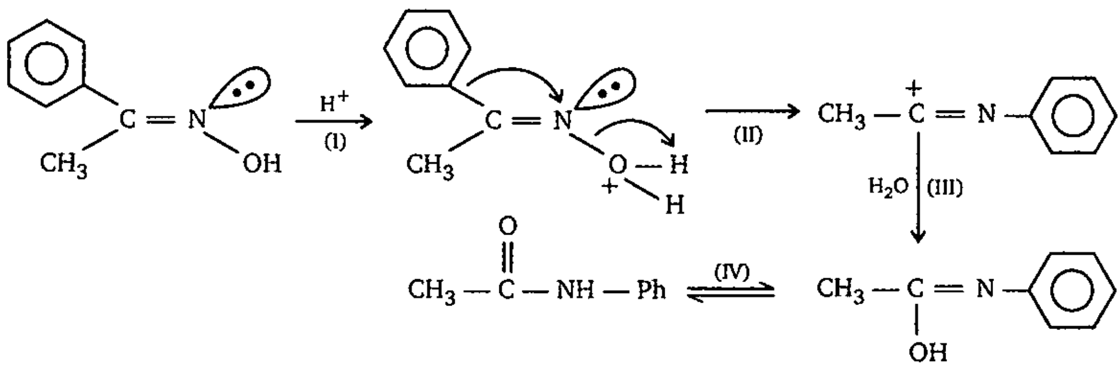
(b) 

(c) 

(d) None of these

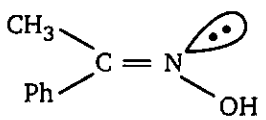
2. Comprehension

Given is mechanism of Beckmann rearrangement.



A. Rate determining step in Beckmann rearrangement :

(a) I (b) II (c) III (d) IV

B. 

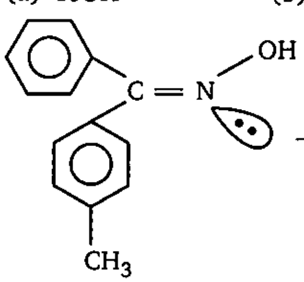
On treatment H_2SO_4 followed by hydrolysis in acidic medium above compound gives.

(a) CH_3-CO_2H, $Ph-NH_2$ (b) CH_3-NH_2, $Ph-CO_2H$

(c) $Ph-CH_2-NH_2+Ph-CO_2H$ (d) $Ph-CO_2H+CH_3-CO_2H$

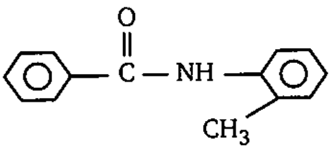
C. Which of the following reagent cannot used in Beckmann rearrangement ?

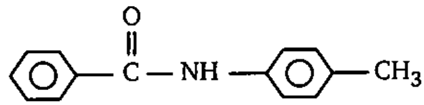
(a) TsOH (b) $R-SO_2Cl$ (c) BF_3 (d) $Ph-Li$

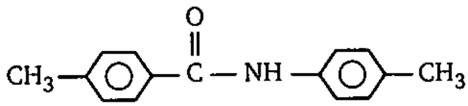
D. 

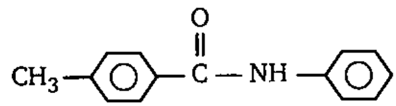
$\xrightarrow[\Delta]{PCl_5}$ (A);

Product (A) of the above reaction is :

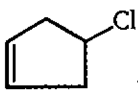
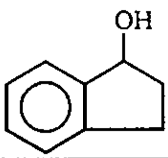
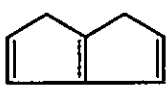
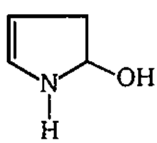
(a) 

(b) 

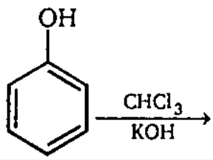
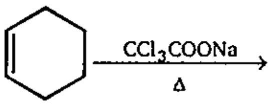
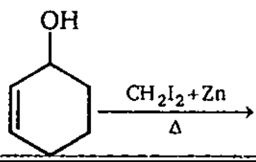
(c) 

(d) 

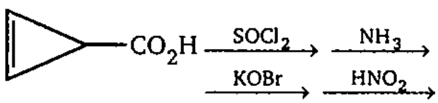
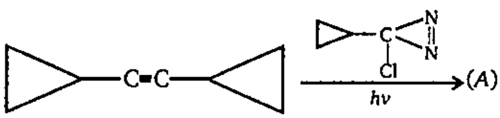
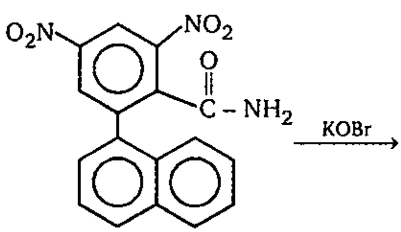
3. Match the column I and II.

	Column (I)		Column (II)
(a)	 $\xrightarrow{\text{aq. KOH}}(A)\xrightarrow[\Delta]{H^+}(B)\xrightarrow[\text{KOH}]{CHCl_3}(C)$	**(p)**	D.B.E. = even for product (Double bond equivalent)
(b)	 $\xrightarrow[\Delta]{H^+}(A)\xrightarrow[\text{KOH}]{CHCl_3}(B)$	**(q)**	D.B.E. = odd for product
(c)	 $\xrightarrow[\text{KOH}]{CHCl_3}(A)\xrightarrow[\text{KOH}]{CHCl_3}(B)$	**(r)**	Ring expansion takes place
(d)	 $\xrightarrow[\Delta]{H^+}(A)\xrightarrow[\Delta]{\text{CHFClBr}}(B)$	**(s)**	Carbene will formed

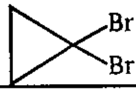
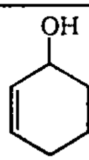
4. **Match the column I and II.**

	Column (I)		Column (II)
(a)		(p)	Reimer Tiemann reaction
(b)		(q)	Reimer Tiemann expansion (or) Abnormal RNT reaction
(c)		(r)	Simman-smith reaction.
(d)		(s)	Increase in carbon takes place

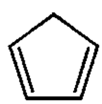
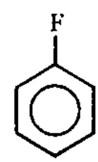
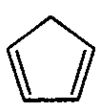
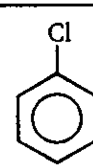
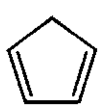
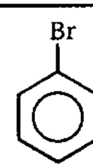
5. **Match the column I and II.**

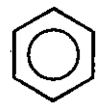
	Column (I)		Column (II)
(a)		(p)	Aromatic compound will formed
(b)		(q)	Migration take place from carbon to electron deficient nitrogen
(c)	$\phi-CHCl_2 \xrightarrow{t-BuO^{\ominus}K^{\oplus}} (A) \xrightarrow{\phi-C\equiv C-\phi} (B) \xrightarrow{AlCl_3} (C)$	(r)	Carbene will formed in this reaction
(d)		(s)	N_2 will evolve.

6. Match the column I and II:

Column (I)		Column (II)	
Reaction		**Intermediate**	
(a)	$CHCl_3 + KOH \xrightarrow[\Delta]{}$	**(p)**	Carbocation
(b)	 $\xrightarrow[\Delta]{Ph-Li}$	**(q)**	Carbanion
(c)	$Cl-\underset{Cl}{\overset{Cl}{C}}-\overset{O}{\overset{\|}{C}}-OH \xrightarrow[\Delta]{Na}$	**(r)**	Free radical
(d)	 $\xrightarrow[\Delta]{H^+}$	**(s)**	Carbene

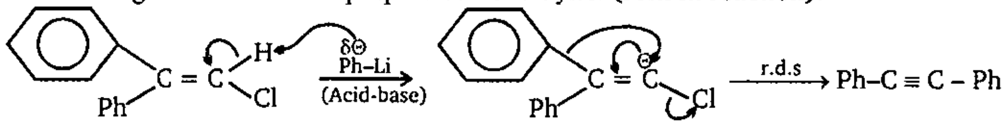
7. Matrix :

Column (I)		Column (II)	
Reaction		**Product**	
(a)	 $\xrightarrow[KOH,\Delta]{CHCl_3}$	**(p)**	
(b)	 $\xrightarrow[KOH,\Delta]{CHFClBr}$	**(q)**	
(c)	 $\xrightarrow[KOH,\Delta]{CHCl_2Br}$	**(r)**	

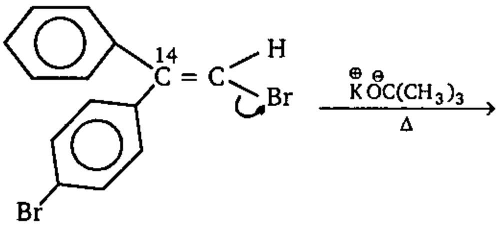
(d)		**(s)**	

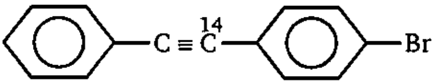
8. Comprehension

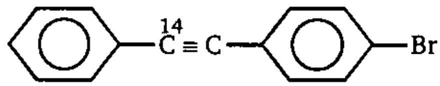
1. Consider the given reaction for preparation of alkyne. (Fritsch reaction).



Anti group will migrate because of less steric hindrance.

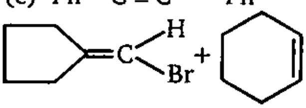
A.  (A) (major) ; Major product (A) is :

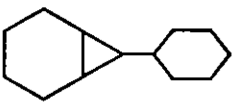
(a) 

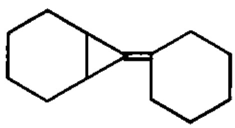
(b) 

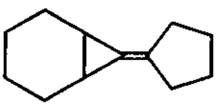
(c) $Ph-C\equiv C^{14}-Ph$

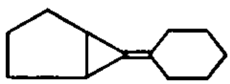
(d) $Ph-C\equiv C-Ph$

B.  + $K^{\oplus}O^{\ominus}C(CH_3)_3 \xrightarrow[\Delta]{} (A)$, product (A) is :

(a) 

(b) 

(c) 

(d) 

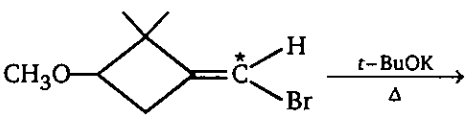
C. Rate of reaction when the halide ion:

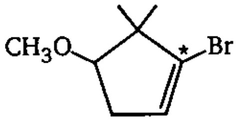
(a) $I^{\ominus} > Cl^{\ominus} > Br^{\ominus} > F^{\ominus}$

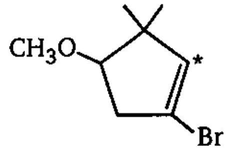
(b) $I^{\ominus} > Br^{\ominus} > Cl^{\ominus} > F^{\ominus}$

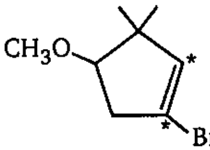
(c) $F^{\ominus} > Cl^{\ominus} > Br^{\ominus} > I^{\ominus}$

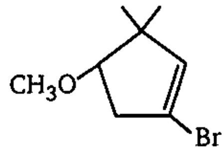
(d) $F^{\ominus} > Br^{\ominus} > Cl^{\ominus} > I^{\ominus}$

D.  (A) (Major) , Product (A) is : $(C^{*} = C^{14})$

(a) 

(b) 

(c) 

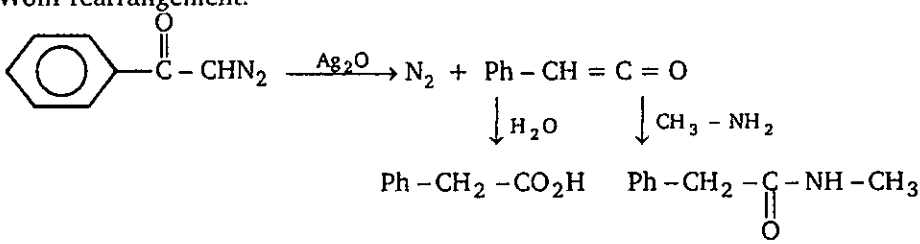
(d) 

9. Comprehension

Wolff rearrangement

When α-Diazoketones are photo-irradiated or heated at high temperature or reacted with silver oxide or silver salts at room temperature, they loose nitrogen and rearrange to form ketene.

The ketenes reacts rapidly with water, alcohol and amines. Therefore, the reactions called Wolff-rearrangement.



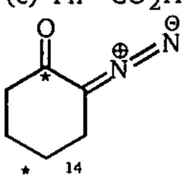
A. $Ph-\overset{O}{\overset{||}{\underset{14}{C}}}-CHN_2 \xrightarrow[H_2O]{Ag_2O} (A)$, Product (A) is :

(a) $Ph-\overset{14}{C}H_2-CO_2H$

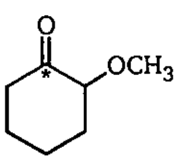
(b) $Ph-CH_2-\overset{14}{C}O_2H$

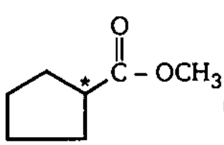
(c) $Ph-\overset{14}{C}O_2H$

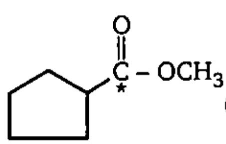
(d) $Ph-CO_2H$

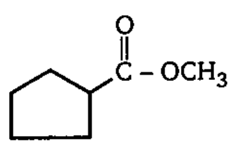
B.  $\xrightarrow[h\nu]{CH_3OH} (A)$ (Major), Product (A) is :

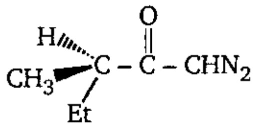
$(\overset{*}{C} = \overset{14}{C})$

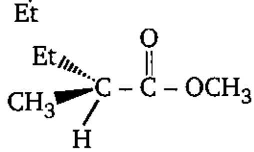
(a) 

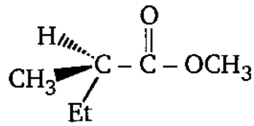
(b) 

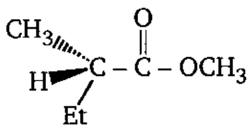
(c) 

(d) 

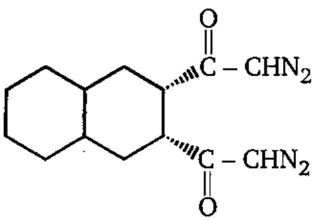
C.  + $CH_3OH \xrightarrow{Ag_2O}$ Major product of the reaction is :

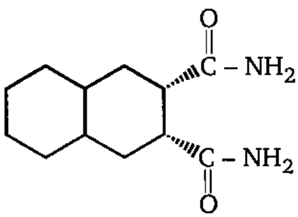
(a) 

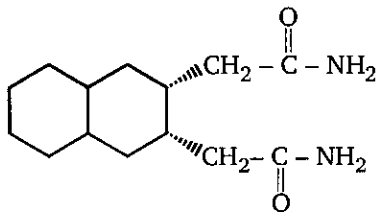
(b) 

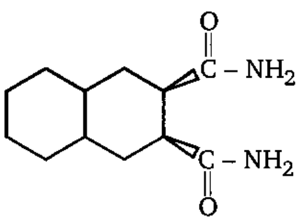
(c) 

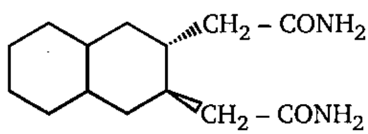
(d) None of these

D.  $\xrightarrow[NH_3]{Ag_2O}$ (A) (Major) , Product (A) is :

(a) 

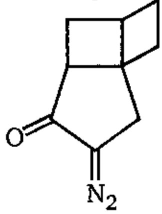
(b) 

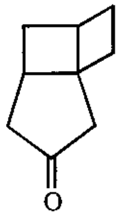
(c) 

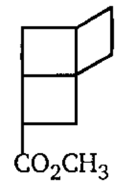
(d) 

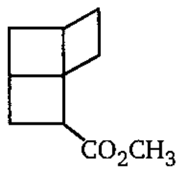
E. $Ph - \overset{N_2}{\overset{||}{C}} - CH_2OCH_3 \xrightarrow[\Delta]{} (A)$ 90% , product (A) is :

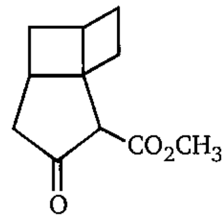
(a) $Ph - CH = CH - OH$
(b) $Ph - CH = CH - OCH_3$
(c) $CH_3 - CH = CH - O - PH$
(d) $CH_3 - CH = CH - OH$

F.  $\xrightarrow[CH_3OH]{h\nu}$ (A) , Product (A) is :

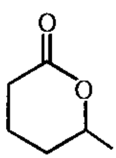
(a) 

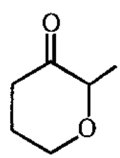
(b) 

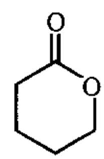
(c) 

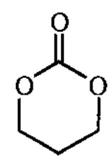
(d) 

G. $HO-CH_2-CH_2-CH_2-\overset{\overset{\large O}{\|}}{C}-CHN_2 \xrightarrow[\Delta]{Ag_2O} (A)$, Product (A) is :

(a) 

(b) 

(c) 

(d) 

ANSWERS — LEVEL 2

1. A – d, ; B – a; C – d, ; D – a,

2. A – b; B – b; C – d; D – b

3. a – p, r, s; b – q, r, s; c – q, r, s; d – p, r, s

4. a – q, s; b – p, s; c – s; d – r, s

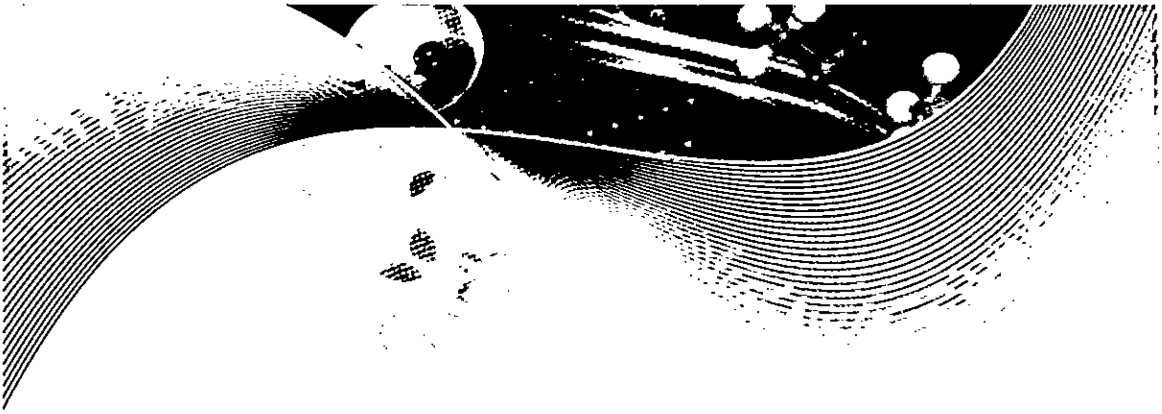
5. a – p, q, s; b – r; c – p, r ; d – q

6. a – q, s; b – q, s; c – q, s; d – p

7. a – q; b – p; c – q; d – q

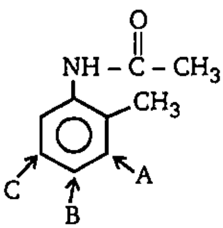
8. A – a; B – c; C – b; D – b

9. A – b; B – c; C – d; D – b; E – b; F – b; G – d



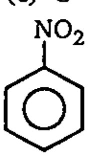
12 AROMATIC COMPOUNDS

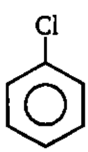
LEVEL-1

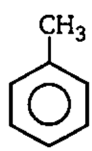
1. 

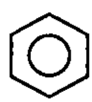
Identify the position where electrophilic aromatic substitution (EAS) is most favourable.

(a) A (b) B
(c) C (d) A and C

2. 
(a)

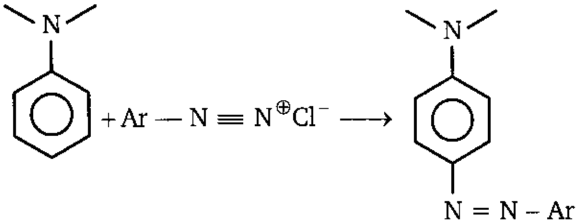

(b)


(c)


(d)

Correct order of rate of EAS (electrophilic aromatic substitution) is :

(a) $c > b > a > d$ (b) $c > d > a > b$
(c) $a > b > c > d$ (d) $c > d > b > a$

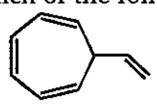
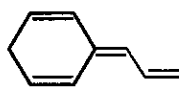
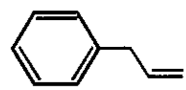
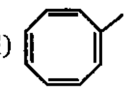
3. 

Above (C—N) coupling reaction take place at :

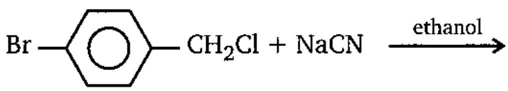
(a) low pH (b) Intermediate pH

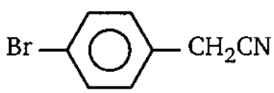
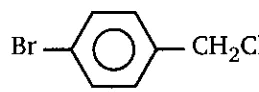
(c) high pH (d) any pH

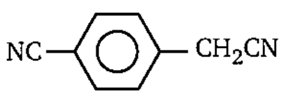
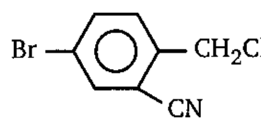
4. Which of the following has the lowest heat of combustion ?

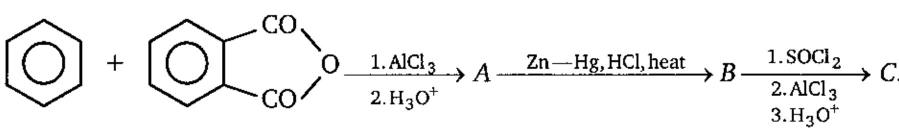
(a)  (b)  (c)  (d) 

5. The product obtained from the reaction is :

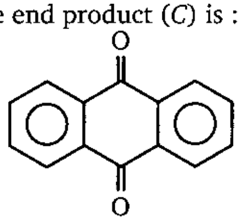
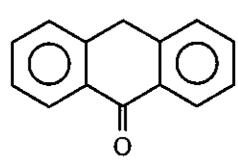


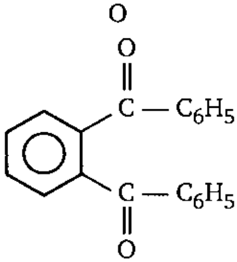
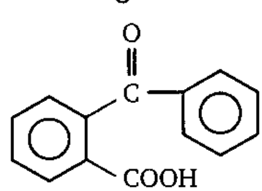
(a)  (b) 

(c)  (d) 

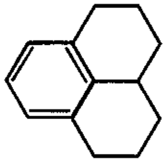
6. 

The end product (C) is :

(a)  (b) 

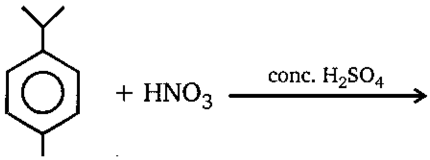
(c)  (d) 

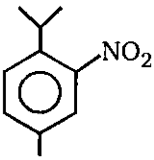
7. How many benzylic hydrogens are present in the hydrocarbon shown below ?

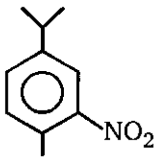


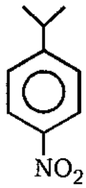
(a) 3 (b) 4 (c) 5 (d) 6 (e) 8

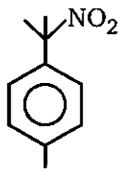
8. The major product formed in the reaction is :



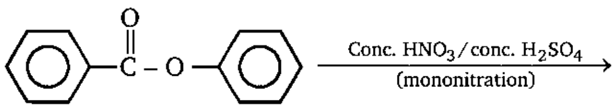
(a) 

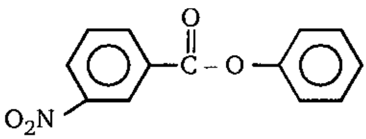
(b) 

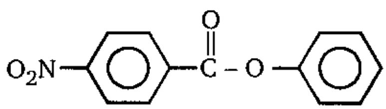
(c) 

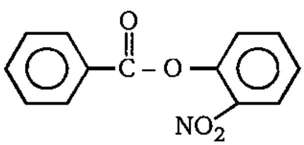
(d) 

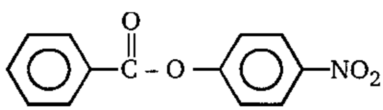
9. The major product formed in the reaction is :



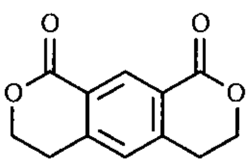
(a) 

(b) 

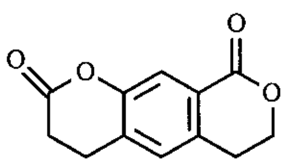
(c) 

(d) 

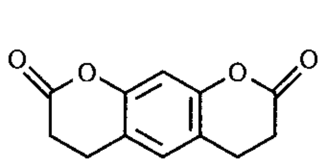
10. Increasing order of rate of reaction with HNO_3/H_2SO_4 is :



(i)



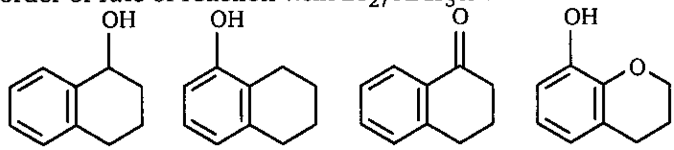
(ii)



(iii)

(a) iii < ii< i (b) ii < iii < i (c) i < iii < ii (d) i < ii < iii

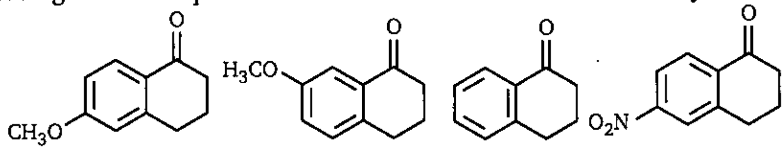
11. Increasing order of rate of reaction with $Br_2/AlCl_3$ is :



(i) (ii) (iii) (iv)

(a) iii < i < ii < iv (b) iv < ii < i < iii (c) ii < iv < iii < i (d) iv < ii < iii < i

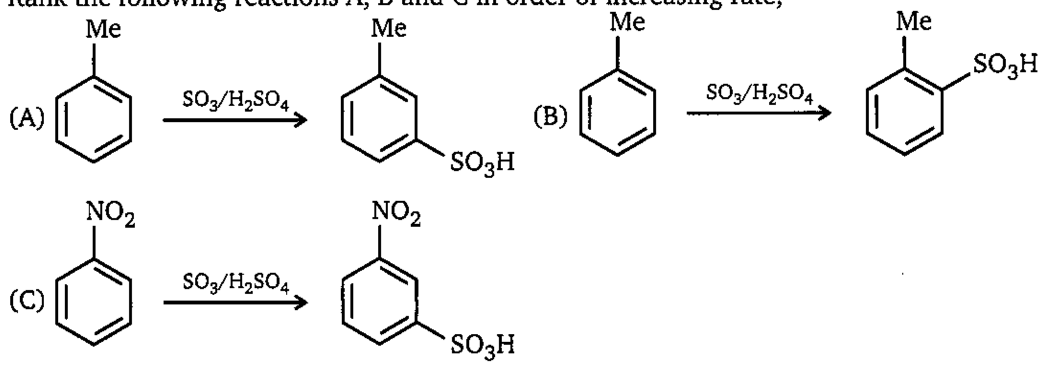
12. Increasing order of equilibrium constant for the formation of a hydrate is :



(i) (ii) (iii) (iv)

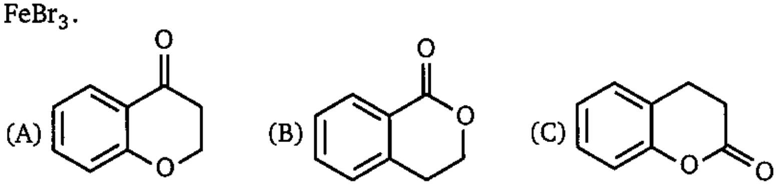
(a) i < ii < iii < iv (b) iv < ii < i < iii (c) ii < iv < iii < i (d) iv < ii < iii < i

13. Rank the following reactions A, B and C in order of increasing rate,



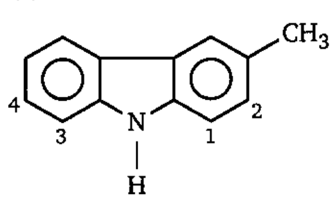
(a) B > A > C (b) B > C > A (c) A > B > C (d) A > C > B

14. Rank in order of increasing rate of reaction towards EAS with bromine in the presence of $FeBr_3$.



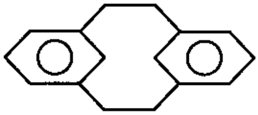
(a) B < A < C
(b) B < C < A
(c) A < B < C
(d) A < C < B

15.

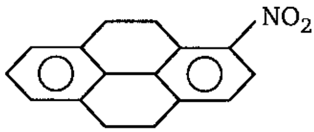


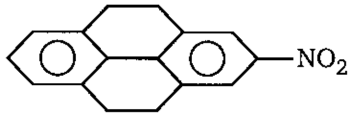
Identify the position where E.A.S. can take place.

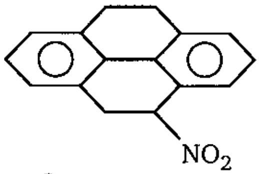
(a) 1 (b) 2 (c) 3 (d) 4

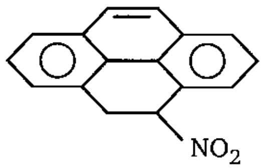
16.  $\xrightarrow[\Delta]{H^+} (A) \xrightarrow[\Delta]{HNO_3} (B)$.

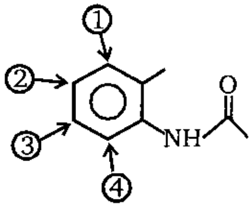
Product (B) in the above reactions is:

(a) 

(b) 

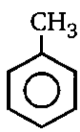
(c) 

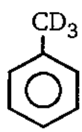
(d) 

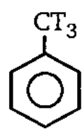
17.  Sulphonation is most favourable at the carbon number... .

(a) 1 (b) 2 (c) 3 (d) 4

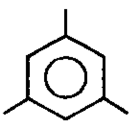
18. Arrange the following in decreasing order of reactivity towards EAS (electrophilic aromatic substitution)

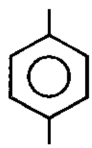

(a)

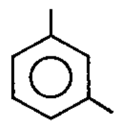

(b)

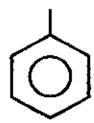

(c)

(a) $a > b > c$ (b) $c > b > a$ (c) $a > c > b$ (d) $c > a > b$

19. 
(a)


(b)


(c)

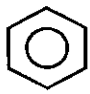
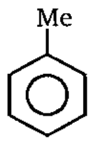
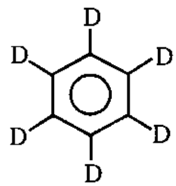
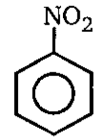
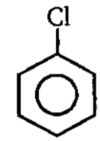

(d)

Decreasing order of rate of electrophilic aromatic substitution is :

(a) $a > b > c > d$ (b) $a > c > b > d$

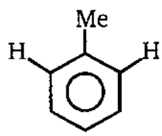
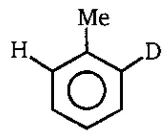
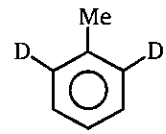
(c) $b > a > c > d$ (d) $b > c > a > d$

20. Arrange the following in increasing order of rate of Nitration:


(a)

(b)

(c)

(d)

(e)

(a) $b < c < a < d < e$ (b) $d < e < a = c < b$

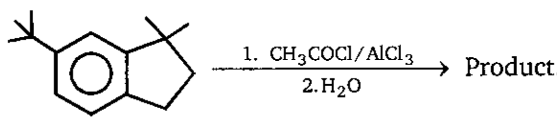
(c) $d < a = c < e < b$ (d) $a < c < b < e < d$

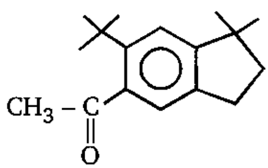
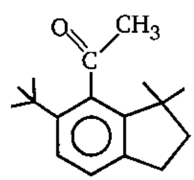
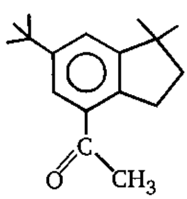
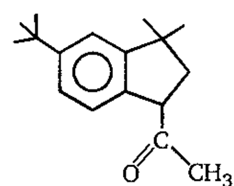
21.

(a)

(b)

(c)

The rate of nitration will be:

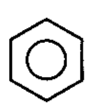
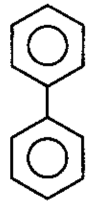
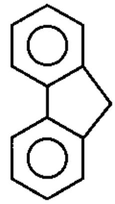
(a) $a > b > c$ (b) $a > c > b$ (c) $a = b = c$ (d) $c > a > b$

22. The major product of the reaction is

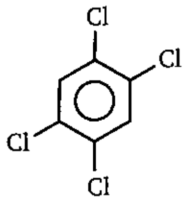


(a)

(b)

(c)

(d)


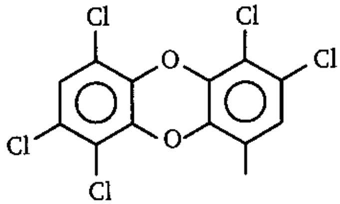
23. Arrange in their decreasing order of rate of electrophilic aromatic substitution :

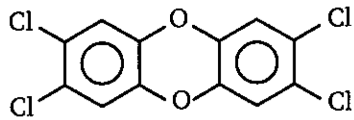

(i)

(ii)

(iii)

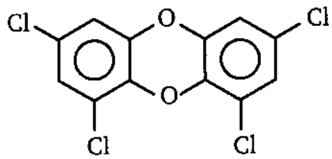
(a) i > ii > iii (b) iii > ii > i (c) iii > i > ii (d) i > iii > ii

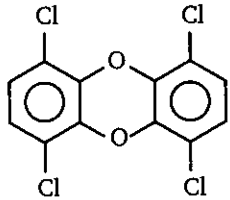
24.  + HO^- (4 mole) $\longrightarrow$ (A) (major) ; Product (A) of the given reaction is :

(2 mole)

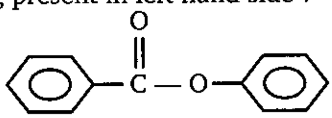
(a) 

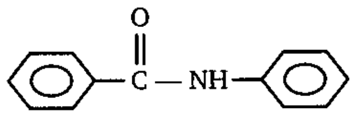
(b) 

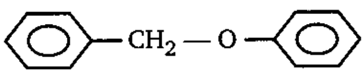
(c) 

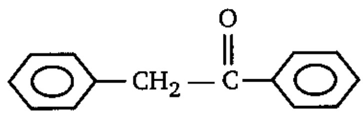
(d) 

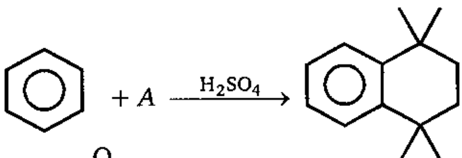
25. In which of the following compound electrophilic aromatic substitution take place in phenyl ring present in left hand side ?

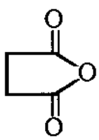
(a) 

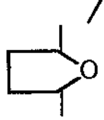
(b) 

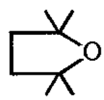
(c) 

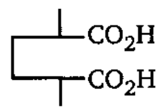
(d) 

26.  ; Reactant (A) is :

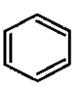
(a) 

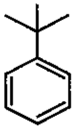
(b) 

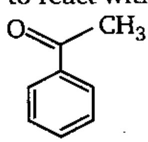
(c) 

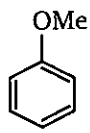
(d) 

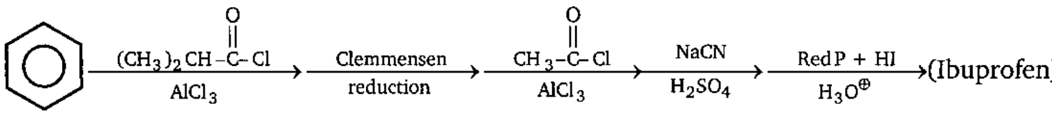
27. Which of the following compounds is the slowest to react with nitrosonium ion (NO^+)?

(a) 

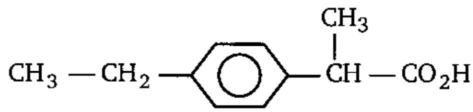
(b) 

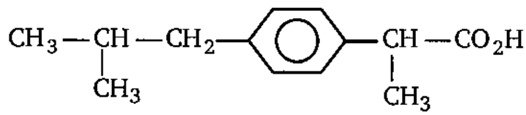
(c) 

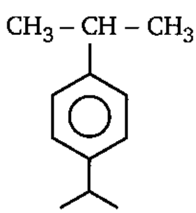
(d) 

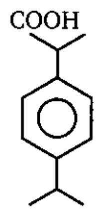
28. 

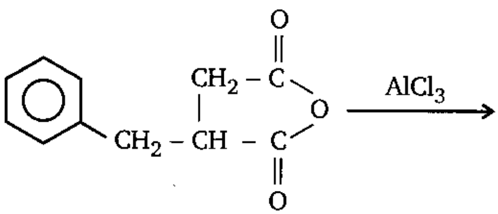
Ibuprofen is :

(a) 

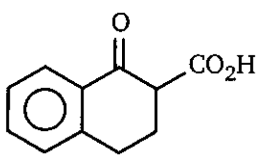
(b) 

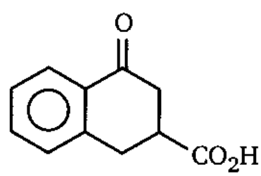
(c) 

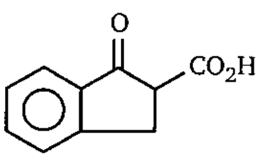
(d) 

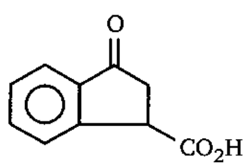
29. 

What is the major product of above Friedel-Craft reaction ?

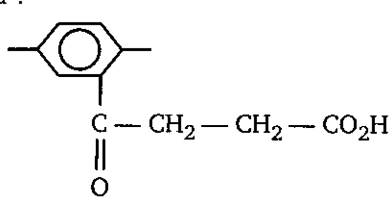
(a) 

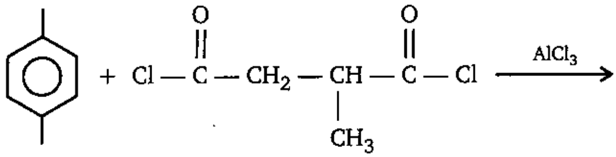
(b) 

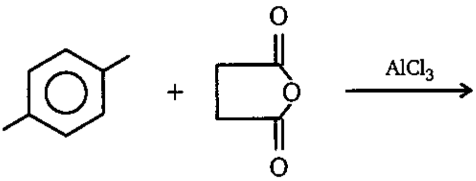
(c) 

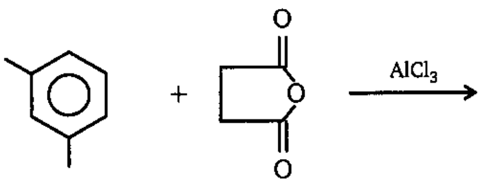
(d) 

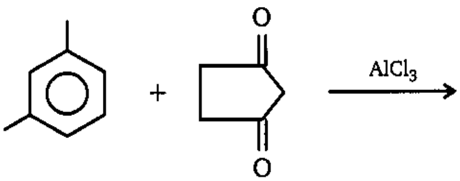
30. What combination of acid chloride or anhydride and arene would you choose to prepare given compound ?



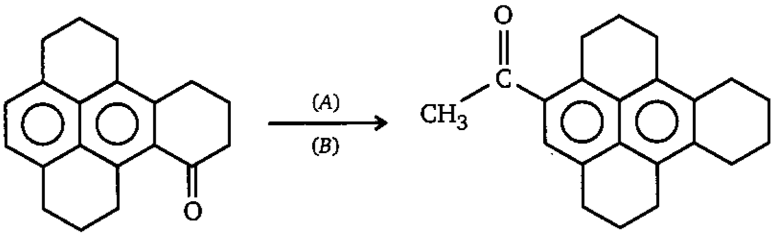
(a) 

(b) 

(c) 

(d) 

31. In the given conversion best yield will obtained with :



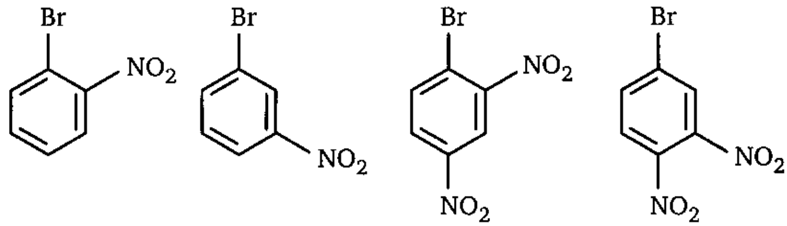
(a) $A = CH_3 - \overset{\overset{O}{||}}{C} - Cl, AlCl_3$, $B = Zn(Hg)$, HCl

(b) $A = Zn(Hg), HCl$, $B = CH_3 - \overset{\overset{O}{||}}{C} - Cl$, $AlCl_3$

(c) $A = CH_3 - CH_2 - Cl$, $AlCl_3$, $B = Zn(Hg)$, HCl

(d) $A = NH_2 - NH_2/HO^-, D$, $B = CH_3 - CH_2 - Cl$, $AlCl_3$

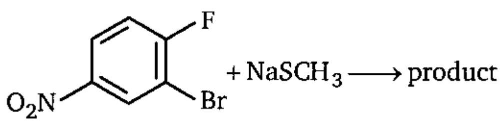
32. Rank the following in order of decreasing rate of reaction with alkoxide ion ($CH_3CH_2O^-$) in a nucleophilic aromatic substitution reaction :

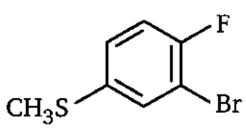
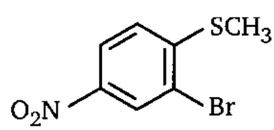


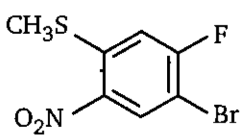
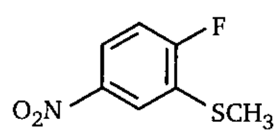
1 2 3 4

(a) $3 > 4 > 1 > 2$ (b) $3 > 4 > 2 > 1$ (c) $2 > 1 > 4 > 3$ (d) $4 > 3 > 2 > 1$

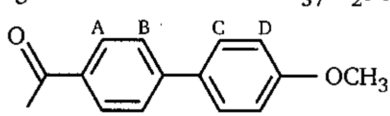
33. Identify the principal organic product of the following reaction.



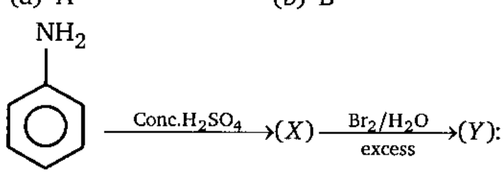
(a)  (b) 

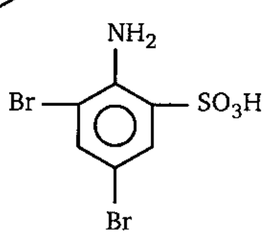
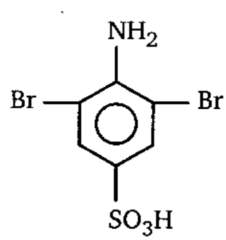
(c)  (d) 

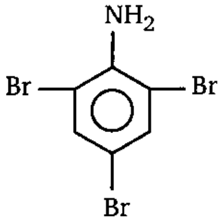
34. Which position will be attacked most rapidly by the nitronium ion $(-NO_2)^+$ when the compound undergoes nitration with HNO_3/H_2SO_4 :

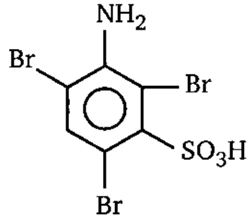


(a) A (b) B (c) C (d) D

35.  Product (*Y*) of this reaction is :

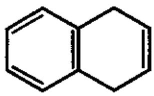
(a)  (b) 

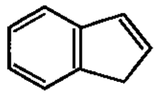
(c) 

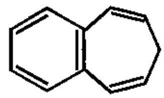
(d) 

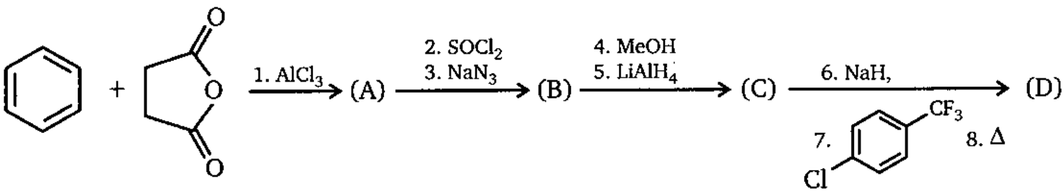
36. All the hydrocarbons shown are very weak acids. One, however, is far more acidic than the others. Which one is the strongest acid ?

(a) 

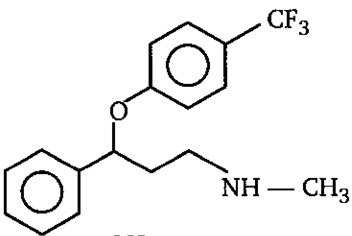
(b) 

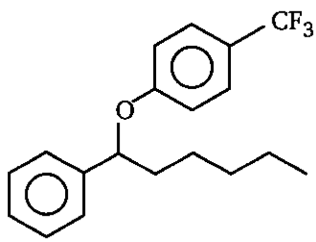
(c) 

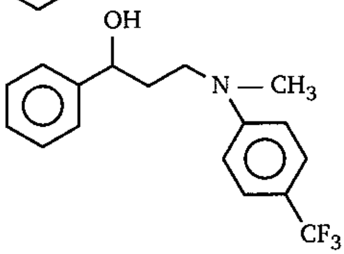
(d) 

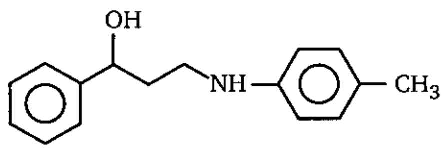
37. 

Product (*D*) in above sequence is :

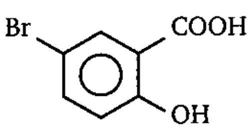
(a) 

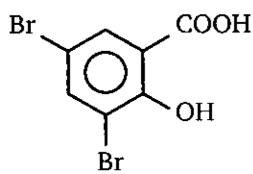
(b) 

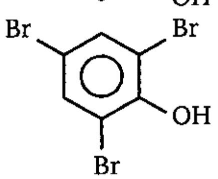
(c) 

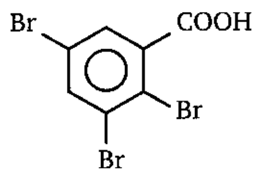
(d) 

38. The action of bromine water (excess) on salicylic acid results in the formation of :

(a) 

(b) 

(c) 

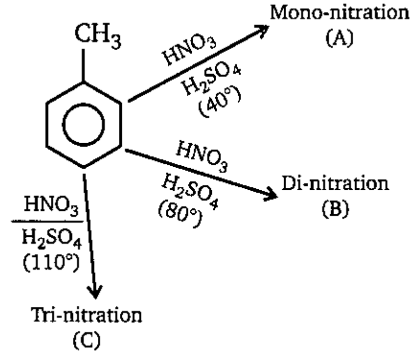
(d) 

39. What is the correct order of o/p ratio when E^+ attacks the following system ?

PhF (A) PhCl (B) PhBr (C) PhI (D)

(a) A < B < C < D (b) A = B = C = D (c) D < C < B < A (d) D < B < A < C

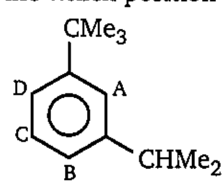
40. How many products are capable of beings formed from toluene in each of following reaction ?



(a) A = 3, B = 6, C = 8 (b) A = 3, B = 6, C = 6

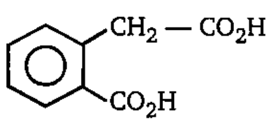
(c) A = 3, B = 6, C = 10 (d) A = 3, B = 4, C = 6

41. Nitration takes place at the which position of the given compound ?

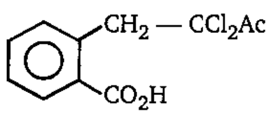


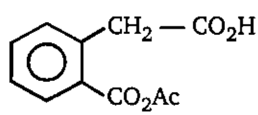
(a) A (b) B

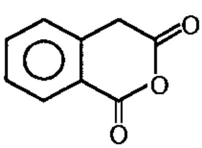
(c) C (d) D

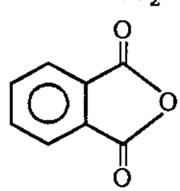
42. 

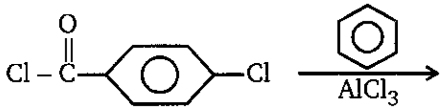
$\xrightarrow[\Delta]{Ac_2O}$? , Indentify the product.

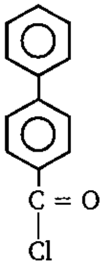
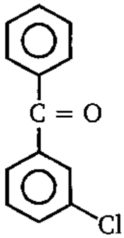
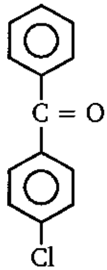
(a) 

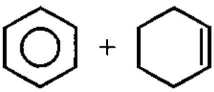
(b) 

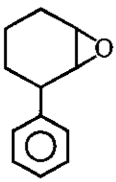
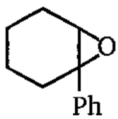
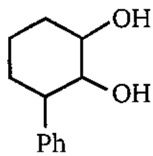
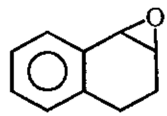
(c) 

(d) 

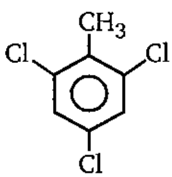
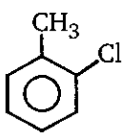
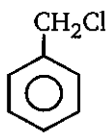
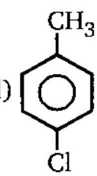
43.  (*A*) ; Unknown (*A*) is :

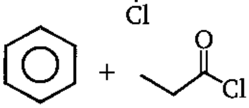
(a) 
(b) 
(c) 
(d) $Ph-\overset{O}{\overset{||}{C}}-Ph$

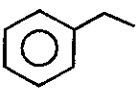
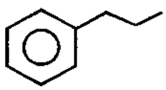
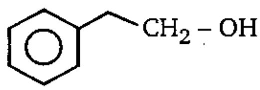
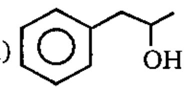
44.  $\xrightarrow[\Delta]{H_2SO_4}$ (*A*) $\xrightarrow[(2)\ \text{alc. KOH}]{(1)\ \text{NBS}}$ (*B*) $\xrightarrow{RCO_3H}$ (*C*) . Product (*C*) is :

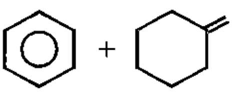
(a) 
(b) 
(c) 
(d) 

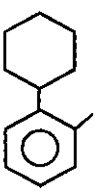
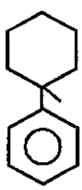
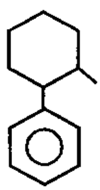
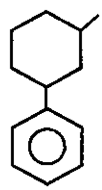
45. The reaction of toluene with chlorine in the presence of light gives :

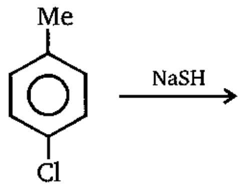
(a) 
(b) 
(c) 
(d) 

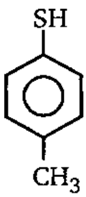
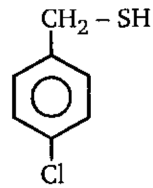
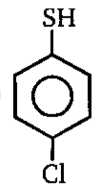
46.  $\xrightarrow[H_2O]{AlCl_3}$ (*A*) $\xrightarrow[HO^-,\ \Delta]{NH_2-NH_2}$ (*B*), Product (*B*) in this reaction is :

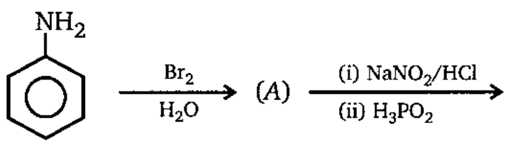
(a) 
(b) 
(c) 
(d) 

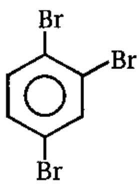
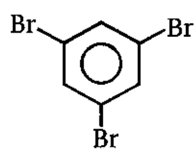
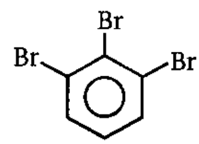
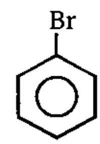
47.  $\xrightarrow[\Delta]{HF}$ Suitable product of this reaction is :

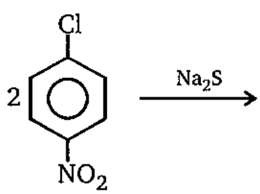
(a) 
(b) 
(c) 
(d) 

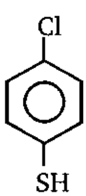
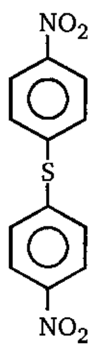
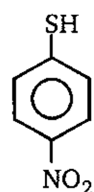
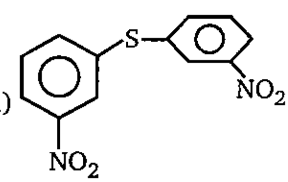
48.  A; Product (A) of the reaction is :

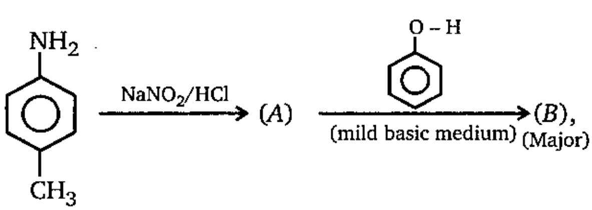
(a) 
(b) no reaction
(c) 
(d) 

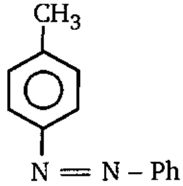
49.  Product (B) in this reaction is :

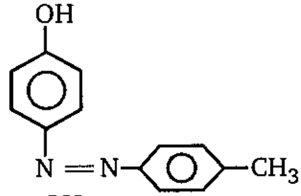
(a) 
(b) 
(c) 
(d) 

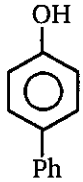
50.  Product (A) in this reaction is :

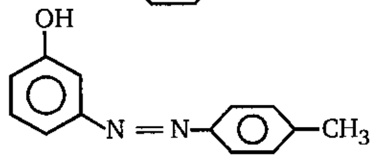
(a) 
(b) 
(c) 
(d) 

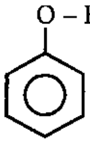
51.  Product (B) of this reaction is :

(a) 

(b) 

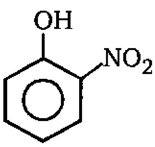
(c) 

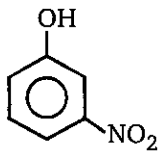
(d) 

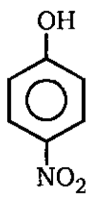
52. 

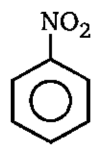
$\xrightarrow{HNO_3/H_2SO_4}$ (*A*) (more volatile) + (*B*) (less volatile)

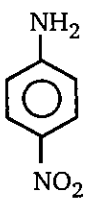
Product (*A*) of the above reaction is :

(a) 

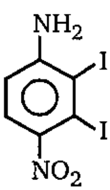
(b) 

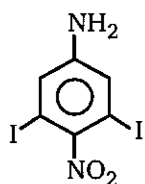
(c) 

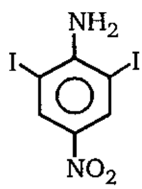
(d) 

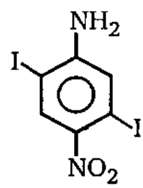
53. 

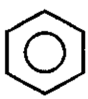
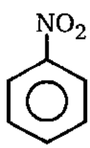
$\xrightarrow{2ICl}$ x (56 – 63%) + 2HCl; Major product (x) in this reaction is :

(a) 

(b) 

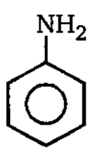
(c) 

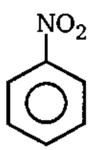
(d) 

54.  $\xrightarrow[H_2SO_4]{HNO_3}$ 

, van't-Hoff factor (i) for this reaction is :

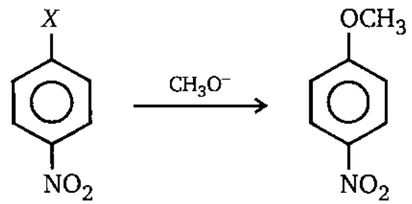
(a) 2 (b) 3 (c) 4 (d) 5

55. 

$\xrightarrow{?}$ 

, the missing reagent is :

(a) CF_3CO_3H (b) H_2SO_4 (c) LAH (d) $NaBH_4$

56. 

above reaction is an example of Nucleophilic aromatic substitution. Which of the following halide (–*X*) is most readily replaced.

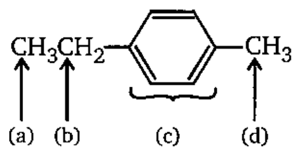
(a) – F (b) – Cl (c) – Br (d) – I

57. When comparing the hydrogenation of benzene with that of a hypothetical 1, 3, 5-cyclohexatriene, benzene ________ than the cyclohexatriene.

(a) absorbs 152 kJ /mol more heat (b) gives off 152 kJ/mol more heat

(c) absorbs 152kJ /mol less heat (d) gives off 152 kJ/mol less heat

58. Which of the following hydrogens is most easily abstracted on reaction with bromine free radicals, Br• ?



(a) a (b) b (c) c (d) d

59. The electrophilic aromatic substitution proceeds through a :

(a) free radical (b) sigma complex (c) benzyne (d) carbene

60. Which of the following substitution of benzene is ortho-para in electrophilic substitution and ortho-para in nucleophilic substitution ?

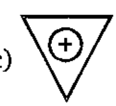
(a) $-NO_2$ (b) – NO

(c) $-SO_3H$ (d) $-SO_2Me$

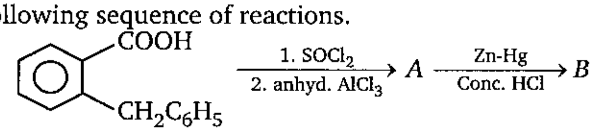
61. The number of possible isomers of dichloronitrobenzene is :

(a) 3 (b) 4 (c) 6 (d) 8

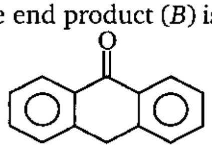
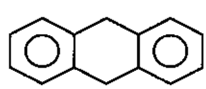
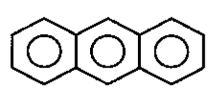
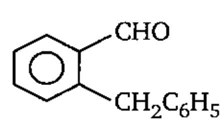
62. Which of the following is not an aromatic compound ?

(a)  (b)  (c)  (d) 

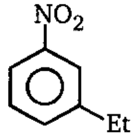
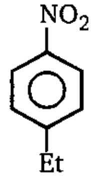
63. Consider the following sequence of reactions.



The end product (*B*) is:

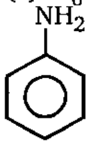
(a)  (b)  (c)  (d) 

64. $Ph-NO_2 + Et-Cl \xrightarrow{AlCl_3} (A)$, Product (A) of the given reaction is :

(a) $Ph-NH-Et$ (b) no–reaction (c)  (d) 

65. In nitration of benzene by mixed acid the rate of reaction will be :

(a) $C_6H_6 = C_6D_6 = C_6T_6$ (b) $C_6H_6 > C_6D_6 > C_6T_6$
(c) $C_6H_6 = C_6D_6 > C_6T_6$ (d) $C_6H_6 < C_6D_6 < C_6T_6$

66.  $\xrightarrow{H_2SO_5} (A) \xrightarrow[EtO^-/\Delta]{Ph-CH_2CN} (B)$; Product (B) is :

(a) $Ph-N=C(Ph)-CN$ (b) $Ph-N=C-Ph$

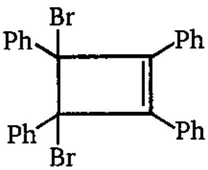
(c) $Ph-N=N-Ph$ (d) $Ph-CH=CH-Ph$

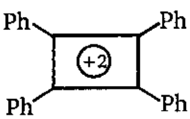
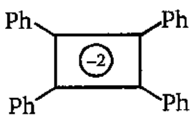
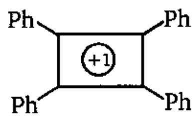
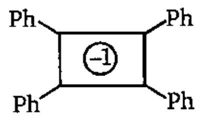
67. Which of the following ring compounds obeys Huckel's rule ?

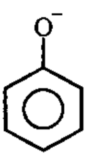
(a) $C_4H_4^{-1}$ (b) $C_4H_4^{+1}$ (c) $C_4H_4^{-2}$ (d) C_4H_4

68. Nitration of which of the following reactant gives maximum % of meta product (using HNO_3/H_2SO_4) ?

(a) Toluene (b) Aniline
(c) Benzene (d) Isopropyl benzene

69.  $\xrightarrow{2AgBF_4} (x)\ 2BF_4^-$; compound (x) will be :

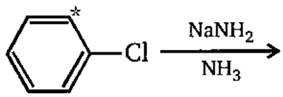
(a)  (b)  (c)  (d) 

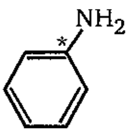
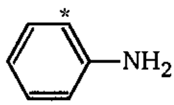
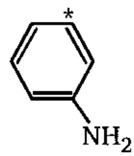
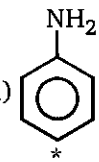
70.  $\xrightarrow[(2)\ H^-]{(1)\ CO_2} (A)$

Which of the following is true statement about the reaction ?

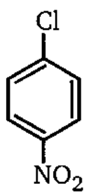
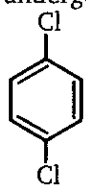
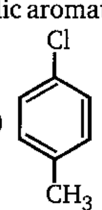
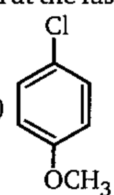
(a) Ortho isomer is major if PhONa is used
(b) Para isomer is major if PhOK is used
(c) Product formed is further used for preparation of drug aspirin
(d) All of these

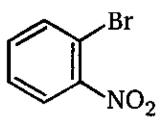
71. Two benzyne intermediates are likely to be formed equally. Reaction with amide ion can occur in two different directions with each benzyne, giving three possible products. They are formed in a 1 : 2 : 1 ratio. Asterisk (*) refers to ^{14}C.


(A) Product major; product (*A*) is :

(a)  (b)  (c)  (d) 

72. Which one of the following undergoes nucleophilic aromatic substitution at the fastest rate ?

(a)  (b)  (c)  (d) 

73. For the reaction ; ? $\longrightarrow$  ; the best combination of reactants is :

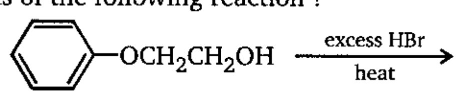
(a) $C_6H_5Br + HNO_3,\ H_2SO_4$ (b) $C_6H_5Br + H_2SO_4$, heat
(c) $C_6H_5NO_2 + Br_2,\ FeBr_3$ (d) $C_6H_5NO_2 + HBr$

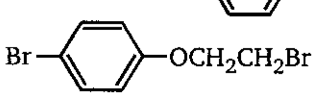
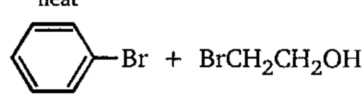
74. The action of $AlCl_3$ in Friedel Craft's reaction is:
(a) to absorb HCl (b) to release HCl
(c) to produce electrophile (d) to produce nucleophile

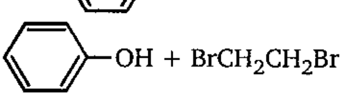
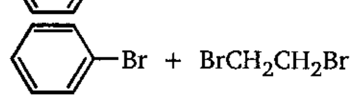
75. *n*-Butylbenzene on oxidation with hot alkanine $KMnO_4$ gives :
(a) benzoic acid (b) butanoic acid (c) benzyl alcohol (d) benzaldehyde

76. Which sequence of steps describes the best synthesis of 2-phenylpropene ?
(a) Benzene + 2-chloropropene , $AlCl_3$
(b) 1. Benzaldehyde ($C_6H_5CH=O$) + CH_3CH_2MgBr, diethyl ether
2. H_3O^+ 3. H_2SO_4, heat
(c) 1. Bromobenzene + Mg, diethyl ether 2. Propanal ($CH_3CH_2CH=O$)
3. H_3O^+ 4. H_2SO_4, heat
(d) 1. Bromobenzene + Mg, diethyl ether 2. Acetone [$(CH_3)_2C=O$]
3. H_3O^+ 4. H_2SO_4, heat

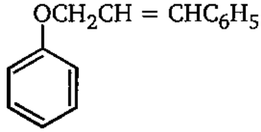
77. What are the products of the following reaction ?

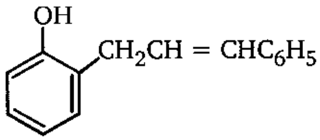


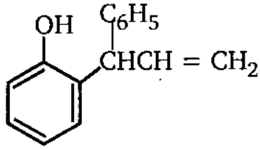
(a)  (b) 

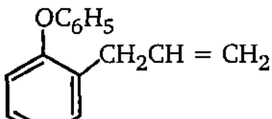
(c)  (d) 

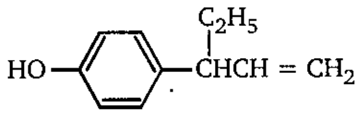
78. What is the product obtained by heating the following allylic ether of phenol ?



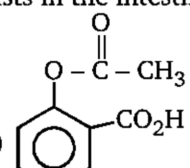
(a) 

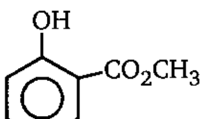
(b) 

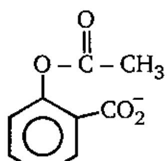
(c) 

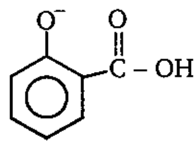
(d) 

79. When you ingest aspirin, it passes through your stomach, which has an acidic pH, before traveling through the basic environment of your intestine. Provide the structure form as it exists in the intestine.

(a) 

(b) 

(c) 

(d) 

80. Which of the following sets of reagents, used in the order shown, would be enable for the preparation of *p*-chlorophenol from *p*-chloronitrobenzene ?

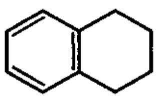
(a) 1. Fe, HCl ; 2. NaOH ; 3. $NaNO_2$, H_2SO_4 ; 4. H_3PO_2

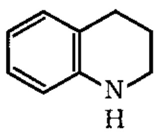
(b) 1. Fe, HCl ; 2. NaOH ; 3. $NaNO_2$, H_2SO_4 ; 4. H_2O, heat

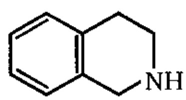
(c) 1. Fe, HCl ; 2. NaOH ; 3. $NaNO_2$, H_2SO_4 ; 4. ethanol

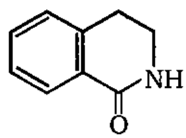
(d) 1. NaOH, heat ; 2. HCl

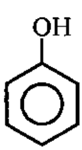
81. Which one of the following compounds undergoes bromination of its aromatic ring (electrophilic aromatic substitution) at the fastest rate ?

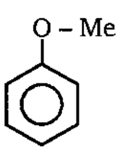
(a) 

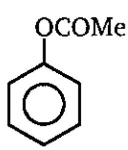
(b) 

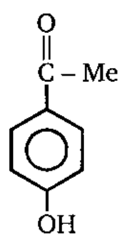
(c) 

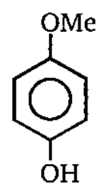
(d) 

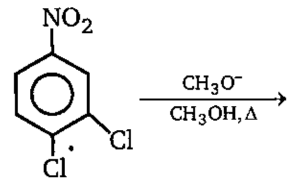
82.  $\xrightarrow{CH_3-\overset{O}{\overset{||}{C}}-Cl} (P) \xrightarrow[\Delta]{\text{Anhy. }AlCl_3} (Q)$. Product (Q) in this reaction is :

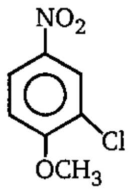
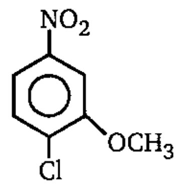
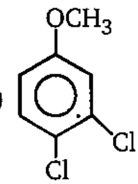
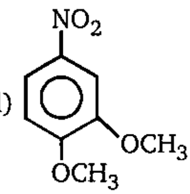
(a) 

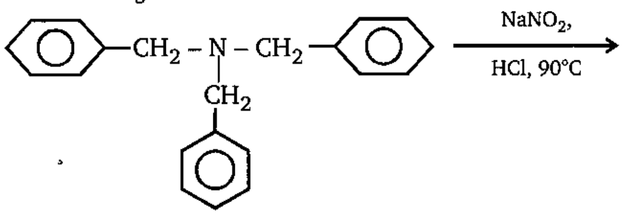
(b) 

(c) 

(d) 

83.  (P) (major) ; The product (P) will be :

(a)  (b)  (c)  (d) 

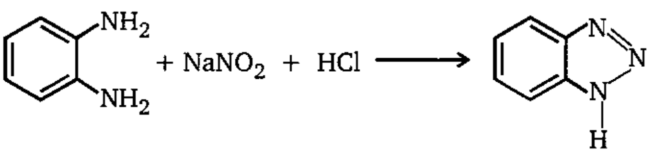
84.  (A) ; Product (A) is :

(a) $Ph-CH_2-N(N=O)-CH_2-Ph$

(b) $Ph-CH_2-N(Ph)-N=O$

(c) $Ph-CH_2-\overset{\oplus}{N}(N=O)(CH_2-Ph)_2$

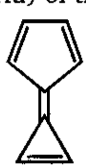
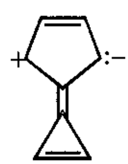
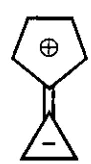
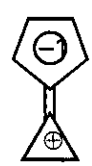
(d) $Ph-N=O$

85. 

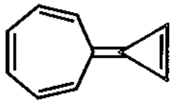
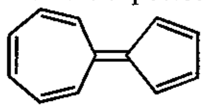
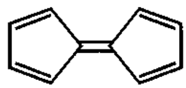
This reaction is example of :
(a) Intermolecular C – N coupling
(b) Intramolecular C – N coupling
(c) Intermolecular N – N coupling
(d) Intramolecular N – N coupling

86. The total number of isomeric trimethylbenzene is :
(a) 2 (b) 3 (c) 4 (d) 6

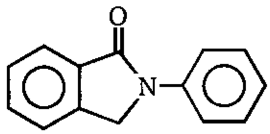
87. Caliene, C_7H_6, is expected to be a fairly polar aromatic molecule. Which of the following resonance forms contributes to the greatest extent towards the real structure (resonance hybrid) of the molecule ?

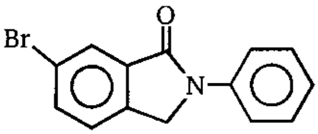
(a)  (b)  (c)  (d) 

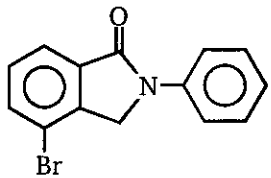
88. Which of the following molecules is expected to have the greatest resonance stabilization ?

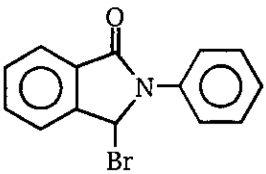
(a)  (b)  (c)  (d) 

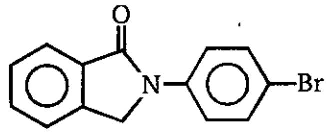
89. In the reaction given below, the major product formed is :

 $\xrightarrow[\text{Fe}]{Br_2(\text{1 mole})}$ Product.

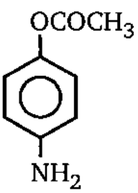
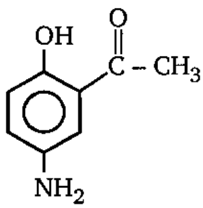
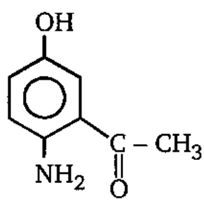
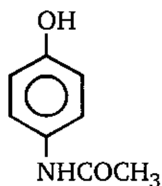
(a) 

(b) 

(c) 

(d) 

90. *p*-aminophenol reacts with one equivalent of acetyl chloride in the presence of pyridine to give mainly :

(a)  (b)  (c)  (d) 

91. Which of the following reactions can be used to prepare acetophenone ?

(a) $C_6H_6 + CH_3COCl \xrightarrow[2\,H_2O]{1.\,AlCl_3}$ (b) $(C_6H_5COO)_2Ca + (CH_3COO)_2Ca \xrightarrow{\text{heat}}$

(c) $C_6H_6CN \xrightarrow[2.\,H_3O^+]{1.\,CH_3MgI}$ (d) All of these

92. Consider the following sequence of reactions.

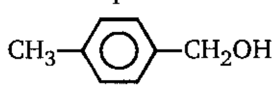
$$C_6H_6 + CH_3CH = CH_2 \xrightarrow[\text{heat}]{H_3PO_4} A \xrightarrow[2.\,H_3O^+,\ \text{heat}]{1.\,O_2,\text{heat}} B + C$$

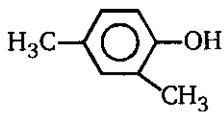
The products (*B*) and (*C*) are :

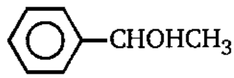
(a) benzaldehyde and acetaldehyde (b) benzoic acid and acetic acid

(c) phenol and propionaldehyde (d) phenol and acetone

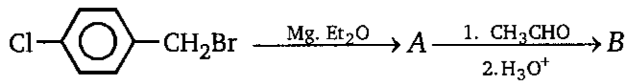
93. An organic compound having the molecular formula $C_8H_{10}O$ on being heated with I_2 and dilute NaOH gives a yellow precipitate. The expected compound is :

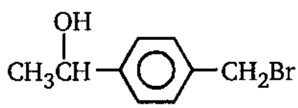
(a) $C_6H_5CH_2CH_2OH$ (b) 

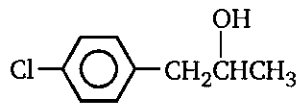
(c) 

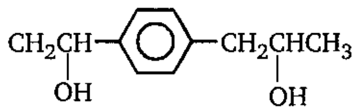
(d) 

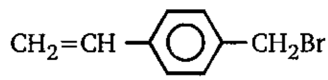
94. The product (*B*) of the reaction sequence is :



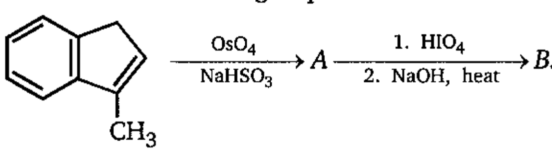
(a) 

(b) 

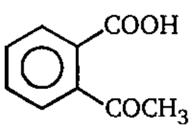
(c) 

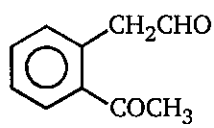
(d) 

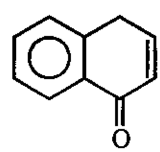
95. Consider the following sequence of reactions.

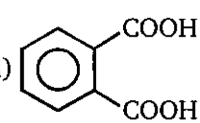


The final product (*B*) is :

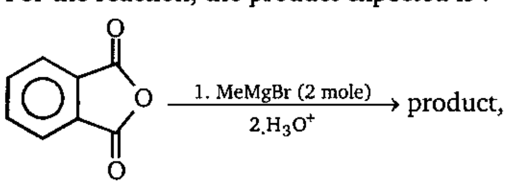
(a) 

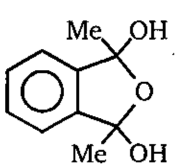
(b) 

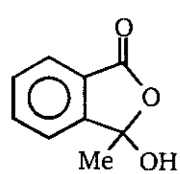
(c) 

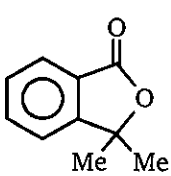
(d) 

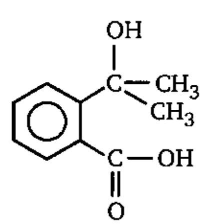
96. For the reaction, the product expected is :



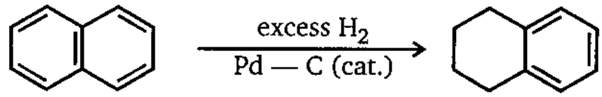
(a) 

(b) 

(c) 

(d) 

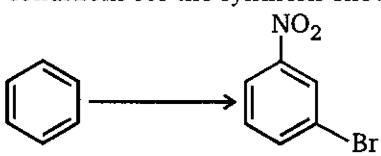
97. Hydrogenation of naphthalene (*P*) with excess hydrogen gas stops cleanly at 1, 2, 3, 4-tetrahydronaphthalene (*Q*). What conclusion can be drawn from this experiment ?



(*P*) (*Q*)

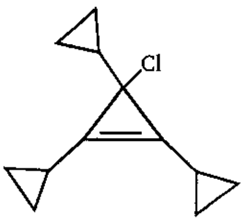
(a) the hydrogenation of *P* is exothermic
(b) one aromatic ring of *P* is more reactive than the aromatic ring of *Q*
(c) one aromatic ring of *P* is less reactive than the other ring of *Q*
(d) reduction of the first C = C of *P* is faster than reduction of the second or third C = C

98. Suggest the best reaction conditions for the synthesis shown below.



(a) (1) HNO_3, H_2SO_2; then (2) Br_2
(b) (1) Br_2; then (2) HNO_3, H_2SO_2
(c) (1) CH_3Br, $AlBr_3$; then (2) HNO_3, H_2SO_3
(d) HNO_3, H_2SO_2, then (2) Br_2, $FeBr_3$

99.



In the above compound Cl will liberated easily in the form of :

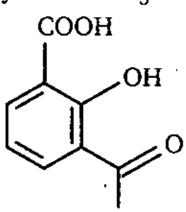
(a) $Cl^{\oplus}$ (b) Cl^- (c) $Cl^{\bullet}$ (d) Cl^{2+}

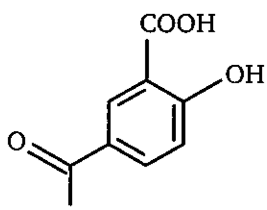
100. Consider the following sequence of reactions:

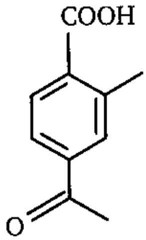
$PhCO_2H \xrightarrow[2. NH_3]{1.\ PCl_5} A \xrightarrow[2. H_2/Ni]{1.\ P_4O_{10}.\ heat} B$. The final product (*B*) is :

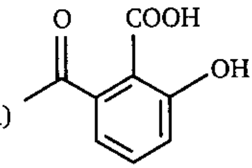
(a) benzonitrile (b) benzylamine (c) aniline (d) benzamide

101. The major product of the acetylation of salicylic acid with Ac_2O/H^+ followed by heating with anhydrous $AlCl_3$ is :

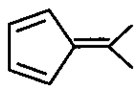
(a) 

(b) 

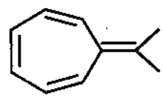
(c) 

(d) 

102. Which one of the following statements is **True:**



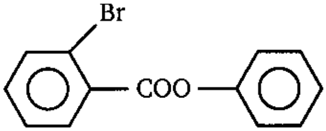
1

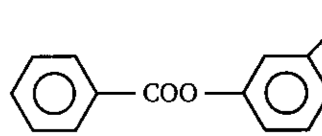


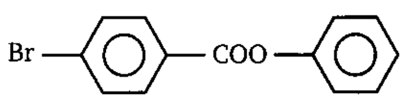
2

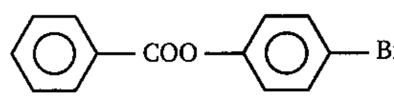
(a) PhLi adds to both compounds with equal ease
(b) PhLi does not add to either of the compounds
(c) PhLi reacts readily with 1 but does not add to 2
(d) PhLi reacts readily with 2 but does not add to 1

103. The major product expected from the mono-bromination of phenyl benzoate is :

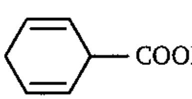
(a) 

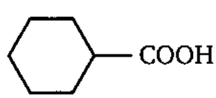
(b) 

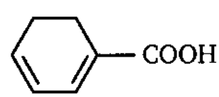
(c) 

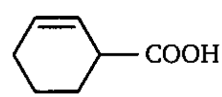
(d) 

104. The Birch reduction of benzoic acid gives :

(a) 

(b) 

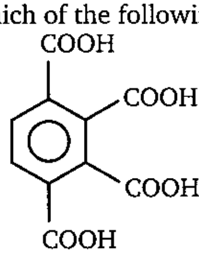
(c) 

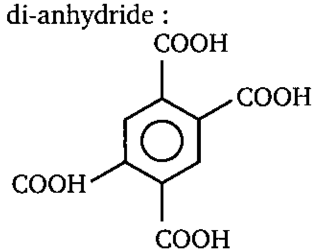
(d) 

105. The decreasing order of reactivity of meta-nitrobromobenzene (I), 2,4,6-trinitrobromobenzene (II), para-nitrobromobenzene (III), and 2,4-dinitrobromobenzene (IV) towards HO^- ions is :

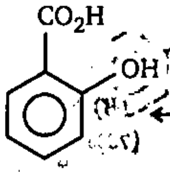
(a) I > II > III > IV (b) II > IV > III > I (c) IV > II > III > I (d) II > IV > I > III

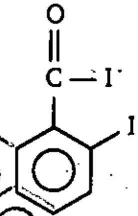
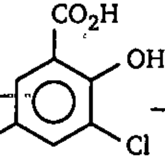
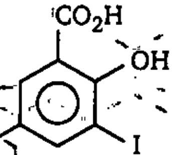
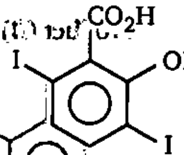
106. Which of the following tetracarboxylic acid form di-anhydride :

(a) 

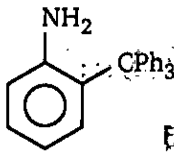
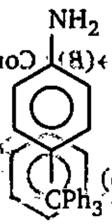
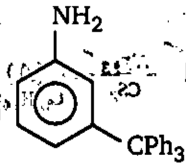
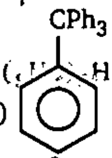
(b) 

(c) neither (a) nor (b)
(d) both (a) and (b)

107.  $\xrightarrow{I-Cl}$ (A); unknown (A) is :

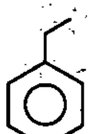
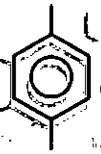
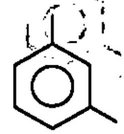
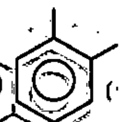
(a)  (b)  (c)  (d) 

108. $Ph-NH_2 + Ph_3COH \xrightarrow{H^+/\Delta}$ P (major) (not a N-derivative), Product (P) is :

(a)  (b)  (c)  (d) 

109. Deduce structure of (A).

(A) $C_8H_{10} \xrightarrow{KMnO_4}$ (B) $C_8H_6O_4 \xrightarrow[Fe]{Br_2} C_8H_5BrO_4$ (C) (one-product only) :

(a)  (b)  (c)  (d) 

110. The deamination of $Ph_2C(OH)CH_2NH_2$ with $NaNO_2$ –HCl gives a product (P), which on oxidation gives benzoic acid only. Identify the product (P).

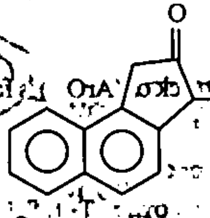
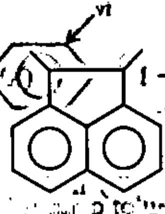
(a) $Ph-CH_2-CH_2-Ph$ (b) $Ph-\overset{O}{\overset{\|}{C}}-CH_2-Ph$

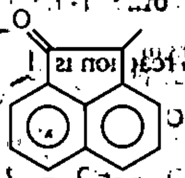
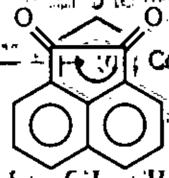
(c) $Ph-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-Ph$ (d) $Ph-CH_2-NH-Ph$

111. $Ph-CO_2H \xrightarrow{SOCl_2} A \xrightarrow{Me_2NH} B \xrightarrow{(C)} Ph-CHO$, unknown reagent (C) is :

(a) $LiAlH_4$ (b) $NaBH_4$

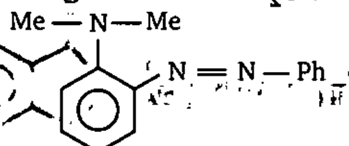
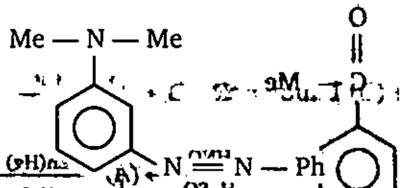
(c) $LiAlH_4(t\text{-}BuO)_3$ (d) PCC/CH_2Cl_2

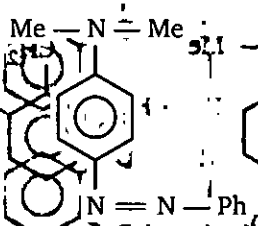
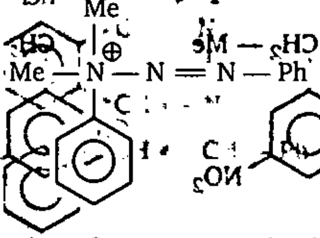
(a) 
(b) 

(c) 
(d) 

128. Ph – NH_2 $\xrightarrow{CH_3-Cl\ (2\text{mole})}$ (A) $\xrightarrow{Ph-\overset{\oplus}{N_2}\,\overset{\ominus}{Cl}}$ (B) (major) Butter yellow

Product of the above reaction is :

(a) 
(b) 

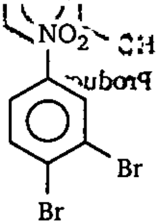
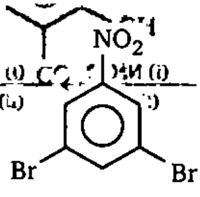
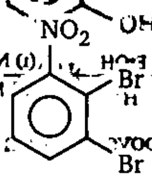
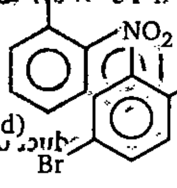
(c) 
(d) 

129. *p*-Toluedine reacts with benzene diazonium chloride to form compound, which on boiling with aq. H_2SO_4 give .... products :

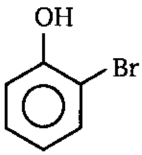
(a) 3 (b) 2 (c) 4 (d) 5

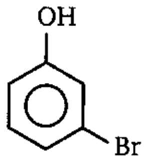
130.  $\xrightarrow{\text{aq}\,NH_3}$ (A) $\xrightarrow[H_2O]{Br_2}$ (B) $\xrightarrow[\text{(ii)}\,H_3PO_2]{\text{(i)}\,NaNO_2+HCl}$ (C)

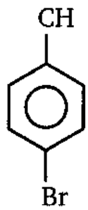
Product (C) of the above reaction is :

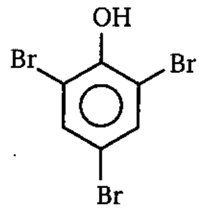
(a) 
(b) 
(c) 
(d) 

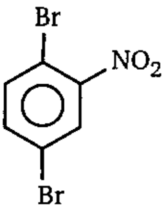
131.  $\xrightarrow[H_2O_2]{Fe^{+2}}$ (Fenton's reagent) (A) $\xrightarrow[H_2O]{Br_2}$ (B) $(\equiv 100\%)$; Major product (B) of this reaction is :

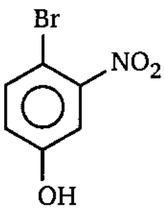
(a) 

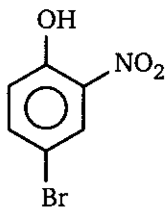
(b) 

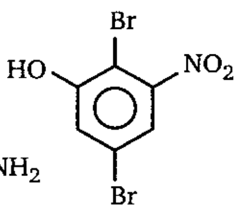
(c) 

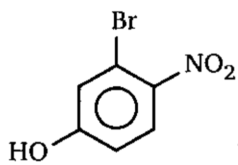
(d) 

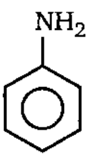
132.  $\xrightarrow{HO^-}$ (A) ; Product of the given reaction is :

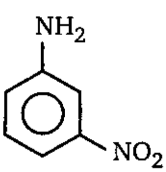
(a) 

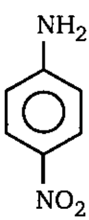
(b) 

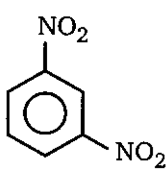
(c) 

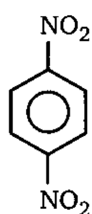
(d) 

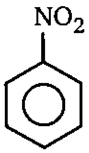
133.  $\xrightarrow{(CH_3CO)_2O}$ (A) $\xrightarrow[H_2SO_4]{HNO_3}$ (B) $\xrightarrow[H_2O]{H^+}$ (C), Product (C) of this reaction is :

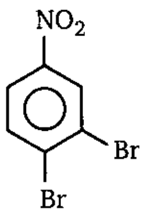
(a) 

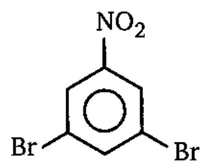
(b) 

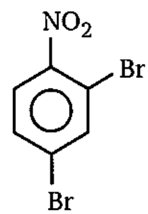
(c) 

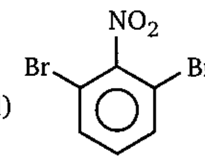
(d) 

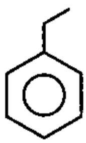
134.  $\xrightarrow[\text{Fe}]{Br_2\,(2\text{mole})}$ (*A*) (major) ; Product (*A*) will be :

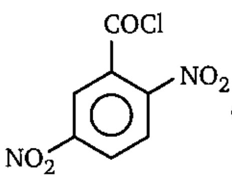
(a) 

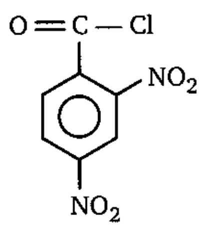
(b) 

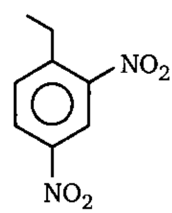
(c) 

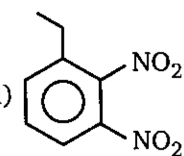
(d) 

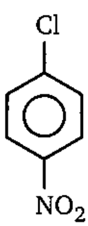
135.  $\xrightarrow[\text{(ii) } H_2SO_4]{\text{(i) } HNO_3}$ (*A*) (Di-nitro product) $\xrightarrow{KMnO_4/\Delta}$ (*B*) $\xrightarrow{SOCl_2}$ (*C*); Product (*C*) of this reaction is :

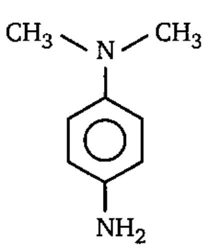
(a) 

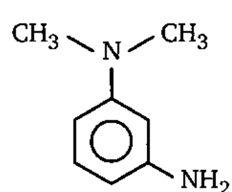
(b) 

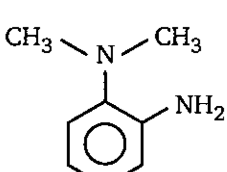
(c) 

(d) 

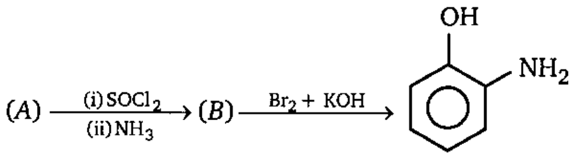
136.  $\xrightarrow{CH_3-NH-CH_3}$ (*A*) $\xrightarrow[\text{HCl}]{\text{Fe}}$ (*B*) ; Product (*B*) of this reaction is :

(a) 

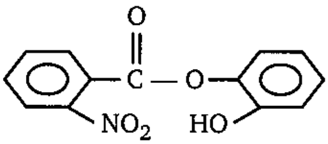
(b) 

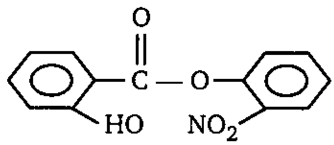
(c) 

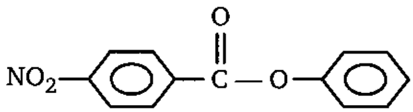
(d) None of these

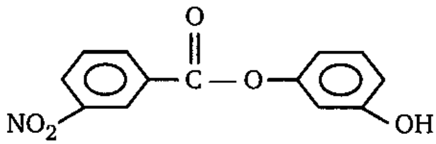
137. 

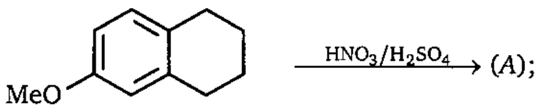
Which of the following compound on hydrolysis gives reactant (*A*) :

(a) 

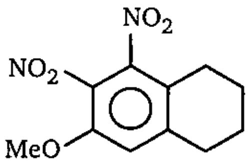
(b) 

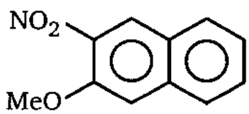
(c) 

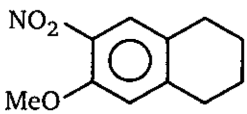
(d) 

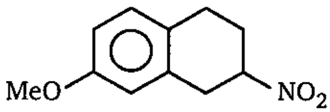
138. 

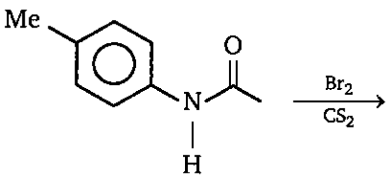
Product (*A*) of the above reaction is :

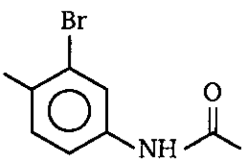
(a) 

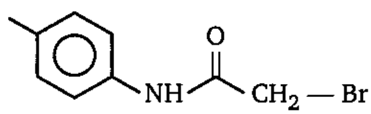
(b) 

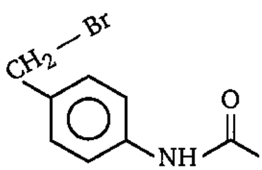
(c) 

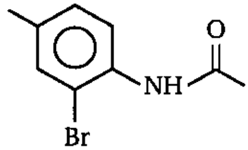
(d) 

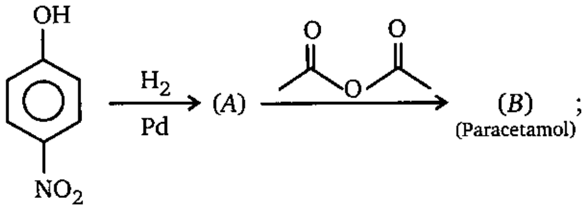
139.  ; Product of the reaction is :

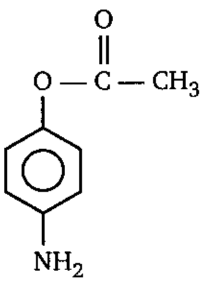
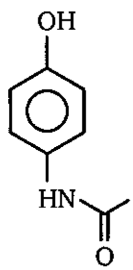
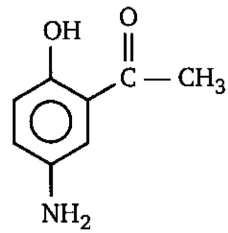
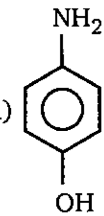
(a) 

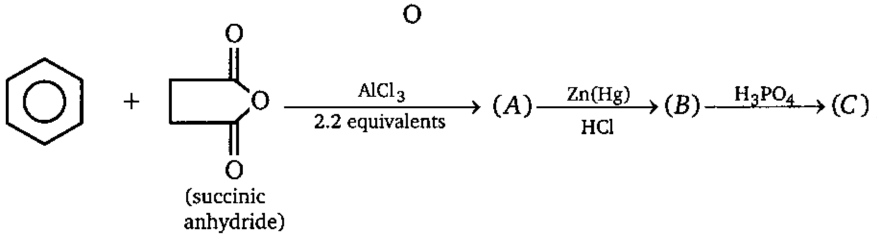
(b) 

(c) 

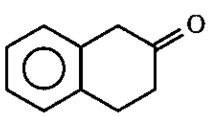
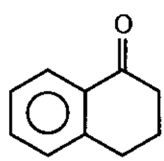
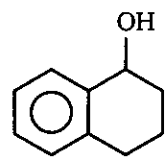
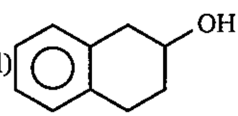
(d) 

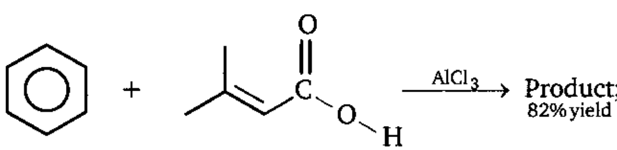
140.  ; Product (*B*) of this reaction is :

(a)  (b)  (c)  (d) 

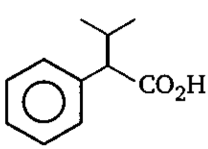
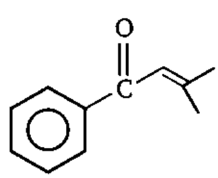
141. 

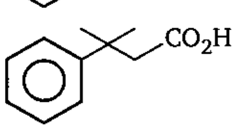
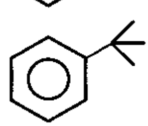
Product (*C*) of the above reaction is :

(a)  (b)  (c)  (d) 

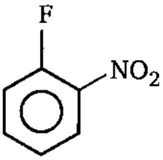
142. 

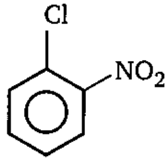
Product of the above Friedel-Craft reaction is :

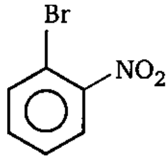
(a)  (b) 

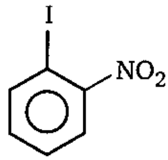
(c)  (d) 

143. Which of the following 2-halo nitrobenzene is most reactive towards nucleophilic aromatic substitution ?

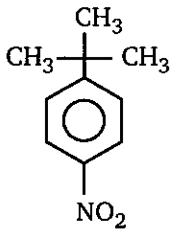
(a) 

(b) 

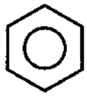
(c) 

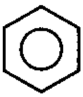
(d) 

144. Choose the best method to prepare given compound :

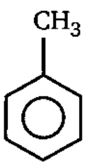


(a)  $\xrightarrow[(2) Me_3CCl/AlCl_3]{(1) HNO_3 + H_2SO_4}$

(b)  $\xrightarrow[(2) HNO_3/H_2SO_4]{(1) Me_3CCl/AlCl_3}$

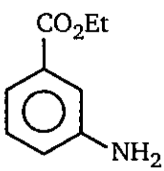
(c)  $\xrightarrow[(2) HNO_3/H_2SO_4]{(1) CH_3-\underset{|}{\overset{CH_3}{CH}}-CH_2-Cl/AlCl_3}$

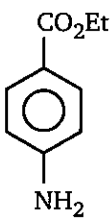
(d)  $\xrightarrow[(2) CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2-Cl/AlCl_3]{(1) HNO_3/H_2SO_4}$

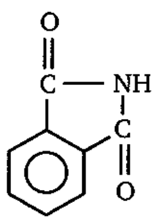
145. 

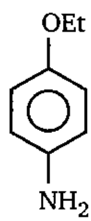
$\xrightarrow[H_2SO_4]{HNO_3}$ (A) (Para isomer) $\xrightarrow[Pd, C]{H_2}$ (B) $\xrightarrow{KMnO_4}$ (C) $\xrightarrow[H^+]{EtOH}$ (D) Benzocaine

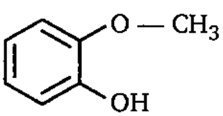
Benzocaine has been used as a component of appetite suppressants, burn and sunburn remedies. Benzocaine is :

(a) 

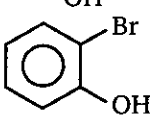
(b) 

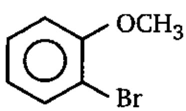
(c) 

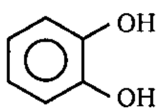
(d) 

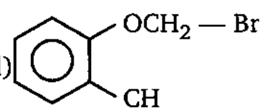
146. 

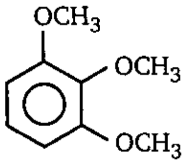
$\xrightarrow[\Delta]{HBr}$ (A) ; Product (A) of this reaction is :
86%

(a) 

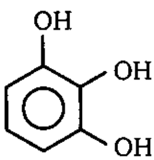
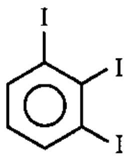
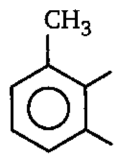
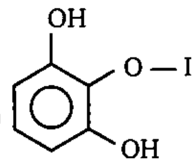
(b) 

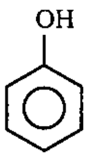
(c) 

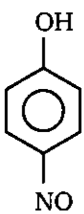
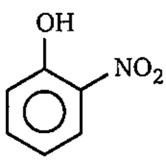
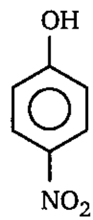
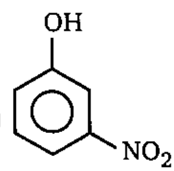
(d) 

147.  $\xrightarrow[\Delta]{HI\,(excess)}$ Product.

Predict major product of the above reaction is :

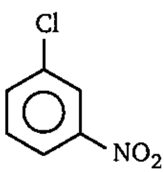
(a)  (b)  (c)  (d) 

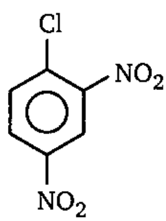
148.  $\xrightarrow[HNO_3]{HNO_2}$ (A) (Major) ; Product (A) is :

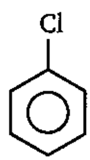
(a)  (b)  (c)  (d) 

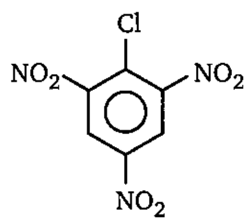
149. Arrange in their decreasing order of rate in SNAr.


(i)


(ii)

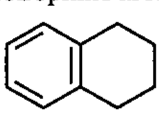
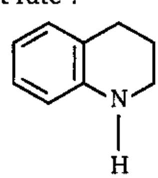

(iii)

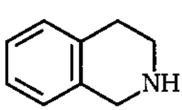
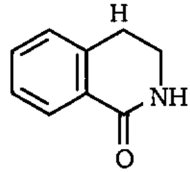

(iv)


(v)

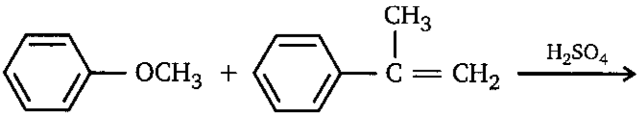
(a) i > ii > iv > iii > v
(b) ii > i > iii > v > iv
(c) v > iii > i > ii > iv
(d) v > iii > ii > i > iv

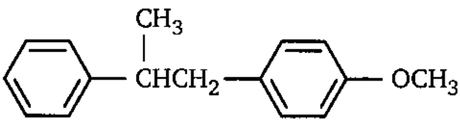
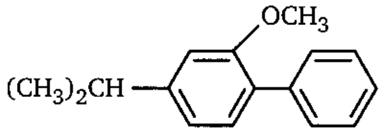
150. Which one of the following compounds undergoes bromination of its aromatic ring (electrophilic aromatic substitution) at the fastest rate ?

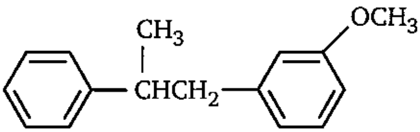
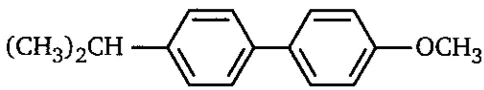
(a)  (b) 

(c)  (d) 

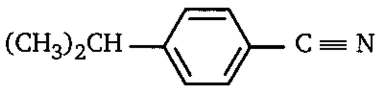
151. What is the product of the following reaction ?



(a)  (b) 

(c)  (d) 

152. Which sequence represents the best synthesis of 4-isopropylbenzonitrile ?



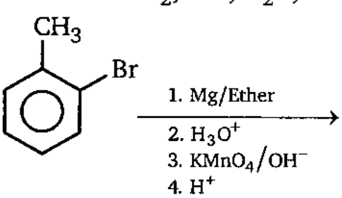
4-Isopropylbenzonitrile

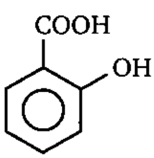
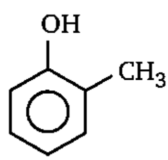
(a) **1.** Benzene + $(CH_3)_2CHCl, AlCl_3$; **2.** $Br_2, FeBr_3$; **3.** KCN

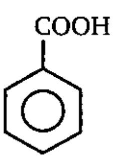
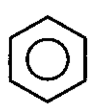
(b) **1.** Benzene + $(CH_3)_2CHCl, AlCl_3$; **2.** HNO_3, H_2SO_4; **3.** Fe, HCl,; **4.** NaOH **5.** $NaNO_2$, HCl, H_2O

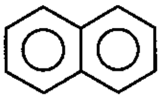
(c) **1.** Benzene +$(CH_3)_2CHCl, AlCl_3$; **2.** HNO_3, H_2SO_4 ; **3.** Fe, HCl ; **4.** $NaNO_2/HCl$ **5.** KCN

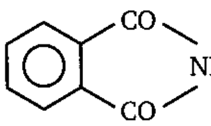
(d) **1.** Benzene + HNO_3, H_2SO_4 ; **2.** $(CH_3)_2CHCl, AlCl_3$; **3.** Fe, HCl; **4.** $NaNO_2, HCl, H_2O$; **5.** CuCN

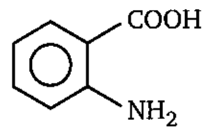
153.  A, Product A is :

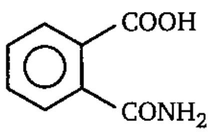
(a)  (b) 

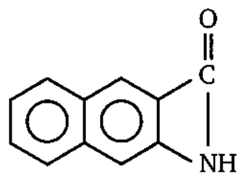
(c)  (d) 

154.  $\xrightarrow[\substack{2.\ NH_3,\Delta \\ 3.\ KOBr,\Delta}]{1.\ Air, V_2O_5,\Delta}$ A, Product A is :

(a) 

(b) 

(c) 

(d) 

155. What is correct order of rate of nitration of the following compounds ?

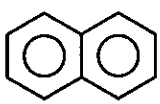
$\underset{A}{C_6H_5CH_3}$ $\underset{B}{C_6H_6}$ $\underset{C}{C_6D_6}$ $\underset{D}{C_6T_6}$ $\underset{E}{C_6H_5Br_3}$ $\underset{F}{C_6H_5\overset{+}{N}R_3}$ $\underset{G}{C_6H_5NMe_2}$

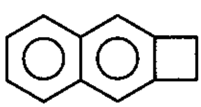
(a) $G > A > B > C > D > E > F$

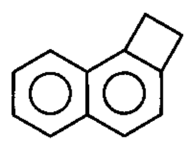
(b) $G > B > C > D > A > F$

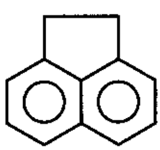
(c) $G > A > B = C = D > E > F$

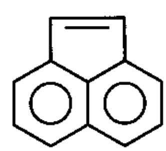
(d) $G > A > B > C = D > E > F$

156.  $+ \begin{array}{c} COCl \\ | \\ COCl \end{array} \xrightarrow{AlCl_3} [X] \xrightarrow[\text{excess}]{Na{-}Hg, HCl} [Y]$; Product Y is :

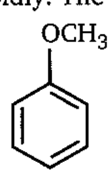
(a) 

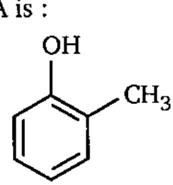
(b) 

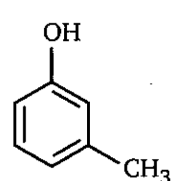
(c) 

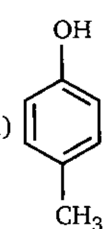
(d) 

157. Compound A (C_7H_8O) is insoluble in water, dilute HCl & aqueous $NaHCO_3$, but it dissolves in dilute NaOH. When A is treated with Br_2 water it is converted into a compound $C_7H_5OBr_3$ rapidly. The structure of A is :

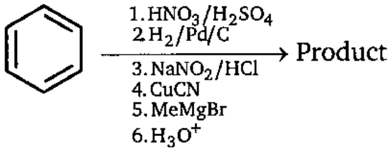
(a) 

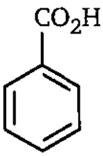
(b) 

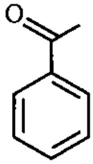
(c) 

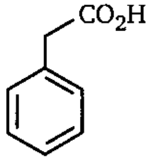
(d) 

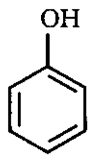
158. Give the product of the following reaction sequence :



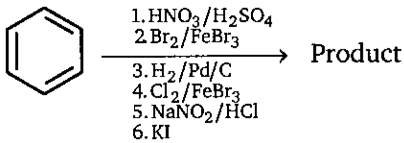
(a) 

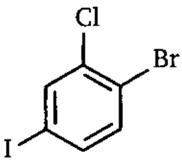
(b) 

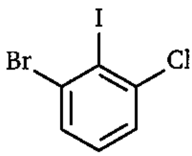
(c) 

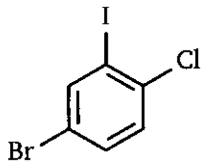
(d) 

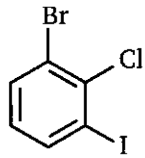
159. Give the product of the following reaction sequence:



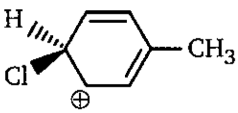
(a) 

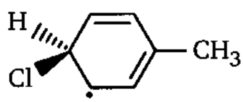
(b) 

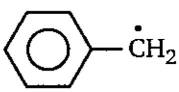
(c) 

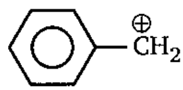
(d) 

160. Which represents an intermediate formed in the reaction of toluene and chlorine at elevated temperature in sunlight ?

(a) 

(b) 

(c) 

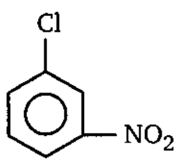
(d) 

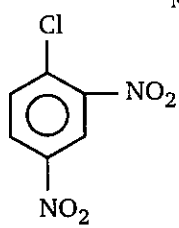
161. The decreasing order of reactivity of *m*-nitrobromobenzene (I), 2, 4, 6- trinitrobromo-benzene (II), *p*-nitrobromobenzene (III), and 2,4-dinitrobromobenzene (IV), towards OH^- ions is :

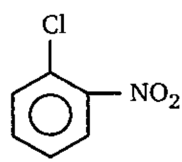
(a) I > II > III > IV
(b) II > IV > III > I
(c) IV > II > III > I
(d) II > IV > I > III

162. Which one of the following compounds is most reactive for ArS_{N^2} reaction ?

(a) 

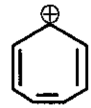
(b) 

(c) 

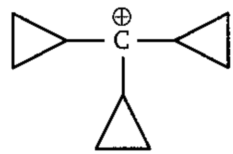
(d) 

163. Which one amongst the following carbocations is most stable ?

(a) $C_6H_5-\overset{\oplus}{C}H-C_6H_5$

(b) 

(c) $CH_3-\overset{\oplus}{\underset{CH_3}{\underset{|}{C}}}-CH_3$

(d) 

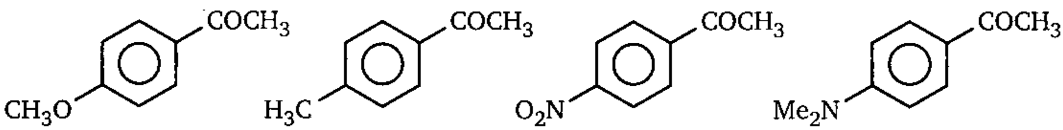
164. Cyclopentadiene is much more acidic than cyclopentane. The reason is that :

(a) cyclopentadiene has conjugated double bonds

(b) cyclopentadiene has both sp^2 and sp^3 hybridized carbon atoms

(c) cyclopentadiene is a strain-free cyclic system

(d) cyclopentadienide ion, the conjugate base of cyclopentadiene, is an aromatic species and hence has higher stability

165. 

(I) (II) (III) (IV)

Friedel-Crafts acylation reaction can be used to obtain the compounds

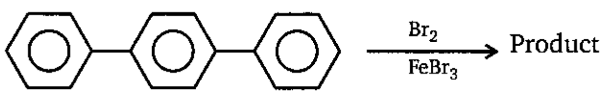
(a) II, III and IV

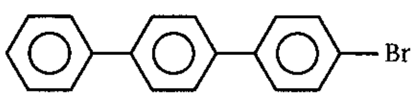
(b) I, III and IV

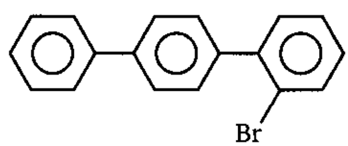
(c) I and II

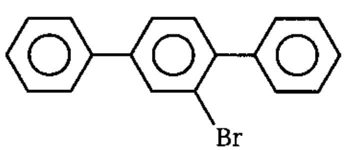
(d) II and III

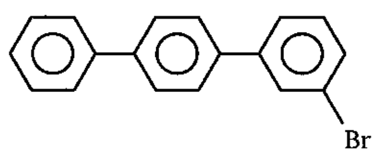
166. The major product of the reaction is :



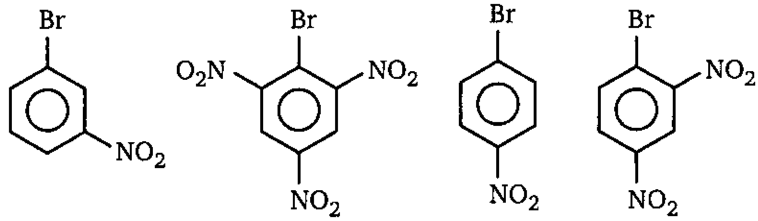
(a) 

(b) 

(c) 

(d) 

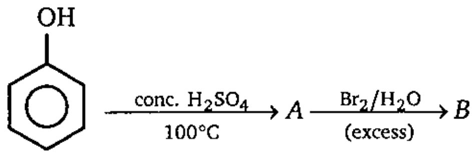
167. The decreasing order of reactivity of given compound towards nucleophilic substitution with aqueous NaOH is :

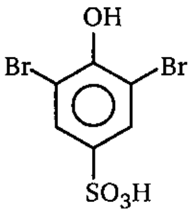
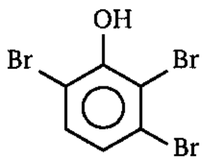
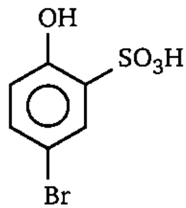
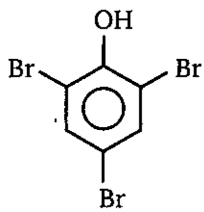


(I) (II) (III) (IV)

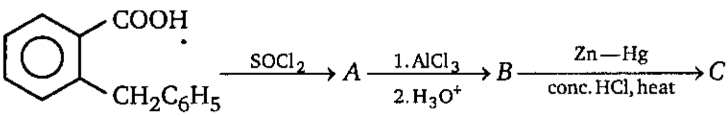
(a) I > II > III > IV
(b) II > IV > III > I
(c) IV > II > III > I
(d) II > IV > I > III

168. Identify the end product (*B*) of the following sequence of reactions.

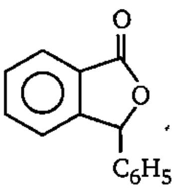
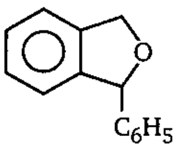
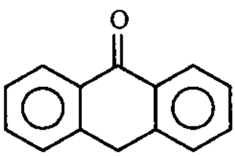
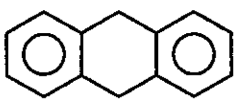


(a) 
(b) 
(c) 
(d) 

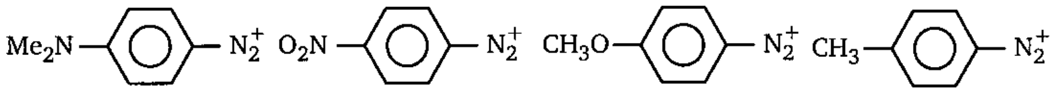
169. Consider the following sequence of reactions :



The end product (*C*) is :

(a) 
(b) 
(c) 
(d) 

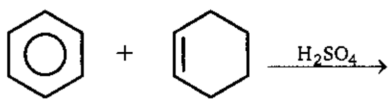
170. For the diazonium ions the order of reactivity towards diazo-coupling with phenol in the presence of dilute NaOH is :



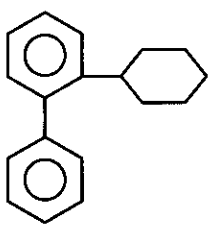
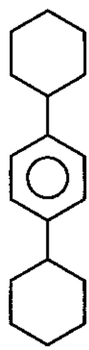
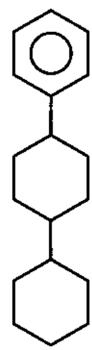
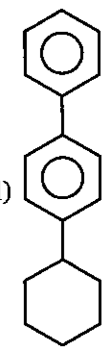
(I) (II) (III) (IV)

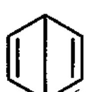
(a) I < IV < II < III
(b) I < III < IV < II
(c) III < I < II < IV
(d) III < I < IV < II

171. Major product obtained in given reaction is :

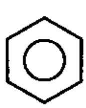
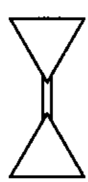
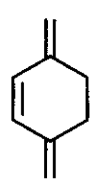
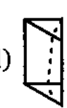


(2 mole)

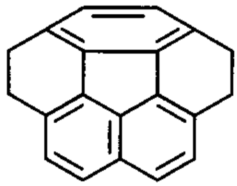
(a) 
(b) 
(c) 
(d) 

172.  (A) $\xrightarrow[\text{or } AlCl_3]{H^{\oplus}}$ (B) (major) ; (A) & (B) are isomers. Product (B) is :

Dewar's Benzene

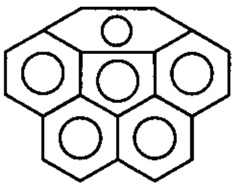
(a) 
(b) 
(c) 
(d) 

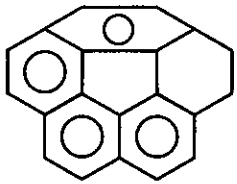
173. The step shown below is a recent synthesis of corannulene.

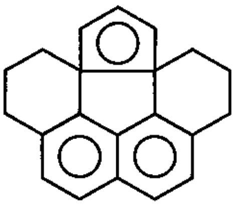


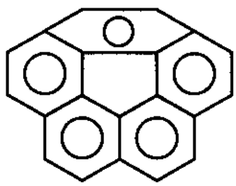
$\xrightarrow[(\Delta)]{Pd/C}$ (A) $C_{20}H_{10}$
Corannulene

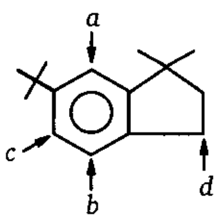
Product (A) is :

(a) 

(b) 

(c) 

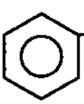
(d) 

174. 

Identify the position where E.A.S. will take place :

(a) a (b) b

(c) c (d) all the position are identical

175.  $CH_2 - \overset{14}{C}O_2H \xrightarrow[(2)\ H_3O^{\oplus}]{(1)\ KMnO_4,\ HO^-,\ \Delta}$

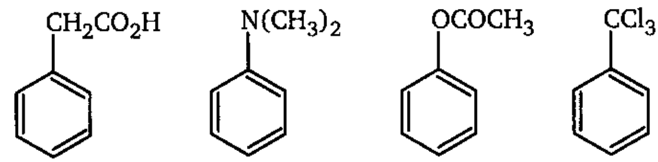
The labelled carbon goes with :

(a) $Ph - \overset{14}{C}O_2H$ (b) $\overset{14}{C}O_2$

(c) $Ph - \overset{14}{C}H_2 - CO_2H$ (d) $\overset{14}{C}H_4$

176. What is the expected order of reactivity of the following compounds in electrophilic chlorination ($Cl_2 + FeCl_3$) ?

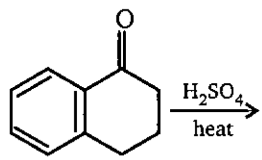
(more reactive > less reactive)

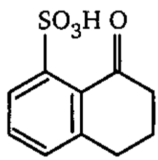


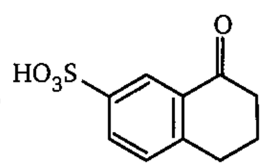
I II III IV

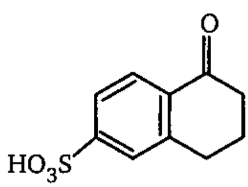
(a) I > II > III > IV
(b) IV > III > II > I
(c) III > I > IV > II
(d) II > III > I > IV

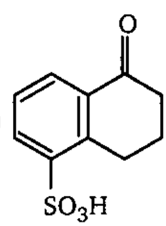
177. Which of the following is the major product from sulfonation of α-tetralone ?



(a) 

(b) 

(c) 

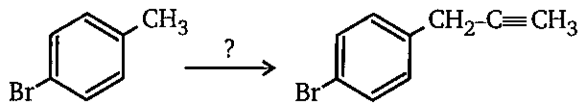
(d) 

178. Which of the following procedures would be best for the preparation of phenyl benzyl ether ?

$C_6H_5OCH_2C_6H_5$

(a) $C_6H_5Cl + C_6H_5CH_2O^{(-)}Na^{(+)}$
(b) $C_6H_5O^{(-)}Na^{(+)} + C_6H_5CH_2Cl$
(c) $2C_6H_5Cl + Na_2O$
(d) $2C_6H_5MgBr + CH_2O$

179. Which of the following procedures would be best for achieving the following reaction ?



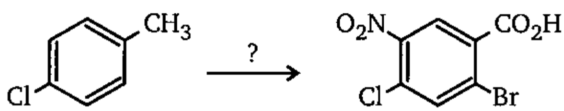
(a) (i) KOH and heat (ii) $CH_3C \equiv C — Br$

(b) (i) $KMnO_4$ and heat (ii) $CH_3C \equiv C^{(-)}Na^{(+)}$ (iii) excess H_2O

(c) (i) NBS in CCl_4 and heat (ii) $CH_3C \equiv C^{(-)}Na^{(+)}$

(d) (i) Mg in ether (ii) $CH_3C \equiv CBr$ (iii) excess H_3PO_4

180. Which of the following procedures would be best for achieving the following reaction ?



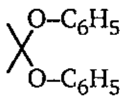
(a) (i) $Br_2 + FeBr_3$ (ii) $KMnO_4$ and heat (iii) HNO_3 and H_2SO_4

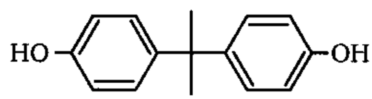
(b) (i) $KMnO_4$ and heat (ii) $Br_2 + FeBr_3$ (iii) HNO_3 and H_2SO_4

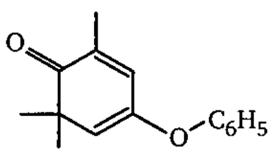
(c) (i) NBS in CCl_4 and heat (ii) $KMnO_4$ and heat (iii) HNO_3 and H_2SO_4

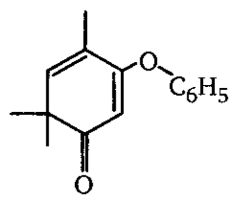
(d) (i) NBS in CCl_4 and heat (ii) $NaNO_2$ and heat

181. Phenol reacts with acetone in the presence of conc. sulphuric acid to form a $C_{15}H_{16}O_2$ product. Which of the following compounds is this product ?

(a) 

(b) 

(c) 

(d) 

182. Heating benzene in a large excess of 80% D_2SO_4 in D_2O results in what product ?

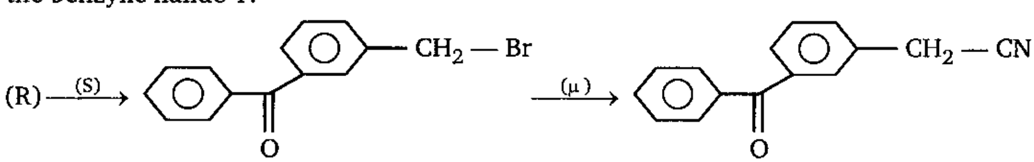
(a) $C_6H_5SO_3D$ (b) C_6H_5OD (c) C_6H_5D (d) C_6D_6

183. A solution of cyclohexene in benzene is stirred at 0°C while concentrated sulphuric acid is added. After washing away the acid and removing the excess benzene, what product is isolated?

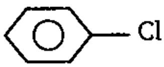
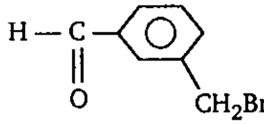
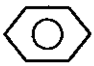
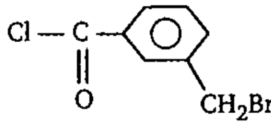
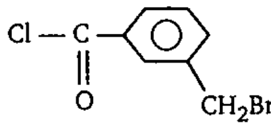
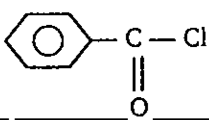
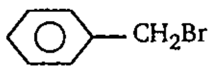
(a) cyclohexylbenzene (b) 1-cyclohexylcyclohexene

(c) *trans*-1,2-diphenylcyclohexane (d) 1,1-diphenylcyclohexane

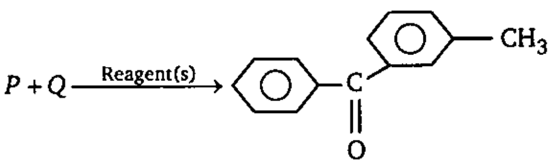
184. Indentify the reagents S and μ in the scheme below in which R is converted to the nitrite V via the benzylic halide T.



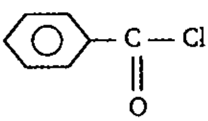
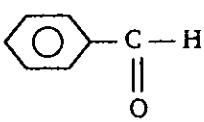
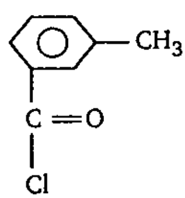
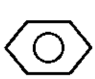
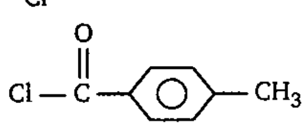
R, S and μ respectively are :

	R	S		μ
(a)			($AlCl_3$)	HCN
(b)			($AlCl_3$)	HCN
(c)			($AlCl_3$)	KCN
(d)			($AlCl_3$)	KCN

185. Two aromatic compounds *P* and *Q* give product *R*.

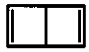


Reactant *P*, *Q* and reagent used in above reaction are :

	P	Q	Reagent
(a)			$AlCl_3$
(b)			$AlCl_3$
(c)			$AlCl_3$
(d)			$ZnCl_2$

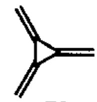
186. Which of the following C_6H_6 compounds has a single set of structurally equivalent hydrogen atoms ?

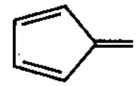

I


II

$H-C\equiv C-CH_2-CH_2-C\equiv C-H$

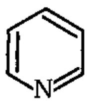
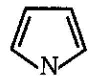
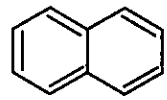

III


IV


V

(a) I and II
(b) I and IV
(c) I and V
(d) I, II and III

187. Which of the following compounds would not be considered aromatic in its behaviour?

(a) 
(b) 
(c) 
(d) 

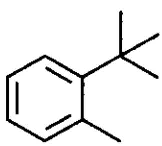
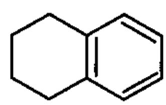
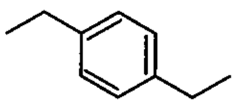
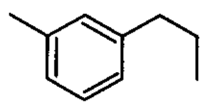
188. A C_8H_{10} hydrocarbon is nitrated by HNO_3 and sulphuric acid. Two, and only two, $C_8H_9NO_2$ isomers are obtained. Which of the following fits this evidence ?

(a) ethyl benzene
(b) *ortho*-xylene
(c) *meta*-xylene
(d) *para*-xylene

189. Which of the following benzene ring substituents is deactivating but *ortho-para* directing ?

(a) $-N=O$
(b) $-OCH_3$
(c) $-COCH_3$
(d) $-NO_2$

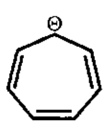
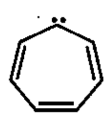
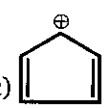
190. Which of the following compounds forms *ortho*- benzenedicarboxylic acid when oxidized by hot aqueous potassium permanganate ?

(a) 
(b) 
(c) 
(d) 

191. Which of the following organic chlorides will not give a Friedel-Craft alkylation product when heated with benzene and $AlCl_3$?

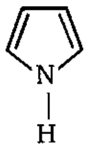
(a) $(CH_3)_3CCl$
(b) $CH_2=CHCH_2Cl$
(c) CH_3CH_2Cl
(d) $CH_2=CHCl$

192. Which of the following is aromatic ?

(a) 
(b) 
(carbene)
(c) 
(d) 
(carbene)

193. Which of the following substance will increase the acidity of phenol ?

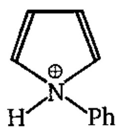
(a) Dil. H_2SO_4 (b) Dil. HCl (c) Conc. H_2SO_4 (d) Conc. CH_3COOH

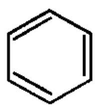
194.  + PhMgBr $\longrightarrow E + F$

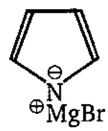
Pyrrole

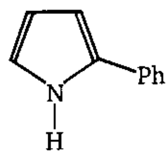
E + MeCl $\longrightarrow G + H$

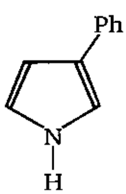
F + MeCl $\longrightarrow$ no reaction without a catalyst

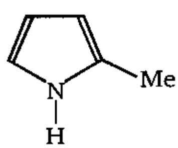

1

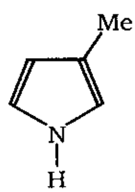

2


3


4


5

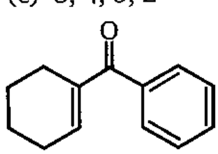

6

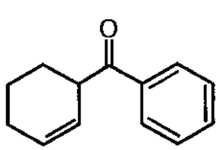

7

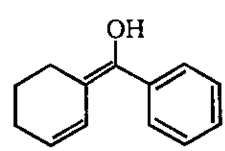
The structure of products $E - H$, respectively are

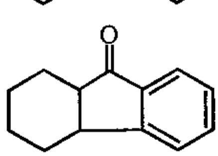
(a) 3, 2, 6, 7 (b) 4, 5, 6, 1

(c) 3, 4, 5, 2 (d) 3, 2, 4, 5

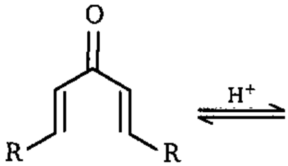
195.  $\xrightarrow{H^+}$ (A); Product A is :

(a) 

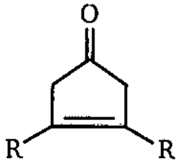
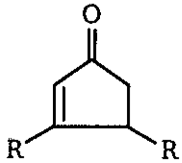
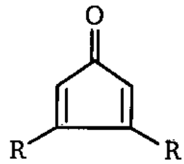
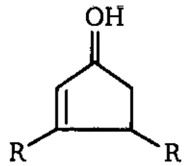
(b) 

(c) 

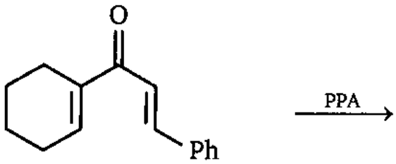
(d) none of these

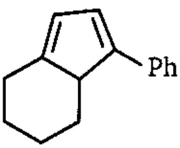
196. 

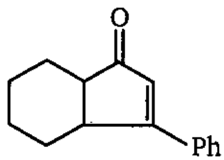
Identify the product of the above rearrangement reaction.

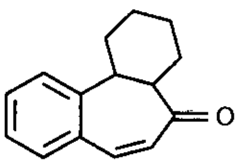
(a)  (b)  (c)  (d) 

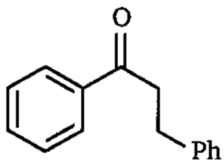
197. Product obtained in the following transformation is :

 PPA = polyphosphoric acid

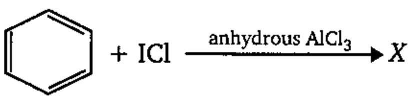
(a) 

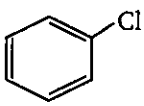
(b) 

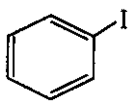
(c) 

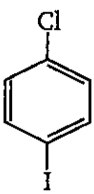
(d) 

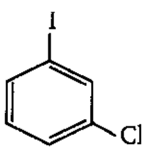
198. The compound X in the reaction.

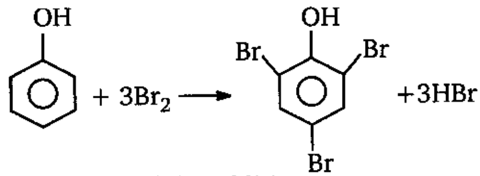


(a) 

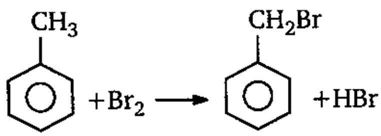
(b) 

(c) 

(d) 

199. 

(a) Nucleophilic addition
(b) Nucleophilic substitution
(c) Electrophilic addition
(d) Electrophilic substitution
(e) Free radical substitution

200. 

(a) Nucleophilic addition
(b) Nucleophilic substitution
(c) Electrophilic addition
(d) Electrophilic substitution
(e) Free radical substitution

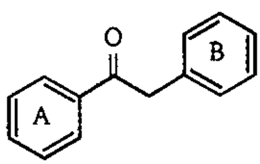
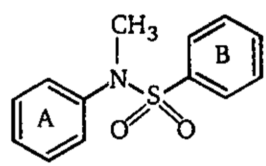
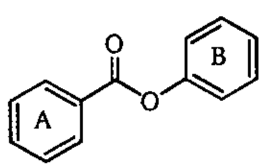
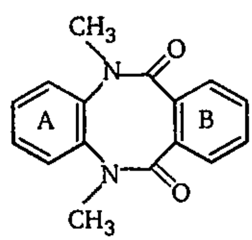
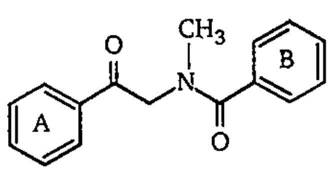
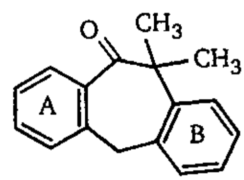
ANSWERS — LEVEL 1

1.	(b)	2.	(d)	3.	(b)	4.	(c)	5.	(a)	6.	(b)	7.	(c)	8.	(b)
9.	(d)	10.	(d)	11.	(a)	12.	(a)	13.	(a)	14.	(a)	15.	(a)	16.	(b)
17.	(b)	18.	(a)	19.	(b)	20.	(b)	21.	(c)	22.	(c)	23.	(b)	24.	(b)
25.	(d)	26.	(c)	27.	(c)	28.	(b)	29.	(b)	30.	(b)	31.	(b)	32.	(a)
33.	(b)	34.	(d)	35.	(c)	36.	(c)	37.	(a)	38.	(c)	39.	(a)	40.	(b)
41.	(b)	42.	(c)	43.	(c)	44.	(b)	45.	(c)	46.	(b)	47.	(b)	48.	(b)
49.	(b)	50.	(b)	51.	(b)	52.	(a)	53.	(c)	54.	(c)	55.	(a)	56.	(a)
57.	(d)	58.	(b)	59.	(b)	60.	(b)	61.	(c)	62.	(b)	63.	(b)	64.	(b)
65.	(a)	66.	(a)	67.	(c)	68.	(b)	69.	(a)	70.	(d)	71.	(b)	72.	(a)
73.	(a)	74.	(c)	75.	(a)	76.	(d)	77.	(c)	78.	(b)	79.	(c)	80.	(b)
81.	(b)	82.	(c)	83.	(a)	84.	(c)	85.	(d)	86.	(b)	87.	(d)	88.	(b)
89.	(d)	90.	(d)	91.	(d)	92.	(d)	93.	(d)	94.	(b)	95.	(c)	96.	(d)
97.	(b)	98.	(d)	99.	(b)	100.	(b)	101.	(b)	102.	(c)	103.	(d)	104.	(a)
105.	(b)	106.	(d)	107.	(c)	108.	(b)	109.	(b)	110.	(b)	111.	(c)	112.	(b)
113.	(c)	114.	(a)	115.	(b)	116.	(b)	117.	(a)	118.	(b)	119.	(b)	120.	(c)
121.	(b)	122.	(b)	123.	(c)	124.	(b)	125.	(b)	126.	(b)	127.	(c)	128.	(c)
129.	(c)	130.	(b)	131.	(d)	132.	(b)	133.	(b)	134.	(a)	135.	(b)	136.	(a)
137.	(b)	138.	(c)	139.	(d)	140.	(b)	141.	(b)	142.	(c)	143.	(a)	144.	(b)
145.	(b)	146.	(c)	147.	(a)	148.	(c)	149.	(c)	150.	(b)	151.	(d)	152.	(c)
153.	(c)	154.	(b)	155.	(c)	156.	(c)	157.	(c)	158.	(b)	159.	(c)	160.	(c)
161.	(b)	162.	(c)	163.	(d)	164.	(d)	165.	(c)	166.	(c)	167.	(b)	168.	(d)
169.	(d)	170.	(b)	171.	(b)	172.	(a)	173.	(a)	174.	(b)	175.	(b)	176.	(d)
177.	(b)	178.	(b)	179.	(c)	180.	(a)	181.	(b)	182.	(d)	183.	(a)	184.	(c)
185.	(c)	186.	(b)	187.	(b)	188.	(b)	189.	(a)	190.	(b)	191.	(d)	192.	(b)
193.	(c)	194.	(a)	195.	(c)	196.	(b)	197.	(b)	198	(b)	199	(d)	200	(e)

LEVEL-2

1. Each of the six compounds shown at the bottom of the page has two aromatic (benzene) rings. In each case the two rings are different and are labeled A & B. **If an electrophilic substitution, such as nitration or bromination**, is carried out on each compound, then identify which ring (A or B) will be preferentially attacked, and indicate the orientation of the substitution (ortho/para, meta or all sites).

Compound	Reactivity		Substitution		Compound	Reactivity		Substitution	
1.	A		ortho/para		2.	A		ortho/para	
	B		meta			B		meta	
			all sites					all sites	
3.	A		ortho/para		4.	A		ortho/para	
	B		meta			B		meta	
			all sites					all sites	
5.	A		ortho/para		6.	A		ortho/para	
	B		meta			B		meta	
			all sites					all sites	

	Compound		Compound
1.		2.	
3.		4.	
5.		6.	

2. When given substituents on a benzene ring, as activating or de-activating and as ortho-para or meta directing for elctrophilic aromatic substitution fill the following by appropriate (✓) right or (✗) wrong.

	Substituent	Activating	De-activating	Ortho/para	Meta
1.	$-OCH_3$				
2.	$-\overset{\overset{\large O}{\Vert}}{C}-O-CH_3$				
3.	$-O-\underset{\underset{\large O}{\Vert}}{C}-CH_3$				
4.	$-CH_3$				
5.	$-F$				
6.	$-Ph$				
7.	$-NH-\overset{\overset{\large O}{\Vert}}{C}-CH_3$				
8.	$-\overset{\overset{\large O}{\Vert}}{C}-NH-CH_3$				
9.	$-Br$				
10.	$-CN$				
11.	$-CF_3$				
12.	$-\overset{\overset{\large O}{\Vert}}{C}-NH_2$				
13.	$-\overset{\overset{\large O}{\Vert}}{C}-OH$				
14.	$-CH=CH_2$				

15.	$-CH=CH-\overset{\overset{O}{\Vert}}{C}-OH$				
16.	$-CH=CH-\overset{\overset{O}{\Vert}}{C}-H$				
17.	$-S-Et$				
18.	$-\underset{\underset{O}{\Vert}}{S}-Et$				
19.	$-\overset{\overset{O}{\Vert}}{\underset{\underset{O}{\Vert}}{S}}-Et$				
20.	$-N=O$				
21.	$-CH_2X$				
22.	$-CHX_2$				

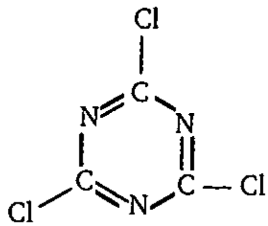
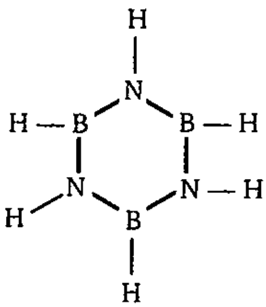
3. Devise a series of reactions to convert benzene into *meta*-chlorobromobenzene.

Select reagents and conditions from the following table, listing them in the order of use.

	Compound		Compound		Compound
1.	sulphuric acid (conc.) heat	**5.**	Mg in ether	**9.**	$Cu_2Br_2 + HBr$
2.	$Cl_2 + FeCl_3$ and heat	**6.**	PBr_3	**10.**	$(CH_3CO)_2O$ + Pyridine
3.	$NaNO_2 + H_3O^{(+)}$ 0°C	**7.**	H_3PO_2		
4.	H_2 Pt catalyst	**8.**	HNO_3(conc.)+ H_2SO_4(conc.) and heat		

(a) 1 then 2 then 6
(b) 2 then 8 then 4 then 3 then 9
(c) 8 then 4 then 10 then 2 then 3 then 9
(d) 8 then 2 then 4 then 3 then 9

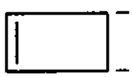
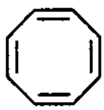
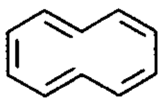
4. Match the Column (I) and Column (II). (Matrix)

	Column (I)		Column (II)
(a)		(p)	Aromatic
(b)		(q)	$(4n + 2)\pi$ electron in a single ring
(c)	$Fe(C_5H_5)_2$	(r)	$4n\pi$ electron in a single ring
(d)	$Cr(C_6H_6)_2$	(s)	Effective atomic number of metal = 36

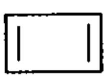
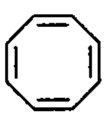
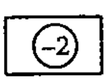
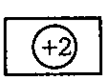
5. Match the Column (I) and Column (II).

	Column (I)		Column (II)
	Compound (Monocyclic)		**Number of π - electron**
(a)	$C_4H_4^{-2}$	(p)	$2\pi e$
(b)	$C_4H_4^{+2}$	(q)	$6\pi e$
(c)	$C_9H_9^{+1}$	(r)	$8\pi e$
(d)	$C_9H_9^{-1}$	(s)	$10\pi e$

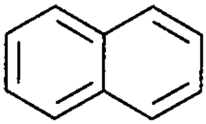
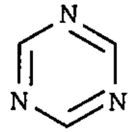
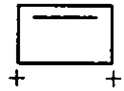
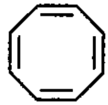
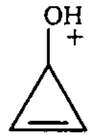
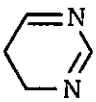
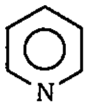
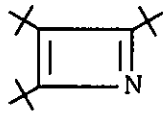
6. Match the Column (I), Column (II) and Column (III). (Matrix)

	Column I		Column II		Column III
(a)		**(p)**	Aromatic	**(w)**	$(4n+2)\pi$ electron. $n = 0, 1, 2, 3$
(b)		**(q)**	Non-aromatic	**(x)**	$4n\pi$ electron $n = 1, 2, 3$
(c)		**(r)**	Anti- aromatic	**(y)**	Non-planar compound
(d)		**(s)**	Planar compound	**(z)**	Readily reacts with active metal

7. Match the Column (I), Column (II) and Column (III). (Matrix)

	Column I		Column II		Column III
(a)		**(p)**	Readily react with active metal	**(w)**	Aromatic
(b)		**(q)**	Readily undergo Dimerization at room temperature	**(x)**	Anti-aromatic
(c)		**(r)**	$(4n+2)\pi$ electron $n = 0, 1, 2, 3$	**(y)**	Non-aromatic
(d)		**(s)**	$4n\pi$ electron	**(z)**	High dipole

8. Among the following compound.

	Compound		Compound		Compound
(a)		(b)		(c)	
(d)		(e)		(f)	
(g)	$C_8H_8^{-2}$	(h)	$C_3H_3^+$	(i)	
(j)		(k)		(l)	

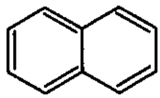
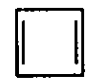
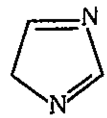
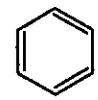
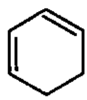
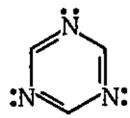
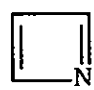
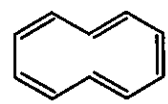
(a) Number of compounds which are aromatic = P
(b) Number of compounds which are anti-aromatic = Q
(c) Number of compounds which are non-aromatic = R
(d) Number of compounds which readily = S
Undergo dimerization at room temperature
(e) Number of compound which reacts with active metal = T

Sum of $P + Q + R + S + T =$

9. Of the following compounds which will react with Br_2 at room temperature in dark.

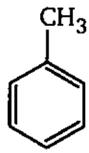
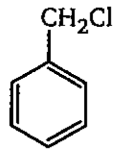
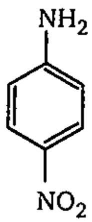
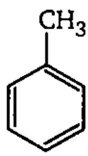
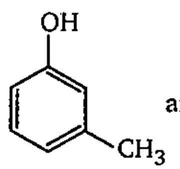
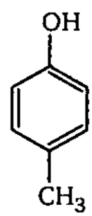
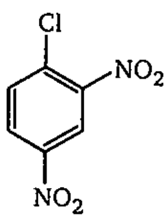
(a)	Benzene (C_6H_6)	
(b)	Cyclohexene (C_6H_{10})	
(c)	Cyclohexane (C_6H_{12})	
(d)	Propanoic Acid ($C_2H_5CO_2H$)	
(e)	Phenol (C_6H_5OH)	
(f)	Nitrobenzene ($C_6H_5NO_2$)	
(g)	Hexyne (C_6H_{10})	
(h)	2,2-dichloropropane ($C_3H_6Cl_2$)	

10. Among the following compound.

	Compound		Compound		Compound
(a)		(b)	$C_8H_8^{-2}$	(c)	
(d)		(e)		(f)	
(g)		(h)		(i)	$C_3H_3^{+1}$
(j)		(k)		(l)	

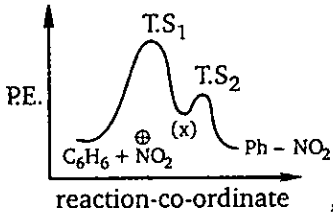
(a) Number of compounds which are aromatic = w
(b) Number of compounds which are non-aromatic = x
(c) Number of compounds which are anti-aromatic = y
(d) Number of compounds which readily undergo Dimerization at room temperature = z
Sum of $w + x + y + z = \dots$

11. Complete the following table.

	Reactant	Reagents(s)/Conditions	Major Organic Products
(a)		(A)	
(b)		1. $NaNO_2$ in dilute H_2SO_4/0 – 5°C 2. heat or boiling	(B)
(c)		SO_3/conc. H_2SO_4	(C)
(d)	(D)	1. NaOH heated at 330°C 2. dilute H_3O^+	 and 
(e)		1. aqueous NaOH heated at 60°C 2. dilute H_3O^+	(E)

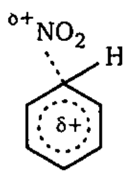
12. Comprehension

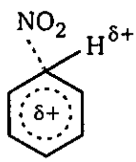
Given is the energy profile diagram of nitration of benzene using mixed acid. ($HNO_3 + H_2SO_4$).



A. Identify (x) in above reaction :

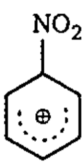
(a) 

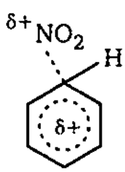
(b) 

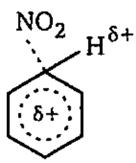
(c) 

(d) None

B. Identify $T.S_1$ in the above reaction.

(a) 

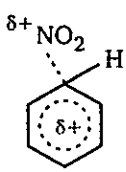
(b) 

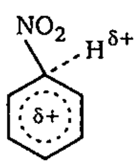
(c) 

(d) None

C. Identify $T.S_2$ in the above reaction :

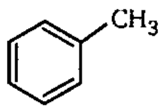
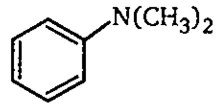
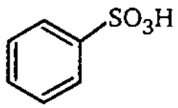
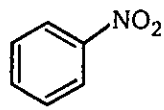
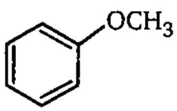
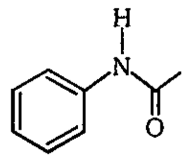
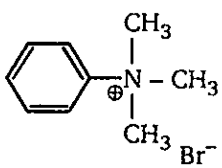
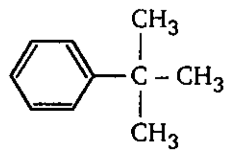
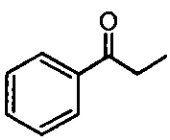
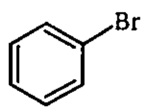
(a) 

(b) 

(c) 

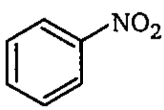
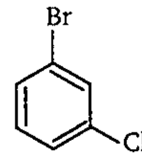
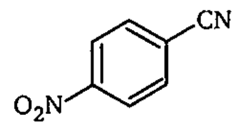
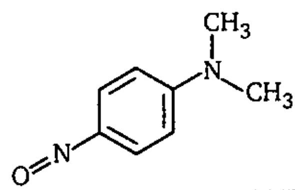
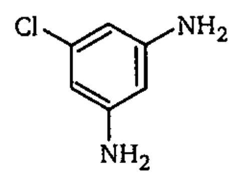
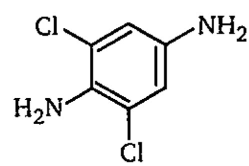
(d) None

13. Examine the ten structural formulas shown below and select those that satisfy each of the following conditions. Enter one or more letters (a through j) in each answer box, reflecting your choice for each.

	Compound		Compound
a.		b.	
c.		d.	
e.		f.	
g.		h.	
i.		j.	

A.	Which compounds undergo electrophilic nitration more rapidly than benzene ?	
B.	Which compounds give meta substitution under electrophilic bromination conditions ?	

14. Nitrobenzene is a versatile compound that may be converted into a wide variety of substituted benzenes. Five such synthesis are shown below. In each reaction box above an arrow write letters designating the reagents and conditions, selected from the list at the bottom of the page, that would effect the transformation. The reagents must be written in the answer box in the correct order of their use. You may assume appropriate heating or cooling takes place, and more than one equivalent of the reagent may be used if needed.

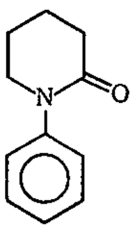
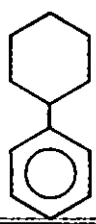
Reactant		Reagent		Product
 nitrobenzene	**a.**	$\longrightarrow$	**v.**	
	b.	$\longrightarrow$	**w.**	
	c.	$\longrightarrow$	**x.**	
	d.	$\longrightarrow$	**y.**	
	e.	$\longrightarrow$	**z.**	

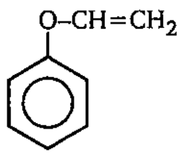
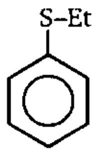
	Reagents		Reagents
A.	H_2, Ni catalyst	**F.**	Cl_2 & $FeCl_3$
B.	KBr & Cu_2Br_2	**G.**	NaOH 10% solution
C.	KCN & $Cu_2(CN)_2$	**H.**	$(CH_3CO)_2O$, pyridine
D.	HNO_2 0°C	**I.**	HNO_3/H_2SO_4
E.	CH_3I & pyridine		

15. Match the column I and II.

Column (I)		Column (II)	
Group		Effect on phenyl ring	
(a)	$-CH=CH-CO_2H$	**(p)**	*o*/*p*-directors
(b)	$-O-\overset{O}{\overset{\|}{S}}-CH_3$	**(q)**	meta-directors
(c)	$-NH-\overset{O}{\overset{\|}{C}}-CH_3$	**(r)**	Activating group
(d)	$-\underset{O}{\underset{\|}{S}}-CH_3$	**(s)**	De-activating group

16. Match the column I and II.

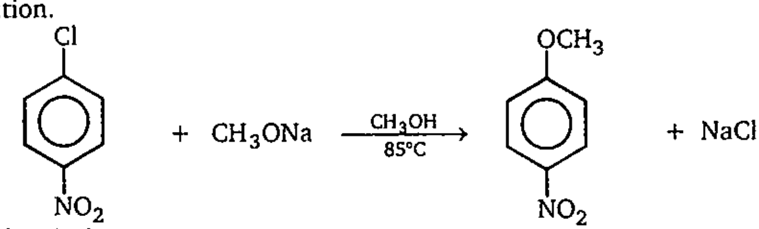
Column (I)		Column (II)	
Group		Effect on phenyl group	
(a)		**(p)**	Activating group
(b)		**(q)**	De-activating group

(c)		(r)	*o/p*-director
(d)		(s)	meta-director

17. Comprehension

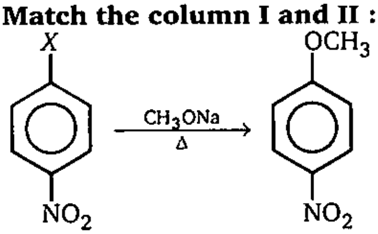
Nucleophilic Aromatic substitution (SN_{Ar}) :

A substituted benzene derivative containing- NO_2 and Cl group at *p*-position is subjected to Nu-substitution.



p-chloronitrobenzene (*p*-Nitroanisole) (92%)

A. Match the column I and II :

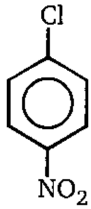


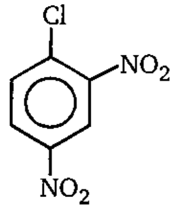
Column (I)		Column (II)	
X = halogen		relative reactivity toward (SN_{Ar}).	
(a)	– F	(p)	312
(b)	– Cl	(q)	1
(c)	– Br	(r)	0.8
(d)	– I	(s)	0.6

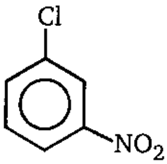
B. If step-2 were rate determining step, which halogen of aryl halide is most reactive toward SN_{Ar}.

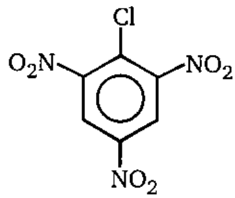
(a) Fluoride (b) Chloride (c) Bromide (D) Iodide

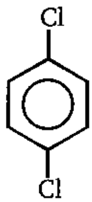
C. Which of the following is most reactive toward SN_{Ar}.

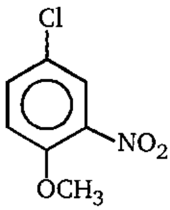
(a) 

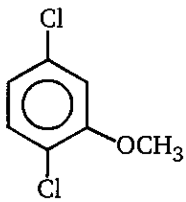
(b) 

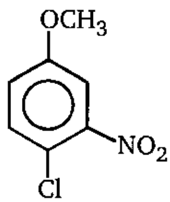
(c) 

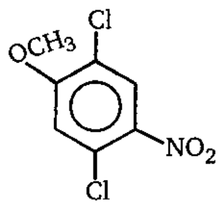
(d) 

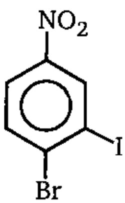
D.  $\xrightarrow{HNO_3}$ (A) $\xrightarrow{CH_3ONa}$ (B) (Major) , product (B) is :

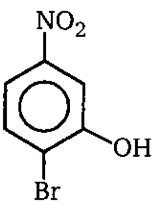
(a) 

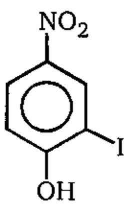
(b) 

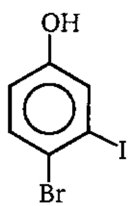
(c) 

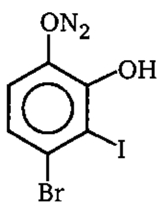
(d) 

E.  $\xrightarrow[(2)\ H_3O^{\oplus}]{(1)\ NaOH,\ \Delta}$ (A) , Product (A) is :

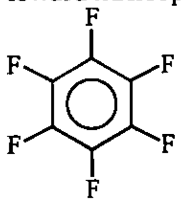
(a) 

(b) 

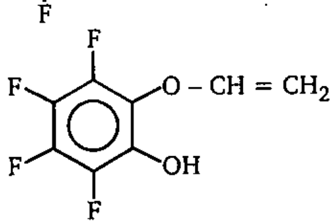
(c) 

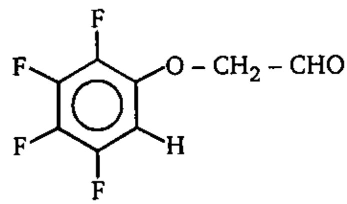
(d) 

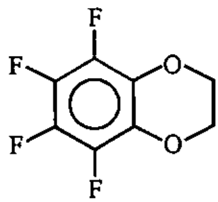
F. The cumulative effect of their fluorine activate the rings of penta and hexa fluorobenzene toward nucleophilic aromatic substitution. What is compound *X* in the following synthesis ?

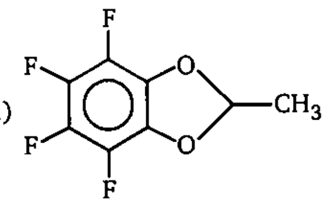


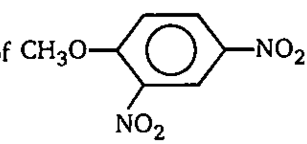
$\xrightarrow[NaOH, \Delta]{HOCH_2CH_2OH} (A) \xrightarrow[\Delta]{K_2CO_3} (X)\ (C_8H_4F_4O_2)$

(a) 

(b) 

(c) 

(d) 

G. Which is the best route for the synthesis of  Strating from benzen of ?

(a) $\xrightarrow[FeBr_3]{Br_2} \xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[CH_3OH]{NaOCH_3}$

(b) $\xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[FeBr_3]{Br_2} \xrightarrow[CH_3OH]{NaOCH_3}$

(c) $\xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[FeBr_3]{Br_2} \xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[CH_3OH]{NaOCH_3}$

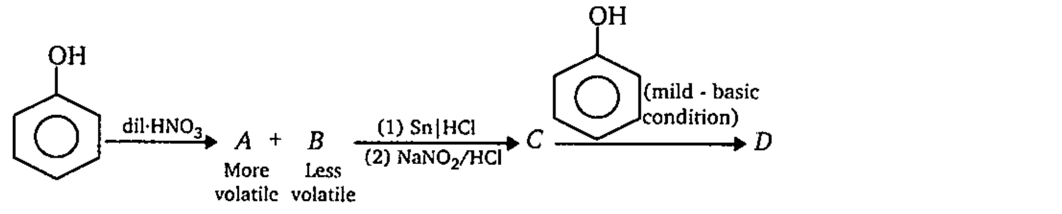
(d) $\xrightarrow[H_2SO_4]{HNO_3} \xrightarrow[FeBr_3]{Br_2} \xrightarrow[CH_3OH]{NaOCH_3} \xrightarrow[H_2SO_4]{HNO_3}$

18. Identify product (*A*) and write its structure.

$Ph_3CH \xrightarrow[AlCl_3]{H^+} (A)$

SUBJECTIVE PROBLEMS

1.



Double bond equivalent of D is :

2. How many isomers 'x' of C_8H_{10} when reacts with hot alkaline $KMnO_4$ give only aromatic dicarboxylic acid ? How many isomers 'y' of C_4H_8 when reacts with hot alkaline $KMnO_4$ give carbondioxide ?

Sum of $x+y=$?

3. How many groups are o/p director in the electrophilic aromatic substitution ?

(i) $—NH_2$	(ii) —COH	(iii) —N$=$O	(iv) —COOH
(v) —OMe	(vi) $—O—\overset{\overset{O}{\parallel}}{C}—Me$	(vii) —Et	(viii) $—\overset{\overset{O}{\parallel}}{C}—NH—Me$
(ix) $—N=NH_2$	(x) $—SO_3H$		

ANSWERS — LEVEL 2

1.

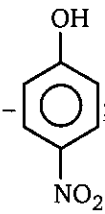
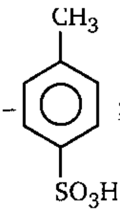
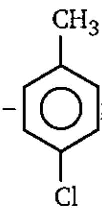
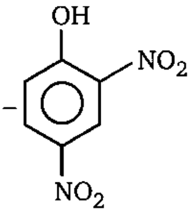
Compound	Reactivity	Substitution
1	B	ortho/para
2	A	ortho/para
3	B	ortho/para
4	A	ortho/para
5	B	meta
6	B	ortho/para

2.

	Substituent	Activating	De-activating	Ortho/para	Meta
1.	$-OCH_3$	✓	✗	✓	✗
2.	$-\overset{\overset{O}{\Vert}}{C}-O-CH_3$	✗	✓	✗	✓
3.	$-O-\overset{\overset{O}{\Vert}}{C}-CH_3$	✓	✗	✓	✗
4.	$-CH_3$	✓	✗	✓	✗
5.	$-F$	✗	✓	✓	✗
6.	$-Ph$	✓	✗	✓	✗
7.	$-NH-\overset{\overset{O}{\Vert}}{C}-CH_3$	✓	✗	✓	✗
8.	$-\overset{\overset{O}{\Vert}}{C}-NH-CH_3$	✗	✓	✗	✓
9.	$-Br$	✗	✓	✓	✗
10.	$-CN$	✗	✓	✗	✓

11.	$-CF_3$	✗	✓	✗	✓
12.	$-\overset{O}{\overset{\Vert}{C}}-NH_2$	✗	✓	✗	✓
13.	$-\overset{O}{\overset{\Vert}{C}}-OH$	✗	✓	✗	✓
14.	$-CH=CH_2$	✓	✗	✓	✗
15.	$-CH=CH-\overset{O}{\overset{\Vert}{C}}-OH$	✗	✓	✓	✗
16.	$-CH=CH-\overset{O}{\overset{\Vert}{C}}-H$	✗	✓	✓	✗
17.	$-S-Et$	✓	✗	✓	✗
18.	$-\underset{O}{\underset{\Vert}{S}}-Et$	✗	✓	✓	✗
19.	$-\overset{O}{\overset{\Vert}{\underset{O}{\underset{\Vert}{S}}}}-Et$	✗	✓	✗	✓
20.	$-N=O$	✗	✓	✓	✗
21.	$-CH_2X$	✗	✓	✗	✓
22.	$-CHX_2$	✗	✓	✗	✓

3. d
4. a – p, q; b – p, q; c – p, q,s ; d – p, q, s
5. a – q; b – p; c – r; d – s
6. a – p, s – w; b – p, s – w; c – q – x, y, z; d – q – w – y
7. a – p, q, s – x; b – p – s – y; c – r – w, z; d – r – w, z
8. $P+Q+R+S+T=19$
9. b, e, g
10. $w+x+y+z=14$

11. A – $Cl_2/h\nu$ or $SO_2Cl_2/h\nu$; B – ; C – ; D – ; E – 

12. A – a; B – b; C – c

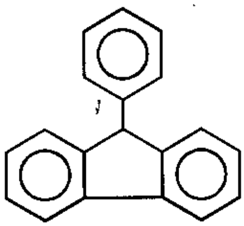
13. A – a, b, e, f, h; B – c, d, g, i (Note : yet C_6H_5Br is less reactive than C_6H_6 but o/p directing)

14. v – F, A, D, B; w – A, H, I, G, D, C; x – A, E, D; y – F, I, A or I, F, A;
z – A, H, I, F, G, A or A, H, I, F, A, G

15. a – p, s; b – p, r; c – p, r; d – p, s

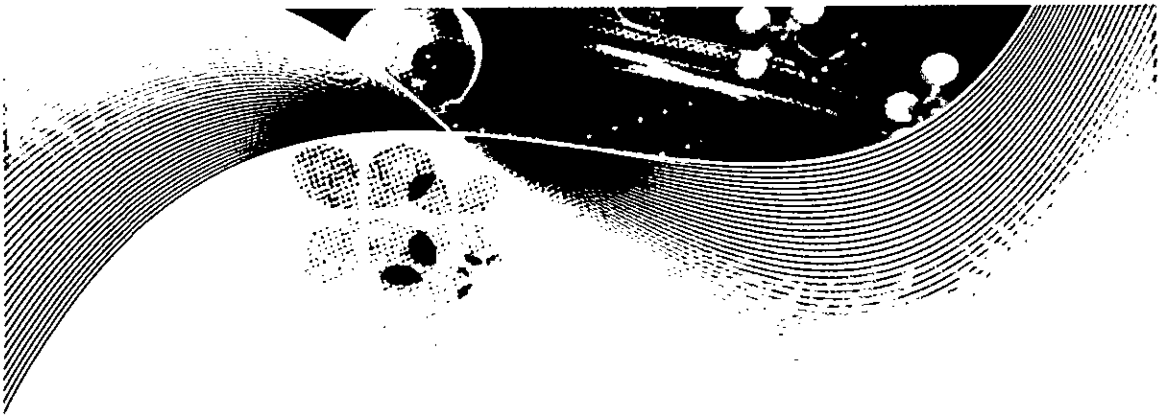
16. a – p, r; b – p, r; c – p, r; d – p, r

17. A –a – p, b – q, c – r, d – s; B – d; C – d; D – a; E – b; F – c; G – a

18. 

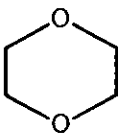
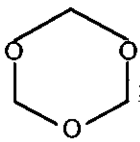
Subjective Problems

1. 9 **2.** 5 **3.** 6



13 PRACTICAL ORGANIC CHEMISTRY

LEVEL-1

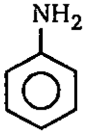
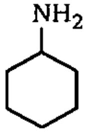
1.  and  ; Compounds (*X*) and (*Y*) can be differentiated by :

(*X*) (*Y*)

(a) $H_3O^{\oplus}$, NaOI
(b) $H_3O^{\oplus}$, then Fehling test
(c) $H_3O^{\oplus}$, then Na
(d) Both (b) and (c)

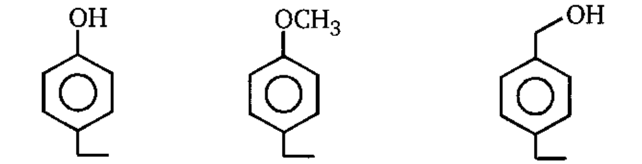
2. Compound $CH_3-CH\begin{matrix}\diagup OEt \\ \diagdown OEt\end{matrix}$ **(*P*) (Acetal)** and $\underset{(Q)}{CH_3-CH_2-O-CH_2-CH_3}$ can be differentiated by :

(a) $H_3O^{\oplus}$, Na
(b) $H_3O^{\oplus}$, Tollens' test
(c) $H_3O^{\oplus}$, Fehling test
(d) All of these

3.  and  can be differentiated by :

(aniline) (cyclohexyl amine)

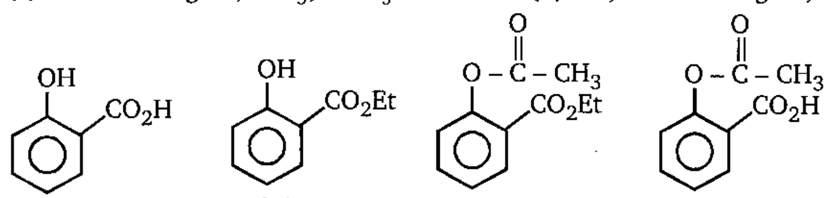
(a) Hinsberg test
(b) Iso-cyanide test
(c) $NaNO_2$, HCl, then β-Naphthol
(d) NaOH

4. 

(p-ethyl phenol) (p-methyl anisole) (p-ethyl benzyl alcohol)

Above compounds can be differentiated by using the reagent:

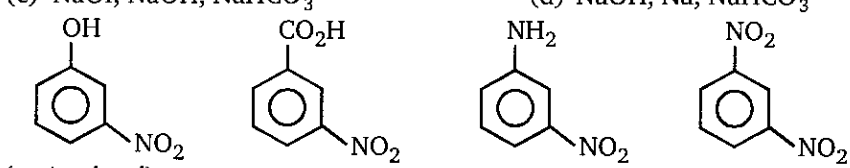
(a) NaOH, Tollen's reagent, $FeCl_3$
(b) CrO_3, Tollen's reagent, $FeCl_3$
(c) Tollen's reagent, CrO_3, $FeCl_3$
(d) Na, Tollen's reagent, $FeCl_3$

5. 

Salicyclic acid | Ethyl salicylate | Ethyl acetyl | acetyl salicyclic acid

Above compounds can be differentiated by the salicylate. Which of the following chemical test? (used in decreasing order)

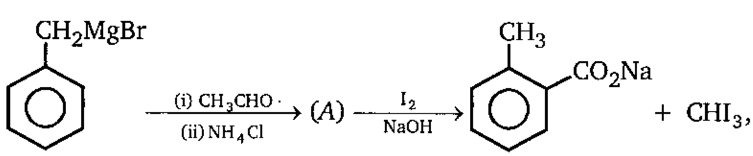
(a) NaOH, $FeCl_3$, $NaHCO_3$
(b) aq. $NaHCO_3$, $FeCl_3$, NaOH
(c) NaOI, NaOH, $NaHCO_3$
(d) NaOH, Na, $NaHCO_3$

6. 

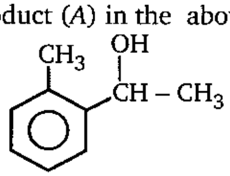
(m-nitrophenol) (m-nitro benzoic acid) (m-nitro aniline) (m-dinitro benzene)

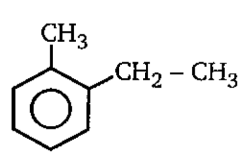
Above compounds can be differentiated by which of the following chemical test ? (used in decreasing order)

(a) NaOH, $NaHCO_3$, HCl
(b) HCl, NaOH, $NaHCO_3$
(c) $NaHCO_3$, NaOH, HCl
(d) NaOH, HCl, $NaHCO_3$

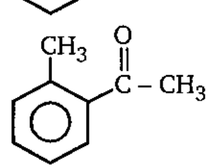
7. 

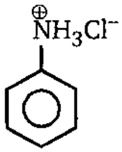
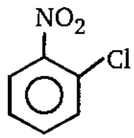
Product (A) in the above reaction is :

(a) 

(b) 

(c) $Ph-CH_2-\underset{}{\overset{OH}{\overset{|}{C}H}}-CH_3$

(d) 

8.  and 

(P) (Q)

Above compounds (P) & (Q) can be differentiated by :

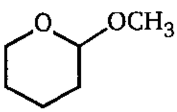
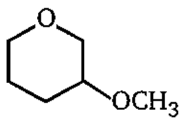
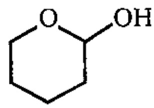
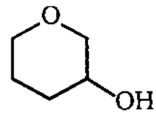
(a) amm. $AgNO_3$ (b) NaOH

(c) $FeCl_3$ (d) Both (a) & (b)

9. Which of following acid give positive Tollen's reagent test.

(a) $(CH_2)_2\begin{smallmatrix}CO_2H\\CO_2H\end{smallmatrix}$ (b) $CH_2\begin{smallmatrix}CO_2H\\CO_2H\end{smallmatrix}$ (c) $\begin{array}{c}CO_2H\\|\\CO_2H\end{array}$ (d) HCO_2H

10. Which of following compounds give positive Tollen's test?

(a)  (b)  (c)  (d) 

11. Give a simple test to differentiate cyclohexane and cyclohexene

(a) Br_2/H_2O (b) Bayer's reagent

(c) Tollen's reagent (d) Both (a) and (b)

12. Give test to differentiate (Bromobenzene) Ph – Br and benzyl bromide ($PhCH_2Br$).

(a) (i) aq. KOH (ii) Na (b) $AgNO_3$

(c) $KMnO_4$ (d) All these

13. Give test to differetiate 1,1-dichloroethane and 1, 2-dichloroethane :

(a) 2,4 -DNP then aq. KOH (b) aq. KOH then 2, 4-DNP

(c) $NaHSO_3$ (d) Lucas reagent

14. Test to differentiate between $\underset{\text{(methanol)}}{(CH_3OH)}$ and $\underset{\text{(Phenol)}}{(Ph-OH)}$ is/are :

(a) Litmus test (b) $FeCl_3$

(c) Br_2/H_2O (d) All of these

15. Acetaldehyde and benzaldehyde can be differentiated by :

(a) Fehling test (b) Iodoform test

(c) Tollen's reagent (d) both (a) and (b)

16. Ethylamine and diethylamine cannot be differentiated by :

(a) Hinsberg test (b) carbylamine test

(c) Iodoform test (d) both (a) and (b)

17. Lassaigne's test for the detection of nitrogen will fail in the case of :

(a) NH_2CONH_2 (b) $NH_2CONHNH_2 . HCl$

(c) $NH_2NH_2 . HCl$ (d) $C_6H_5NHNH_2 . 2HCl$

18. Sodium nitroprusside when added to an alkaline solution of sulphide ions produces a colouration which is :

(a) red (b) blue
(c) brown (d) purple

19. In Kjeldahl's method, nitrogen present is estimated as :

(a) N_2 (b) NH_3
(c) NO_2 (d) none of these

20. In Kjeldahl's method of estimation of nitrogen, K_2SO_4 acts as :

(a) an oxidising agent (b) catalytic agent
(c) hydrolysing agent (d) boiling point elevator

21. The prussian blue colour obtained during the test of nitrogen by Lassaigne's test is due to the formation of :

(a) $Fe[Fe(CN)_6]_3$ (b) $Na_3[Fe(CN)_6]$
(c) $Fe(CN)_3$ (d) $Na_4[Fe(CN)_5NOS]$

22. A compound which does not give a positive test in Lassaigne's test for nitrogen is:

(a) urea (b) hydrazine (c) azobenzene (d) phenyl hydrazine

23. *p*-nitrophenol and *o*-nitrophenol are separated by :

(a) distillation (b) steam distillation
(c) crystallization (d) fractional crystallization

24. Which of the following reagent is used for the separation of acetaldehyde from acetophenone ?

(a) NH_2OH (b) NaOI
(c) Tollen's reagent (d) $C_6H_5NHNH_2$

25. The formula of gas is $[CO]_x$. If its vapour density is 70, the value of x will be :

(a) 2.5 (b) 3.0
(c) 5.0 (d) 6.0

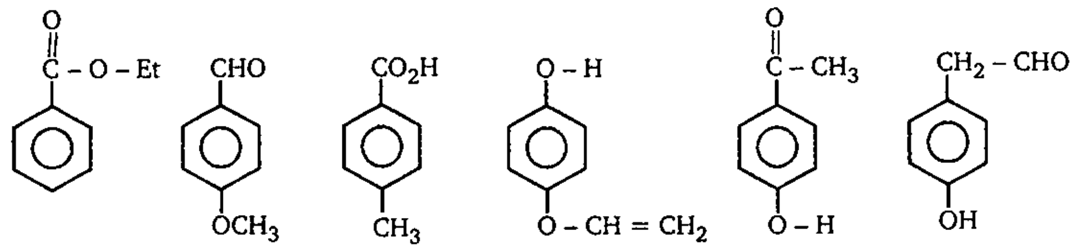
ANSWERS — LEVEL 1

1.	(d)	**2.**	(d)	**3.**	(c)	**4.**	(b)	**5.**	(b)	**6.**	(c)	**7.**	(a)	**8.**	(d)
9.	(d)	**10.**	(c)	**11.**	(d)	**12.**	(d)	**13.**	(b)	**14.**	(d)	**15.**	(d)	**16.**	(c)
17.	(c)	**18.**	(b)	**19.**	(b)	**20.**	(d)	**21.**	(d)	**22.**	(b)	**23.**	(a)	**24.**	(c)
25.	(c)														

LEVEL-2

1. Comprehension

Given are the isomers of $C_8H_8O_2$.



(a) (b) (c) (d) (e) (f)

A. Which isomer gives positive iodoform test ?

(a) a (b) b

(c) d (d) e

B. Which isomer gives +ive Tollen's test, also reacts with $FeCl_3$?

(a) b (b) f

(c) c (d) d

C. Which isomer reacts with $NaHCO_3$?

(a) c (b) d

(c) e (d) f

D. Which isomer on hydrolysis gives 1, 4-di hydroxybenzene ?

(a) a (b) d

(c) e (d) f

2. $Ph-\overset{\overset{\displaystyle O}{\|}}{C}-OH \xrightarrow{NaH\overset{14}{C}O_3} (A)\text{gas}$; $Ph-OH \xrightarrow{Na} (B)\text{gas}$

Sum of molecular mass of gas $(A+B=?)$

ANSWERS — LEVEL 2

1. A – d; B – b; C – a; D – b

2. 48

14 BIOMOLECULES

LEVEL-1

1. Which statement correctly completes the statement ?

Except for glycine, which is achiral, all the amino acids present in proteins ......

(a) are chiral, but racemic
(b) have the L configuration at their α carbon
(c) have the R configuration at their α carbon
(d) have the S configuration at their α carbon

2. Assume that a particular amino acid has an isoelectric point of 6.0. In a solution at pH 1.0, which of the following species will predominate ?

(a) $H_3\overset{+}{N}\underset{}{\overset{R}{\overset{|}{C}}}HCO_2H$ (b) $H_2N\overset{R}{\overset{|}{C}}HCO_2H$

(c) $H_3\overset{+}{N}\overset{R}{\overset{|}{C}}HCO_2^-$ (d) $H_2N\overset{R}{\overset{|}{C}}HCO_2^-$

3. The pK_a values for the three ionizable groups X, Y and Z of glutamic acid are 4.3, 9.7 and 2.2 respectively

$$\underset{X}{HO_2C}-CH_2-\underset{\overset{|}{+NH_3}}{CH}-\underset{Z}{CO_2H}$$

The isoelectric point for the amino acid is :

(a) 7.00 (b) 3.25 (c) 4.95 (d) 5.95

4. An amino acid may be represented by general formula $H_2N-\underset{}{\overset{\displaystyle R}{\overset{|}{C}}}H-COOH$. If $R = -CH_2C_6H_5$ then it is phenylalanine (Phe) and if $R = CH_3$ then it is alanine (Ala). Find the sequence of reagents from those given below to synthesize Phe - Ala.

(1) $ZNH\overset{\displaystyle CH_3}{\overset{|}{C}}HCO_2H$ (2) $H_2N\overset{\displaystyle CH_3}{\overset{|}{C}}HCO_2CH_2C_6H_5$

(3) $ZNH\overset{\displaystyle CH_2C_6H_5}{\overset{|}{C}}HCO_2H$ (4) $H_2N\overset{\displaystyle CH_2C_6H_5}{\overset{|}{C}}HCO_2CH_2C_6H_5$

(a) 1 and 2 (b) 1 and 4 (c) 2 and 3 (d) 3 and 4

5. Iso-electric point of alanine is (pH = 6). At which pH, maximum concentration of zwitter ion of alanine will be present ?

(a) pH > 6 (b) pH < 6 (c) pH = 6 (d) pH = 7

6. $$NH_2-\underset{\displaystyle CH_3}{\underset{|}{C}}H-\overset{\displaystyle O}{\overset{||}{C}}-NH-CH_2-CO_2H$$

Identify the amino acid obtained by hydrolysis of the above compound:

(a) Glycine (b) Alanine (c) Both (a) and (b) (d) None of these

7. At iso-electric point :

(a) conc. of cation is equal to conc of anion
(b) Net charge is zero.
(c) Maximum conc. of di-polar ion (Zwitter ion) will be present
(d) All of the above

8. Which of following amino acid has lowest iso-electric point ?

(a) Glycine (b) Alanine (c) Aspartic acid (d) Lysine

9. Find iso-electric point of given amino acid

$$CH_3-\underset{\displaystyle \overset{\oplus}{N}H_3}{\underset{|}{C}}H-CO_2H \quad pK_a = 2.2$$

$$pK_b = 4.4$$

(a) 3.3 (b) 5.9 (c) 9.6 (d) 11.8

10. Find iso-electric point of the given amino acid

$$H-O-\overset{\displaystyle O}{\overset{||}{C}}-CH_2-CH_2-\underset{\displaystyle \overset{\oplus}{N}H_3}{\underset{|}{C}}H-CO_2H \ (pK_a = 2)$$

$$(pK_a=4) \qquad\qquad (pK_a=9)$$

(a) 5.5 (b) 6.5 (c) 3 (d) 5

11. $H-C\equiv C-H \xrightarrow[H_2SO_4]{HgSO_4} (A) \xrightarrow[(2)\ H_3O^{\oplus}]{(1)\ NH_3+HCN} (B)$; Product (B) of given reaction is :

(a) Glycine (b) Alanine
(c) valine (d) Leucine

12. Which amino acid does not contain chiral centre ?

(a) Valine (b) Leucine (c) Glycine (d) Iso-leucine

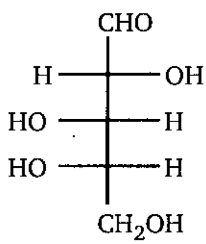
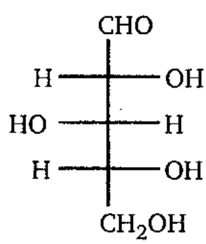
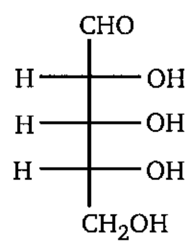
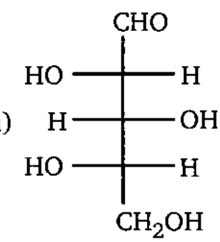
13. Which of the following is Sanger reagent ?

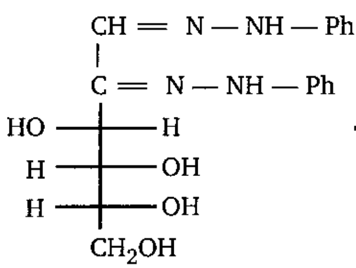
(a) 2,4-Di-nitro flurobenzene (b) Phenyl isocyanate
(c) 2, 4-Di-nitro chlorobenzene (d) 2, 4-Di-nitro iodobenzene

14. A D-carbohydrate is :

(a) Always dextrorotatory
(b) Always laevorotatory
(c) Always the mirror of the corresponding L-carbohydrate
(d) None of these

15. Which L-sugar on oxidation gives an optically active dibasic acid (2 COOH groups) ?

(a)  (b)  (c)  (d) 

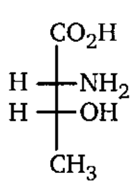
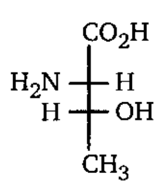
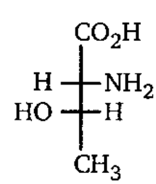
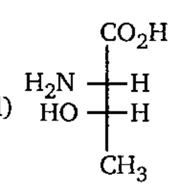
16.  The given osazone can be obtained by :

(a) D-glucose (b) D-mannose (c) D-Idose (d) Both (a) & (b)

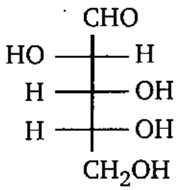
17. Which of the following pair gives same phenyl osazone ?

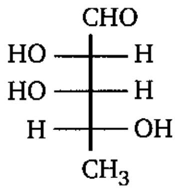
(a) D-Glucose and D-Allose (b) D-Glucose and D-Alfrose
(c) D-Glucose and D-Mannose (d) D-Glucose and D-Talose

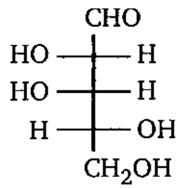
18. Which of the following is the Fischer projection of L-threonine (also known as (2S, 3R)-2-amino-3-hydroxybutanoic acid) ?

(a)  (b)  (c)  (d) 

19. Among the three compounds shown below, two yield the same product on reaction with warm HNO_3. The exception is :

(a) 

(b) 

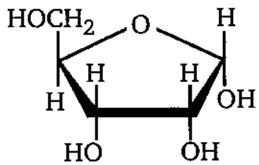
(c) 

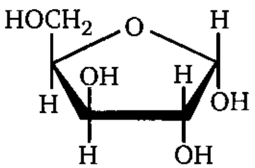
(d) None of these

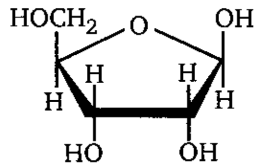
20. The optical rotation of the α- form of a pyranose is + 150.7°, that of the β- form is + 52.8°. In solution an equilibrium mixture of these anomers has an optical rotation of + 80.2°. The percentage of the α-form in equilibrium mixture is :

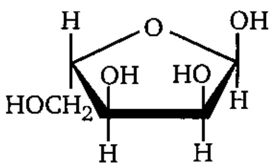
(a) 28% (b) 32 % (c) 68% (d) 72%

21. Which of the following represents the anomer of the compound shown ?



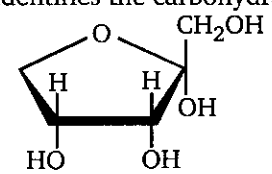
(a) 

(b) 

(c) 

(d) None of these

22. Which set of terms correctly identifies the carbohydrate shown ?



(1) Pentose (2) Pentulose (3) Hexulose (4) Hexose
(5) Aldose (6) Ketose (7) Pyranose (8) Furanose

(a) 2, 6, 8 (b) 2, 6, 7
(c) 1, 5, 8 (d) A set of terms other than these

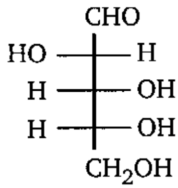
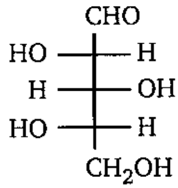
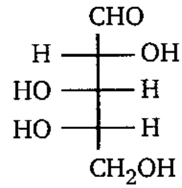
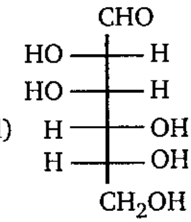
23. For the complex conversion of D-glucose into the corresponding osazone, the minimum number of equivalents of phenyl hydrazine required is :

(a) two (b) three (c) four (d) five

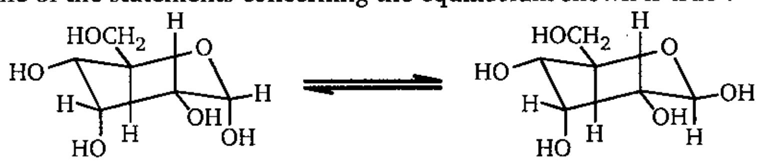
24. Which one of the following compounds will form an osazone derivative ?

(a) $CH_3CH_2COCH_2OH$ (b) $CH_3COCH_2CH_2OH$
(c) $CH_3CH_2CHOHCH_2OH$ (d) $CH_3CH_2COCH_2OCH_3$

25. Which of the following structure is L-arabinose?

(a)  (b)  (c)  (d) 

26. Which one of the statements concerning the equilibrium shown is true ?



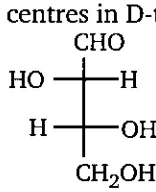
(a) The two structures are enantiomers of each other. They have equal but opposite optical rotations and recemize slowly at room temperature

(b) The two structures are enantiomers of each other. They racemize too rapidly at room temperature for their optical rotations to be measured

(c) The two structures are diastereomers of each other. Their interconversion is called mutarotation

(d) The two structures are diastereomers of each other. Their interconversion does not require breaking and making bonds, only a change in conformation

27. The configurations of the chirality centres in D-threose (shown) are :



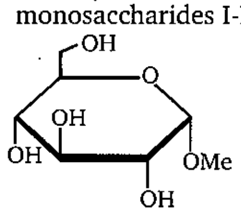
(a) 2R, 3R (b) 2R, 3S (c) 2S, 3R (d) 2S, 3S

28. Rapid interconversion of α-D-glucose and β-D-glucose in solution is known as :

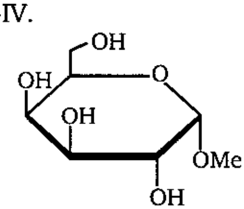
(a) racemization (b) asymmetric induction

(c) fluxional isomerization (d) mutarotation

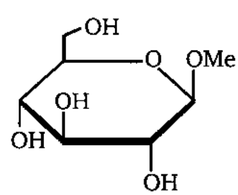
29. Identify the correct set of stereochemical relationships amongst the following monosaccharides I-IV.



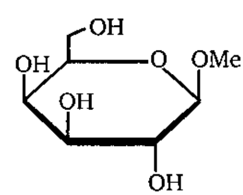
(I)



(II)



(III)



(IV)

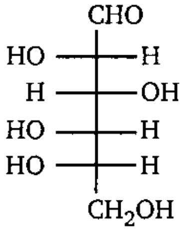
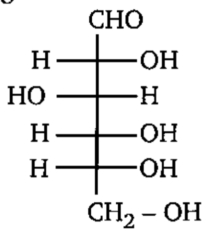
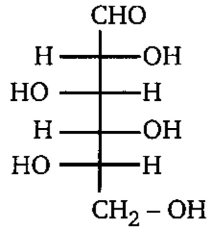
(a) I and II are anomers ; III and IV are epimers

(b) I and III are epimers ; II and IV are anomers

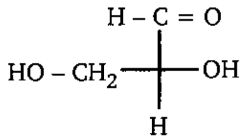
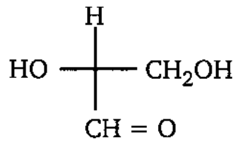
(c) I and II are epimers ; III and IV are anomers

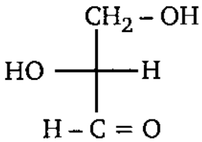
(d) I and III are anomers ; I and II are epimers

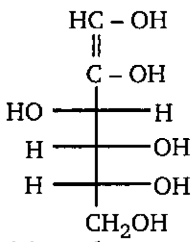
30. What is the structure of L-glucose ?

(a)  (b)  (c)  (d) None of these

31. What is the structure of L-glyceraldehyde?

(a)  (b) 

(c)  (d) Both (a) and (b)

32.  , the given is enol form of :

(a) D-glucose (b) D-mannose (c) D-fructose (d) All of these

33. D-glucose $\overset{HO^-}{\rightleftharpoons}$ A + B; A and B are :

(a) D-mannose & D-mannitol (b) D-mannose & D-Fructose

(c) D-Allose & D-Altrose (d) D-Glucose & D-Idose

34. Stereoisomers of aldoheptose is (a) and stereoisomers of ketoheptose is (b).
Ratio of a/b is :

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$ (c) $\frac{4}{1}$ (d) $\frac{1}{4}$

35. D-Glucose $\xrightarrow[\Delta]{HNO_3}$ (A); Product (A) is :

(a) D-Gluconic acid (b) D-Glucitol (c) D-Fructose (d) D-Glucaric acid

36. D-glucose & D-fructose can be differentiated by :

(a) Fehling solution (b) Tollens reagent

(c) Benedict test (d) Br_2/H_2O

37. D-Glucose exist in x different forms. The value of x (stereoisomer) is :

(a) 2 (b) 3

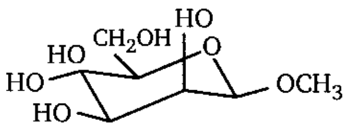
(c) 4 (d) 5

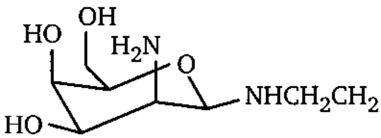
38. D-Mannose $\xrightleftharpoons{HO^-}$ D-Glucose $\xrightleftharpoons{HO^-}$ (A) ;

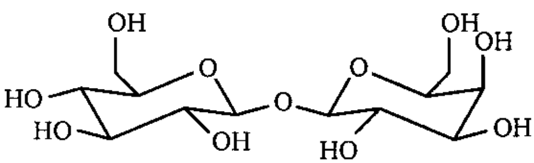
Product (A) of above reaction is :

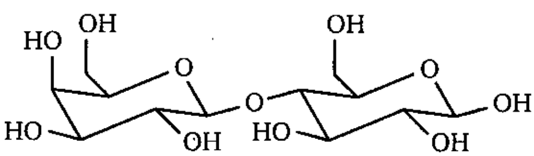
(a) D-glucose (b) D-fructose
(c) D-talose (d) D-idose

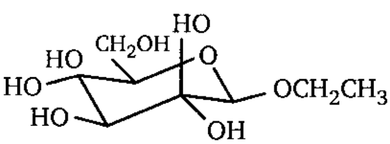
39. Which of the molecules below will react with Ag^+ ?

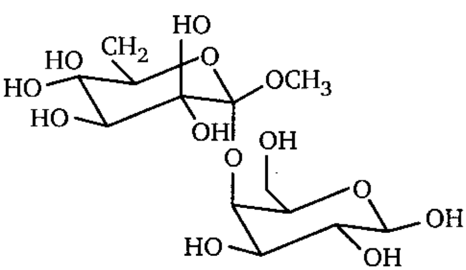
(i) 

(ii) 

(iii) 

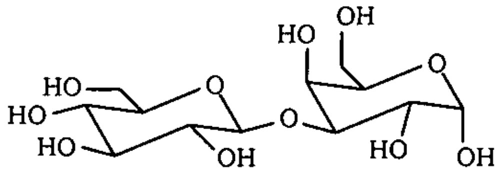
(iv) 

(v) 

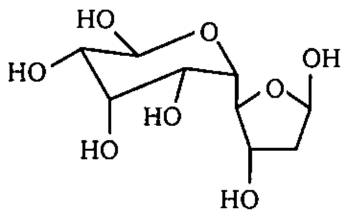
(vi) 

(a) (i), (iii) and (v) (b) (ii) and (iv)
(c) (iv) and (vi) (d) (i), (ii), (iii) and (vi)

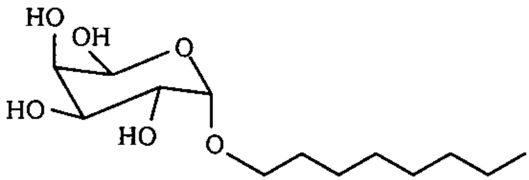
40. **A.**



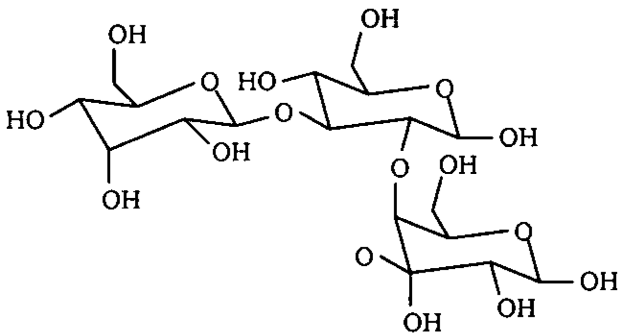
B.



C.



D.



Which of the compounds (A-D) depicted above is NOT a hemiacetal linkage ?

(a) Compound A (b) Compound B

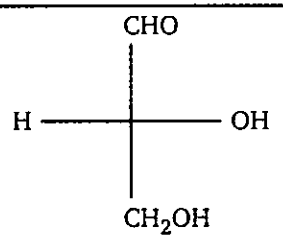
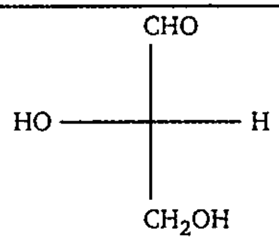
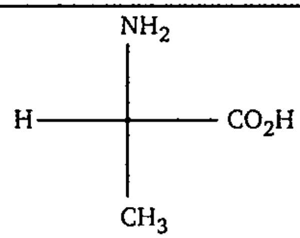
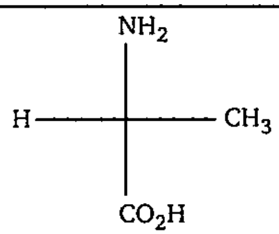
(c) Compound C (d) Compound D

(e) None of the above (they are all hemiacetals)

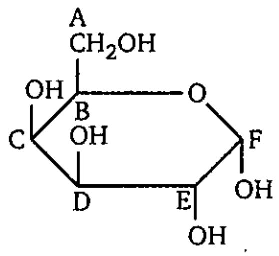
ANSWERS — LEVEL 1															
1.	(b)	**2.**	(a)	**3.**	(b)	**4.**	(c)	**5.**	(c)	**6.**	(c)	**7.**	(d)	**8.**	(c)
9.	(b)	**10.**	(c)	**11.**	(b)	**12.**	(c)	**13.**	(a)	**14.**	(d)	**15.**	(a)	**16.**	(d)
17.	(c)	**18.**	(b)	**19.**	(b)	**20.**	(a)	**21.**	(b)	**22.**	(a)	**23.**	(b)	**24.**	(a)
25.	(c)	**26.**	(c)	**27.**	(c)	**28.**	(d)	**29.**	(d)	**30.**	(a)	**31.**	(d)	**32.**	(d)
33.	(b)	**34.**	(a)	**35.**	(d)	**36.**	(d)	**37.**	(b)	**38.**	(b)	**39.**	(c)	**40.**	(e)

LEVEL-2

1. **Match the Column (I) and Column (II). (Matrix)**

Column (I)		Column (II)	
	Molecule		**Configuration**
(a)		**(p)**	R- (Rectus)
(b)		**(q)**	S- (Sinister)
(c)		**(r)**	D
(d)		**(s)**	L

2. Comprehension



One cyclic acetal form of D-galactose is shown above.

A. Which atom is the anomeric carbon ?

(a) Atom A (b) Atom B (c) Atom C (d) Atom D

(e) Atom E (f) Atom F

B. Which name most completely describes this cyclic acetal form ?

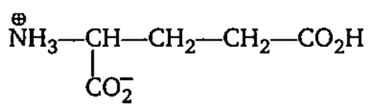
(a) α-D-Galactofuranose (b) β-P- Galactofuranose

(c) α-D- Galactopyranose (d) β-D- Galactopyranose

3. How many compound which is given below is isomer of *D*-Glucose ?

D-Mannose, *D*-Fructose, *D*-Gulose, *D*-Idose, *D*-Galactose, *D*-Arabinose, *D*-Ribose.

4. How many acidic group is present in given amino acid ?



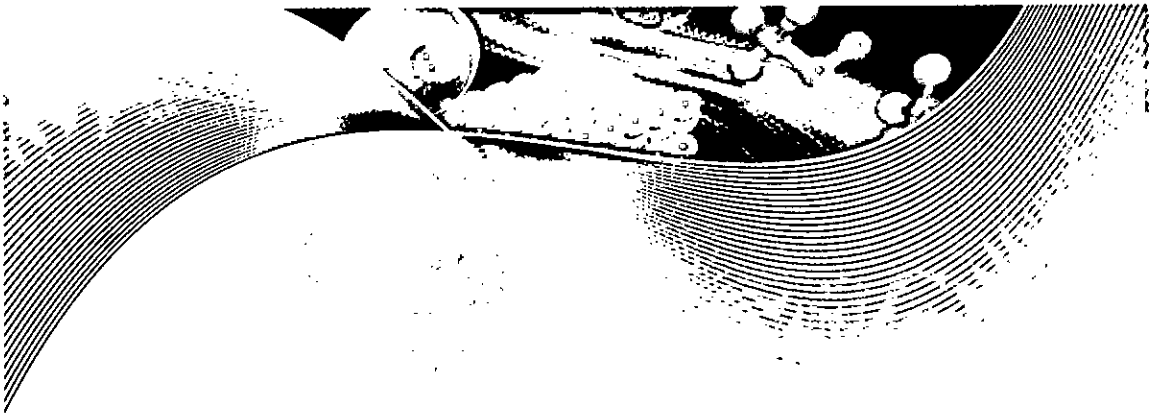
ANSWERS — LEVEL 2

1. a – p, r; b – q, s; c – q, s; d – p, r

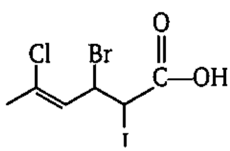
2. A – f; B – c

3. 5

4. 2

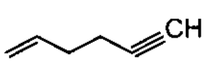


15 IUPAC NAME

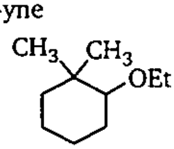
1. 

Total number of substituent present in the above compound :

(a) 1
(b) 2
(c) 3
(d) 4

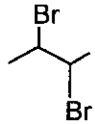
2.  IUPAC name will be :

(a) Hex-5-en-1-yne
(b) Hex-1-en-5-yne
(c) Hex-6-en-1-yne
(d) Hex-1-en-6-yne

3. IUPAC name of  is

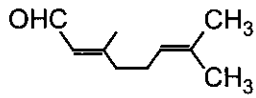
(a) 1-Ethoxy-2, 2-dimethylcyclohexane
(b) 2-ethoxy-1, 1-dimethyl cyclohexane
(c) 1, 1-Dimethyl-2-ethoxycyclohexane
(d) 2-methyl-1, 1-ethoxy cyclohexane

4. How many secondary carbon and hydrogen atoms are present in the molecule given below respectively ?



(a) 2, 3 (b) 2, 2 (c) 3, 3 (d) 2, 0

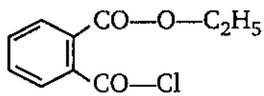
5. Which IUPAC name is correct for the given compound ?



(a) 3, 7-dimethylocta-2, 6-dienal (b) 2, 6-dimethyloct-2, 6-dienal-8

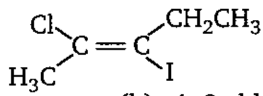
(c) 7-formyl-2, 6-dimethylhept-2, 6-diene (d) 7-aldo-2,6-dimethylhept-2, 6-diene

6. Write the IUPAC name of the following compound :



(a) ethyl-2-(chlorocarbonyl) benzoate (b) ethyl-2-(chlorocarbonyl) hexanoate

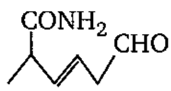
(c) 2-(thoxycarbonyl) benzoyl chloride (d) None of these

7. The IUPAC name of the compound  is :

(a) *trans*-2-chloro-3-iodo-2-pentene (b) *cis*-2-chloro-3-iodo-2-pentene

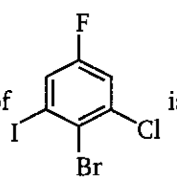
(c) *trans*-3-iodo-4-chloro-3-pentene (d) *cis*-3-iodo-4-chloro-3-pentene

8. The IUPAC name of the compound is :



(a) 2-methyl-6-oxohex-3-enamide (b) 6-keto-2-methyl hexanamide

(c) 2-carbamoylhexanal (d) 2-carbamoylhex-3-enal

9. The IUPAC name of  is:

(a) 1-Bromo-2-chloro-3-fluoro-6-iodo benzene

(b) 2-Bromo-1-chloro-5-fluoro-3-iodo benzene

(c) 4-Bromo-2-chloro-5-iodo-1-fluoro benzene

(d) 2-Bromo-3-chloro-1-iodo-5-fluoro benzene

10. The IUPAC name of $CH_3—CH_2—\underset{\displaystyle C_2H_5}{\underset{|}{CH}}—\overset{\displaystyle O}{\overset{||}{C}}—OCH_3$ is:

(a) Methyl 2-ethylbutanoate (b) 1-methoxy-2-ethylbutanone

(c) 3-Methoxycarbonylpentane (d) 1-methoxy-2-ethylbutanal

11. The IUPAC name of $CH_3—CH=CH—\overset{\displaystyle O}{\overset{||}{C}}—OH$ is:

(a) But-1-en-4-oic acid (b) 1-hydroxybut-2-en-1-one

(c) But-2-en-1-oic acid (d) But-2-en-4-oic acid

12. The IUPAC name of $CH_3—CH=\overset{\displaystyle OCH_3}{\overset{|}{C}}—CH_3$ is:

(a) 1-Methoxy-1-methylpropene (b) 2-Methoxybut-2-ene

(c) dimethylpropeneether (d) none of these

13. The IUPAC name of $CH_2=\overset{\displaystyle Me}{\overset{|}{C}}—\overset{\displaystyle O}{\overset{||}{C}}—OC_2H_5$ is:

(a) Ethyl 2-methylprop-2-enoate (b) Ethyl 2-methylprop-1-enoate

(c) 1-Ethoxy-2-methylprop-2-enone (d) 1-Ethoxy-2-methylprop-2-enal

14. The IUPAC name of $CH_3—\overset{\displaystyle CH_3}{\overset{|}{CH}}—\overset{\displaystyle CH_3}{\overset{|}{CH}}—CH_2NH_2$ is:

(a) 2, 3-Dimethylbutan-4-amine (b) 2, 4-Dimethylbutan-1-amine

(c) 2,4-Dimethylbutan-4-amine (d) 2, 3-Dimethylbutan-1-amine

15. The IUPAC name of $CH_3—\overset{\displaystyle O}{\overset{||}{C}}—\underset{\displaystyle C_2H_5}{\underset{|}{CH}}—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_3$ is:

(a) 3-(Methylethyl) pentan-2-one (b) 3-(Methylethyl)pentan-4-one

(c) 3-Ethyl-4-methylpentan-2-one (d) 3-Ethyl-2-methylpentan-4-one

16. The IUPAC name of $CH_3—\underset{\displaystyle CH_3}{\underset{|}{CH}}—CH_2—\overset{\displaystyle O}{\overset{||}{C}}—Br$ is:

(a) 2-Methylbutanoyl bromide (b) 2-Methylbutan-4-oyl bromide

(c) 1-Bromo-3-Methylbutanone (d) 3-Methylbutanoyl bromide

17. The IUPAC name of $CH_3-\underset{\underset{C_6H_5}{|}}{CH}-CH_2-OH$ is:

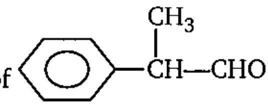
(a) 2-Phenylpropan-1-ol
(b) 2-Phenylpropan-3-ol
(c) 1-(2-Hydroxy-1-methylethyl) benzene
(d) 1-((Hydroxymethyl)ethyl) benzene

18. The IUPAC name of $CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{I}{|}}{CH}-CH_2-CH_3$ is:

(a) 3-Iodo-4,5,5-trimethylhexane
(b) 4-Iodo-1, 1, 3-trimethylhexane
(c) 4-Iodo-2, 2-dimethylheptane
(d) 4-Iodo-2, 2, 3-trimethylhexane

19. The IUPAC name of $CH_3-CH_2-\underset{\underset{Cl}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-\overset{\overset{CH_3}{|}}{\underset{\underset{OH}{|}}{C}}-CH_3$ is:

(a) 4-Chloro-2, 3-dimethylhexane-2-ol
(b) 4-Chloro-2-hydroxy-2, 3-dimethylhexane
(c) 4-Chloro-1, 1, 2-trimethylpentan-2-ol
(d) 3-Chloro-2, 3-dimethylhexane-2-ol

20. The IUPAC name of  is:

(a) 2-Phenylpropan-3-al
(b) Formylethylbenzene
(c) 2-Phenylpropanal
(d) Ethylformylbenzene

21. The IUPAC name of $CH_3-\overset{\overset{O}{\|}}{C}-CH\Big\langle^{CH_3}_{CH_3}$ is:

(a) 2-Methylbutan-3-one
(b) 3-Methylbutan-2-al
(c) 2-Methylbutan-3-al
(d) 3-Methylbutan-2-one

22. The IUPAC name of $\begin{matrix}CH_3-CO\\ CH_3-CH_2-CO\end{matrix}\!\!>O$ is:

(a) Ethanoic propanoic anhydride
(b) Propanoic ethanoic anhydride
(c) 1-Ethanoyloxypropanone
(d) 3-Ethanoyloxypropan-3-one

23. The IUPAC name of $CH_3-\underset{\underset{OH}{|}}{CH}-\underset{\underset{C_2H_5}{|}}{CH}-CH_2-OH$ is:

(a) 3-Ethylbutane-2, 4-diol
(b) 2-Ethylbutane-1, 3-diol
(c) 3-Ethylbutane-1, 3-diol
(d) 2-Ethyl-1-methylpropane-1, 3-diol

24. The IUPAC name of $\begin{array}{l} CH_3 - \underset{\underset{O}{\|}}{C} - \underset{\underset{O}{\|}}{C} - CH_3 \end{array}$ is:

(a) Butane-2, 3-dial (b) Butane-1, 3-dione

(c) Butane-2, 3-dione (d) 1, 2-dimethylethanedione

25. The IUPAC name of $CH_2 = CH - CH = CH_2$ is:

(a) Butane (b) Buta-1, 3-diene (c) Butane-1, 3-diene (d) none of these

26. The IUPAC name of $\underset{\underset{COOH}{|}}{CH_2} - CH_2 - \underset{\underset{COOH}{|}}{CH_2}$ is:

(a) Pentane-1, 5-dioic acid (b) Pentane-1, 5-dicarboxylic acid

(c) Propane-1, 3-dioic acid (d) none of these

27. The IUPAC name of $\underset{\underset{CHO}{|}}{CH_2} - CH = CH - CHO$ is:

(a) propene-1, 3-dial (b) Propene-1, 3-dicarbaldehyde

(c) Pent-3-ene-1, 5-dial (d) Pent-2-ene-1, 5-dial

28. The IUPAC name of $\underset{\underset{CH_2-CN}{|}}{CH_2} - CN$ is:

(a) Butane-1, 4-dicarbonitrile (b) Ethane-1, 2-dicarbonitrile

(c) Ethane-1, 2-dinitrile (d) Butane-1, 4-dinitrile

29. The IUPAC name of $\underset{\underset{NH_2}{|}}{CH_2} - \underset{\underset{CH_3}{|}}{CH} - CH_2 - \underset{\underset{NH_2}{|}}{CH_2}$ is:

(a) 2-Methylbutane-1, 4-diamine

(b) 3-Methylbutane-1, 4-diamine

(c) 3-(Aminomethyl)butanamine

(d) 2-(Aminomethyl)butan-4-amine

30. The IUPAC name of $\underset{\underset{Cl}{|}}{CH_2} - \overset{\overset{CH_2Cl}{|}}{CH} - \underset{\underset{Cl}{|}}{CH_2}$ is:

(a) Tris(chloromethyl) methane

(b) 1, 3-Dichloro-2 (chloromethyl) propane

(c) 1-Chlorobis(chloromethyl) ethane

(d) none of these

31. The IUPAC name of $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH}}-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-CH_3$ is:

(a) 3, 5, 5-Trimethylhexane-2, 4-diol (b) 2, 2, 4-Trimethylhexane-3, 5-diol

(c) 1, 2, 4, 4-Tetramethylpantane-1, 3-diol (d) 2, 2, 4, 5-Tetramethylpantane-3, 5-diol

32. The IUPAC name of $HOOC-CH=CH-COOH$ is:

(a) But-2-ene-1, 4-dicarboxylic acid (b) But-2-ene-1, 4-dioic acid

(c) Ethene dicarboxylic acid (d) Ethene dioic acid

33. The IUPAC name of $CH_3-\overset{\displaystyle OCH_3}{\overset{|}{CH}}-CHO$ is:

(a) 1-Formyl-1-methoxyethane (b) 2-Methoxypropan-3-one

(c) 2-Methoxypropanal (d) 2-Methoxypropan-3-al

34. The IUPAC name of $CH_2=\overset{\displaystyle CH_3}{\overset{|}{C}}-COOCH_3$ is:

(a) Methyl-2-methylprop-1-en-3-oate (b) 2-Methoxycarbonylpropene

(c) 2-Methoxycarbonylprop-2-ene (d) Methyl-2-methylprop-2-enoate

35. The IUPAC name of $CH_3-CH=CH-COOH$ is:

(a) But-2-ene-1-oic acid (b) But-1-ene-1-oic acid

(c) But-2-ene-1-carboxylic acid (d) Propene-1-carboxylic acid

36. The IUPAC name of $CH_3-\overset{\displaystyle OH}{\overset{|}{CH}}-COOH$ is:

(a) 2-Hydroxypropanoic acid (b) 1-Hydroxypropanoic acid

(c) 1-Hydroxyethane carboxylic acid (d) 1-Hydroxyethanoic acid

37. The IUPAC name of $\begin{array}{c} HO-CH-COOH \\ | \\ HO-CH-COOH \end{array}$ is:

(a) 2, 3-Dihydroxybutane-1, 4-carboxylic acid

(b) 2, 3-Dihydroxybutane-1, 4-dioic acid

(c) 1, 2-Dihydroxyethane dicarboxylic acid

(d) none of these

38. The IUPAC name of $CH_3-\underset{CH_3}{\underset{|}{CH}}-\underset{O}{\underset{\|}{C}}-COOH$ is:

(a) 3-Methyl-2-oxobutanecarboxylic acid (b) 2-Methyl-3-oxobutan-4-oic acid

(c) 3-Methyl-2-oxobutanoic acid (d) 3-Methyl-1,2-dioxobutanoic acid

39. The IUPAC name of $NC-CH_2-CH_2-COOH$ is:

(a) 3-Carboxy propanenitrile (b) 4-Cyanobutanoic acid

(c) 2-Cyanoethane Carboxylic acid (d) 3-Cyanopropanoic acid

40. The IUPAC name of $\begin{array}{l} CH_2COOH \\ | \diagup OH \\ C \\ | \diagdown COOH \\ CH_2COOH \end{array}$ is:

(a) 3-Carboxy-3-hydroxypentanedicarboxylic acid

(b) 2-Hydroxypropane-1, 2, 3-tricarboxylic acid

(c) 2-Hydroxypropane-1, 2, 3-trioic acid

(d) 3-Hydroxypropane-1, 2, 3-tricarboxylic acid

41. The IUPAC name of $CH_3-\underset{COOC_2H_5}{\underset{|}{C}}=CH-CH_2-\overset{O}{\overset{\|}{\underset{OH}{\underset{|}{C}}}}$ is:

(a) 4-ethoxycarbonylpent-3-enoic acid

(b) 4-ethanoyloxypent-3-enoic acid

(c) 3-ethoxycarbonylbut-2-enecarboxylic acid

(d) 3-ethoxycarbonylpent-3-enoic acid

42. The IUPAC name of $CH_3-\underset{CH_3}{\underset{|}{CH}}-\underset{O}{\underset{\|}{C}}-\underset{O}{\underset{\|}{C}}-\underset{Br}{\underset{|}{NH}}$ is:

(a) (*N*-Bromo)-2-keto-3-methylbutanamide

(b) (*N*-Bromo)-2-keto-4-methylbutanamide

(c) (*N*-Bromo)-1, 2-diketo-3-methylbutanamine carboxamide

(d) (*N*-Bromo)-1-keto-2-methylpropane

43. The IUPAC name of $\underset{Cl}{\underset{|}{CH_2}}-\underset{CH_3}{\underset{|}{C}}=CH-CH_2OH$ is:

(a) 4-Chloro-3-methylbut-2-en-1-ol (b) 1-Chloro-2-methylbut-2-en-4-ol

(c) 4-Chloro-1-hydroxy-3-methylbut-2-ene (d) 1-Chloro-4-hydroxy-2-methylbut-2-ene

44. The IUPAC name of $\underset{\displaystyle Br}{\underset{|}{CH_2}}-\underset{\displaystyle CONH_2}{\underset{|}{CH}}-\overset{\displaystyle O}{\overset{\|}{C}}-CH_2-CH_3$ is:

(a) 2-(Bromomethyl)-3-oxopentane carboxamide

(b) 1-Bromo-2-carbamoylpentan-3-one

(c) 5-Bromo-4-carbamoylpentan-3-one

(d) 2-(Bromomethyl)-3-oxopentanamide

45. The IUPAC name of $(CH_3)_3C\cdot CH_2CH_2Cl$ is:

(a) 2, 2-Dimethyl-4-chloro butane

(b) 1-Chloro-3, 3-dimethylbutane

(c) 4-Chloro-2, 2-dimethyl butane

(d) none of these

46. The IUPAC name of $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH}}-\underset{\displaystyle OH}{\underset{|}{CH}}-CHO$ is:

(a) 2, 3-Dihydroxy-4-methylpentanal

(b) 1-oxo-2, 3-Dihydroxy-4-methylpentane

(c) 2,3-Dihydroxy-4-methylpentanone

(d) 1, 2-Dihydroxy-3-methylbutanecarbaldehyde

47. The IUPAC name of $CH_3-CO-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2Cl$ is:

(a) 1-Chloro-3-methylpentan-4-one

(b) 1-Chloro-2-(oxoethylbutane)

(c) 5-Chloro-3-methylpentan-2-one

(d) 3-(2-Chloroethyl)butan-2-one

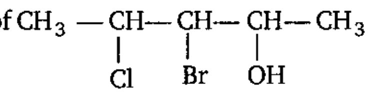
48. The IUPAC name of $CH_3-\overset{\displaystyle OH}{\overset{|}{\underset{\displaystyle H}{\underset{|}{C}}}}-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3$ is:

(a) 2-Hydroxypentan-4-one

(b) 4-Hydroxypentan-2-one

(c) 4-oxopentan-2-ol

(d) 2-oxopentan-4-ol

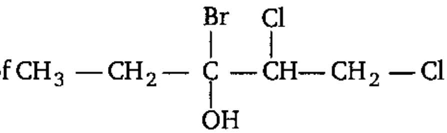
49. The IUPAC name of  is:

(a) 3-Bromo-4-chloropentan-2-ol

(b) 3-Bromo-2-chloro-4-hydroxypentane

(c) 3-Bromo-2-chloropentane-4-ol

(d) none of these

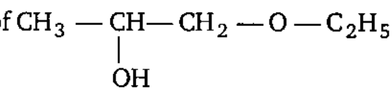
50. The IUPAC name of  is:

(a) 3-Bromo-4, 5-dichloropentan-3-ol

(b) 3-Bromo-1, 2-dichloro-3-hydroxypentane

(c) 3-Bromo-1, 2-dichloropentan-3-ol

(d) 3-Bromo-4, 5-dichloro-3-hydroxypentane

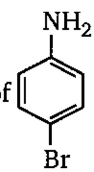
51. The IUPAC name of  is:

(a) 1-Ethoxypropan-2-ol

(b) 3-Ethoxypropan-2-ol

(c) 1-Ethoxy-2-hydroxypropane

(d) none of these

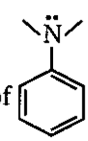
52. The IUPAC name of  is:

(a) 4-Bromo benzenamine

(b) 4-Amino-1-bromobenzene

(c) 4-Bromo benzenamide

(d) 1-Bromo benzencarboxamide

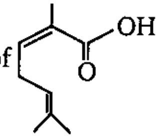
53. The IUPAC name of  is:

(a) *N*, *N*-Dimethyl aminobenzene

(b) *N*, *N*-Dimethyl benzenamine

(c) (a) and (b) both are correct

(d) none of these

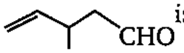
54. The IUPAC name of  is:

(a) 2, 6-Dimethylhepta-2, 5-dienoic acid

(b) 3, 7-Dimethylhepta-2, 5-dienoic acid

(c) 1-Hydroxy-2, 6-dimethylhepta-2, 5-dienone

(d) none of these

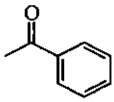
55. The IUPAC name of  is:

(a) 3-Methylpent-1-en-4-al

(b) 3-Methylpent-4-enal

(c) 3-Methylpent-4-carbaldehyde

(d) 3-Methyl-5-oxopent-1-ene

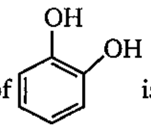
56. The IUPAC name of  is:

(a) 2-Phenyl ethanone

(b) 1-Phenyl ethanone

(c) 1-(Oxoethyl)benzene

(d) 1-(Ethyaloxo)-benzene

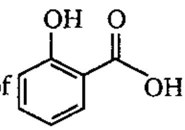
57. The IUPAC name of  is:

(a) 2-Hydroxybenzenol

(b) 1, 2-Dihydroxybenzene

(c) Benzene-1, 2-diol

(d) 2-Hydroxyphenol

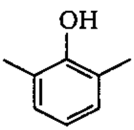
58. The IUPAC name of  is:

(a) 2-Carboxyphenol

(b) 2-Hydroxybenzoic acid

(c) 1-Carboxy-2-hydroxybenzene

(d) 2-Carboxy-1-hydroxybenzene

59. The IUPAC name of  is:

(a) 1,3-Dimethyl phenol

(b) 1-Hydroxy-2-6-dimethyl benzene

(c) 2, 6-Dimethyl benzenol

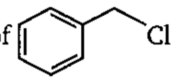
(d) 2-Hydroxy-1-3-dimethylbenzene

60. $\mathrm{Ph{-}CH{=}CH{-}\overset{\overset{\displaystyle O}{\|}}{C}{-}OH}$

The IUPAC name is :

(a) 3-phenyl prop-2-enoic acid (b) 3-phenol prop-1-enoic acid

(c) 3-carboxy-prop-1-ene benzene (d) but-2-enoic acid

61. The IUPAC name of 

is:

(a) Chloromethylbenzene (b) Chlorophenylmethane

(c) (a) and (b) both (d) none of these

62. The IUPAC name of the compound having the formula is :

$$\mathrm{H_3C-\underset{\underset{\displaystyle CH_3}{|}}{\overset{\overset{\displaystyle CH_3}{|}}{C}}-CH=CH_2}$$

(a) 3, 3, 3-Trimethylprop-1-ene (b) 1, 1, 1-Trimethylprop-2-ene

(c) 3, 3-Dimethylbut-1-ene (d) 2, 2-Dimethylbut-3-ene

63. The IUPAC name of the compound $CH_2=CH-CH(CH_3)_2$ is :

(a) 1, 1-Dimethylprop-2-ene (b) 3-Methylbut-1-ene

(c) 2-Vinyl propane (d) none of these

64. The number of sigma and pi-bonds in 1-butene 3-yne are :

(a) 5 sigma and 5 pi (b) 7 sigma and 3 pi

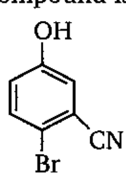
(c) 8 sigma and 2 pi (d) 6 sigma and 4 pi

65. The IUPAC name of C_6H_5COCl is :

(a) Benzoyl Chloride (b) Benzene chloro ketone

(c) Benzene carbonyl chloride (d) Chloro phenyl ketone

66. The IUPAC name of the following compound is :



(a) 4-Bromo-3-cyanophenol (b) 2-Bromo-5-hydroxybenzonitrile

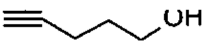
(c) 2-Cyano-4-hydroxybromobenzene (d) 6-Bromo-3-hydroxybenzonitrile

ANSWERS — LEVEL 1

1.	(c)	**2.**	(b)	**3.**	(b)	**4.**	(b)	**5.**	(a)	**6.**	(a)	**7.**	(a)	**8.**	(a)
9.	(b)	**10.**	(a)	**11.**	(c)	**12.**	(b)	**13.**	(a)	**14.**	(d)	**15.**	(c)	**16.**	(d)
17.	(a)	**18.**	(d)	**19.**	(a)	**20.**	(c)	**21.**	(d)	**22.**	(a)	**23.**	(b)	**24.**	(c)
25.	(b)	**26.**	(a)	**27.**	(d)	**28.**	(d)	**29.**	(a)	**30.**	(b)	**31.**	(a)	**32.**	(b)
33.	(c)	**34.**	(d)	**35.**	(a)	**36.**	(a)	**37.**	(b)	**38.**	(c)	**39.**	(d)	**40.**	(b)
41.	(a)	**42.**	(a)	**43.**	(a)	**44.**	(d)	**45.**	(b)	**46.**	(a)	**47.**	(c)	**48.**	(b)
49.	(a)	**50.**	(c)	**51.**	(a)	**52.**	(a)	**53.**	(b)	**54.**	(a)	**55.**	(b)	**56.**	(b)
57.	(c)	**58.**	(b)	**59.**	(c)	**60.**	(a)	**61.**	(b)	**62.**	(c)	**63.**	(b)	**64.**	(b)
65.	(c)	**66.**	(b)												

LEVEL-2

Give the IUPAC name of the following compounds

1. 

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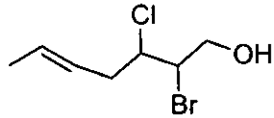
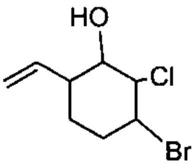
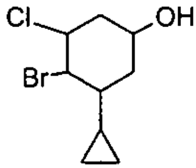
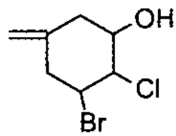
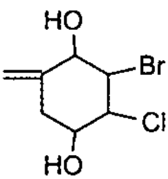
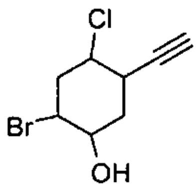
3. 

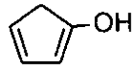
4. 

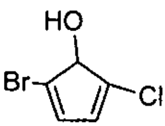
5. 

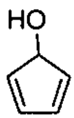
6. 

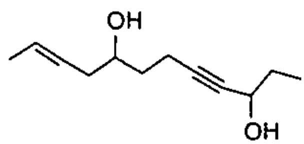
7. 

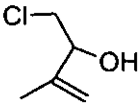
8. 

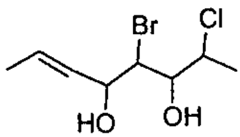
9. 

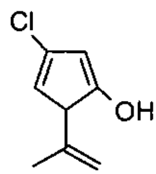
10. 

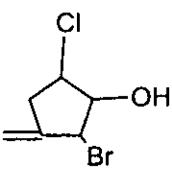
11. 

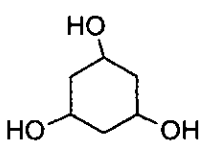
12. 

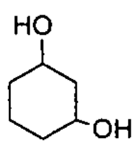
13 

14. 

15. 

16 

17 

18. 

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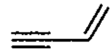
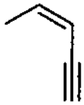
20. 

21. 

22. 

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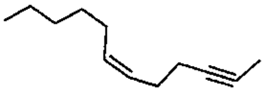
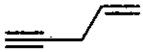
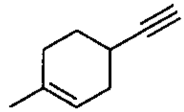
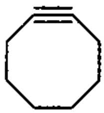
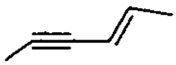
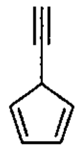
25. 

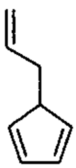
26. 

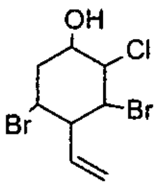
27. 

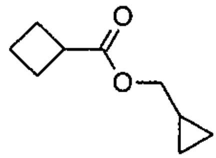
28. 

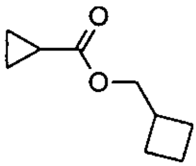
29. 

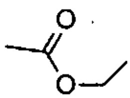
30. 

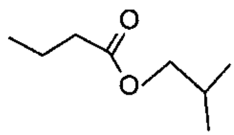
31. 

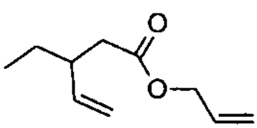
32. 

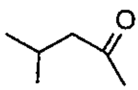
33. 

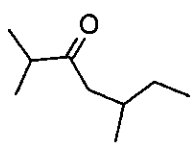
34. 

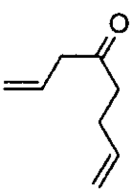
35. 

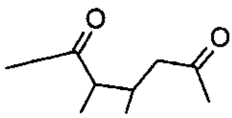
36. 

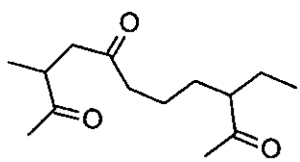
37. 

38. 

39. 

40. 

41. 

42. 

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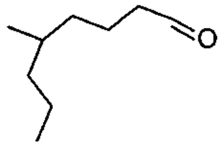

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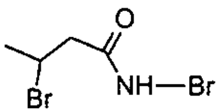

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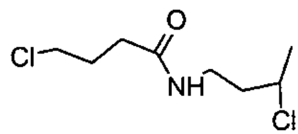

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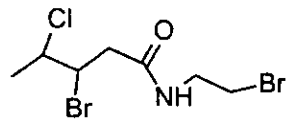

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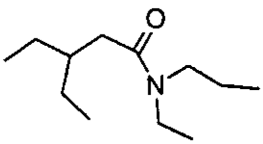

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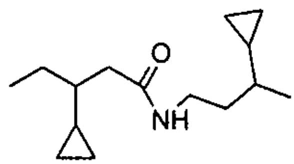

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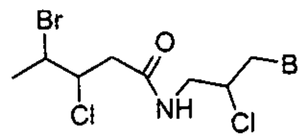

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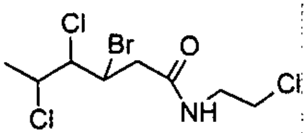

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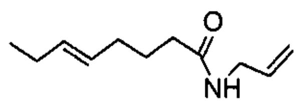

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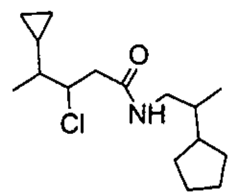

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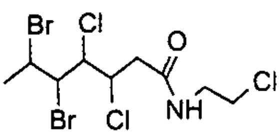

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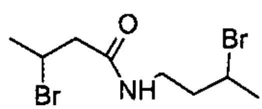

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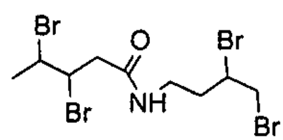

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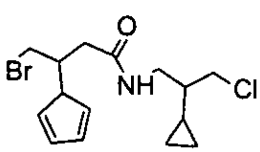

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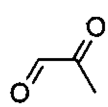

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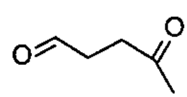

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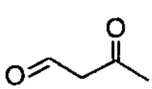

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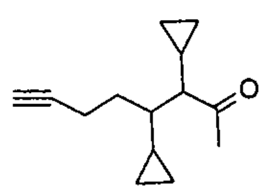

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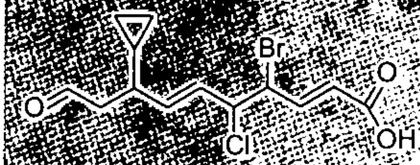

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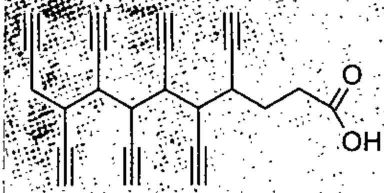

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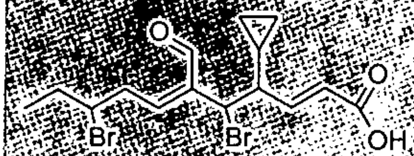

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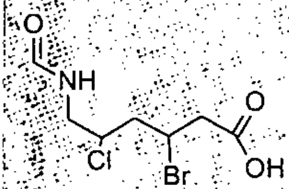

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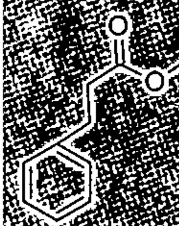

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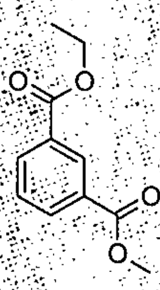

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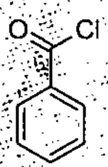

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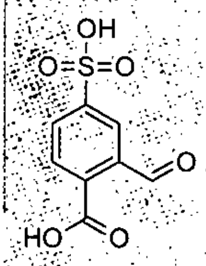
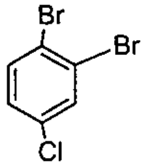
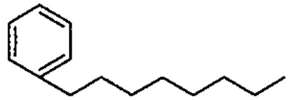
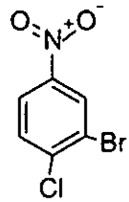
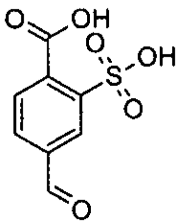
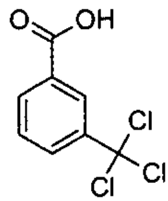


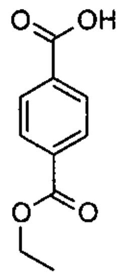
73. 

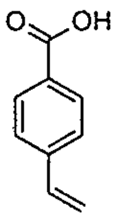
74. 

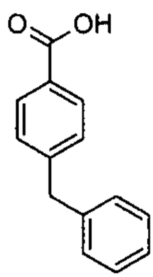
75. 

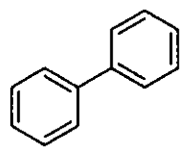
76. 

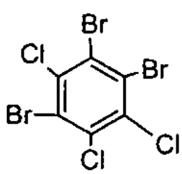
77. 

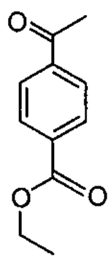
78. 

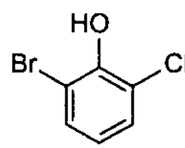
79. 

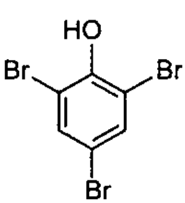
80. 

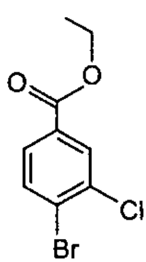
81. 

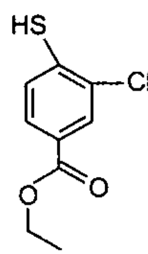
82. 

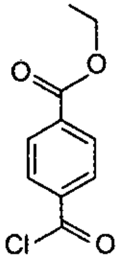
83. 

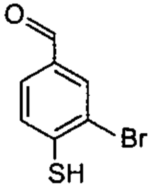
84. 

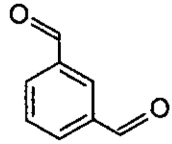
85. 

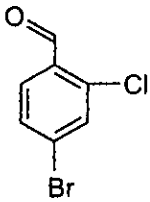
86. 

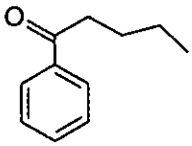
87. 

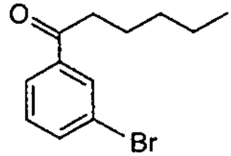
88 

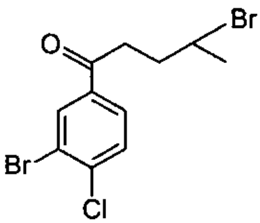
89. 

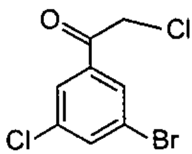
90. 

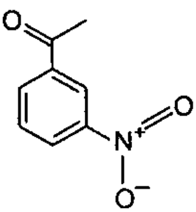
91. 

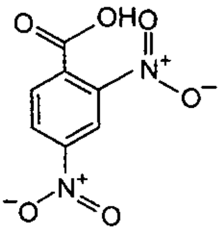
92. 

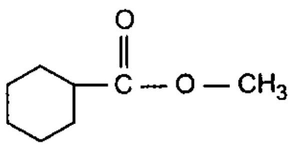
93. 

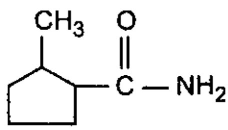
94. 

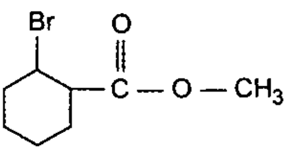
95. 

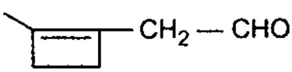
96. 

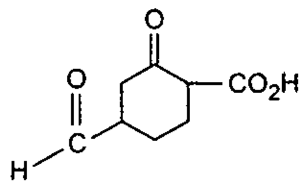
97. 

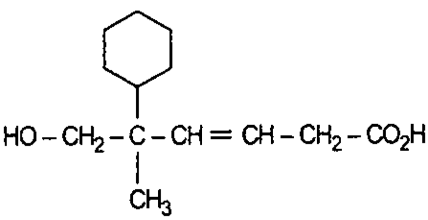
98. 

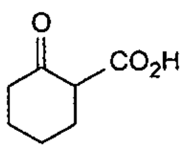
99. 

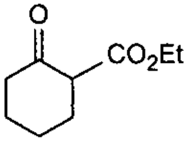
100 

101. 

102. 

103. 

104. 

105. 

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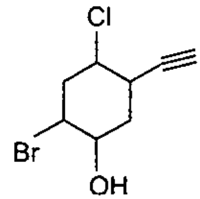
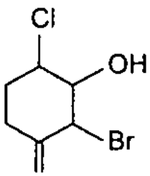
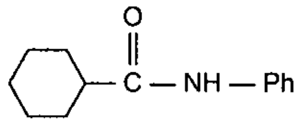
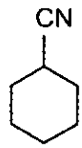
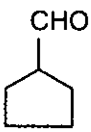
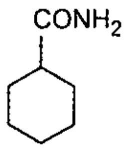
107. 

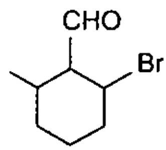
108. 

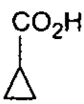
109. 

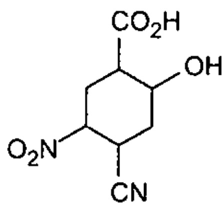
110. 

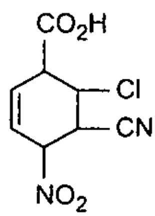
111. 

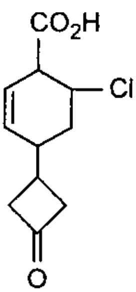
112. 

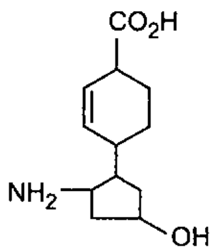
113. 

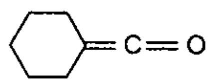
114. 

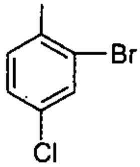
115. 

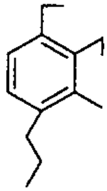
116. 

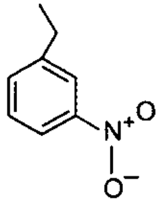
117. 

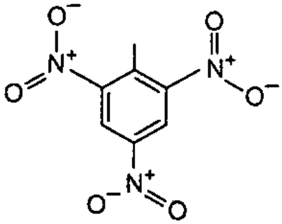
118. 

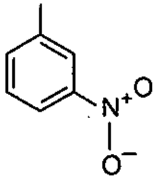
119. 

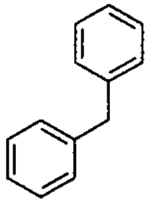
120. 

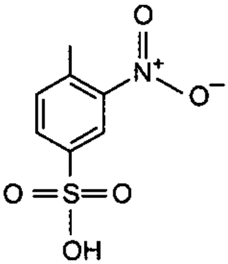
121. 

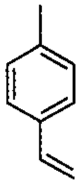
122. 

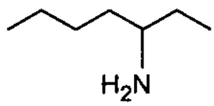
123. 

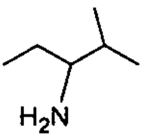
124. 

125. 

126. 

127. 

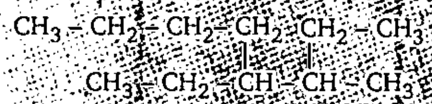
128. 

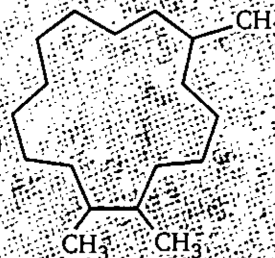
129. 

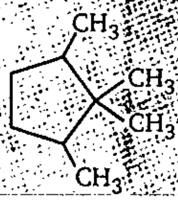
130. Give the IUPAC name of the following compounds :

(a) $CH_3-CH_2-CH(CH_3)-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH(CH_3)-CH_3$

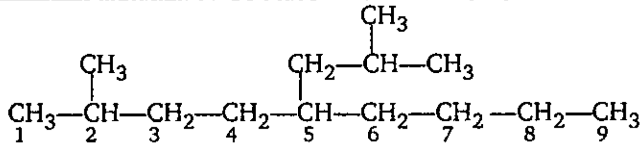
(b) $CH_3-CH_2-CH(OH)-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH(CH_3)-CH_3$

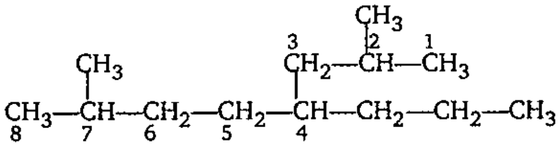
(c) 

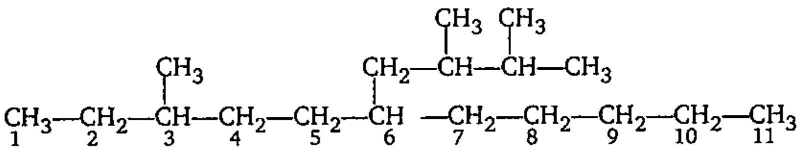
(d) 

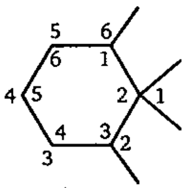
(e) 

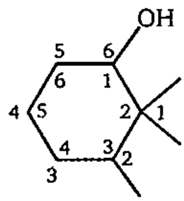
131. Give the IUPAC name of the following :

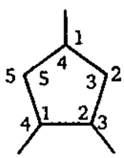
(a) 

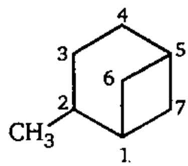
(b) 

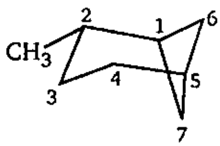
(c) 

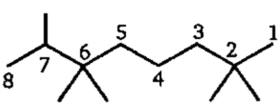
(d) 

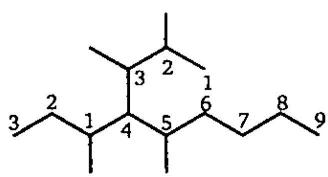
(e) 

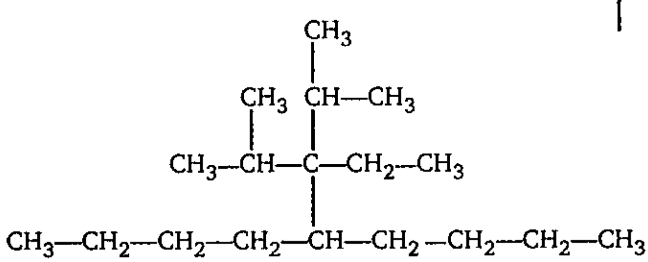
(f) 

(g) 

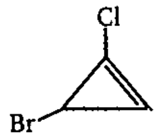
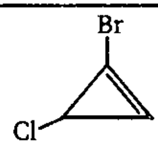
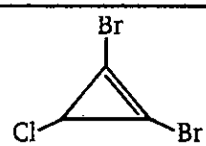
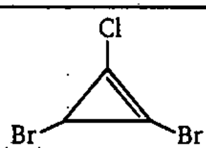
(h) 

(i) 

(j) 

(k) 

132. Match the Column :

Column (I)		Column (II)	
Compound		IUPAC Name	
(a)		**(p)**	1, 3-dibromo-2-chlorocyclopropane
(b)		**(q)**	1, 2-dibromo-3-chlorocyclopropene
(c)		**(r)**	3-bromo-1-chlorocyclopropene
(d)		**(s)**	1-bromo-3-chlorocyclopropene

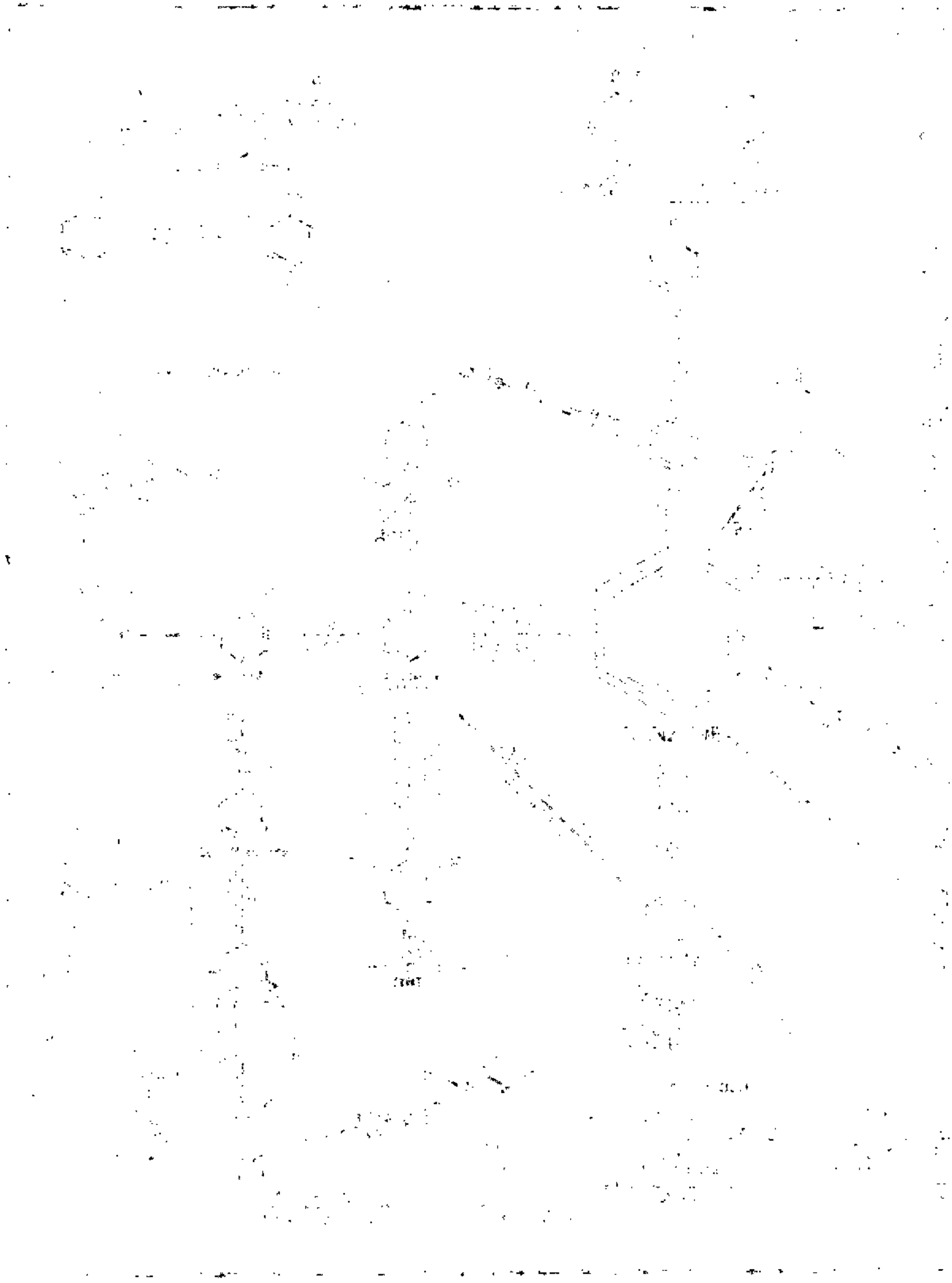
ANSWERS – IUPAC Name

1.	pent-4-yn-1-ol	2.	pent-4-en-1-ol
3.	(5*E*)-2-bromo-3-chlorohept-5-en-1-ol	4.	3-bromo-2-chloro-6-ethenylcyclohexanol
5.	4-bromo-3-chloro-5-cyclopropylcyclohexanol		
6.	3-bromo-2-chloro-5-methylidenecyclohexanol		
7.	3-bromo-2-chloro-5-methylidenecyclohexane-1,4-diol		
8.	2-bromo-4-chloro-5-ethynylcyclohexanol	9.	cyclopenta-1,3-dien-1-ol
10.	2-bromo-5-chlorocyclopenta-2,4-dien-1-ol		
11.	cyclopenta-2,4-dien-1-ol	12.	dodec-10-en-4-yne-3,8-diol
13.	1-chloro-3-methylbut-3-en-2-ol	14.	4-bromo-2-chlorooct-6-ene-3,5-diol
15.	3-chloro-5-(1-methylethenyl)cyclopenta-1,3-dien-1-ol		
16.	2-bromo-5-chloro-3-methylidenecyclopentanol		
17.	cyclohexane-1,3,5-triol	18.	cyclohexane-1,3-diol
19.	cyclopenta-1,3-diene	20.	(6*E*)-oct-6-en-1-yne
21.	but-1-en-3-yne	22.	(3*Z*)-pent-3-en-1-yne
23.	buta-1,3-diyne	24.	(2*E*)-dec-2-en-5-yne
25.	(6*Z*)-dodec-6-en-2-yne	26.	pent-1-en-4-yne
27.	4-ethynyl-1-methylcyclohexene	28.	cyclooctyne
29.	(2*E*)-hex-2-en-4-yne	30.	5-ethynylcyclopenta-1,3-diene
31.	5-(prop-2-enyl) cyclopenta-1,3-diene		
32.	3,5-dibromo-2-chloro-4-ethenylcyclohexanol		
33.	cyclopropylmethyl cyclobutanecarboxylate		
34.	cyclobutylmethyl cyclopropanecarboxylate		
35.	ethyl ethanoate	36.	2-methylpropyl butanoate
37.	prop-2-enyl 3-ethylpent-4-enoate	38.	4-methylpentan-2-one
39.	2,5-dimethylheptan-3-one	40.	octa-1,7-dien-4-one
41.	3,4-dimethylheptane-2,6-dione	42.	9-ethyl-3-methylundecane-2,5,10-trione

43.	5-methyloctanal	**44.**	but-3-enal
45.	3-ethylheptanal	**46.**	*N*,3-dibromobutanamide
47.	4-chloro-*N*-(3-chlorobutyl)butanamide		
48.	3-bromo-*N*-(2-bromoethyl)-4-chloropentanamide		
49.	*N*,3-diethyl-*N*-propylpentanamide		
50.	3-cyclopropyl-*N*-(3-cyclopropylbutyl)pentanamide		
51.	4-bromo-*N*-(3-bromo-2-chloropropyl)-3-chloropentanamide		
52.	3-bromo-4,5-dichloro-*N*-(2-chloroethyl)hexanamide		
53.	(5*E*)-*N*-(prop-2-en-yl)oct-5-enamide		
54.	3-chloro-*N*-(2-cyclopentylpropyl)-4-cyclopropylpentanamide		
55.	5,6-dibromo-3,4-dichloro-*N*-(2-chloroethyl)heptanamide		
56.	3-bromo-*N*-(3-bromobutyl)butanamide		
57.	3,4-dibromo-*N*-(3,4-dibromobutyl)pentanamide		
58.	4-bromo-*N*-(3-chloro-2-cyclopropylpropyl)-3-(cyclopenta-2,4-dien-yl)butanamide		
59.	2-oxopropanal	**60.**	4-oxopentanal
61.	3-oxobutanal	**62.**	3,4-dicyclopropyloct-7-yn-2-one
63.	(2*E*,6*E*)-4-bromo-5-chloro-8-cyclopropyl-10-oxodeca-2,6-dienoic acid		
64.	4,5,6,7,8,9-hexaethynyldodec-11-ynoic acid		
65.	(2*E*,6*E*)-5,9-dibromo-4-cyclopropyl-6-formylundeca-2,6-dienoic acid		
66.	3-bromo-5-chloro-6-(formylamino)hexanoic acid		
67.	ethyl 3-phenylpropanoate	**68.**	ethyl methyl benzene-1,3-dicarboxylate
69.	ethenylbenzene	**70.**	benzoyl chloride
71.	methyl 4-acetyl-2-nitrobenzoate	**72.**	2-formyl-4-sulphobenzoic acid
73.	1,2-dibromo-4-chlorobenzene	**74.**	octylbenzene
75.	2-bromo-1-chloro-4-nitrobenzene	**76.**	4-formyl-2-sulphobenzoic acid
77.	3-(trichloromethyl)benzoic acid	**78.**	4-(ethoxycarbonyl)benzoic acid

79.	4-ethenylbenzoic acid	80.	4-benzylbenzoic acid
81.	biphenyl	82.	1,2,5-tribromo-3,4,6-trichlorobenzene
83.	ethyl 4-acetylbenzoate	84.	2-bromo-6-chlorophenol
85.	2, 4, 6-tribromophenol	86.	ethyl 4-bromo-3-chlorobenzoate
87.	ethyl 3-chloro-4-mercapto/sulpho benzoate	88.	ethyl 4-(chlorocarbonyl)benzoate
89.	3-bromo-4-sulphobenzaldehyde	90.	benzene-1, 3-dicarbaldehyde
91.	4-bromo-2-chlorobenzaldehyde	92.	1-phenylpentan-1-one
93.	1-(3-bromophenyl)hexan-1-one		
94.	4-bromo-1-(3-bromo-4-chlorophenyl)pentan-1-one		
95.	1-(3-bromo-5-chlorophenyl)-2-chloroethanone		
96.	1-(3-nitrophenyl)ethanone	97.	2,4-dinitrobenzoic acid
98.	methylcyclohexane carboxylate	99.	2-methylcyclopentane carboxamide
100.	methyl-2-bromocyclohexane carboxylate	101.	2-(2-methylcyclobut-1-enyl)ethanal
102.	4-formyl-2-oxocyclohexane-1-carboxylic acid		
103.	5-cyclohexyl-6-hydroxy-5-methylhex-3-en-1-oic acid		
104.	2-oxocyclohexane-1-carboxylic acid	105.	ethyl-2-oxocyclohexane-1-carboxylate
106.	*N*-methylmethanamide	107.	2-bromo-4-chloro-5-ethynylcyclohexanol
108.	2-bromo-6-chloro-3-methylidene-cyclohexanol		
109.	*N*-phenylcyclohexane carboxamide	110.	cyclohexane carbonitrile
111.	cyclopentanecarbaldehyde	112.	cyclohexanecarboxamide
113.	2-bromo-6-methyl-cyclohexanecarbaldehyde		
114.	cyclopropane carboxylic acid		
115.	4-cyno-2-hydroxy-5-nitrocyclohexane carboxylic acid		
116.	6-chloro-5-cyno-4-nitrocyclohex-2-ene carboxylic acid		
117.	6-chloro-4-(3-oxo cyclobutyl)cyclohex-2-ene carboxylic acid		
118.	4-(2-amino-4-hydroxycyclopentyl cyclohex-2-enecarboxylic acid		

119.	cyclohexylidenemethanone	**120.**	2-bromo-4-chloro-1-methylbenzene
121.	1,2-diethyl-3-methyl-4-propylbenzene	**122.**	1-ethyl-3-nitrobenzene
123.	2-methyl-1, 3, 5-trinitrobenzene	**124.**	1-methyl-3-nitrobenzene
125.	Diphenylmethane	**126.**	4-Methyl-3-nitrobenzene sulphonic acid
127.	1-ethenyl-4-methylbenzene	**128.**	heptan-3-amine
129.	2-methylpentan-3-amine		
130.	**(a)** 2,11-dimethyltridecane		
	(b) 12-methyl-tridecan-3-ol		
	(c) 4-ethyl-3-methyloctane		
	(d) 1,2,7-trimethylcyclopentadecane		
	(e) 1,1,2,5-tetramethylcyclopentane		
131.	**(a)** 5-isobutyl-2-methylnonane, 5-2-methylnonane (2-methylpropyl)		
	(b) 2,7-dimethyl-4-propyloctane		
	(c) 6-(2,3-dimethylbutyl) 3-methyl undecane		
	(d) 1,1,2,6-tetramethylcyclohexane		
	(e) 2,2,3-trimethylcyclohexanol		
	(f) 1,2,4-trimethylcyclopentane		
	(g) 2-methylbicyclo[3.1.1] heptane		
	(h) 2-methylbicyclo[3.1.1] heptane		
	(i) 2,2,6,6,7-pentamethyloctane		
	(j) 4-(1methylpropyl)-2,3,5-trimethyl nonane **Not** 2-butyl		
	(k) 5-(1-ethyl-2-methyl-1-(1-methylethyl)propyl) nonane		
132.	a - r; b - s; c - q; d - p		



About the Author

M.S. Chouhan, the author, is B.Tech in Chemical Engineering from Mumbai University. Due to his keen interest in teaching, he opted his career in guiding the JEE aspirants. He is highly dedicated to Organic Chemistry and successfully shaping the dreams of IITians, who are the most honoured technocrats and earning the name for themselves and the country.

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