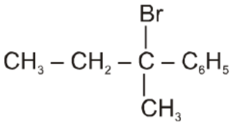
Exercise-1

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

Section (A) : Unimolecular elimination (E1) reaction of alkyl halides

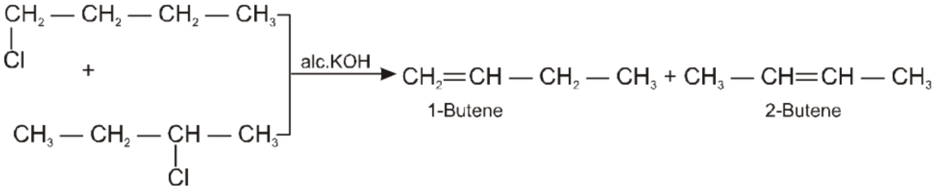
A-1. Sol. Elimination reaction generally occurs with the formation of one pi bond.

A-2. Sol. 
$CH_3-CH_2-C(Br)(CH_3)-C_6H_5$ produce most stable carbocation.

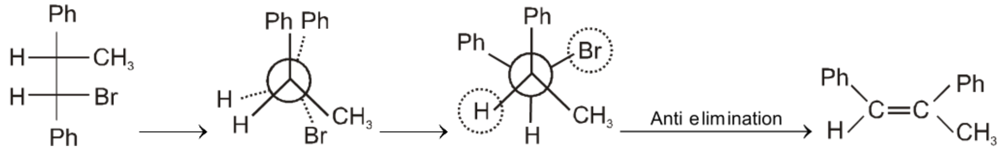
A-5. Sol. Carbocation of 1 is most stable becuase of resonance.

Section (B) : Bimolecular elimination (E2) reaction of Alkyl halide

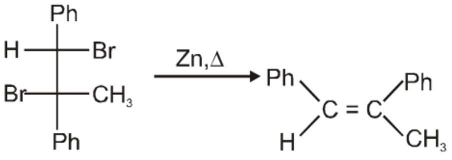
B-7. Sol.



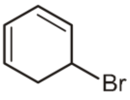
B-11. Sol.



B-12. Sol.



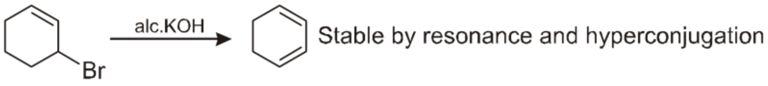
(Anti–elimination)

B-15. Sol.  give benzene on elimination which is aromatic in nature.

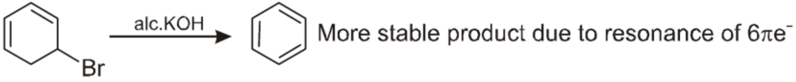
B-16. Sol. But-2-ene is saytzeff's alkene.

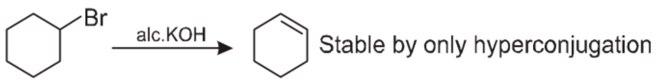
B-17. Sol. F, Cl, Br and I are the elements of VII A group. In A group atomic, radii increases from top to bottom and the bond dissociation energy decreases as -
R – F > R – Cl > R – Br > R – 1
So, during dehydrohalogenation R – I bond breaks more easily than R – F bond. Hence, order of reactivity will be -
R – I > R – Br > R – Cl > R – F

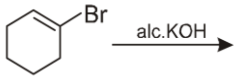
B-20. Sol. (1)



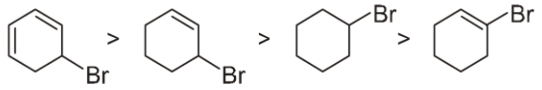
(2)



(3) 

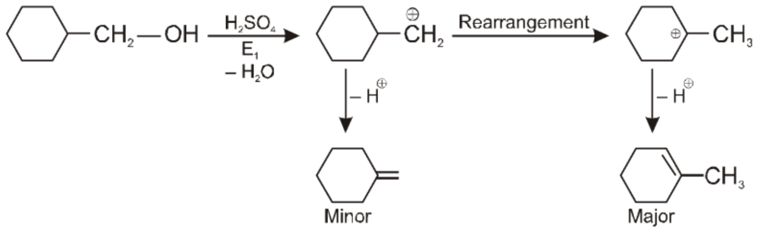
(4) 

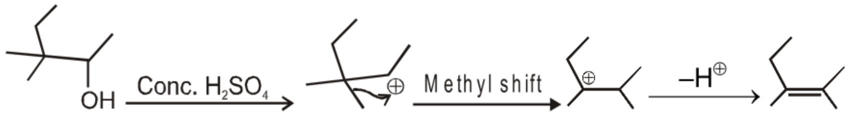
No reaction

∴ Rate of de-bromination is 

Section (C) : Elimination reaction of alcohols

C-1. **Sol.** Dehydration of alcohol is an example of elimination reaction.

C-3. **Sol.** 

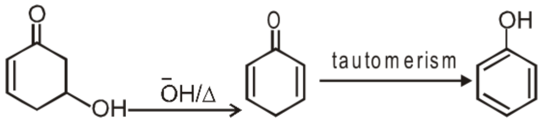
C-4. **Sol.** 

C-5. **Sol.** H_2SO_4, Al_2O_3 and H_3PO_4 all are dehydrating agent.

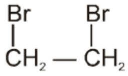
C-9. **Sol.** In dehydration of alcohol, β-hydrogen atom (sp^3 hybridised) must be present in compound.

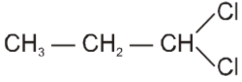
C-12. **Sol.** According to stability of carbocation.

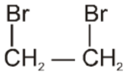
Section (D) : Miscellaneous elimination reactions

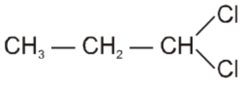
D-5. **Sol.** 

Section (E) : Chloroform / CCl_4 / Freon / Ethylene glycol / Glycerol

E-1. **Sol.** (1)  $\underset{\text{Br}}{CH_2}-\underset{\text{Br}}{CH_2}$ vicinal dihalides.

(2)  $CH_3-CH_2-CH\begin{matrix}Cl\\Cl\end{matrix}$ gem dihalides.

(3)  $\underset{\text{Br}}{CH_2}-\underset{\text{Br}}{CH_2}$ vicinal dihalides.

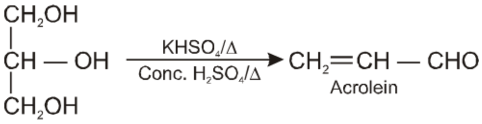
(4)  $CH_3-CH_2-CH\begin{matrix}Cl\\Cl\end{matrix}$ secondary alkyl halides.

E-2. **Sol.** $\underset{\text{Chloroform}}{CHCl_3}\xrightarrow[\text{light of sun}]{\text{Air}}\underset{\text{Phosgene}}{COCl_2}$

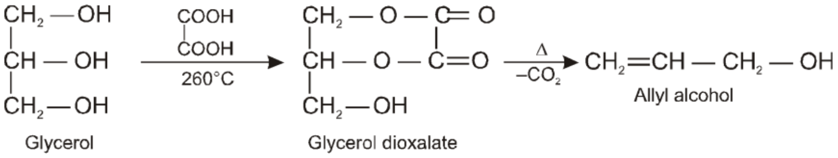
E-3. **Sol.** Impure chloroform give white ppt. of AgCl due to presence of HCl.

E-4. **Sol.** CHI_3 give yellow ppt. with $AgNO_3$ solution.

E-10. **Sol.**



E-11. **Sol.**



E-13. **Sol.** Methanol and ethanol form hydrogen bonding with water molecules so they are soluble in water.

E-14. **Sol.** Alcohols form intermolecular hydrogen bonding so they have higher boiling points than hydrocarbon.

E-15. **Sol.** It is fact.

E-16. **Sol.** Freons (chlorofluoro carbons)
Freons are mainly Freon-011 ($CFCl_3$) and Freon-012 (CF_2Cl_2). They form free radical of chlorine in presence of UV-radiation. Such free radical decomposes O_3 as follows :

$$Cl^{\bullet} + O_3 \longrightarrow ClO^{\bullet} + O_2$$

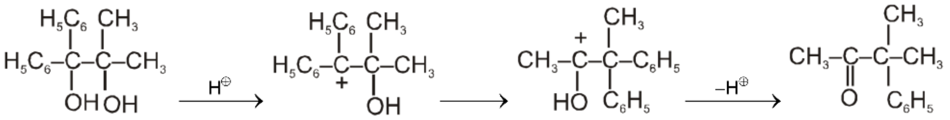
$$ClO^{\bullet} + O_3 \longrightarrow \underset{\substack{\text{chlorine free}\\ \text{radical}}}{Cl^{\bullet}} + 2O_2$$

Exercise-2

Marked Questions may have for Revision Questions.

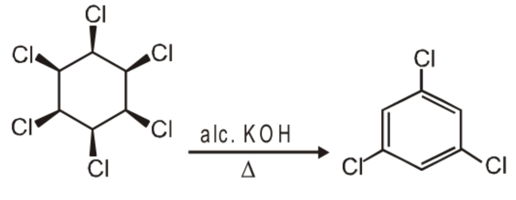
PART - I : OBJECTIVE QUESTIONS

2. **Sol.**

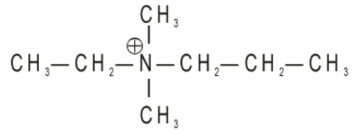


3. **Sol.** $PhCH_2CH_2OH \xrightarrow{TsCl} PhCH_2CH_2OTs \xrightarrow{KBr} PhCH_2CH_2Br \xrightarrow{alc.KOH} PhCH{=}CH_2$

5. **Sol.**



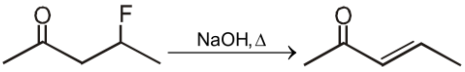
6. **Sol.**



$\xrightarrow{\overset{\ominus}{O}H/\Delta} CH_2{=}\,CH_2$

7. **Ans.** All can give E1 cB reaction.
Sol. All the three have more acdic β–Hydrogen so in presence of strong base give product through E1cB reaction.

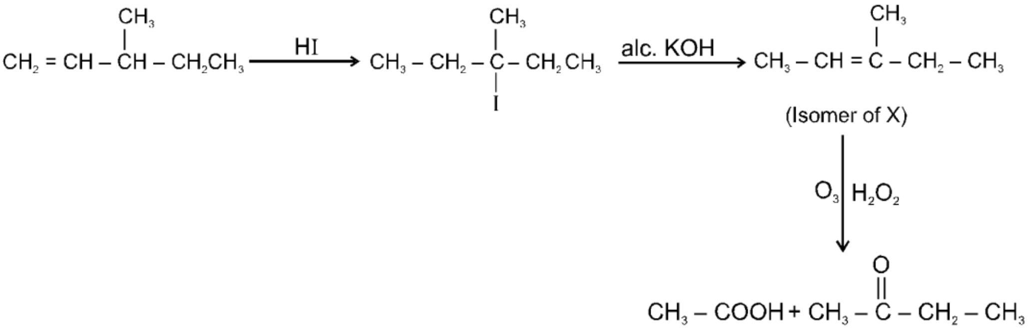
8. **Sol.** Bulky base give Hoffmann alkene as major product.

9. **Sol.** 

(E1cB mechanism)

13. **Sol.** Ethanol used to make Phosgene non-poisonous because it form diethyl carbonate with phosgene.

16. **Sol.**



$$CH_2=CH-\overset{CH_3}{\overset{|}{CH}}-CH_2CH_3 \xrightarrow{HI} CH_3-CH_2-\underset{\underset{I}{|}}{\overset{CH_3}{\overset{|}{C}}}-CH_2CH_3 \xrightarrow{alc.\ KOH} CH_3-CH=\overset{CH_3}{\overset{|}{C}}-CH_2-CH_3$$

(Isomer of X)

$$\xrightarrow{O_3,\ H_2O_2} CH_3-COOH+CH_3-\overset{O}{\overset{||}{C}}-CH_2-CH_3$$

PART - II : MISCELLANEOUS QUESTIONS

Section (A) : ASSERTION/REASONING

A-1. **Ans.** (4)
Sol. Reactivity of alcohol for dehydration : Tertiary > Secondary > Primary

A-2. **Ans.** (1)

A-3. **Ans.** (2)

A-4. Ans. (3)

A-5. **Ans.** (1)
Sol. The cleavage of C–D bond is more difficult than the cleavage of C–H bond.

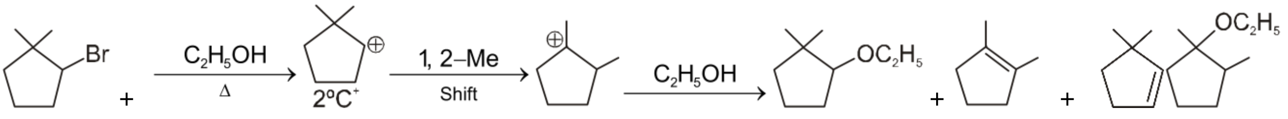
Section (B) : MATCH THE COLUMN

B-1. **Ans.** (1) → (q) ; (2) → (s) ; (3) → (r) ; (4) → (p)

Sol. – 1° Alkyl halide and anionic strong nucleophile ⇒ S_N2
– 2° Alkyl halide and anionic strong base ⇒ E2
– 3° Alcohol and acidic medium ⇒ E1
– 3° Alkyl halide and weak neutral nucleophile ⇒ S_N1

Section (C) : ONE OR MORE THAN ONE OPTIONS CORRECT

C-1. **Sol.**



C-2. **Sol.** Hindered base gives Hofmann alkene while unhindered base gives Saytzeff alkene.

C-3. **Sol.** Strong electronegative group (F, $\overset{+}{N}R_3$, $\overset{+}{S}R_2$) exert strong - I due to this reaction followed by E1cB mechanism. t-also give Hofmann product.

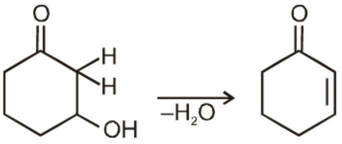
C-4. **Sol.** For E1 cB reaction electron withdrawing group and bad leaving group should be present.

C-5. **Sol.** Rate of E2 reaction ∝ Stability of alkene

Exercise-3

PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

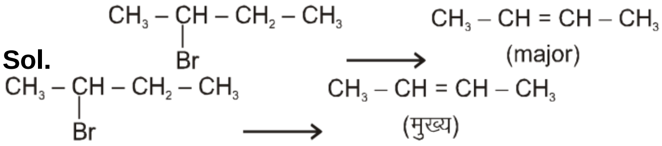
1. **Sol.** Dehydrated product will be conjugated with –C = O and carbocation is also more stable.
futZyhdj.k ls –C = O ds lkFk la;qXeh mRikn nsrk gS rFkk dkcZ/kuk;u e/;orhZ Hkh vf/kd LFkk;h gksrk gSA



2. **Sol.** R – OH $\xrightarrow{H^{\oplus}}$ R – $\overset{\ominus}{O}H_2$ this step is initiation step.

3. **Sol.** According to stability of carbocation.

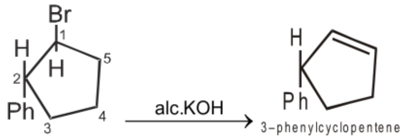
4. **Sol.**



$CH_3-\underset{\displaystyle Br}{\underset{|}{C}H}-CH_2-CH_3 \longrightarrow CH_3-CH=CH-CH_3$ (major)

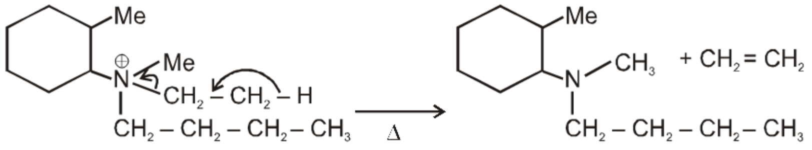
$CH_3-\underset{\displaystyle Br}{\underset{|}{C}H}-CH_2-CH_3 \longrightarrow CH_3-CH=CH-CH_3$ (मुख्य)

5. **Sol.**

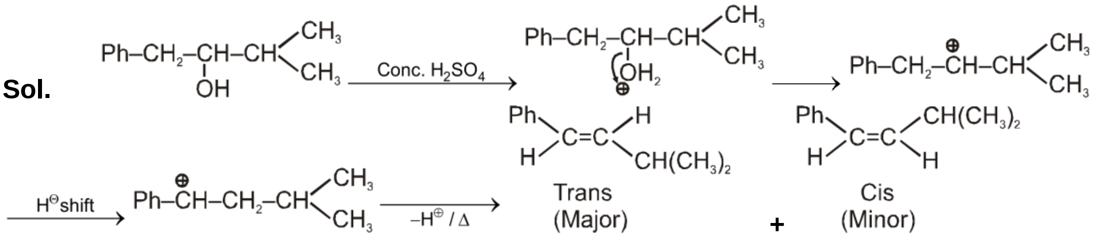


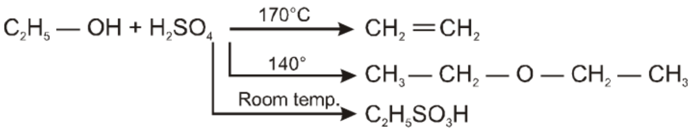
It is anti elimination reaction so hydrogen atom from second carbon will not eliminated as it is in syn-position rather hydrogen atom from 5th carbon will be eliminated.

6. **Sol.**



7. **Sol.**





$C_2H_5-OH + H_2SO_4 \xrightarrow{170°C} CH_2=CH_2$

$\xrightarrow{140°} CH_3-CH_2-O-CH_2-CH_3$

$\xrightarrow{\text{Room temp.}} C_2H_5SO_3H$

8. **Sol.**

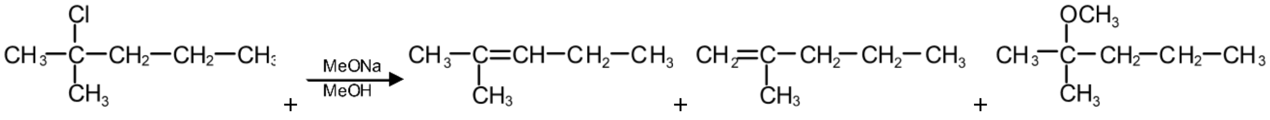
Acetylene is not formed under any conditions.

9. **Sol.**

$2CH_3-CCl_3 \xrightarrow[\Delta]{6Ag} \underset{\text{But-2-yne}}{CH_3-C\equiv C-CH_3} + 6AgCl$

$2CH_3-CCl_3 \xrightarrow[\Delta]{6Ag} \underset{\text{ब्यूट-2-आईन}}{CH_3-C\equiv C-CH_3} + 6AgCl$

10. **Sol.**



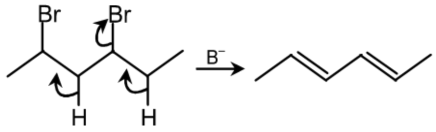
$CH_3-\overset{Cl}{\underset{CH_3}{C}}-CH_2-CH_2-CH_3 \xrightarrow[MeOH]{MeONa} CH_3-\underset{CH_3}{C}=CH-CH_2-CH_3 + CH_2=\underset{CH_3}{C}-CH_2-CH_2-CH_3 + CH_3-\overset{OCH_3}{\underset{CH_3}{C}}-CH_2-CH_2-CH_3$

Elimination dominate over substitution in the given reaction but all the products are possible.

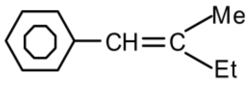
JEE (MAIN) ONLINE PROBLEMS (PREVIOUS YEARS)

1.

Sol.



Conjugated alkene with more HC is more stable and major product.

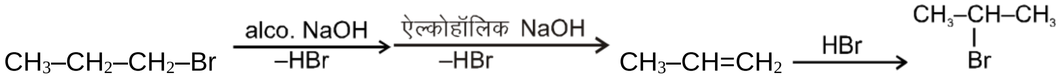
2. **Sol.** 

is most stable Alkene due to conjugation E_2 rate stable alkene.

PART - II : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

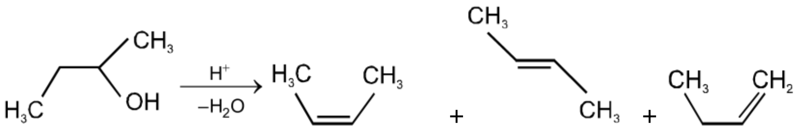
*** Marked Questions may have more than one correct option.**

1. **Sol.**



$CH_3-CH_2-CH_2-Br \xrightarrow[-HBr]{\text{alco. NaOH}} \xrightarrow[-HBr]{\text{ऐल्कोहॉलिक NaOH}} CH_3-CH=CH_2 \xrightarrow{HBr} CH_3-\underset{Br}{CH}-CH_3$

2. **Sol.**

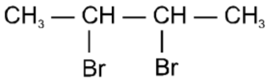


Cis-Butene-2 (1) + Trans-Butene-2 (2) Major + Butene-1 (3)

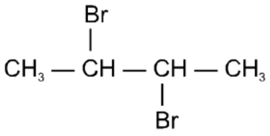
In [F] order of quantity of alkene 2 > 1 > 3.

These on addition with Br_2 / CCl_4 to give their addition products which have $C_4H_8Br_2$ as molecular formula

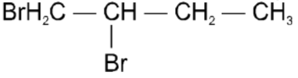
These five products are

(1) 

$CH_3-\underset{Br}{CH}-\underset{Br}{CH}-CH_3$ (Meso)

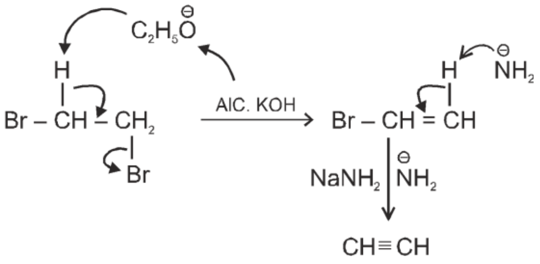
(2) 

$CH_3-\overset{Br}{CH}-\underset{Br}{CH}-CH_3$ (dl)

(3) 

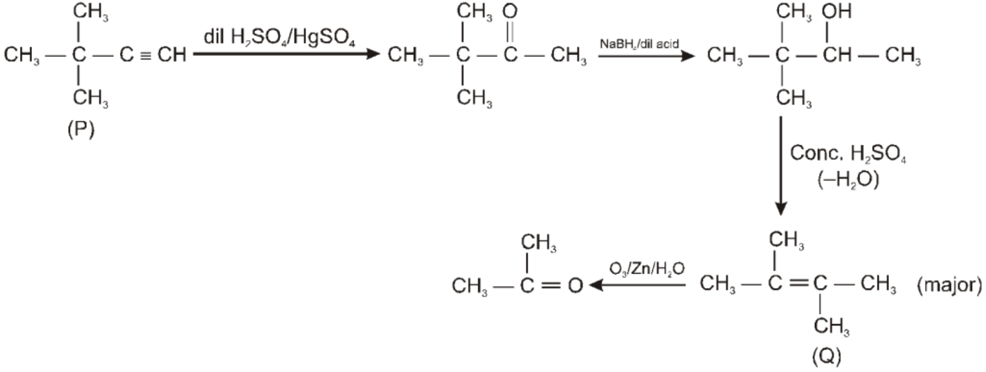
$BrH_2C-\underset{Br}{CH}-CH_2-CH_3$ (dl)

3. **Sol.** Concentrated H_3PO_4 is a dehydrating agent.

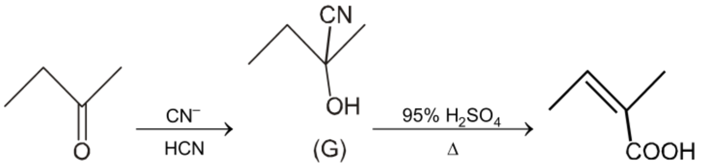


4. **Ans.**

6. **Sol. (5 & 6)**



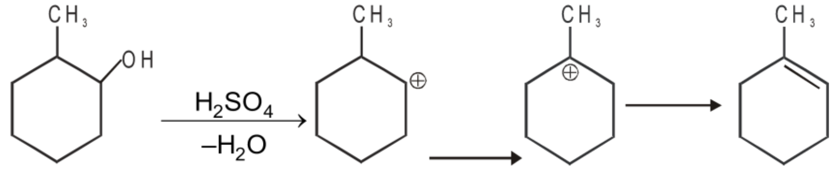
7. **Sol.**



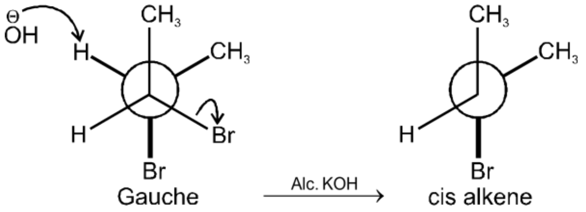
Additional Problems For Self Practice (APSP)

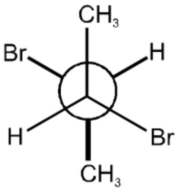
PART - I : PRACTICE TEST PAPER

2. **Sol.**



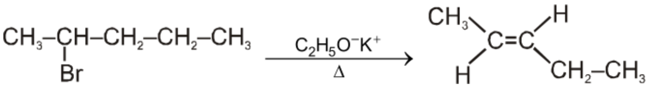
4. **Sol.**



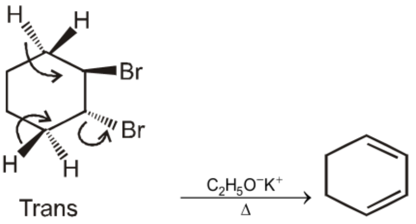


No anti β-H is present.

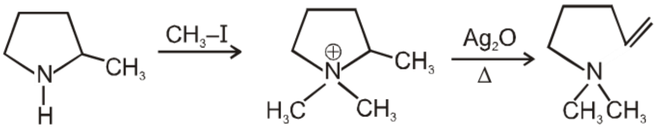
5. **Sol.**



7. **Sol.**

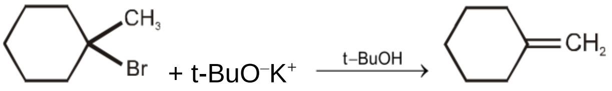


8. **Sol.**



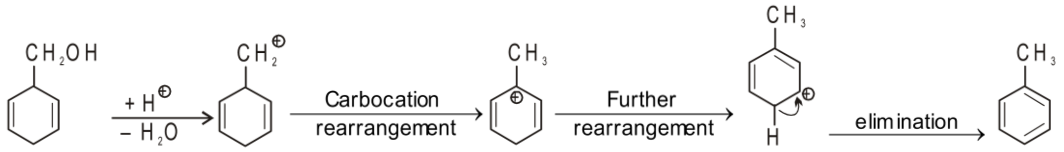
9. **Sol.** Self understood

10. **Sol.**



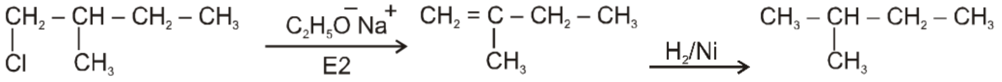
12. **Sol.** The reaction follows E1cb mechanism in which reactant undergoes D exchange alongwith an elimination product.

13. **Sol.**



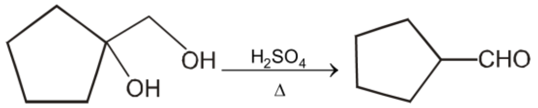
14. **Sol.** It is a basic fact.

15. **Sol.**



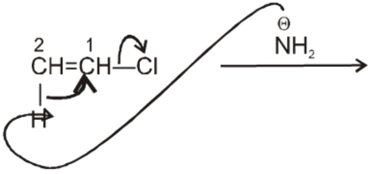
$$\underset{Cl}{CH_2}-\underset{CH_3}{CH}-CH_2-CH_3 \xrightarrow[E2]{C_2H_5\bar{O}Na^+} CH_2=\underset{CH_3}{C}-CH_2-CH_3 \xrightarrow{H_2/Ni} CH_3-\underset{CH_3}{CH}-CH_2-CH_3$$

17. **Sol.**



(Pinacol–Pinacolone rearrangement).

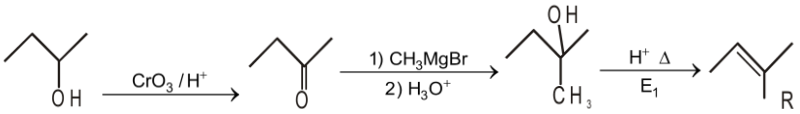
18. **Sol.** β-elimination is that elimination reaction in which substrate looses two atoms from 1 & 2 position.



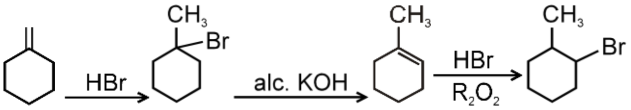
$CH \equiv CH + HCl$

$NaNH_2$ is strong base so give β-elimination reaction.

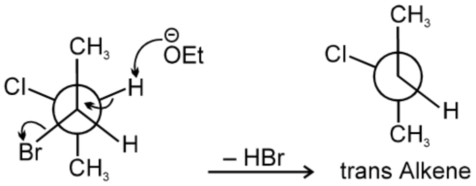
19. **Sol.**



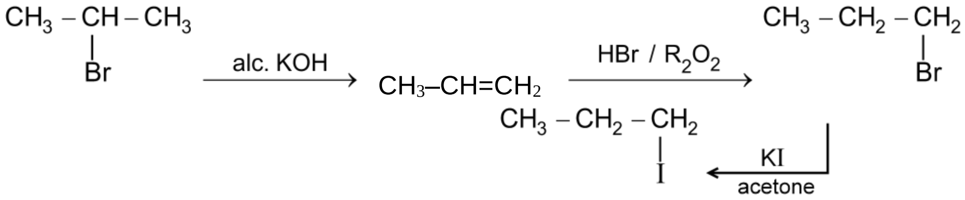
20. **Sol.**



21. **Sol.** The T.S. involves

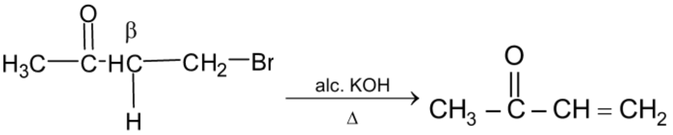


22. **Sol.**



$$\underset{Br}{CH_3-CH-CH_3} \xrightarrow{alc.\ KOH} CH_3-CH=CH_2 \xrightarrow{HBr\ /\ R_2O_2} CH_3-CH_2-\underset{Br}{CH_2} \xrightarrow[acetone]{KI} CH_3-CH_2-\underset{I}{CH_2}$$

29. **Sol.**

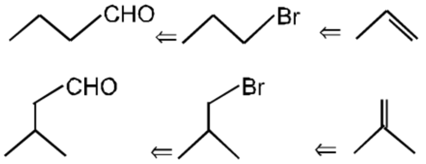


$$H_3C-\overset{O}{\overset{\|}{C}}-\overset{\beta}{\underset{H}{HC}}-CH_2-Br \xrightarrow[\Delta]{alc.\ KOH} CH_3-\overset{O}{\overset{\|}{C}}-CH=CH_2$$

β-hydrogen is more acidic.

PART - II : PRACTICE QUESTIONS

3. **Sol.**

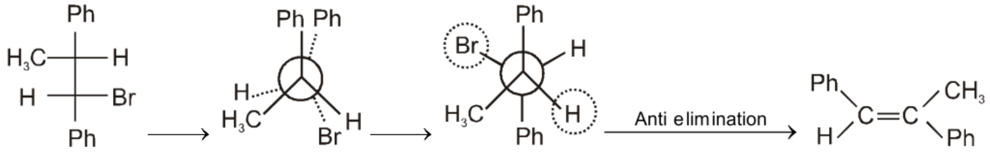


5. **Sol.** $CH_3–CH_2–OH \xrightarrow[-H_2O]{Conc.H_2SO_4\,/\,\Delta} CH_2 = CH_2$

8. **Sol.** 1 and 3 give β–elimination reaction while 2 give α -elimination.

9. **Sol.** Both Cl and H atoms are eliminated from same carbon atom.

10. **Sol.**

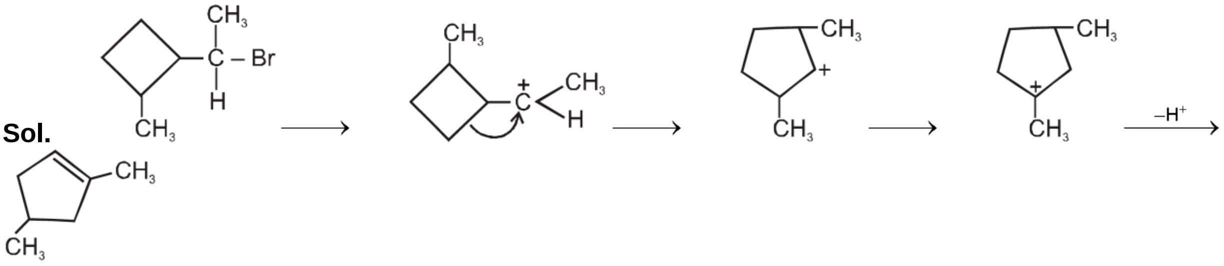


11. **Sol.** For E1cB reaction β-hydrogen must be present and an β-hydrogen must be acidic.

12. **Sol.** $Cl_3C–\boxed{H + HO}–NO_2 \longrightarrow$ Cl_3C $–NO_2$ chloropicrin.

13. **Sol.** No reaction

15. **Sol.**



17. **Sol.** $CHI_3 + Ag + CHI_3 \longrightarrow HC\equiv CH + 6AgI$

20. **Sol.** ROH $\xrightarrow[\substack{PX_3(X=Cl,Br,I)\text{ or}\\ ZnCl_2/HCl}]{PCl_5 \text{ or } SOCl_2 \text{ or}}$ RCl

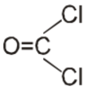
$CH_3CH_2CH_2OH \xrightarrow[-HCl]{PCl_5} CH_3\underset{Alkene}{CH} = CH_2$

B is an alkene (propene)

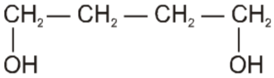
21. **Sol.** Ethyl alcohol is used as a negative catalyst for the aerial oxidation of chloroform in presence of light. So, ethyl alcohol is added to chloroform.

22. **Sol.** It is elimination reaction.

23. **Sol.**



Carbonyl Chloride.

24. **Sol.** 
$\underset{OH}{CH_2}-CH_2-CH_2-\underset{OH}{CH_2}$ has maximum boiling point due to more hydogen bonding.

25. **Sol.** Oxygen is more electronegative thus form stronger hydrogen bonding.