PREFACE

This book contains the Daily Practice Problems (DPPs) designed for the aspirants JEE(Main+Advanced). It is a collection of problems (Physics, Chemistry & Mathematics in separate booklets) from multiple topics to understand the application of concepts learned in theory. Each DPP is kind of a timed test with marking scheme and prescribed time to be spent on each problem. It enables a student to practice time management while solving a problem.

It covers all the pattern of problems asked in Target exam. Answer Key and Hints & Solutions are also given for self evaluation. In all, it is a great tool for regular practice of problems in a systematic manner.

Every effort has been taken to keep this book error free, however any suggestions to improve are welcome at ***dlpd@resonance.ac.in.***

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PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 1

Total Marks : 28

Max. Time : 30 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.5, 6, 8	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.1 to Q.2	(4 marks, 4 min.)	[8, 8]
Short Subjective Questions ('–1' negative marking) Q.3	(3 marks, 3 min.)	[3, 3]
Match the Following (no negative marking) (2 × 4) Q.7	(8 marks, 10 min.)	[8, 10]

1.* 124 amu of P_4 will contain : (At. mass of P = 31)
(A) $4N_A$ atoms of phosphorus
(B) 4 atoms of phosphorus
(C) 1 molecule of phosphorus
(D) N_A molecules of phosphorus

2.* In which of the following pairs do 1 g of each have an equal number of molecules :
(A) N_2O and CO
(B) N_2 and C_3O_2
(C) N_2 and CO
(D) N_2O and CO_2

3._ How many atoms are present in '64 amu' of oxygen.

4. Fill the blanks in the table (where N_A is Avogadro number)

S.No.	Sample	Gram Atomic mass of sample	Moles of sample	No. of atoms present in the sample	Mass removed from the sample	Mole removed from the sample	Atoms removed from the sample	Mass of same no. of C atom as no. of atoms present in the original sample
1.	8 g O	–––	–––	–––	–––	–––	–––	–––
	For Example	16 g	½ mole	$\frac{N_A}{2}$	2 g	⅛ mole	$\frac{N_A}{8}$	6 g
2.	230 g Na				46 g			
3.	60 g Ca					1 mole		
4.	20 g He					3 mole		
5.	56 g N					½ mole		
6.	12 g Mg						$\frac{N_A}{4}$	
7.	128 g S						N_A	
8.	93 g P						$\frac{3N_A}{2}$	

5. If the mass of 0.25 moles of an element X is 2.25 g, the mass of one atom of X is about :
(A) 1.5×10^{-24} g
(B) 2.5×10^{-23} g
(C) 1.5×10^{-23} g
(D) 2.5×10^{-24} g

6. From 392 mg of H_2SO_4, 1.204×10^{21} molecules of H_2SO_4 are removed. How many moles of H_2SO_4 are left:
(A) 2×10^{-3}
(B) 1.2×10^{-3}
(C) 4×10^{-3}
(D) 1.5×10^{-3}.

7.

	Column - I		Column - II
(A)	49 g H_2SO_4	(p)	0.5 mole of given unit
(B)	20 g NaOH	(q)	1.5 N_A atoms
(C)	11.2 L of CO_2 at STP	(r)	0.5 N_A molecules
(D)	6.022×10^{23} atoms of Oxygen	(s)	2 mole of 'O' atom

8. If all the O-atoms from 4.4 g CO_2, 6.022×10^{22} molecules of N_2O_5, 0.2 moles of CO and 1.12 L of SO_2 gas at NTP are removed and combined to form O_2 gas, then the resulting gas occupies a volume of ..... at NTP.
(A) 22.4 L
(B) 44.8 L
(C) 33.6 L
(D) 11.2 L

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 2

Total Marks : 33

Max. Time : 33 min.

Topic : Mole Concept

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.11	**(3 marks, 3 min.)**	**[33, 33]**

1. The mass of half mole of electrons is about : (Given : Mass of electron = 9.109×10^{-28} g)
(A) 0.548 mg (B) 0.274 mg (C) 1.096 mg (D) 9.109 mg

2. 39.4 kg of gold was recovered from a smuggler. The number of atoms of gold recovered are :
(A) 200 (B) 1.2044×10^{25} (C) 6.022×10^{25} (D) 1.2044×10^{26}

3. The mass of Magnesium that contains the same number of atoms as are present in 2g of Calcium is :
(A) 1.2 g (B) 2.4 g (C) 0.6 g (D) 1.8 g

4. The number of gram-atoms present in 288g of sulphur is :
(A) 18 (B) 9 (C) 4.5 (D) 13.5

5. 1.5×10^{22} atoms of an element weigh 0.9 g. The atomic mass of the element (in amu) is :
(A) 36 (B) 18 (C) 54 (D) 72

6. The ratio of mass of a Titanium atom to the mass of a Carbon atom is 4 : 1. Then, the molar mass of Titanium is :
(A) 3 g (B) 48 g (C) 12 g (D) 24 g

7. A hypothetical element Z exists in nature as two isotopes Z^{65} and Z^{67} with their relative abundances 25% and 75% respectively. Then, the average atomic mass (in u) of element Z is :
(A) 65.5 (B) 66 (C) 66.25 (D) 66.5

8. The mass of a molecule of water is :
(A) 3×10^{-26} kg (B) 3×10^{-25} kg (C) 1.5×10^{-26} kg (D) 2.5×10^{-26} kg

9. The weight of 1×10^{22} molecules of $MgSO_4.7H_2O$ is :
(A) 4.1 g (B) 41 g (C) 410 g (D) 0.41 g

10. Among the following samples, the largest number of molecules is in :
(A) 28 g of CO (B) 46 g of C_2H_5OH (C) 36 g of H_2O (D) 54 g of N_2O_5

11. 124 g of P_4 will contain which of the following :
(1) 4 atoms of Phosphorus (2) $4N_A$ atoms of Phosphorus
(3) N_A molecules of Phosphorus (4) 1 molecule of Phosphorus
(A) 1 and 4 (B) 2 and 3 (C) 1 and 3 (D) 2 and 4

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 3

Total Marks : 41

Max. Time : 43 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1'negative marking)Q.1,2,4 to 9,11,12	(3 marks, 3 min.)	[30, 30]
Short Subjective Questions ('–1' negative marking) Q.10	(3 marks, 3 min.)	[3, 3]
Match the Following (no negative marking) (2 × 4) Q.3	(8 marks, 10 min.)	[8, 10]

1. Number of gold atoms in 300 mg of a gold ring of 20 carat gold (pure gold is 24 carat) are :

(A) 4.5×10^{20} (B) 6.8×10^{15} (C) 7.6×10^{20} (D) 9.5×10^{20}

2. From a container having 64 g Oxygen, 11.2 L Oxygen gas at S.T.P. and 6.022×10^{23} Oxygen atoms are removed. Find the mass of the oxygen gas left :

(A) zero (B) 32 g (C) 16 g (D) none

3.

Column-I	Column-II
(A) 32 g each of O_2 and S	(p) 2 moles of Fe
(B) 2 gram-molecules of $K_3[Fe(CN)_6]$	(q) 3 moles of ozone molecule
(C) 144 g of Oxygen atom	(r) one mole of given unit
(D) From 168 g of iron, 6.022×10^{23} atoms of iron are removed, then the iron left	(s) 12 moles of carbon atoms

4. If a sample of Ferric sulphate $Fe_2(SO_4)_3$ contains 7.2 moles of O-atoms, then the number of S-atoms in the given sample are :

(A) $1.8\ N_A$ (B) $1.2\ N_A$ (C) $1.6\ N_A$ (D) $1.4\ N_A$

5. 10 moles of CO_2 do not contain :

(A) 120 g of C (B) 6.022×10^{24} atoms of O

(C) $10\ N_A$ molecules of CO_2 (D) 20 gram-atoms of O.

6. A compound has the molecular formula X_4O_6. If 11 g of X_4O_6 has 6.2 g of X, then atomic mass of X is :

(A) 31 amu (B) 37 amu (C) 42 amu (D) 98 amu

7. A sample of $CaCO_3$ has Ca = 40%, C = 12% and O = 48% by mass. If the law of constant proportions is true, then the mass of Ca in 5 g of $CaCO_3$ from another source will be:

(A) 2 g (B) 0.2 g (C) 0.02 g (D) 20 g

8. In compound A, 1 g nitrogen combine with 0.57 g oxygen. In compound B, 2 g nitrogen combine with 2.28 g oxygen and in compound C, 3 g nitrogen combine with 5.13 g oxygen. These results obey the law of:

(A) multiple proportions (B) constant proportions

(C) mixed proportions (D) none of these

9. The respective ratio of weight of oxygen in samples of pure CuO and Cu_2O, if both samples contain the same mass of copper, is :

(A) 1 : 2 (B) 1 : 1 (C) 2 : 1 (D) none of these

10. Find the relative density of SO_3 gas with respect to methane.

11. The density of air at STP is 0.001287 g mL^{-1}. Its vapour density is :

(A) 143 (B) 14.3 (C) 1.43 (D) 0.143

[**Hint :** Divide with the density of hydrogen at STP, i.e., 0.00009 g mL^{-1}]

12. The atomic mass of a metal is 27. If its valency is 3, the vapour density of the volatile metal chloride will be:

(A) 66.75 (B) 6.675 (C) 667.5 (D) 81

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 4

Total Marks : 31

Max. Time : 33 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.3,4,6,7	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.1,8	(4 marks, 4 min.)	[8, 8]
Short Subjective Questions ('–1' negative marking) Q.2	(3 marks, 3 min.)	[3, 3]
Match the Following (no negative marking) (2 × 4) Q.5	(8 marks, 10 min.)	[8, 10]

1.* 11.2 L of a gas at STP weighs 14 g The gas could be :
(A) N_2O (B) NO_2 (C) N_2 (D) CO

2. A compound of Mg contains 6% of Mg by mass. If the minimum molar mass of the compound is n × 10^2 g/mol then determine value of 'n'.

3. A sample of a compound contains 9.75 g Zn, 1.8 × 10^{23} atoms of Cr and 0.6 gram-atoms of O. What is empirical formula of compound ? (Atomic Mass Zn = 65)
(A) $ZnCrO_4$ (B) $ZnCr_2O_4$ (C) Zn_2CrO_4 (D) $ZnCr_2O_2$

4. An organic compound on analysis was found to contain 0.032% of sulphur by mass. The molecular mass of the compound, if its one molecule contains two sulphur atoms, is :
(A) 100000 u (B) 10000 u (C) 20000 u (D) 200000 u

5.

Column - I	Column - II
(A) A compound containing 5 g 'S' and 5 g oxygen	(p) Empirical formula is CH_2
(B) A hydrocarbon containing $\frac{600}{7}$ % 'C' by mass	(q) Molecular formula is C_2H_4
(C) A compound containing $\frac{300}{11}$% of 'C' and $\frac{800}{11}$% of 'O' by mass	(r) Empirical formula is SO_2
(D) A hydrocarbon containing $\frac{100}{7}$ % H by mass (Molecular mass = 28)	(s) Empirical formula is CO_2

6. 0.1 mole of a carbohydrate with empirical formula CH_2O contains 1 g of hydrogen. What is its molecular formula?
(A) $C_5H_{10}O_5$ (B) $C_6H_{12}O_6$ (C) $C_4H_8O_4$ (D) $C_3H_6O_3$

7. The number of moles of oxygen obtained by the electrolytic decomposition of 90 g water is :

$$(2H_2O \xrightarrow{\text{elec.}} 2H_2 + O_2)$$

(A) 2.5 (B) 5 (C) 7.5 (D) 10

8.* In a gaseous reaction of type :

$$xA(g) + yB(g) \longrightarrow pC(g) + qD(g)$$

where x, y, p and q are stoichiometric coefficients.
Which of the following statements is/are correct :
(A) At STP, x litre of A combine with y litre of B to give C and D
(B) x mole of A combine with y mole of B to give C and D
(C) x g of A combine with y g of B to give C and D.
(D) x molecules of A combine with y molecules of B to give C and D.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 5

Total Marks : 33

Max. Time : 34 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1,2,3,5	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.4,6	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.8 to 10	(3 marks, 3 min.)	[9, 9]

1. Sulphur trioxide is prepared by the following two reactions :

$S_8(s) + 8O_2(g) \rightarrow 8SO_2(g)$

$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$

How many grams of SO_3 are produced from 1 mole of S_8 :

(A) 1280 (B) 640 (C) 960 (D) 320

2. 3L of N_2 gas are mixed with 6L of H_2 gas to form NH_3 gas. What volume of NH_3 gas can be produced, if all volumes are measured under same temperature and pressure conditions :

(A) 6L (B) 4L (C) 9L (D) 2L

3. Zinc and hydrochloric acid react according to the reaction :

$Zn(s) + 2HCl(aq.) \longrightarrow ZnCl_2(aq.) + H_2(g)$

If 0.30 mole of Zn are added to hydrochloric acid containing 0.52 mole HCl, how many moles of H_2 are produced:

(A) 0.26 (B) 0.52 (C) 0.14 (D) 0.30

4.* 3 moles of gas C_2H_6 are mixed with 60 g of this gas and 2.4×10^{24} molecules of the gas are then removed. The left over gas is burnt in the presence of excess oxygen.

Then : ($N_A = 6 \times 10^{23}$) (Density of water = 1g/mL)

(A) 2 moles of C_2H_6 are left for combustion.

(B) Volume of CO_2 at S.T.P. produced after combustion is 44.8 litre.

(C) Volume of liquid water produced is 54 mL.

(D) None of these

5. 3.68 g of a mixture of $CaCO_3$ and $MgCO_3$ is heated to liberate 0.04 mole of CO_2. The mole % of $CaCO_3$ and $MgCO_3$ in the mixture is respectively :

(A) 50%, 50% (B) 60%, 40% (C) 40%, 60% (D) 30%, 70%

6.* Amongst the following, select the **false** statements :

(A) Limiting reagent must have the least moles among all the reactants available in a chemical reaction.

(B) If equal masses of aluminium and oxygen are made to combine to produce Al_2O_3, then aluminium will be the limiting reagent.

(C) A 2 : 3 molar ratio mixture of Na_2CO_3 and $MgCO_3$ produces 0.3 mole of CO_2 per mole of the initial mixture upon strong heating.

(D) All of these

7. 120 g Mg was burnt in air to give a mixture of MgO and Mg_3N_2. The mixture is now dissolved in HCl to form $MgCl_2$ and NH_4Cl. If 107 grams NH_4Cl is produced, then determine the moles of $MgCl_2$ formed.

Comprehension # (Q. 8 to Q. 10)

For a reaction :

$$aA + bB \longrightarrow cC + dD$$

Three students stated different ways of determining limiting reagent.

Student 1 : Calculate the minimum moles of 'A' needed to completely consume 'B', and if available amount of 'A' exceeds what is needed, then 'B' is limiting reagent, otherwise 'A' will be limiting reagent.

Student 2 : Calculate the mole ratio (ratio of moles of the reactants initially taken) of reactant, then compare it with theoretical mole ratio (according to stoichiometry of the reaction). If the theoretical ratio exceeds ratio of moles actually taken, then reactant in denominator will be limiting reagent.

Student 3 : Calculate the amount of product (any one of the product) that can be obtained if each reactant is completely consumed and that reactant is limiting reagent, which has produced least mass of product.

8. Which student(s) has/have defined limiting reagent correctly :

(A) Student – 1 (B) Student – 2

(C) Student – 3 (D) All are correct

9. If student 1 in first experiment finds that, when 1 mole of 'A' reacted with excess of reagent 'B' and in second experiment when 1 mole of 'B' reacted with excess of reagent 'A', then in the later experiment, mass of the product produced was greater. Then which should be the limiting reagent :

(A) A (B) B

(C) None of these (D) Cannot be predicted

10. If initially 'x' moles of 'A' are taken with 'y' moles of 'B', which of the following is correct :

(i) If $\frac{a}{b} = \frac{x}{y}$, then no reactant is left over

(ii) If $\frac{a}{b} > \frac{x}{y}$, then 'B' reactant is llimiting reagent

(iii) If $\frac{a}{b} < \frac{x}{y}$, then 'B' is limiting reagent

(iv) If $\frac{x}{y} > \frac{a}{b}$, then 'A' is limiting reagent.

(A) i & iv (B) i & iii (C) Only i (D) i , ii & iv

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 6

Total Marks : 32

Max. Time : 32 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1,2,9,7	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.6,10	(4 marks, 4 min.)	[8, 8]
Short Subjective Questions ('–1' negative marking) Q.8	(3 marks, 3 min.)	[3, 3]
Comprehension ('–1' negative marking) Q.3 to 5	(3 marks, 3 min.)	[9, 9]

1. The oxidation number of sulphur in S_8, S_2F_2 and H_2S respectively are :
(A) 0, + 1 and – 2 (B) + 2, + 1 and – 2 (C) 0, + 1 and + 2 (D) – 2, + 1 and – 2

2. Which of the following compounds have sulphur atom in its maximum oxidation state :
$X = H_2SO_4$; $Y = H_2SO_5$; $Z = H_2S_2O_8$
(A) Z only (B) Y and Z only (C) Y only (D) X, Y and Z

Comprehension # (Q. 3 to Q. 5)

Oxidation state of an element in a particular species (atom, molecule or ion) is the number of electrons gained or lost by that element during its change from free state into combined state. For example, the oxidation state of Na in NaCl is +1, calcium in $Ca_3(PO_4)_2$ is +2, and chlorine in Cl_2 is zero.
(1) Oxidation number is given positive sign if electrons are lost and oxidation number is given negative sign if electrons are gained.
(2) Oxidation number represents charge in case of ionic compounds. However, in covalent compounds, it represents imaginary charge. Now answer the following questions (3-5) :

3. Identify the **correct** statement :
(A) Halogens always have –1 oxidation state in their compounds.
(B) Oxidation number can be zero, negative, positive, integer or fractional.
(C) In OF_2, the oxidation number of F is +1.
(D) Hydrogen is always given + 1 oxidation number in its compounds.

4. When $KMnO_4$ reacts with $FeSO_4$ in acidic medium, it is converted into $MnSO_4$. Then change in oxidation number for Mn in the above process is :
(A) 7 (B) 2 (C) 5 (D) 0

5. $K_2Cr_2O_7 + C_2O_4^{2-} + H_2SO_4 \longrightarrow K_2SO_4 + CO_2 + Cr_2(SO_4)_3 + H_2O$
In above reaction, identify the elements which do not undergo change in their oxidation state :
(A) C (B) S & Cr (C) K, O , S & H (D) C & O

6.* Which of the following changes involve either oxidation or reduction :
(A) $VO^{2+} \rightarrow V_2O_3$ (B) $Na \rightarrow Na^+$ (C) $Zn^{+2} \rightarrow Zn$ (D) $CrO_4^{-2} \rightarrow Cr_2O_7^{-2}$

7. Which of the following is not a redox reaction :
(A) $Mg + N_2 \longrightarrow Mg_3N_2$ (B) $MnO_4^- + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2$
(C) $CuSO_4 + KI \longrightarrow 2CuI + I_2 + K_2SO_4$ (D) $AgCl + NH_3 \longrightarrow [Ag(NH_3)_2]Cl$

8. $Zn + NO_3^- \longrightarrow Zn^{2+} + NH_4^+ + H_2O$
How many moles of electrons, per mole of NO_3^- ion, are gained in the above reaction ?

9. Arsenic estimation can be done by Bettendorff's process. The reaction is given below :
$As_4O_6 + SnCl_2 + HCl \longrightarrow As_4 + SnCl_4 + H_2O$
Find out the exact stoichiometric cofficiant of the reactants respectively :
(in the order as given in question)
(A) 2, 4, 6 (B) 1, 6, 12 (C) 2, 8, 20 (D) None of these

10.* Which of the following can show disproportionation reaction :
(A) ClO_4^- (B) Cl^- (C) ClO_2^- (D) ClO_3^-

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 7

Total Marks : 15

Max. Time : 15 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Short Subjective Questions ('–1' negative marking) Q.4 to Q.5	(3 marks, 3 min.)	[6, 6]

1. When white phosphorus reacts with caustic soda, the products are PH_3 and NaH_2PO_2. This reaction is an example of :

(A) Oxidation (B) Reduction

(C) Disproportionation (D) Neutralisation

2. Which of the following changes does not involve either oxidation or reduction :

(A) $VO^{2+} \rightarrow V_2O_3$ (B) $Na \rightarrow Na^+$

(C) $Zn^{+2} \rightarrow Zn$ (D) $CrO_4^{-2} \rightarrow Cr_2O_7^{-2}$

3. Which of the following is not a redox reaction :

(A) $Mg + N_2 \longrightarrow Mg_3N_2$ (B) $MnO_4^- + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2$

(C) $CuSO_4 + KI \longrightarrow 2CuI + I_2 + K_2SO_4$ (D) $AgCl + NH_3 \longrightarrow [Ag(NH_3)_2]Cl$

4. Identify the oxidant and the reductant in the following reactions :

(a) $KMnO_4 + KCl + H_2SO_4 \longrightarrow MnSO_4 + K_2SO_4 + H_2O + Cl_2$

(b) $FeCl_2 + H_2O_2 + HCl \longrightarrow FeCl_3 + H_2O$

(c) $Cu + HNO_3$ (dil) $\longrightarrow Cu(NO_3)_2 + H_2O + NO$

(d) $Na_2HAsO_3 + KBrO_3 + HCl \longrightarrow NaCl + KBr + H_3AsO_4$

(e) $I_2 + Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + NaI$

5. Balance the following redox equations :

(i) $K_2Cr_2O_7 + H_2O_2 + H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + O_2$

(ii) $Zn + NaNO_3 + NaOH \longrightarrow Na_2ZnO_2 + H_2O + NH_3$

(iii) $Al \longrightarrow [Al(OH)_4]^- + H_2$ (basic)

(iv) $Cu_3P + Cr_2O_7^{2-} \longrightarrow Cu^{2+} + H_3PO_4 + Cr^{3+} + H_2O$

(v) $ClO_3^- + Fe^{2+} + H^+ \longrightarrow Cl^- + Fe^{3+} + H_2O$

(vi) $N_2O_4 + BrO_3^- \longrightarrow NO_3^- + Br^-$ (in acidic medium)

(vii) $S_2O_3^{2-} + Sb_2O_5 \longrightarrow SbO + H_2SO_3$

(viii) $Cr_2O_7^{2-} + I^- + H^+ \longrightarrow Cr^{3+} + I_2 + H_2O$

(ix) $IO_4^- + I^- + H^+ \longrightarrow I_2 + H_2O$

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 8

Total Marks : 32

Max. Time : 32 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1,3,4	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.5,6	(4 marks, 4 min.)	[8, 8]
Short Subjective Questions ('–1' negative marking) Q.2	(3 marks, 3 min.)	[3, 3]
Comprehension ('–1' negative marking) Q.7 to 10	(3 marks, 3 min.)	[12, 12]

1. What volume of a 0.8 M solution contains 100 millimoles of the solute :
(A) 100 mL (B) 125 mL (C) 500 mL (D) 62.5 mL

2. Calculate the volume in litre of 1M solution of HCl, which contains 36.5 g HCl.

3. The molarity of the KOH solution which is 2.8% (mass/volume) solution is :
(A) M/10 (B) M/2 (C) M/5 (D) 1 M

4. 75 ml of H_2SO_4 (specific gravity = 1.18) containing 49% H_2SO_4 by mass is diluted to 590 ml. Calculate molarity of the diluted solution :
(A) 0.7 M (B) 7.5 M (C) 0.75 M (D) 0.25 M

5*. If 100 ml of 1M H_2SO_4 solution is mixed with 100 ml of 9.8%(w/w) H_2SO_4 solution (d = 1 g/ml), then :
(A) concentration of solution remains same
(B) volume of solution become 200 ml
(C) mass of H_2SO_4 in the solution is 98 g
(D) mass of H_2SO_4 in the solution is 19.6 g

6*. For 100 ml of 0.3 M $CaCl_2$ solution + 400 ml of 0.1 M HCl solution, correct datas is/are :
(A) Total concentration of cation(s) = 0.14 M
(B) Total concentration of cation(s) = 0.07 M
(C) $[Cl^-]$ = 0.1 M
(D) $[Cl^-]$ = 0.2 M

Comprehension # (Q.7 to Q.10)

The concentrations of solutions can be expressed in number of ways; viz : mass fraction of solute (or mass percent), Molar concentration (Molarity) and Molal concentration (molality). These terms are known as concentration terms and also they are related with each other i.e.knowing one concentration term for the solution, we can find other concentration terms also. The definition of different concentration terms are given below :
Molarity : It is number of moles of solute present in one litre of the solution.
Molality : It is the number of moles of solute present in one kg of the solvent.

$$\text{Mole Fraction} = \frac{\text{moles of solute}}{\text{moles of solute} + \text{moles of solvent}}$$

If molality of the solution is given as 'a', then mole fraction of the solute can be calculated by :

$$\text{Mole Fraction} = \frac{a}{a + \frac{1000}{M_{solvent}}} = \frac{a \times M_{solvent}}{(a \times M_{solvent} + 1000)}$$

where a = molality and $M_{solvent}$ = Molar mass of solvent.

We can change : Mole fraction $\leftrightarrow$ Molality $\leftrightarrow$ Molarity.

7. 120 g of solution containing 40% by mass of NaCl is mixed with 200 g of a solution containing 15% by mass NaCl. Determine the mass percent of sodium chloride in the final solution :
(A) 24.4% (B) 78% (C) 48.8% (D) 19.68%

8. What is the molality of the above final solution :
(A) 4.4 m (B) 5.5 m (C) 24.4 m (D) none of these

9. What is the mole fraction of the solute in the above final solution :
(A) 0.18 (B) 0.75 (C) 0.09 (D) 0.25

10. What is the molarity of above final solution if density of solution is 1.6 g/ml :
(A) 5.5 M (B) 6.6 M (C) 2.59 M (D) None of these

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 9

Total Marks : 49

Max. Time : 54 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.2,4,5	(3 marks, 3 min.)	[9, 9]
True or False (no negative marking) Q.6	(2 marks, 2 min.)	[2, 2]
Subjective Questions ('–1' negative marking) Q.7, 8 & 10	(4 marks, 5 min.)	[12, 15]
Short Subjective Questions ('–1' negative marking) Q.1,3,6,10	(3 marks, 3 min.)	[9, 9]
Match the Following (no negative marking) (2 × 4) Q.9	(8 marks, 10 min.)	[8, 10]
Comprehension ('–1' negative marking) Q.11 to Q.13	(3 marks, 3 min.)	[9, 9]

1. If the mass of one atom of an element X is about 6×10^{-23} g, how many moles of X are equivalent to 144 g of X ?

2. The atomic weight of an element is 'a'. If this element occurs in nature as a triatomic gas, then the correct formula for the number of moles of gas in its 'w' g is :

(A) $\frac{3w}{a}$ (B) $\frac{w}{3a}$ (C) 3wa (D) $\frac{a}{3w}$

3. Find the total number of protons in 11.2 L of phosphine (PH_3) gas under NTP conditions.

4. The density of water at 4°C is 1×10^{3} kg m^{-3}. Assuming no empty space to be present between water molecules, the volume occupied by one molecule of water is approximately :

(A) 3×10^{-23} mL (B) 6×10^{-22} mL (C) 3×10^{-21} mL (D) 9×10^{-23} mL

5. The density of air at STP is 0.001277 g mL^{-1}. Its vapour density is about :

(A) 143 (B) 14.3 (C) 1.43 (D) 0.143

6. State whether the following statements are true or false :

(i) According to law of definite proportions, two elements always combine in the same ratio by mass.

(ii) Different proportions of oxygen for a fixed mass of nitrogen in the various oxides of nitrogen prove the law of multiple proportions.

(iii) If 2.8 L of an unknown gas at NTP weighs 5.5 g, then the gas could be CO_2 or N_2O.

(iv) 5 g urea (NH_2CONH_2) and 5 g Acetic acid (CH_3COOH), both contain the same total number of atoms.

7. An oxide of Osmium (symbol Os) is pale yellow solid. If 2.794 g of the compound contains 2.09 g of osmium, what is its empirical formula ? (At. wt. of Os = 190)

8. When Dinitrogen pentaoxide (N_2O_5, a white solid) is heated, it decomposes into nitrogen dioxide and oxygen.

If a sample of N_2O_5 produces 1.6 g O_2, then how many grams of NO_2 are formed ?

$$N_2O_5(s) \xrightarrow{\Delta} NO_2(g) + O_2(g) \quad \text{(not balanced)}$$

9. Match the following :

	Column-I For 1 mole of reactant placed in an open container in each reaction		Column-II Product
(A)	PCl_5 (g) $\xrightarrow{\Delta}$ PCl_3 (g) + Cl_2(g)	(p)	$2N_A$ molecules are produced
(B)	$CaCO_3$ (s) $\xrightarrow{\Delta}$ CaO(s) + CO_2 (g)	(q)	67.2 litre gaseous product at STP
(C)	2HCl (g) $\xrightarrow{\Delta}$ H_2 (g) + Cl_2 (g)	(r)	22.4 litre gaseous product at STP
(D)	NH_4COONH_2 (s) $\xrightarrow{\Delta}$ $2NH_3$(g) + CO_2(g)	(s)	44.8 litre gaseous product at STP

10. An alloy of iron and carbon was treated with sulfuric acid, in which only iron reacts :

$$2Fe(s) + 3H_2SO_4(aq) \longrightarrow Fe_2(SO_4)_3(aq) + 3H_2(g)$$

If a sample of alloy weighing 140 g gave 6 g of hydrogen, what is the percentage of iron in the alloy ?

Comprehension # (Q. 11 to Q. 13)

Iodine is an important substance needed by the body of a human being. We consume it in the form of salt, which has very-very small % content of I_2. Iodine has various industrial applications also. The following process has been used to obtain iodine from oil-field brines in California :

$$NaI + AgNO_3 \longrightarrow AgI + NaNO_3$$

$$AgI + Fe \longrightarrow FeI_2 + Ag$$

$$FeI_2 + Cl_2 \longrightarrow FeCl_3 + I_2$$

11. If 381 kg of iodine is produced per hour, then mass of $AgNO_3$ required per hour will be :

(A) 170 kg (B) 340 kg (C) 255 kg (D) 510 kg

12. If above reaction is carried out by taking 150 kg of NaI and 85 kg of $AgNO_3$, then number of moles of iodine formed is :

(A) 0.5 (B) 500 (C) 250 (D) 0.25

13. If 324 g of Ag is recovered in pure form, then minimum amount of NaI required will be :

(A) 450 g (B) 150 g (C) 300 g (D) 600 g

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 10

Total Marks : 52

Max. Time : 62 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Subjective Questions ('–1' negative marking) Q.1 to 3 , 7 to 11, 13	(4 marks, 5 min.)	[32, 40]
Short Subjective Questions ('–1' negative marking) Q.12	(3 marks, 3 min.)	[3, 3]
Comprehension ('–1' negative marking) Q.4 to 6	(3 marks, 3 min.)	[9, 9]
Match the Following (no negative marking) (2 × 4) Q.14	(8 marks, 10 min.)	[8, 10]

1. An alloy has Fe,Co and Mo equal to 60%,29.5% and 10.5% by mass respectively. How many cobalt atoms are there in a cylinder made from same alloy, having radius 2.1 cm and a length of 10 cm ? The density of alloy is $\frac{100}{21}$ g/mL. Atomic weight of cobalt = 59 u.

2. What weight of CO is required to form $Re_2(CO)_{10}$ from 2.42 g of Re_2O_7 according to the given unbalanced reaction ? $Re_2O_7 + CO \longrightarrow Re_2(CO)_{10} + CO_2$
(Atomic mass of Re = 186 u)

3. Haemoglobin contains 0.25% iron by weight. The molecular weight of Haemoglobin is 89600 u. Calculate the weight of $K_4[Fe(CN)_6]$ that can be produced, if all the iron atoms from 4.48 kg haemoglobin are converted into $K_4[Fe(CN)_6]$ through a series of reactions.

Comprehension # (Q. 4 to Q. 6).

Nitric acid is the most important oxyacid formed by nitrogen. It is one of the major industrial chemicals and is widely used. Nitric acid is manufactured by the catalytic oxidation of ammonia, that is known as Ostwald process, which can be represented by the sequence of reactions shown below :

$$4NH_3(g) + 5O_2(g) \xrightarrow[\text{Catalyst}]{Pt/Rh} 4NO(g) + 6H_2O(g) \quad ...(1)$$

$$2NO(g) + O_2(g) \xrightarrow{1120\,K} 2NO_2(g) \quad ...(2)$$

$$3NO_2(g) + H_2O(\ell) \longrightarrow 2HNO_3(aq) + NO(g) \quad ...(3)$$

The aqueous nitric acid obtained by this method can be concentrated by distillation to ≈ 68.5% by weight. Further concentration to 98% acid can be achieved by dehydration with concentrated sulfuric acid.

4. 85 kg of NH_3 (g) was heated with 320 kg oxygen in the first step and HNO_3 is prepare according to the above reactions. If the final solution has volume 500 L, then molarity of HNO_3 solution is :
(A) 2M (B) 8M (C) 3.33 M (D) 6.66 M

5. If 180 L of water completely reacts with NO_2 produced to form nitric acid according to the above reactions, then the volume of air required at STP containing 20% of NH_3 by volume is : $(\rho_{H_2O} = 1\,g/mL)$
(A) 1.56×10^6 L (B) 6.72×10^4 L (C) 3.36×10^6 L (D) None of these

6. If 170 kg of NH_3 is heated in excess of oxygen, then the volume of H_2O (ℓ) produced in 1st reaction at STP is : $(\rho_{H_2O} = 1\,g/mL)$

(A) 336×10^3 L (B) 270 L (C) 224×10^3 L (D) 170 L

7. How many grams of Sodium dichromate ($Na_2Cr_2O_7$) should be added to a 50 mL volumetric flask to prepare 0.025 M $Na_2Cr_2O_7$ solution, when the flask is filled upto the mark with water ?

8. What volume of 0.25 M HNO_3 (nitric acid) solution reacts with 50 mL of 0.15 M Na_2CO_3 (sodium carbonate) solution in the following reaction :

$$2HNO_3(aq) + Na_2CO_3(aq) \longrightarrow 2NaNO_3(aq) + H_2O(\ell) + CO_2(g)$$

9. How would you prepare exactly 3 litre of 1 M NaOH solution by mixing proportions of stock solutions of 2.5 M NaOH and 0.4 M NaOH, if no water is to be used. Find the ratio of the volume (v_1/v_2).

10. A sample of H_2SO_4 (density 1.4 g mL^{-1}) solution is labelled as 84% by weight. What is molarity of acid solution? What volume of this acid solution has to be used to make 1 litre of 0.2 M H_2SO_4 solution ?

11. 10 mL of sulphuric acid solution (sp. gr. = 1.84) contains 98% by weight of pure acid. Calculate the volume of 2.5 M NaOH solution required to just neutralize the above acid solution.

12. When 10 g NaOH is added with 90 g of H_2O, a solution having density 1.2 g/mL is obtained. Then, calculate the following for this solution :

(i) % w/w (ii) % w/v (iii) mole fraction of NaOH (iv) molarity (M) (v) molality (m)

13. Out of 5.85% w/v aq. NaCl solution and 5.55% w/v aq. $CaCl_2$ solution, which solution has more number of Cl^- ions per mL of solution ?

14. **Match the following :**

Column-I	**Column-II**
(A) 1 M glucose solution	(p) 1 mole solute per litre solution
(B) 3 M urea solution	(q) 180 g solute per litre solution
(C) 3 M CH_3COOH solution	(r) % w/v = 18% (solution)
(D) 1 M H_2SO_4 solution	(s) % w/v = 9.8% (solution)

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 11

Total Marks : 25

Max. Time : 26 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to 3,6,7	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]
Short Subjective Questions ('–1' negative marking) Q.4,5	(3 marks, 3 min.)	[6, 6]

1. The mass of a neutron is .... than the mass of a proton :

(A) slightly less (B) slightly more

(C) exactly equal (D) their masses cannot be compared

2. The ratio of the number of neutrons present in one atom each of C and Si with respect to mass number of 12 and 28 respectively is :

(A) 3 : 7 (B) 7 : 3 (C) 3 : 4 (D) 6 : 28

3. An atom consist of electrons, protons and neutrons. If the mass attributed to neutron was halved and that attributed to the electron was doubled, the atomic mass of $_6C^{12}$ would be approximately :

(A) Same (B) Doubled (C) Halved (D) Reduced by 25%

4. There are 11 protons and 12 neutrons in the nucleus of an atom. Find the atomic number (Z), mass number (A), number of electrons and the symbol of the element.

5. Calculate the number of protons, electrons and neutrons in $^{15}_{8}O^{2-}$.

6. The total number of electrons in a nitrate ion is :

(A) 31 (B) 62 (C) 32 (D) 63

7. Atomic radius is of the order of 10^{-8} cm and nuclear radius is of the order of 10^{-13} cm. The fraction of atom that is occupied by nucleus is :

(A) 10^{-5} (B) 10^{5} (C) 10^{-15} (D) None of these

8._ If an atom of an element X contains equal number of protons, neutrons and electrons, and its atomic number (Z) and mass number (A) are related as : 2A + 3Z = 140, then find the total number of nucleons present in one atom of element X. Also identify the element.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 12

Total Marks : 44

Max. Time : 46 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1,3,5	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.2, 4,6	(4 marks, 4 min.)	[12, 12]
Short Subjective Questions ('–1' negative marking) Q.10,12	(3 marks, 3 min.)	[6, 6]
Comprehension ('–1' negative marking) Q.7 to 9	(3 marks, 3 min.)	[9, 9]
Match the Following (no negative marking) (2 × 4) Q.11	(8 marks, 10 min.)	[8, 10]

1. The potential energy of the electron present in the ground state of Li^{2+} ion is represented by :

(r = Radius of ground state)

(A) $+\dfrac{3e^2}{4\pi \epsilon_0 r}$ (B) $-\dfrac{3e}{4\pi \epsilon_0 r}$ (C) $-\dfrac{3e^2}{4\pi \epsilon_0 r^2}$ (D) $-\dfrac{3e^2}{4\pi \epsilon_0 r}$

2. Which of the following are isotopes :

(i) Atom, whose nucleus contains 20p + 15n
(ii) Atom, whose nucleus contains 20p + 17n
(iii) Atom, whose nucleus contains 18p + 22n
(iv) Atom, whose nucleus contains 18p + 21n

(A) (i) and (iii) (B) (i) and (ii) (C) (ii) and (iii) (D) (iii) and (iv)

3. Which of the following are isobars :

(i) Atom, whose nucleus contains 20p + 15n
(ii) Atom, whose nucleus contains 20p + 20n
(iii) Atom, whose nucleus contains 18p + 17n
(iv) Atom, whose nucleus contains 18p + 22n

(A) (i) and (iii) (B) (ii) and (iii) (C) (iii) and (iv) (D) (i) and (iv)

4. Which of the following is/are isotones :

(A) ${}_1^2H$, ${}_1^3H$ (B) ${}_7^{15}N$, ${}_8^{16}O$ (C) ${}_{18}^{40}Ar$, ${}_{20}^{40}Ca$ (D) ${}_1^3H$, ${}_2^4He$

5. Which of the following are isoelectronic :

(I) CH_3^+ (II) H_3O^+ (III) NH_3 (IV) CH_3^-

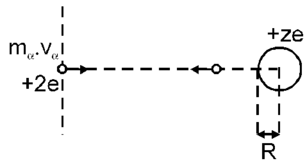
(A) I and III (B) III and IV (C) I and II (D) II, III and IV

6.* Which of the following are isoelectronic species :

(A) CO_3^{2-}, NO_3^- (B) SO_4^{2-}, PO_4^{3-} (C) CO_2, N_2O (D) N^{3-}, Al^{3+}

Comprehension # (Q.7 to Q.9)

The approximate size of the nucleus can be calculated by using energy conservation theorem in Rutherford's α-scattering experiment. If an α-particle is projected from infinity with speed v, towards the nucleus having z protons, then the α-particle which is reflected back or which is deflected by 180^0 must have approached closest to the nucleus. It can be approximated that α-particle collides with the nucleus and gets back. Now, if we apply the energy conservation equation at initial point and collision point, then :



$$(\text{Total Energy})_{\text{initial}} = (\text{Total Energy})_{\text{final}}$$

$$(K.E.)_i + (P.E.)_i = (K.E.)_f + (P.E.)_f$$

$(P.E.)_i = 0$, since P.E. of two charge system separated by infinite distance is zero. Finally the particle stops and then starts coming back.

$$\frac{1}{2} m_\alpha v_\alpha^2 + 0 = 0 + \frac{Kq_1q_2}{R} \Rightarrow \frac{1}{2} m_\alpha v_\alpha^2 = K\frac{2e \times ze}{R} \Rightarrow R = \frac{4Kze^2}{m_\alpha v_\alpha^2}$$

Thus the radius of nucleus can be calculated using above equation. The nucleus is so small a particle that we can't define a sharp boundary for it. Experiments show that the average radius R of a nucleus may be written as:

$$R = R_0(A)^{1/3}$$

where $R_0 = 1.2 \times 10^{-15}$ m

A – mass number of atom

R – radius of nucleus

7. If the diameter of two different nuclei are in the ratio 1:2, then their mass number are in the ratio :

(A) 1:2 (B) 8:1 (C) 1:8 (D) 1:4

8. An α-particle with speed v_0 is projected from infinity and it approaches up to r_0 distance from a nuclei. Then, the speed of α-particle which approaches upto $2r_0$ distance from the nucleus is :

(A) $\sqrt{2}\, v_0$ (B) $\frac{v_0}{\sqrt{2}}$ (C) $2v_0$ (D) $\frac{v_0}{2}$

9. Radius of a particular nucleus is calculated by the projection of α-particle from infinity at a particular speed. Let this radius is the true radius. If the radius calculation for the same nucleus is made by another α-particle with half of the earlier speed, then the percentage error involved in the radius calculation is :

(A) 75% (B) 100% (C) 300% (D) 400%

10. With what velocity should an α-particle travel towards the nucleus of a Copper atom, so as to arrive at a distance of 10^{-13} m from the nucleus of Copper atom. (At. No. of Cu = 29). (Take $\sqrt{40}$ = 6.32)

11.

	Column-I		**Column-II**
(A)	Frequency	(p)	Linear distance travelled by a wave per unit time.
(B)	Wavelength	(q)	Number of waves passing through a point in one second.
(C)	Time period	(r)	Linear distance between starting and end point of one complete wave.
(D)	Speed	(s)	Time taken for one complete wave to pass through a point.

12. For a wave, frequency is 10 Hz and wavelength is 2.5 m. How much linear distance will it travel in 40 seconds ?

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 13

Total Marks : 31

Max. Time : 35 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.4,9	(3 marks, 3 min.)	[6, 6]
Subjective Questions ('–1' negative marking) Q.1,6,7,8	(4 marks, 5 min.)	[16, 20]
Short Subjective Questions ('–1' negative marking) Q.2,3,5	(3 marks, 3 min.)	[9, 9]

1. Visible spectrum contains light of following colours "Violet - Indigo - Blue - Green - Yellow - Orange - Red" (VIBGYOR).
Its frequency ranges from Violet (7.5×10^{14} Hz) to Red (4×10^{14} Hz). Find out the maximum wavelength (in Å) in this range.

2. For a broadcasted electromagnetic wave having frequency of 1200 KHz, calculate number of waves that will be formed in 1 km distance (wave number per km).

3. **(a)** If volume of nucleus of an atom V is related to its mass number A as $V \propto A^n$, find the value of n.

(b) If the frequency of violet radiation is 7.5×10^{14} Hz, find the value of wavenumber ($\bar{v}$) (in m^{-1}) for it.

4. The ratio of the energy of a photon of wavelength 3000 Å to that of a photon of wavelength 6000Å respectively is:
(A) 1 : 2 (B) 2 : 1 (C) 3 : 1 (D) 1 : 3

5. Assume that 10^{-17} J of light energy is needed by the interior of the human eye to see an object. How many photons of green light (λ = 310 nm) are needed to generate this minimum energy ?

6. A photon of 300 nm is absorbed by a gas and then, it re-emits two photons and attains the same initial energy level. One re-emitted photon has wavelength 500 nm. Calculate the wavelength of other photon re-emitted out.

7. Find out the number of photons emitted by a 60 watt bulb in one minute, if wavelength of an emitted photon is 620 nm.

8. If a photon having wavelength 620 nm is used to break the bond of A_2 molecule having bond energy 144 KJ mol^{-1}, then find the % of energy of photon that is converted into kinetic energy of A atoms.
[hc = 12400 eVÅ ,1 eV/atom = 96 KJ/mol]

9. A certain dye absorbs light of certain wavelength and then fluorescence light of wavelength 5000 Å. Assuming that under given conditions, 50% of the absorbed energy is re-emitted out as fluorescence and the ratio of number of quanta emitted out to the number of quanta absorbed is 5 : 8, find the wavelength of absorbed light (in Å) : [hc = 12400 eVÅ]
(A) 4000 Å (B) 3000 Å (C) 2000 Å (D) 1000 Å

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 14

Total Marks : 37

Max. Time : 41 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.3 to Q.9	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.1 to Q.2	(4 marks, 5 min.)	[8, 10]
Match the Following (no negative marking) (2 × 4) Q.10	(8 marks, 10 min.)	[8, 10]

1. In I experiment, electromagnetic radiations of a certain frequency are irradiated on a metal surface ejecting photoelectrons having a certain value of maximum kinetic energy. However, in II experiment,on doubling the frequency of incident electromagnetic radiations, the maximum kinetic energy of ejected photoelectrons becomes three times. What percentage of incident energy is converted into maximum kinetic energy of photoelectrons in II experiment ?

2. The potential difference applied on the metal surface to reduce the velocity of photoelectron to zero is known as Stopping Potential. When a beam of photons of wavelength 40 nm was incident on a surface of a particular pure metal, some emitted photoelectrons had stopping potential equal to 18.6 V, some had 12 V and rest had lower values. Calculate the threshold wavelength (λ_0) of the metal (in Å) assuming that at least one photoelectron is ejected with maximum possible kinetic energy. (hc = 12400 eVÅ)

3. For which of the following species, Bohr model is not valid :
(A) He^+ (B) H (C) Li^{2+} (D) H^+

4. Wavelength of radiations emitted when an electron in a H-like atom jumps from a state A to C is 2000 Å and it is 6000 Å, when the electron jumps from state B to state C. Wavelength of the radiations emitted when an electron jumps from state A to B will be :
(A) 2000 Å (B) 3000 Å (C) 4000 Å (D) 6000 Å

5. If the radius of the first Bohr orbit of the H atom is r, then for Li^{2+} ion, it will be :
(A) 3r (B) 9r (C) r/3 (D) r/9

6. In a certain electronic transition in the Hydrogen atom from an initial state i to a final state f, the difference in the orbit radius ($r_i - r_f$) is seven times the first Bohr radius. Identify the transition :
(A) $4 \to 1$ (B) $4 \to 2$ (C) $4 \to 3$ (D) $3 \to 1$

7. The velocity of electron in the ground state of H atom is 2.184×10^8 cm/sec. The velocity of electron in the second orbit of Li^{2+} ion in cm/sec would be :
(A) 3.276×10^8 (B) 2.185×10^8 (C) 4.91×10^8 (D) 1.638×10^8

8. The potential energy of the electron present in the ground state of Li^{2+} ion is represented by :
(A) $+\frac{3e^2}{4\pi \epsilon_0 r}$ (B) $-\frac{3e}{4\pi \epsilon_0 r}$ (C) $-\frac{3e^2}{4\pi \epsilon_0 r^2}$ (D) $-\frac{3e^2}{4\pi \epsilon_0 r}$

9. If the angular momentum of an electron in a Bohr orbit is $\frac{2h}{\pi}$, then the value of potential energy of this electron present in He^+ ion is :
(A) – 13.6 eV (B) – 3.4 eV (C) – 6.8 eV (D) – 27.2 eV.

10. **Match the following :**
E_n = total energy, ℓ_n = angular momentum, K_n = K.E. , V_n = P.E., T_n = time period, r_n = radius of n^{th} orbit

Column (I)	**Column (II)**
(A) $E_n^{-y} \propto r_n/Z$, then y is	(p) 1/2
(B) $\ell_n \propto n^x$,then x is	(q) – 2
(C) Value of $\frac{E_n}{V_n}$ is	(r) – 3
(D) $T_n \propto \frac{Z^t}{n^m}$, t & m are respectively	(s) 1

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 15

Total Marks : 25

Max. Time : 25 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6,8	(3 marks, 3 min.)	[21, 21]
Multiple choice objective ('–1' negative marking) Q.7	(4 marks, 4 min.)	[4, 4]

1. An electron in a H–like atom jumps from a higher energy level 'n' to ground state by emitting two successive photons of wave numbers 5.25×10^8 m^{-1} and 7.25×10^8 m^{-1}. If the same electron undergoes the same transition by emitting a single photon, then the wavelength of this photon is :

(A) 32.84 Å (B) 8 Å (C) 0.125 Å (D) 0.03 Å

2. The ratio of the difference in energy between the first and second Bohr orbit to that between the second and third Bohr orbit in a H-like species is :

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{4}{9}$ (D) $\frac{27}{5}$

3. The radii of two of the first four Bohr orbits of the Hydrogen atom are in the ratio 1 : 4. The energy difference between them may be :

(A) Either 12.09 eV or 3.4 eV (B) Either 2.55 eV or 10.2 eV

(C) Either 13.6 eV or 3.4 eV (D) Either 3.4 eV or 0.85 eV

4. The ratio of radius of two different orbits in a H-atom is 4 : 9. Then, the ratio of the frequency of revolution of electron in these orbits is :

(A) 2 : 3 (B) 27 : 8 (C) 3 : 2 (D) 8 : 27

5. According to Bohr's theory, the ratio of electrostatic force of attraction acting on electron in 3rd orbit of He^+ ion and 2nd orbit of Li^{2+} ion is $\left(\frac{3}{2}\right)^x$. Then, the value of x is :

(A) 7 (B) –6 (C) 6 (D) –7

6. Suppose a hypothetical H-like atom produces a blue, yellow, red and violet line in emission spectrum. Match the above lines with their corresponding possible electronic transition :

Colour of spectral lines	Possible corresponding transitions
(A) Blue	(p) $6 \rightarrow 3$
(B) Yellow	(q) $2 \rightarrow 1$
(C) Red	(r) $5 \rightarrow 2$
(D) Violet	(s) $4 \rightarrow 3$

(A) (A) $\rightarrow$ r , (B) $\rightarrow$ p , (C) $\rightarrow$ s , (D) $\rightarrow$ q (B) (A) $\rightarrow$ r , (B) $\rightarrow$ s , (C) $\rightarrow$ q, (D) $\rightarrow$ p

(C) (A) $\rightarrow$ p , (B) $\rightarrow$ r , (C) $\rightarrow$ s , (D) $\rightarrow$ q (D) (A) $\rightarrow$ p , (B) $\rightarrow$ r , (C) $\rightarrow$ q, (D) $\rightarrow$ s

7. If the binding energy of 2nd excited state of a hypothetical H-like atom is 12 eV, then :

(A) I excitation potential = 81 V (B) II Excitation energy = 96 eV

(C) Ionisation potential = 192 V (D) Binding energy of 2nd state = 27 eV

8. Wave number of a spectral line for a given transition is x cm^{-1} for He^+ ion. Then, its value for Be^{3+} ion (isoelectronic of He^+) for same transition is :

(A) x cm^{-1} (B) 4x cm^{-1} (C) $\frac{x}{4}$ cm^{-1} (D) 2x cm^{-1}

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 16

Total Marks : 37

Max. Time : 43 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.5,6,8,9	(4 marks, 5 min.)	[16, 20]
Match the Following (no negative marking) (2 × 4) Q.7	(8 marks, 10 min.)	[8, 10]

1. If numerical value of mass and velocity are equal for a particle, then its de-Broglie wavelength in terms of K.E. is :

(A) $\frac{mh}{2K.E.}$ (B) $\frac{h}{2mK.E.}$ (C) both are correct (D) none is correct.

2. A wavelength of 400 nm of electromagnetic radiation corresponds to :

(A) frequency (ν) = 7.5×10^{14} Hz (B) wave number($\bar{\nu}$) = 2.5×10^{6} m^{-1}.

(C) momentum of photon = 1.66×10^{-27} kg ms^{-1} (D) all are correct values.

3. In one experiment, a proton having initial kinetic energy of 1 eV is accelerated through a potential difference of 3 V. In another experiment, an α-particle having initial kinetic energy 20 eV is retarded by a potential difference of 2 V. The ratio of de-Broglie wavelengths of proton and α-particle is :

(A) $2\sqrt{6}$: 1 (B) 8 : 1 (C) 4 : 1 (D) $2\sqrt{2}$: 1

4.* When photons of energy 4.25 eV strike the surface of a metal A, the ejected photoelectrons have maximum kinetic energy $(K.E)_A$ and de-Broglie wavelength is λ_A. The maximum kinetic energy of photoelectrons liberated from another metal B by photons of energy 4.7 eV is $(KE)_B$, where $(KE)_B = (KE)_A - 1.5$ eV. If the de-Broglie wavelength of these photoelectrons is λ_B (= $2\lambda_A$), then :

(A) The work function of metal A is 2.25 eV (B) The work function of metal B is 4.20 eV

(C) $(KE)_A$ = 2 eV (D) $(KE)_B$ = 2.75 eV

5. Average life time of an electron in hydrogen atom excited to n = 2 state is 10^{-8} s. Find the number of revolutions made by the electron on the average, before it jumps to the ground state.

6. The ionisation energy of He^{+} ion is 19.6×10^{-18} J per ion. Calculate the energy of the first stationary state of Li^{2+} ion.

7. **Match the following :**

Column (I)	**Column (II)**
(A) Binding energy of 5th excited state of Li^{2+} sample	(p) 10.2 V
(B) Ist excitation potential of H-atom	(q) 3.4 eV
(C) 2nd excitation potential of He^{+} ion	(r) 13.6 eV
(D) I.E. of H-atom	(s) 48.4 V

8. The IP of H-atom is 13.6 V. It is exposed to electromagnetic waves of wavelength 1026 Å and then, it gives out induced radiations. Find the wavelength of all possible induced radiations.

9. The ionization energy of a Hydrogen like species is 4 Rydberg. What is the radius of the first orbit of this atom ? (Given : Bohr radius of hydrogen = 5.3×10^{-11} m; 1 Rydberg = 2.2×10^{-18} J)

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 17

Total Marks : 36

Max. Time : 38 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4,10	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.5	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]
Match the Following (no negative marking)(2 × 4) Q.9	(8 marks, 10 min.)	[8, 10]

1. The wavenumber of the spectral line of shortest wavelength of Balmer series of He^+ ion is :
(R = Rydberg's constant)
(A) R (B) 3R (C) 4R (D) 4R/9

2. Last line of the Lyman series of H-atom has frequency ν_1, last line of Lyman series of He^+ ion has frequency ν_2 and 1st line of Lyman series of He^+ ion has frequency ν_3. Then :
(A) $4\nu_1 = \nu_2 + \nu_3$ (B) $\nu_1 = 4\nu_2 + \nu_3$ (C) $\nu_2 = \nu_3 - \nu_1$ (D) $\nu_2 = \nu_1 + \nu_3$

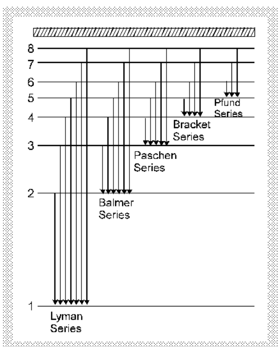
3. If λ_1 and λ_2 are respectively the wavelengths of the series limit of Lyman and Balmer series of Hydrogen atom, then the wavelength of the first line of the Lyman series of the H-atom is :
(A) $\lambda_1 - \lambda_2$ (B) $\sqrt{\lambda_1\lambda_2}$ (C) $\frac{\lambda_2 - \lambda_1}{\lambda_1\lambda_2}$ (D) $\frac{\lambda_1\lambda_2}{\lambda_2 - \lambda_1}$

4. **STATEMENT -1:** We can use two photons successively of 1240 Å and 2000 Å wavelength in order to ionise a H atom from ground state.
STATEMENT -2: Sum of the energies of both the photons is greater than IE of H atom.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

5. Which of the following statements is/are INCORRECT :
(A) All spectral lines belonging to Balmer series in Hydrogen spectrum lie in visible region.
(B) If a light of frequency ν falls on a metal surface having work function $h\nu$, photoelectric effect will take place only if $\nu \le \nu_0$.
(C) The number of photoelectrons ejected from a metal surface in photoelectric effect depends upon the intensity of incident radiations.
(D) The series limit wavelength of Balmer series for H-atom is $\frac{4}{R}$, where R is Rydberg's constant.

Comprehension # (Q.6 to Q.8)]

The only electron in the hydrogen atom resides under ordinary conditions in the first orbit. When energy is supplied, the electron moves to higher energy orbit depending on the amount of energy absorbed. When this electron returns to any of the lower orbits, it emits energy. Lyman series is formed when the electron returns to the lowest orbit, while Balmer series is formed when the electron returns to second orbit. Similarly, Paschen, Brackett and Pfund series are formed when electron returns to the third, fourth and fifth orbits from higher energy orbits respectively (as shown in figure)



Maximum number of lines produced when an electron jumps from *n*th level to ground level is equal to $\frac{n(n-1)}{2}$. For example, in the case of n = 4, number of lines produced is 6. ($4 \rightarrow 3$, $4 \rightarrow 2$, $4 \rightarrow 1$, $3 \rightarrow 2$, $3 \rightarrow 1$, $2 \rightarrow 1$). When an electron returns from n_2 to n_1 state, the number of lines in the spectrum will be equal to :

$$\frac{(n_2 - n_1)(n_2 - n_1 + 1)}{2}$$

If the electron comes back from energy level having energy E_2 to energy level having energy E_1, then the difference may be expressed in terms of energy of photon as :

$$E_2 - E_1 = \Delta E\ , \quad \lambda = \frac{hc}{\Delta E}, \qquad \Delta E = h\nu \ \ (\nu \text{ - frequency})$$

Since h and c are constants, ΔE corresponds to definite energy; thus each transition from one energy level to another will produce a light of definite wavelength. This is actually observed as a line in the spectrum of hydrogen atom.

Wave number of line is given by the formula $\bar{\nu} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$.

where R is Rydberg constant ($R = 1.1 \times 10^7\ m^{-1}$)

(i) First line of a series : It is called 'line of longest wavelength' or 'line of lowest energy'.

(ii) Series limit or last line of a series : It is the line of shortest wavelength or line of highest energy.

6. In a hydrogen like sample, electrons are in a particular excited state. If electrons make transition upto 1^{st} excited state, then it produces maximum 15 different types of spectral lines. Then, electrons were initially in :

(A) 5^{th} state (B) 6^{th} state (C) 7^{th} state (D) 8^{th} state

7. The difference between the wave number of 1^{st} line of Balmer series and last line of Paschen series for Li^{2+} ion is :

(A) $\frac{R}{36}$ (B) $\frac{5R}{36}$ (C) 4R (D) $\frac{R}{4}$

8. In a single isolated atom of hydrogen, electrons make transition from 4^{th} excited state to ground state producing maximum possible number of wavelengths. If the 2^{nd} lowest energy photon is used to further excite an already excited sample of Li^{2+} ion, then transition will be :

(A) $12 \rightarrow 15$ (B) $9 \rightarrow 12$ (C) $6 \rightarrow 9$ (D) $3 \rightarrow 6$

9. **Match the following :**

List-I	**List-II**
(A) From n = 6 upto n = 3 (In H-atom sample)	(p) 10 lines in the spectrum
(B) From n = 7 upto n = 3 (In H-atom sample)	(q) Spectral lines in visible region
(C) From n = 5 upto n = 2 (In H-atom sample)	(r) 6 lines in the spectrum
(D) From n = 6 upto n = 2 (In H-atom sample)	(s) Spectral lines in infrared region

10. A photon of frequency $\frac{3Rc}{4}$ cannot be emitted from which of the following transitions :

(Given : R = Rydberg's constant, c = speed of light)

(A) From 5 upto 1 transition in a sample of H– atom.

(B) From 6 upto 1 transition in a sample of He^+ ion.

(C) From 7 upto 3 transition in a sample of Li^{2+} ion.

(D) From 8 upto 3 transition in a sample of He^+ ion.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 18

Total Marks : 30

Max. Time : 33 min.

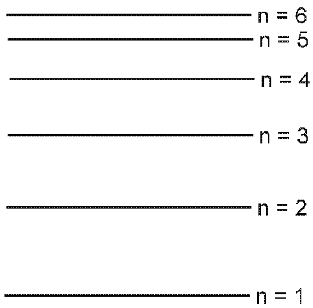
Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1'negative marking) Q.1 to Q.4,7,8	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.5 to Q.6,9	(4 marks, 5 min.)	[12, 15]

1. In a mixture of sample of H-atoms and He^+ ions, electrons in all the H-atoms and He^+ ions are present in n = 4^{th} state. Then, find total number of spectral lines obtained when all the electrons make transition from n = 4 upto ground state :

(A) 12 (B) 6 (C) 11 (D) 16

2. What would be the maximum number of emission lines for atomic hydrogen that you would expect to see with the naked eye, if the only electronic energy levels involved are those shown in the Figure :



(A) 4 (B) 6 (C) 5 (D) 15

3. A sample of H–like ion is in a particular excited state n_2. The electron in it makes back transition upto a lower excited state n_1 producing a maximum of 10 different spectral lines. The change in angular momentum of electron corresponding to maximum frequency line is expressed as y $\frac{h}{4\pi}$ J-s. Then, the value of y is :

(A) 2 (B) 4 (C) 8 (D) 6

4. In a sample of H–atom, electron makes transition from lower state n_1 to higher state n_2 by absorbing photons emitted by another sample of Li^{2+} ions from $12 \rightarrow 3$ transition. The electron in H–atom then makes back transition from state n_2 to ground state by emitting all posible photons. Then, the number of lines in infrared region in emission spectrum of H–atom sample is :

(A) 3 (B) 2 (C) 1 (D) 0

5. In a sample containing a finite number of H- like atoms, electrons make transition from n = 6 upto ground state producing a total of 10 different spectral lines. Find the minimum number of atoms that must have been present in the sample.

6. An ion (atomic number Z), isoelectronic with Hydrogen, is in n^{th} excited state. This ion emits two photons of energies 10.2 eV and 17eV successively to return to first exited state. It can also emit two photons of energies 4.25 and 5.95 eV successively to return to second excited state. What is value of n and Z ?

7. Determine the de-Broglie wavelength associated with an electron in the 3^{rd} Bohr's orbit of He^+ ion :

(A) 10 Å (B) 2 Å (C) 5 Å (D) 1 Å

8. If the radius of first Bohr's orbit of H-atom is x, which of the following is the INCORRECT conclusion :

(A) The de-Broglie wavelength of electron in the third Bohr orbit of H-atom = 6 πx.

(B) The fourth Bohr's radius of He^+ ion = 8x.

(C) The de-Broglie wavelength of electron in third Bohr's orbit of Li^{2+} = 2πx.

(D) The second Bohr's radius of Be^{2+} = x

9. An electron is present in n^{th} orbit of Be^{3+} ion such that its de-Broglie wavelength is same as associated with the electron in 3^{rd} orbit of C^{5+} ion. Find the distance between two adjacent crests of wave associated with motion of an electron in n^{th} orbit of Be^{3+} ion.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 19

Total Marks : 27

Max. Time : 27 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.9	(3 marks, 3 min.)	[27, 27]

1. Which of the following quantum numbers has not been derived from Schrodinger wave equation :
(A) Principal quantum number (n) (B) Subsidiary quantum number (ℓ)
(C) Magnetic quantum number (m) (D) Spin quantum number (s)

2. Which d -orbital does not has four lobes :
(A) $d_{x^2-y^2}$ (B) d_{xy} (C) d_{yz} (D) d_{z^2}

3. The total number of subshells in n^{th} main energy level are :
(A) n^2 (B) $2n^2$ (C) (n–1) (D) n.

4. Which of the following orbital does not make sense :
(A) 3d (B) 3f (C) 5p (D) 7s.

5. The maximum number of electrons that can be accomodated in s, p and d-subshells respectively are :
(A) 2 in each (B) 2, 6 and 6 (C) 2, 6 and 10 (D) 2, 6 and 12.

6. Any p-orbital can accommodate upto :
(A) four electrons (B) two electrons with parallel spin
(C) six electrons (D) two electrons with opposite spin.

7. In which transition, the change in de-Broglie wavelength of electron is maximum :
(A) $n = 8 \rightarrow n = 6$ (B) $n = 5 \rightarrow n = 4$ (C) $n = 3 \rightarrow n = 2$ (D) $n = 2 \rightarrow n = 1$

8. **S_1 :** Photoelectric effect can be explained on the basis of wave nature of electromagnetic radiations.

S_2 : An orbital represented by n = 2, ℓ = 1 is dumb-bell shaped.

S_3 : d_{xy} orbital has zero probability of finding electrons along X-axis and Y-axis.

(A) FTF (B) FTT (C) TFT (D) TFF

9. **S_1 :** According to Bohr model, the angular momentum of revolving electron is directly proportional to the atomic
number of H-like species bearing the electron.

S_2 : An orbital cannot accomodate more than 2 electrons.

S_3 : All orbitals have directional character.

(A) FTF (B) TFF (C) FFT (D) TTF

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 20

Total Marks : 35

Max. Time : 37 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Comprehension ('–1' negative marking) Q.5 to Q.9	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.10 to Q.11	(4 marks, 5 min.)	[8, 10]

1. The orbital angular momentum corresponding to n = 4 and m = –3 is :

(A) 0 (B) $\frac{h}{\sqrt{2}\pi}$ (C) $\frac{\sqrt{6}\,h}{2\pi}$ (D) $\frac{\sqrt{3}\,h}{\pi}$

2. Spin magnetic moment of X^{n+} (Z = 26) is $\sqrt{24}$ B.M. Hence number of unpaired electrons and value of n respectively are :

(A) 4, 2 (B) 2, 4 (C) 3, 1 (D) 0, 2

3. Spin magnetic moments of V (Z = 23), Cr (Z = 24), Mn (Z = 25) are x, y, z respectively. Hence :

(A) x = y = z (B) x < y < z (C) x < z < y (D) z < y < x

4. Which of the following sets of quantum numbers can be correct for an electron in 4f-orbital :

(A) n = 3, ℓ = 2, m = –2, s = $+\frac{1}{2}$ (B) n = 4, ℓ = 4, m = –4, s = $-\frac{1}{2}$

(C) n = 4, ℓ = 3, m = +1, s = $+\frac{1}{2}$ (D) n = 4, ℓ = 3, m = +4, s = $+\frac{1}{2}$

Comprehension # (Q.5 to Q.9)

Azimuthal quantum number (ℓ) : It describes the shape of electron cloud and the number of subshells in a shell.

* It can have values from 0 to (n – 1)
* **value of ℓ** **subshell**

value of ℓ	subshell
0	s
1	p
2	d
3	f

* Number of orbitals in a subshell = $2\ell + 1$
* Orbital angular momentum L = $\frac{h}{2\pi}\sqrt{\ell(\ell+1)} = \hbar\sqrt{\ell(\ell+1)}$ $\left[\hbar = \frac{h}{2\pi}\right]$

Magnetic quantum number (m) : It describes the orientations of the subshells. It can have values from –l to + l including zero, i.e., total (2l + 1) values. Each value corresponds to an orbital. s-subshell has one orbital,

p-subshell three orbitals (p_x, p_y and p_z), d-subshell five orbitals ($d_{xy}, d_{yz}, d_{zx}, d_{x^2-y^2}, d_{z^2}$) and f-subshell has seven orbitals.

Spin quantum number (s) : It describes the spin of the electron. It has values +1/2 and –1/2 signifying clockwise spinning and anticlockwise rotation of electron about its own axis.

Spin of the electron produces angular momentum equal to S = $\sqrt{s(s+1)}\frac{h}{2\pi}$ where s = + $\frac{1}{2}$.

Total spin of an atom = $+\frac{n}{2}$ or $-\frac{n}{2}$

where n is the number of unpaired electron.

The magnetic moment of an atom, $\mu_s = \sqrt{n(n+2)}$ B.M.

n – number of unpaired electrons, B.M. (Bohr magneton)

5. A d-block element has total spin value of +3 or –3. Then, the spin only magnetic moment of the element is approximately :

(A) 2.83 B.M. (B) 3.87 B.M. (C) 5.9 B.M. (D) 6.93 B.M.

6. Spin only magnetic moment of $_{25}Mn^{x+}$ ion is $\sqrt{15}$ B.M. Then, the value of x is :

(A) 1 (B) 2 (C) 3 (D) 4

7. Spin only magnetic moment of $_{26}Fe^{2+}$ ion is same as :

(A) $_{26}Fe$ (B) $_{24}Cr^{2+}$ (C) $_{28}Ni^{4+}$ (D) All of these

8. Orbital angular momentum of an electron is $\sqrt{3}\frac{h}{\pi}$. Then, the number of orientations of this orbital in space are :

(A) 3 (B) 5 (C) 7 (D) 9

9. The correct order of the magnetic moment of [$_{25}Mn^{4+}$, $_{24}Cr^{3+}$, $_{26}Fe^{3+}$] is :

(A) $Fe^{3+} > Cr^{3+} = Mn^{4+}$ (B) $Fe^{3+} > Cr^{3+} > Mn^{4+}$

(C) $Cr^{3+} = Mn^{4+} > Fe^{3+}$ (D) $Fe^{3+} > Mn^{4+} > Cr^{3+}$

10. What is the maximum possible number of electrons in an atom with ($n + \ell = 7$) ?

11. Predict total spin for each configuration :

(a) $1s^2$ (b) $1s^2\ 2s^2\ 2p^6$ (c) $1s^2\ 2s^2\ 2p^5$

(d) $1s^2\ 2s^2\ 2p^3$ (e) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 21

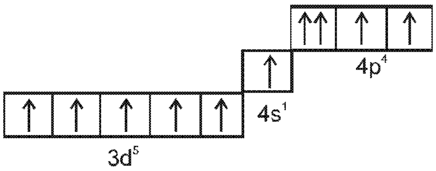
Total Marks : 28

Max. Time : 32 min.

Topic : Atomic Structure

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.5 to Q.8	(4 marks, 5 min.)	[16, 20]

1. In the following electronic configuration, some rules have been violated :



I : Hund II : Pauli's exclusion III : Aufbau

(A) I and II (B) I and III (C) II and III (D) I, II and III

2. What is the potential difference through which an electron, with a de Broglie wavelength of 1.5 Å should be accelerated, if its de Broglie wavelength has to be reduced to 1 Å :

(A) 110 volts (B) 70 volts (C) 83 volts (D) 55 volts

3. X^{2+} is isoelectronic with sulphur and has (Z + 2) neutrons (Z is atomic no. of element X). Hence, mass number of X^{2+} is :

(A) 34 (B) 36 (C) 38 (D) 40

4. Which of the following compounds is isoelectronic with $[NH_3 \rightarrow BH_3]$:

(A) B_2H_6 (B) C_2H_6 (C) C_2H_4 (D) C_3H_6

5. A neutral atom of an element has 2K, 8L, 9M and 2N electrons. Find out the following :

(a) Atomic number of element
(b) Total number of s electrons
(c) Total number of p electrons
(d) Total number of d electrons
(e) Number of unpaired electrons in element

6. Calculate :
(a) the value of spin only magnetic moment of Co^{3+} ion (in BM).
(b) the number of radial nodes in a 3p-orbital.
(c) the number of electrons with (m = 0) in Mn^{2+} ion.
(d) the orbital angular momentum for the unpaired electron in V^{4+}.

7. An element undergoes a reaction as shown :

$X + e^- \rightarrow X^-$ Energy released = 30.876 eV

The energy released, is used to dissociate 8 g of H_2 molecules equally into H^+ and H*, where H* is in an excited state, in which the electron travels a path length equal to four times its debroglie wavelength.
(a) Determine the least amount (moles) of 'X' that would be required.
Given: I.E. of H = 13.6 eV/atom
Bond energy of H_2 = 4.526 eV/molecule.
(b) Why is the amount of X calculated in the above question 'least'?

8. A compound of Vanadium has a spin magentic moment 1.73 BM. Work out the electronic configuration of the Vanadium ion in the compound.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 22

Total Marks : 58

Max. Time : 65 min.

Topic : Atomic Structure

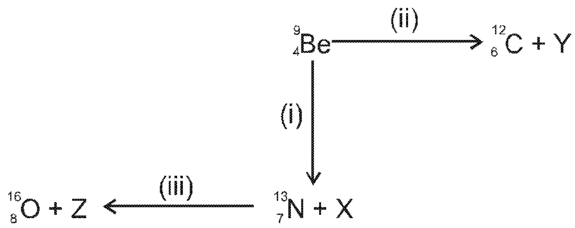
Type of Questions		M.M., Min.
Single choice Objective('–1'negative marking) Q.1 to Q.4,10,13	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.5 to Q.7	(4 marks, 4 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.8,11,12,14,15	(4 marks, 5 min.)	[20, 25]
Match the Following (no negative marking) (2 × 4) Q.9	(8 marks, 10 min.)	[8, 10]

1. The number of neutrons in the atom left after emission of 1 α-particle from $_{92}U^{238}$ is :
(A) 144 (B) 140 (C) 120 (D) 146

2. Which of the following is not a natural decay series :
(A) 4 n series (B) 4n + 1 series (C) 4n + 2 series (D) 4n + 3 series

3. $_{95}Am^{241}$ and $_{90}Th^{234}$ belong respectively to :
(A) 4n and 4n + 1 radioactive disintegration series
(B) 4n + 1 and 4n + 2 radioactive disintegration series
(C) 4n + 1 and 4n + 3 radioactive disintegration series
(D) 4n + 1 and 4n radioactive disintegration series

4. Bombardment by α-particle leads to artificial disintegration in three ways, (I), (II) and (III) as shown. Products **X**, **Y** and **Z** respectively are :



(A) β-particle, proton, positron (B) positron, neutron, proton
(C) β-particle, neutron, proton (D) positron, proton, neutron

5.* Decrease in atomic number is observed during :
(A) Alpha emission (B) Beta emission (C) Positron emission (D) Electron capture

6.* Atomic number of a radioactive element is 100. It first decays into an element Y, which then decays into Z. In both the processes, a charged particle is emitted. Which of the following can be true :
(A) Y has atomic number 102 (B) Y has atomic number 101
(C) Z has atomic number 100 (D) Z has atomic number 99

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7.* Assuming that the charged particles emitted during natural decay of ${}_{92}U^{235}$ atoms are α and β particles only, which of the following products is/are not possible :

(A) ${}_{89}Ac^{231}$ (B) ${}_{89}Ac^{227}$ (C) ${}_{89}Ac^{225}$ (D) ${}_{82}Pb^{207}$

8. A radioactive element A decays as follows :

$$A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C \xrightarrow{-\beta} D$$

Identify the isotopes and isobars among A, B, C and D.

9.

	Column-I		Column-II
(i)	Velocity	**(p)**	$\alpha < \beta < \gamma$
(ii)	Ionisation power	**(q)**	$\alpha > \beta > \gamma$
(iii)	Penetrating power	**(r)**	$\gamma < \beta < \alpha$
(iv)	mass	**(s)**	$\gamma > \beta > \alpha$

10. ${}^{23}Na$ is more stable isotope of Na. Find out the process by which ${}^{24}_{11}Na$ can undergo radioactive decay :

(A) β^- emission (B) α emission (C) β^+ emission (D) K electron capture

11. ${}_{92}X^{234} \xrightarrow[-6\beta]{-8\alpha}$ Y. Find out atomic number & mass number of Y and identify it.

12. Complete the following equations :

(a) ${}^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{87}_{38}Sr + {}^{147}_{54}Xe +$ ......

(b) ${}^{84}_{34}Se \longrightarrow$ .... $+ 2\ {}^{0}_{-1}e$

13. A positron is emitted from ${}^{23}_{11}Na$. The ratio of the mass number and atomic number of the resulting nuclide is:

(A) 22/10 (B) 22/11 (C) 23/10 (D) 23/12

14. The total number of α and β particles emitted in the nuclear reaction ${}^{238}_{92}U \rightarrow {}^{214}_{82}Pb$ is :

15. The number of neutrons emitted when ${}^{235}_{92}U$ undergoes controlled nuclear fission to ${}^{142}_{54}Xe$ and ${}^{90}_{38}Sr$ is :

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 23

Total Marks : 28

Max. Time : 28 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5,8,9	(3 marks, 3 min.)	[21, 21]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Short Subjective Questions ('–1' negative marking) Q.7	(3 marks, 3 min.)	[3, 3]

1. If P, V, T represents the pressure, volume and temperature of gas respectively, then according to Boyle's law, which is correct for a fixed amount of ideal gas :

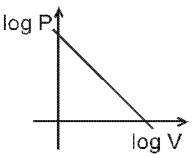
(A) $V \propto \frac{1}{T}$ (At constant P)
(B) $V \propto P$ (At constant T)
(C) $V \propto \frac{1}{P}$ (At constant T)
(D) PV = nRT

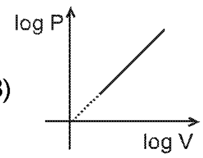
2. If an ideal gas at 1 atmosphperic pressure, is spreading from 20 cm^3 to 50 cm^3 at constant temperature, then find the final pressure :
(A) 0.4 atm (B) 2.5 atm (C) 5 atm (D) None of these.

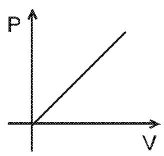
3. A vessel of 120 mL capacity contains a certain mass of an ideal gas at 20ºC and 750 mm pressure. The gas was transferred to another vessel, whose volume is 180 mL. Then the pressure of gas at 20ºC is :
(A) 500 mm (B) 250 mm (C) 1000 mm (D) None of these

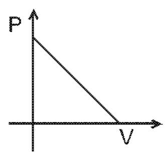
4. 5 L of a sample of a gas at 27°C and 1 bar pressure is compressed to a volume of 1000 mL keeping the temperature constant. The percentage increase in pressure is :
(A) 100 % (B) 400 % (C) 500% (D) 80%

5. For a fixed amount of ideal gas at constant temperature, which of the following plots is correct :

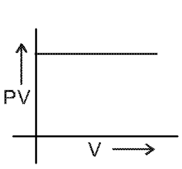
(A) 

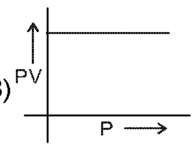
(B) 

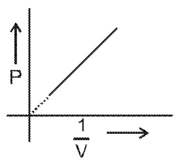
(C) 

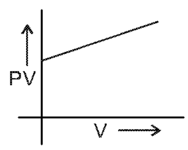
(D) 

6. For a fixed amount of ideal gas at constant temperature, which of the following plots is/are correct :

(A) 

(B) 

(C) 

(D) 

7. What should be the percentage increase in pressure for a 5% decrease in volume of an ideal gas at constant temperature ?

8. In which of the following cases is the pressure of air in air column maximum : (Assume same length of Hg column in each case) :

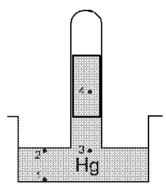
(A) 

(B) 

(C) 

(D) 

9. Compare the values of pressure at different points in the given diagram :



(A) $P_1 > P_2 > P_3 > P_4$
(B) $P_1 < P_2 < P_3 < P_4$
(C) $P_1 > P_2 = P_3 > P_4$
(D) $P_1 < P_2 = P_3 < P_4$

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 24

Total Marks : 31

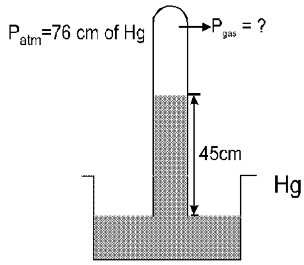
Max. Time : 38 min.

Topic : Gaseous State

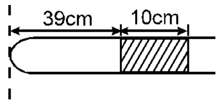
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.2 to Q.8	(4 marks, 5 min.)	[28, 35]

1. If some gas is trapped above the mercury column in a Barometer during measurement of atmospheric pressure, the height of Hg column is observed to be h. Then :
(A) h > 76 cm (B) h < 76 cm (C) h = 76 cm (D) cannot be predicted.

2. In the following arrangement, find the pressure of the confined gas (in cm of Hg).

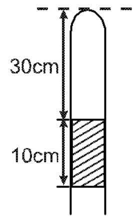


3. Given a one meter long glass tube closed at one end having a uniform cross-section containing a mercury column of 10 cm length, at a distance of 39 cm from the closed end. By what distance would this column move down, if the tube is held vertical with the open end downwards ? [Take atmo
spheric pressure to be 75 cm of Hg]



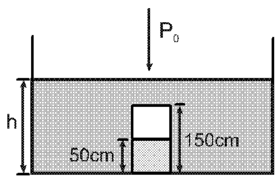
4. If another liquid L (ρ = 10.2 g/cm^3) is used in place of mercury, then what should be the minimum length of Barometer tube to measure normal atmospheric pressure ?
(Take normal atmoshperic pressure to be 76 cm of Hg).

5. Given a long glass tube closed at one end having a uniform cross-section containing a mercury column of 10 cm length, at a distance of 30 cm from the closed end when held vertically as shown. The air trapped above the Hg column has pressure 85 cm of Hg. What will be the length of air column
if the glass tube is held horizontally ?

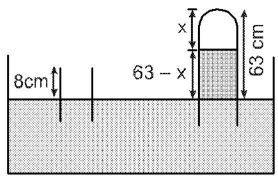


6. A glass tube with a sealed end is completely submerged in a vessel with mercury vertically. The air column is 15 cm long. To what height must the upper end be raised above the level of Hg, so that the level of Hg inside the tube is at the level of Hg in the vessel ? [Atmospheric pressure = 75 cm of Hg column]

7. A cylindrical diving bell (initially in open air), whose length is 150 cm, is lowered to the bottom of a tank. The water is found to rise 50 cm in the bell. Find the depth of the tank. Assume the atmospheric pressure at the surface as equivalent to 1000 cm height of water and the temperature as constant



8. An open glass tube is immersed in mercury in such a way that a length of 8 cm extends above the mercury level. The open end of the tube is then closed and raised further by 55 cm. What will be the length of air column above mercury in the tube ?
[Atmospheric pressure = 76 cm of Hg]



PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 25

Total Marks : 32

Max. Time : 37 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.5 to Q.9	(4 marks, 5 min.)	[20, 25]

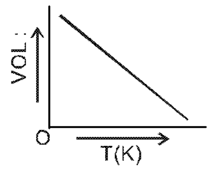
1. At constant pressure for a fixed amount of gas, which of the following represents Charles law :

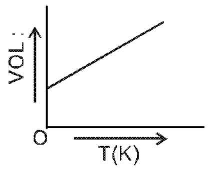
(A) $V \propto \frac{1}{T}$ (B) $V \propto T$ (C) $V \propto \frac{1}{T^2}$ (D) $V \propto d$

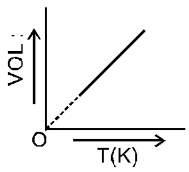
2. If V_0 is the volume of a given mass of gas at 273 K at constant pressure, then according to Charles law, the volume at 10ºC will be :

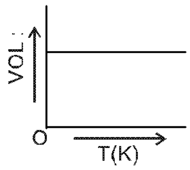
(A) $10\ V_0$ (B) $\frac{1}{273}(V_0 + 10)$ (C) $V_0 + \frac{10}{273}$ (D) $\frac{283}{273} V_0$

3. The correct representation of Charles law is given by :

(A) 

(B) 

(C) 

(D) 

4. Which of the following shows explicitly the relationship between Boyles law and Charles law :

(A) $\frac{P_1}{P_2} = \frac{T_1}{T_2}$ (B) $PV = K$ (C) $\frac{P_2}{P_1} = \frac{V_1}{V_2}$ (D) $\frac{V_2}{V_1} = \frac{P_1}{P_2} \times \frac{T_2}{T_1}$

5. 20 mL of hydrogen gas measured at 7ºC is heated to 77ºC. What is the new volume of gas at the same pressure?

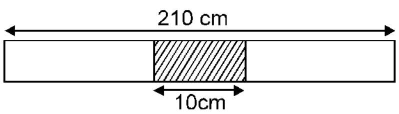
6. At what temperature in centrigrade, will the volume of a gas at 0ºC double itself, pressure remaining constant ?

7. A flask is of capacity one litre. What volume of air will escape from the open flask, if it is heated from 27°C to 37°C? Assume pressure to be constant.

8. A balloon blown up with 1 mole of gas has a volume of 480 mL at 14°C. At this stage, the balloon is filled to (7/8)th of its maximum capacity. Suggest :

(a) Will the balloon burst at 30°C ? (b) The minimum temperature at which it will burst.

9. A mercury column with a length 10 cm is in the middle of a horizontal tube with a length 210 cm closed at both ends . If the tube is placed vertically, the mercury column will shift through a distance 10 cm from its initial position .



At what distance will the centre of the column be from the middle of the tube,
(a) if one end of the tube placed horizontally is opened to atmosphere.
(b) if the upper end of the tube placed vertically is opened to atmosphere.
(c) if the lower end of the tube placed vertically opened to atmosphere.
[Take atmospheric pressure = 100 cm of Hg]

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 26

Total Marks : 30

Max. Time : 35 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.3	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.4 to Q.8	(4 marks, 5 min.)	[20, 25]

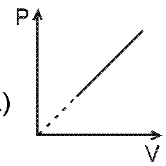
1. A bottle is heated with mouth open to have a final temperature as 125ºC from its original value of 25°C. The mole percentage of expelled air is about :

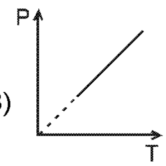
(A) 50% (B) 25% (C) 33% (D) 40%

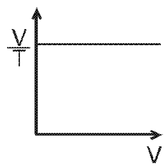
2. 1 litre of N_2 and 7/8 litre of O_2 are taken separately at the same temperature and pressure. What is the relation between the masses of the gases :

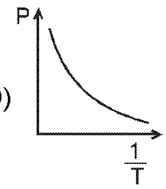
(A) $m_{N_2} = 3\,m_{O_2}$ (B) $m_{N_2} = 8\,m_{O_2}$ (C) $m_{N_2} = m_{O_2}$ (D) $m_{N_2} = 16\,m_{O_2}$

3. Which of the following graphs is /are possible for a fixed amount of gas :

(A) 

(B) 

(C) 

(D) 

4. A student forgot to add the reaction mixture to a round bottomed flask at 27°C but he put it on the flame. After a lapse of time, he realised his mistake. Using a pyrometer, he found that the temperature of the flask was 477°C. What fraction of moles of air would have expelled out ?

5. If the volume of a gas contained in a vessel increases by 0.4 % when heated by 1ºC, then find the initial temperature of gas in ºC.

6. A gas occupies 300 mL at 27°C and 684 mm pressure. What would be its volume at STP ?

7. 2 g of a gas A is introduced into an evacuated flask kept at 27°C. The pressure is found to be 1 atm. If 3 g of another gas B is added to the same flask, the total pressure becomes 1.5 atm. Assuming constant temperature and ideal gas behaviour, calculate :

(a) the ratio of mol. weight of gases, M_A and M_B. (b) the volume of the vessel, if gas A is He

8. Equal volumes of two gases, which do not react together, are enclosed in separate vessels. Their pressures are 100 mm and 400 mm respectively. If the two vessels are joined together, then what will be the pressure of the resulting mixture (temperature remaining constant) :

(A) 350 mm (B) 500 mm (C) 1000 mm (D) 250 mm

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 27

Total Marks : 36

Max. Time : 36 min.

Topic : Gaseous State

Type of Questions **M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.12 **(3 marks, 3 min.)** **[36, 36]**

1. At what pressure would a gas sample consisting of 2 mole CO_2 gas occupy a volume of 5.6 L at 273ºC :
(A) 32 atm (B) 24 atm (C) 16 atm (D) 8 atm

2. A sample of N_2O gas occupies a volume of $0.1 m^3$ at 684 mm of Hg pressure and 87ºC. The number of molecules present in the gas sample is : (Take R = $\frac{1}{12}$ L atm K^{-1} mol^{-1})
(A) 1.8066×10^{23} (B) 1.2044×10^{24} (C) 6.022×10^{23} (D) 1.8066×10^{24}

3. If the volume occupied by x mole of ethane (C_2H_6) gas at 2.46 atm pressure and 27ºC temperature is 0.5 L then the value of x is :
(A) 0.5 (B) 0.05 (C) 0.005 (D) 0.0005

4. A gas mixture consisting of 0.1 mole each of O_2 and N_2 gases occupies a volume of 1×10^4 mL at 38 cm of Hg pressure and a certain temperature. Find the value of T :
(A) 300°C (B) 600 K (C) 300 K (D) 600°C

5. 32 g of SO_2 is stored in a cylinder at 1 atm pressure and at 27ºC temperature. The volume of cylinder is : (Take R = 1/12 L atm K^{-1} mol^{-1})
(A) 12.5 m^3 (B) 12.5 dm^3 (C) 12.5 cc (D) 12.5 mL

6. A cylinder can hold maximum 12.5 L of any liquid when it is fully filled. If ozone gas (O_3) is stored in cylinder at 10^5 Pa pressure and – 73ºC temperature, then the weight of ozone gas in the cylinder is:
(A) 36 kg (B) 12 g (C) 36 g (D) 12 kg

7. A mixture consisting of 54 g N_2O_5 gas, 1.2044×10^{23} molecules of NO gas, 0.2 gram-molecule of N_2O gas and 0.1 mole of N_2 gas would occupy a volume of ..... dm^3 at 760 torr pressure and 27 ºC temprature :
(A) 22.4 (B) 24.6 (C) 0.0246 (D) 0.0224

8. If 66 g of an unknown gas X occupies a volume of about 125 dm^3 at 0.6 bar pressure and 600 K temprature, then the gas X could be :
(A) N_2 (B) N_2O (C) CO (D) CO_2

9. Three different containers contain three different gases with the following parameters :
Container I of volume (V_1), containing 6 g of H_2 gas at 273 K, 1 atm.
Container II of volume (V_2), containing 2 mole of CO_2 gas at 273 ºC, 2 atm.
Container III volume (V_3), containing 24×10^{23} molecules of O_2 gas at 0 ºC, 760 torr .
The correct order of volume of containers is :
(A) I > II > III (B) III > I > II (C) I > III > II (D) II > III > I

10. 3.06 L of H_2O vapour is taken at a pressure of 1 atm and 373 K. It is now condensed to H_2O (ℓ) at 373 K. Calculate the approximate volume occupied by H_2O (ℓ) : (assume density of liquid water at 373 K = 1 g/mL)
(A) 3.06 L (B) 1.8 mL (C) 1.8 L (D) 3.06 mL

11. Which of the following relations is correct : (Where T represents temperature and d represents density) :
(A) 1 bar = 1 torr (B) T (in °C) = T (in K) + 273 (C) $1 m^3 = 10^{-6}$ mL (D) $d_{g/mL} = \frac{d_{kg/m^3}}{1000}$

12. Two flasks A and B of equal volume contain H_2 gas under same pressure conditions. The temperature in flask A is greater than in flask B. Then :
(A) Flask A contains greater number of moles of H_2 gas than flask B.
(B) Flask B contains greater number of moles of H_2 gas than flask A.
(C) Flask A contains same number of moles of H_2 gas as flask B.
(D) Such a case is not possible.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 28

Total Marks : 30

Max. Time : 33 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.7 to Q.9	(4 marks, 5 min.)	[12, 15]

1. The density of Nitrogen gas is maximum at :
(A) STP (B) 273 K and 1 atm (C) 546 K and 2 atm (D) 546 K and 4 atm

2. A gas has a density of 1.25 g L^{-1} at STP. Identify it :
(A) NO_2 (B) O_2 (C) N_2 (D) SO_2

3. A sample of impure air contains 80% N_2, 10% O_2, 5% CO_2 and 5% Ar by volume. The average molecular weight of the sample is : (At wt. of Ar = 40)
(A) 29.4 (B) 29.8 (C) 30.0 (D) 29.6

4. The density of gas A is twice that of a gas B at the same temperature. The molecular weight of gas B is thrice that of A.The ratio of the pressure exerted on A and B will be :
(A) 6 : 1 (B) 7 : 8 (C) 2 : 5 (D) 1 : 4

5. A mixture of two gases A and B in the mole ratio 2 : 3 is kept in a 2 litre vessel. A second 3 litre vessel has the same two gases in the mole ratio 3 : 5. Both gas mixtures have the same temperature and same pressure. They are allowed to intermix and the final temperature and pressure are the same as the initial values, the final volume being 5 litres. Given that the molar masses are M_A and M_B, what is the mean molar mass of the final mixture :
(A) $\frac{77M_A+123M_B}{200}$ (B) $\frac{123M_A+77M_B}{200}$ (C) $\frac{77M_A+123M_B}{250}$ (D) $\frac{123M_A+77M_B}{250}$

6. Two flasks of equal volume connected by a narrow tube (of negligible volume) contains a certain amount of N_2 gas at 2 atm and 27°C. The I[st] flask is then immersed into a bath kept at 47°C while the II[nd] flask is immersed into a bath kept at 127°C. The ratio of the number of moles of N_2 in I[st] flask and II flask respectively after sometime will be :
(A) 5 : 4 (B) 2 : 3 (C) 3 : 2 (D) 4 : 5

7. Two glass bulbs of equal volume and filled with a gas at 500 K and pressure of 76 cm of Hg, are connected by a narrow tube. One of the bulb is then placed in a water bath maintained at 700 K and the other bulb is maintained at 500 K. What is the new value of the pressure inside the bulbs ? The volume of the connecting tube is negligible.

8. A certain amount of gas is enclosed in a sphere of volume 5L at pressure 7atm and temperature 327ºC. It is then connected to another sphere of volume 2.5 L by a narrow tube and stopcock. The second sphere is initially evacuated and the stopcock is closed. After opening the stopcock, the temperature of gas in the second sphere becomes 127ºC, while the first sphere is maintained at 327ºC. Find the final gas pressure within the two spheres.

9. The stop cock connecting the two bulbs of volume 8 litre and 10 litre containing an ideal gas at 6.25 atm and 4 atm respectively, is opened. What is the final pressure, if the temperature remains same ?

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 29

Total Marks : 36

Max. Time : 40 min.

Topic : Gaseous State

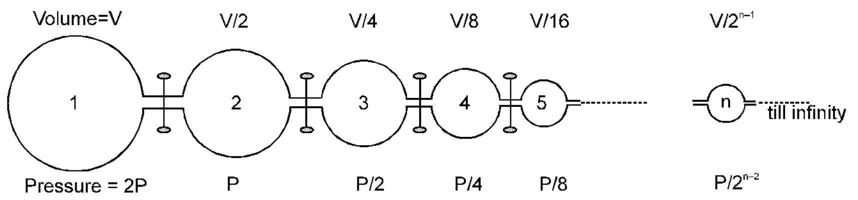
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3,7	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.1,4	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.4,5,6,8	(4 marks, 5 min.)	[16, 20]

1. Equal masses of Sulphur dioxide and Oxygen gases are mixed in an empty container at 25°C. The fraction of the total pressure exerted by sulphur dioxide is :

(A) 1/3 (B) 1/2 (C) 2/3 (D) $\frac{1}{3} \times \frac{273}{298}$

2. A mixture of helium and methane gases at 1.4 bar pressure contains 20% by mole of helium. Partial pressure of helium will be :
(A) 0.7 bar (B) 0.28 bar (C) 0.56 bar (D) 0.8 bar

3.



Infinite number of flasks are connected to one another as shown above. The volumes and pressures in each flask vary as shown. The stopcocks are initially closed. The common pressure, when all the stopcocks are opened, is : (Assume constant temperature)

(A) P (B) $\frac{1}{2}$P (C) $\frac{P}{4}$ (D) $\frac{4}{3}$P

4. The density of a mixture of O_2 and N_2 gases at NTP is 1.3 g litre^{-1}. Calculate partial pressure of O_2.

5. Two gases A and B having molecular weights 60 and 40 respectively are enclosed in a vessel. The weight of A is 0.6 g and that of B is 0.2 g . The total pressure of the mixture is 750 mm. Calculate the partial pressure of the two gases.

6. A spherical balloon of mass 100 Kg and diameter 21 m is filled with He gas at 168° C and 5 atm pressure.If the density of air is $\frac{14}{11}$ g/L, find the value of payload of the balloon (in Kg). Take R = $\frac{1}{12}$ L atm K^{-1} mol^{-1}

7. A mixture of He and SO_2 at one bar pressure contains 20% by weight of He. Partial pressure of He will be:
(A) 0.2 bar (B) 0.4 bar (C) 0.6 bar (D) 0.8 bar

8. A 11 litre flask contains 20g of Neon and an unknown weight of Hydrogen. The gas density is found to be 2g/litre at 0^{0}C. Determine the average molecular weight of the gas mixture.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 30

Total Marks : 31

Max. Time : 33 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.2 to Q.3	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.1,4	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.5,9	(4 marks, 5 min.)	[8, 10]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. A gaseous organic compound has a density of 2.5 kg/m^3 at 2 atm and at 273^{0}C. The molecular formula of the compound can be :

(A) C_3H_4O (B) C_4H_6O (C) C_4H_8 (D) C_5H_{10}

2. The ratio of rates of diffusion of SO_2, O_2 and CH_4 under identical conditions is :

(A) $1 : \sqrt{2} : 2$ (B) 1 : 2 : 4 (C) $2 : \sqrt{2} : 1$ (D) $1 : 2 : \sqrt{2}$

3. If the number of molecules of SO_2 (molecular weight = 64) effusing through an orifice of unit area of cross-section in unit time at 0°C and 1 atm pressure is n, the number of He molecules (atomic weight = 4) effusing under similar conditions at 273°C and 0.25 atm is :

(A) $\frac{n}{\sqrt{2}}$ (B) $n\sqrt{2}$ (C) 2n (D) $\frac{n}{2}$

4. The time taken for effusion of 32 mL of oxygen gas will be the same as the time taken for effusion of which gas sample under identical conditions : (Take $\sqrt{2}$ = 1.4, $\sqrt{3}$ = 1.7)

(A) 64 mL of H_2 (B) 50 mL of N_2 (C) 44.8 mL of CH_4 (D) 22.4 mL of SO_2

5. 5 mL of He gas diffuses out in 1 second from a hole. Find the volume of SO_2 that will diffuse out from the same hole under identical conditions in 2 seconds.

Comprehension # (Q.6 to Q.8)

Graham's Law :

"Under similar conditions of pressure (partial pressure), the rate of diffusion of different gases is inversely proportional to square root of the density of different gases."

rate of diffusion $r \propto \frac{1}{\sqrt{d}}$ (d = density of gas) r = volume flow rate $= \frac{dV_{out}}{dt}$

r = moles flow rate $= \frac{dn_{out}}{dt}$

r = distance travelled by gaseous molecules per unit time $= \frac{dx}{dt}$

The general form of the Grahams law of diffusion shows the variation of rate of diffusion of a gas with pressure of gas, temperature of gas, area of cross-section of orifice and molecular mass of the gas.

Now answer the following questions :

6. A bottle of dry NH_3 & a bottle of dry HCl connected through a long tube are opened simultaneously under identical conditions at both ends. The white ammonium chloride ring first formed will be:

(A) at the centre of the tube (B) near the HCl bottle

(C) near the NH_3 bottle (D) throughout the length of tube

7. At room temperature, A_2 gas (vapour density = 40) at 1 atm pressure and B_2 gas (vapour density = 10) at p atm pressure are allowed to diffuse through identical pinholes from opposite ends of a glass tube of 1m length and of uniform cross-section. The two gases first meet at a distance of 60 cm from the A_2 end. The value of p is :

(A) $\frac{4}{3}$ atm (B) $\frac{1}{3}$ atm (C) $\frac{3}{4}$ atm (D) $\frac{1}{6}$ atm

8. A mixture containing 2 moles of He and 1 mole of CH_4 is taken in a closed container and made to effuse through a small orifice of container. Then, which is the correct effused volume percentage of He and CH_4 initially, respectively :

(A) 40%, 60% (B) 20% , 80% (C) 80% , 20% (D) 60% , 40%

9. Pressure in a bulb dropped from 2000 to 1500 mm in 50 minute, when the contained oxygen leaked through a small hole. The bulb was then completely evacuated. A mixture of oxygen and another gas of molecular weight 72 in molar ratio 1 : 1 at a total pressure of 6000 mm was introduced. Find the molar ratio of two gases remaining in the bulb after a period of 70 minute.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 31

Total Marks : 30

Max. Time : 30 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Comprehension ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Single choice Objective ('–1' negative marking) Q.7 to Q.10	(3 marks, 3 min.)	[12, 12]

Comperhension # (Q.1 to Q.3)

Gas 'A' (Molar Mass = z128 g mol^{-1}) is taken in a closed container at the initial total pressure of 1000 mm of Hg. Pressure of the gas decreases to 900 torr in 5 seconds due to the diffusion though a square cross-section. Another similar sized container is taken in which gaseous mixture of A and B (Molar Mass = 72g mol^{-1}) is taken. Initial molar mass of the mixture is $\frac{472}{5}$ (calculated from density data) at the total pressure of 5000 torr. A rectangular cross-section is made in this container and gases are allowed to diffuse. Width of this cross-section is same as the side of the previous square cross section and length of the rectangular cross-section is 50% more than that of its width. Assume that the gases A and B are non-reacting and rate of diffusion of the gases are only dependent upon the initial total pressure and it is independent of the change in the pressure due to diffusion. Assume all other conditions to be identical.

Now answer the following questions :

1. Gas mixture diffused out initially from 2nd container has composition :

(A) $X_A = \frac{3}{7}$ (B) $X_B = \frac{3}{5}$ (C) $X_A = \frac{1}{3}$ (D) $X_B = \frac{1}{4}$

2. Ratio of the number of moles of A and B left in the container after 10 seconds from the start of diffusion, is :

(A) $\frac{7}{9}$ (B) $\frac{2}{3}$ (C) $\frac{8}{11}$ (D) None of the above

3. What is the time after which container will have same number of moles of A and B :

(A) 15 sec. (B) 50 sec. (C) 25 sec. (D) $\frac{50}{3}$ sec.

Comperhension # (Q.4 to Q.6)

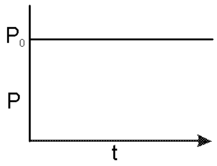
Graham's law tells as about rate of effusion or diffusion of gases. In modern form, it simply states that the rate of effusion or diffusion of any ideal gas is inversely proportional to square root of its molar mass.

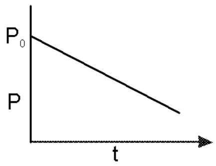
$$\frac{r_1}{r_2} = \frac{P_1}{P_2}\sqrt{\frac{M_2}{M_1}}$$

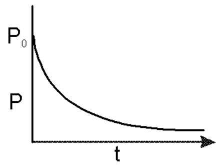
Also, rate of effusion of a gas mixture is simply the sum of rates of effusion of individual gases, since ideal gases do not affect each other.

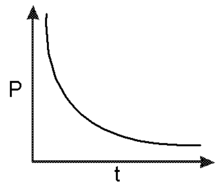
Now answer the following questions :

4. 10 moles of N_2 gas are placed in a vessel of constant volume and temperature. A hole is punctured in the vessel and left in vacuum. The pressure of N_2 in the vessel will vary with time as :

(A) 

(B) 

(C) 

(D) 

5. If a mixture of (80 mol %) He and (20 mol%) SO_2 is taken in an isothermal isochoric vessel, as the gases leak through a small hole in the vessel, when placed in vacuum :

(A) Average molar mass of gas mixture left in vessel increases with time.

(B) Average molar mass of gas mixture left in vessel remains same with time.

(C) Average molar mass of gas mixture left in vessel decreases with time.

(D) Variation of M_{avg} with time depends on temperature as well as area of hole, so it cannot be commented upon, in general.

6. In the previous question, what will be the rate of effusion of the initial gas mixture relative to D_2 under same conditions of total pressure and temperature :

(A) 1/2 (B) 0.29 (C) 2 (D) 0.85

7. A helium atom is two times heavier than a hydrogen molecule. At 298 K, the average translational kinetic energy of helium is :

(A) two times that of hydrogen molecule (B) same as that of hydrogen molecule

(C) four time that of hydrogen molecule (D) half that of hydrogen molecule

8. At what temperature, will hydrogen molecules have the same average translational kinetic energy as nitrogen molecules have, at 35°C?

(A) $\left(\frac{28 \times 35}{2}\right)$°C (B) $\left(\frac{2 \times 35}{28}\right)$°C (C) $\left(\frac{2 \times 28}{35}\right)$°C (D) 35 °C

9. Average translational K.E. of one mole of helium gas at 273 K in calories is :

(A) 819 Cal (B) 81.9 Cal (C) 8.19 Cal (D) None of these

10. Average translational kinetic energy of 14 grams of nitrogen gas at 127°C is nearly : (mol. mass of nitrogen = 28 and gas constant = 8.3 J/mol/K)

(A) 4980 J (B) 1660 J (C) 2490 J (D) 9960 J

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PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 32

Total Marks : 35

Max. Time : 36 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3,5,6,7	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.9 to Q.11	(3 marks, 3 min.)	[9, 9]

1. Calculate the temperature at which the R.M.S. velocity of sulphur dioxide molecules is the same as that of oxygen gas molecules at 300 K :
(A) 600°C (B) 600 K (C) 300 K (D) 300°C

2. Suppose that we change the rms speed, v_{rms}, of the gas molecules in closed container of fixed volume from 5×10^4 cm sec^{-1} to 10×10^4 cm sec^{-1}. Which one of the following statements might correctly explain how this change was accomplished :
(A) By heating the gas, we double the temperature.
(B) By pumping out 75% of the gas at constant temperature, we decreased the pressure to one quarter of its original value.
(C) By heating the gas, we quadrupled the pressure.
(D) By pumping in more gas at constant temperature, we quadrupled the pressure.
(E) None of the above.

3. Express the average kinetic energy per mole of a monoatomic gas of molar mass M, at temperature T K in terms of the mean speed of the molecules ($\bar{c}$) :
(A) $\frac{8M}{3\pi}(\bar{c})^2$ (B) $\frac{3M}{16}(\bar{c})^2$ (C) $\left(\frac{2M}{\pi}\right)(\bar{c})^2$ (D) $\left(\frac{3\pi M}{16}\right)(\bar{c})^2$

4. At same temperature and pressure, which of the following gases will have same average translational kinetic energy per mole as N_2O :
(A) He (B) H_2S (C) CO_2 (D) NO_2

5. Which of the following statements is not true :
(A) The ratio of the mean speed to the rms speed is independent of temperature of gas.
(B) The square of the mean speed of the molecules is equal to the mean squared speed at a certain temperature.
(C) Mean translational kinetic energy of the gas molecules at any given temperature is independent of the molecular mass of gas.
(D) The difference between rms speed and mean speed at any temperature for different gases diminishes as larger and yet larger molar masses are considered.

6. A flask of 4.48 L capacity contains a mixture of N_2 and H_2 at 0ºC and 1 atm pressure. If the mixture is made to react to form NH_3 gas at the same temperature, the pressure in the flask reduces to 0.75 atm. The partial pressure of NH_3 gas in the final mixture is :
(A) 0.33 atm (B) 0.50 atm (C) 0.66 atm (D) 0.25 atm

7. If the density of a gas sample is 4 g/L at pressure 1.2×10^5 Pa, the value of V_{RMS} will be :
(A) 600 m/s (B) 300 m/s (C) 150 m/s (D) 450 m/s

8. The value of v_{rms} for a gas X at 546° C was found to be equal to the value of v_{mp} for another gas Y at 273° C. Assuming ideal behaviour, find the molecular mass of gas Y (in amu) if the molecular mass of gas X is 9 amu.

Comprehension # (Q.9 to Q.11)

The speed of a molecule of a gas changes continuously as a result of collisions with other molecules and with the walls of the container. The speeds of individual molecules therefore change, but it is expected that the distribution of molecular speeds does not change with time.

A direct consequence of the distribution of speeds is that the average kinetic energy is constant for a given temperature.

The average K.E, is defined as

$$\overline{KE} = \frac{1}{N}\left(\frac{1}{2}mv_1^2 + \frac{1}{2}mv_2^2 + ... + \frac{1}{2}mv_N^2\right) = \frac{1}{2N}\ m(v_1^{\,2} + v_2^{\,2} + ... + v_N^{\,2}) = \frac{1}{2}\ m\overline{V^2}$$

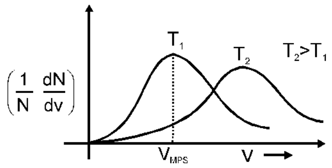
Alternatively it may be defined as $\overline{KE} = \frac{1}{N}\left(\frac{1}{2}m\sum_i dN_i v_1^2\right) = \frac{1}{2}m\left(\sum_i \frac{dN_i}{N}\cdot v_1^2\right)$

where $\frac{dN_i}{N}$ is the fraction of molecules having speeds between v_i and

v_i + dv and as proposed by Maxwell $\frac{dN}{N} = 4\pi\left(\frac{m}{2\pi KT}\right)^{3/2}$ exp $(-mv^2/$

$2kT).v^2.dv$

The plot of $\left(\frac{1}{N}\frac{dN}{dv}\right)$ is plotted for a particular gas at two different temperatures against 'v' as shown.



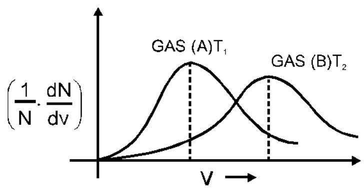
The majority of molecules have speeds which cluster around v_{MPS} in the middle of the range of v. There area under the curve between any two speeds v_1 and v_2 is the fraction of molecules having speeds between v_1 and v_2.

The speed distribution also depends on the mass of the molecule. As the area under the curve is the same (equal to unity) for all gas samples, samples which have the same v_{MPS} will have identical Maxwellian plots. On the basis of the above passage answer the questions that follow.

9. If a gas sample contains a total of 'N' molecules, the area under any given maxwellian plot is equal to:

(A) infinite (B) N (C) 1 (D) $\int_0^N \left(\frac{dN}{dv}\right)\cdot dv$

10. For the above graph drawn for two different samples of gases at two different temperatures T_1 and T_2, which of the following statements is necessarily true :



(A) If $T_2 > T_1$, M_A is necessarily greater than M_B

(B) If $T_1 > T_2$, M_B is necessarily greater than M_A

(C) $\frac{T_2}{M_B} > \frac{T_1}{M_A}$

(D) Nothing can be predicted

11. If two gases 'A' and 'B' and at temperature T_A and T_B respectively have identical Maxwellian plots, then which of the following statements are true :

(A) $T_B = T_A$

(B) $M_B = M_A$

(C) $\frac{T_A}{M_A} = \frac{T_B}{M_B}$

(D) Gases A and B may be O_2 and SO_2 at 27ºC and 327ºC respectively.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 33

Total Marks : 26

Max. Time : 28 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. The vapour pressure of water depends upon :
(A) Surface area of water in container
(B) Volume of container
(C) Temperature
(D) All of these

2. Among the following substances, the maximum vapour pressure is exerted by :
(A) Water (b.pt. = 100ºC)
(B) Acetone (b.pt. = 56ºC)
(C) Ethanol (b.pt. = 78ºC)
(D) Chloroform (b.pt. = 61ºC)

3. A sample of air is saturated with benzene (vapour pressure = 100 mm Hg at 298 K) at 298K, 750 mm Hg pressure. If it is isothermally compressed to one third of its initial volume, the final pressure of the system is:
(A) 2250 torr (B) 2150 torr (C) 2050 torr (D) 1950 torr

4. A vessel has nitrogen gas and water vapours in equilibrium with liquid water at a total pressure of 1 atm. The partial pressure of water vapours is 0.3 atm. The volume of this vessel is reduced to one third of the original volume, at the same temperature, then total pressure of the system is :(Neglect volume occupied by liquid water)
(A) 3.0 atm (B) 1 atm (C) 3.33 atm (D) 2.4 atm

5. 60 mL of pure dry O_2 is subjected to silent electric discharge. If only 20% of it is converted to O_3, volume of the mixture of gases (O_2 and O_3) after the reaction is V_1 mL and after passing through turpentine oil is V_2 mL. V_1 and V_2 are :
(A) 56 mL and 52 mLrespectively
(B) 48 mL and 40 mL respectively
(C) 48 mL and 44 mL respectively
(D) 56 mL and 48 mL respectively

6. 15 mL of a gaseous hydrocarbon was exploded with 72 mL of oxygen. The volume of gases on cooling was found to be 57 mL, 30 mL of which was absorbed by KOH and the rest was absorbed in a solution of alkalline pyrogallol. Then the formula of hydrocarbon is :
(A) C_3H_4 (B) C_2H_4 (C) C_2H_6 (D) C_3H_6

7. 1 litre of a mixture of CO and CO_2 is taken. This mixture is passed through a tube containing red hot charcoal, where the following reaction takes place :

$$CO_2 + C \longrightarrow 2CO$$

The volume now becomes 1.6 litres. Find the volume of gas sample obtained by passing 1 litre of initial gas mixture through KOH solution.

8. 1120 mL of ozonised oxygen ($O_2 + O_3$) at STP weighs 1.76 g. Calculate the reduction in volume on passing this through alkalline pyrogallol solution

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PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 34

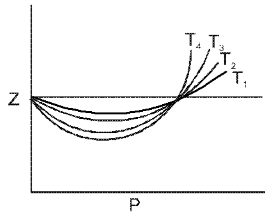
Total Marks : 29

Max. Time : 31 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4 to Q.6	(4 marks, 4 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

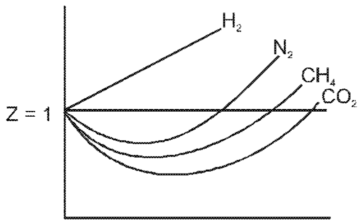
1. Which of the following is correct order of temperature shown in the above graph Z Vs P for the same gas :



(A) $T_4 < T_3 < T_2 < T_1$ (B) $T_1 < T_2 < T_3 < T_4$
(C) $T_1 < T_2 < T_4 < T_3$ (D) $T_3 < T_4 < T_2 < T_1$

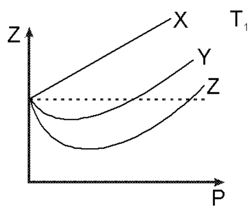
2. A real gas most closely approaches the behaviour of an ideal gas at :
(A) low pressure & low temperature (B) high pressure & high temperature
(C) low pressure & high temperature (D) high pressure & low temperature

3. What is the correct increasing order of liquifiability of the gases shown as in above graph :

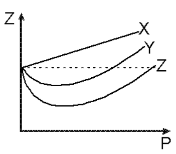


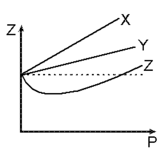
(A) $H_2 < N_2 < CH_4 < CO_2$ (B) $CO_2 < CH_4 < N_2 < H_2$
(C) $H_2 < CH_4 < N_2 < CO_2$ (D) $CH_4 < H_2 < N_2 < CO_2$

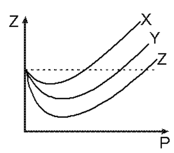
4.* Z vs P graph is plotted for 1 mole of three different gases X, Y and Z at temperature T_1.

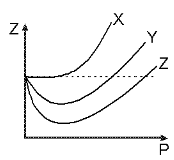


Then, which of the following may be correct if the above plot is made for 1 mole of each gas at T_2 temperature ($T_2 < T_1$) :

(A)


(B)


(C)


(D)


5.* Which of the following statements regarding compressibility factor (Z) is/are correct :

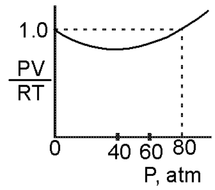
(A) In the lower pressure region, value of Z initially decreases on increasing pressure and then increases, however H_2 and He gases are exception to this.

(B) Z for an ideal gas is greater than one.

(C) Z for a non-ideal gas can be greater than or less than unity depending on temperature and pressure.

(D) When Z < 1, intermolecular attraction dominates over intermolecular repulsion.

6.* The Vander waal's equation of state for a non-ideal gas can be rearranged to give $\frac{PV}{RT} = \frac{V}{V-b} - \frac{a}{VRT}$ for 1 mole of gas. The constants a & b are positive numbers . When applied to H_2 at 80K, the equation gives the curve as shown in the figure. Which one of the following statements is(are) correct :



(A) At 40 atm, the two terms V/(V – b) & a/VRT are equal.

(B) At 80 atm, the two terms V/(V – b) & a/VRT are equal.

(C) At a pressure greater than 80 atm, the term V/(V – b) is greater than a/VRT.

(D) At 60 atm, the term V/(V – b) is smaller than $1+\frac{a}{VRT}$.

7. Compressibility factor (Z) for N_2 at – 23°C and 820 atm pressure is 1.9. Find the number of moles of N_2 gas required to fill a gas cylinder of 95 L capacity under the given conditions.

8. Find the temperature at which the translational kinetic energy of hydrogen atom is equal to the transition energy of electron between n_1 = 1 and n_2 = 2 levels. (Take : Boltzmann constant K = 1.36 × 10^{-23} J/K.)

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 35

Total Marks : 26

Max. Time : 27 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5,8	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]

1. Vander waal's equation for 1 mole of a real gas under given conditions :

(a) high pressure — (i) $PV = RT + Pb$

(b) low pressure — (ii) $PV = RT - a/V$

(c) force of attraction between gas molecules is negligible — (iii) $PV = RT + a/V$

(c) volume of gas molecules is negligible — (iv) $[P - (a/V^2)]\ (V - b) = RT$.

(A) (a)-(i), (b)-(ii), (c)-(i), (d)-(ii)
(B) (a)-(i), (b)-(ii), (c)-(iii), (d)-(iv)
(C) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)
(D) (a)-(iv), (b)-(ii), (c)-(iii). (d)-(i).

2. Four different identical vessels at same temperature contains one mole each of C_2H_6, CO_2, Cl_2 and H_2S at pressures P_1, P_2, P_3 and P_4 respectively. The value of Vander waal's constant 'a' for C_2H_6, CO_2, Cl_2 and H_2S is 5.562, 3.640, 6.579 and 4.490 atm.L^2.mol^{-2} respectively. If value of Vander waal's constant 'b' is taken to be same for all gases, then :

(A) $P_3 < P_1 < P_4 < P_2$
(B) $P_1 < P_3 < P_2 < P_4$
(C) $P_2 < P_4 < P_1 < P_3$
(D) $P_1 = P_2 = P_3 = P_4$

3. Consider the following statements :

1. $(a)_{NH_3} > (a)_{H_2O}$ [(a) is Vander waal's constant]

2. Pressure of the real gas is always more than the ideal gas for same temperature and volume of the container.

3. Compresssibilty factor for H_2 (g) is never less than unity at any temperature.

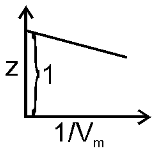
The above statements 1, 2, 3 respectively are : (T = True, F = False)

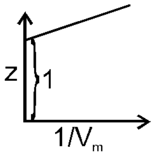
(A) T F F
(B) F F F
(C) F T F
(D) T T F

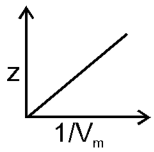
4. For a real gas with very large value of molar volume, which of the following equation can most suitably be applied:

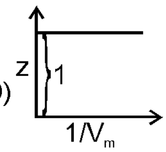
(A) $Z = 1 - \dfrac{a}{V_m RT}$
(B) $PV_m = RT$
(C) $Z = 1 + \dfrac{Pb}{RT}$
(D) $PV_m - RT = \dfrac{a}{V_m}$

5. For a real gas under low pressure conditions, which of the following graph is correct :

(A) 

(B) 

(C) 

(D) 

6.* Which of the following statements is/are correct about Boyle temperature (T_B) :

(A) Temperature at which 1st virial cofficient becomes Zero

(B) Temperature at which 2nd virial cofficient becomes Zero

(C) According to Vander waal's equation, value of T_B = a\Rb

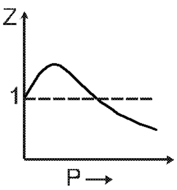
(D) T_B of a gas depends upon the nature of gas

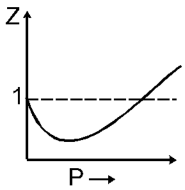
7. A hypothetical real gas A, having molar mass 16 g, has a density of 0.8 kg/m^3 at 2 atm pressure and a temperature of 127ºC. Determine : [Take R = 1/12 L atm K^{-1} mol^{-1}]

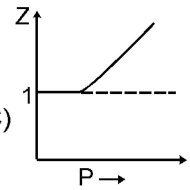
(i) the value of compressibility factor Z for gas A.

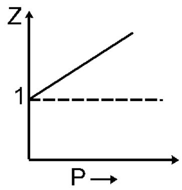
(ii) which forces are dominating among gas molecules, attractive or repulsive ?

8. Plot at Boyle's temperature for a real gas will be :

(A) 

(B) 

(C) 

(D) 

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PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 36

Total Marks : 30

Max. Time : 32 min.

Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.7	(4 marks, 4 min.)	[4, 4]
Match the Following (no negative marking) (2 × 4) Q.8	(8 marks, 10 min.)	[8, 10]

1. At the critical point for H_2 gas, value of Z = 3/8. Then, the value of Z under the similar conditions for CO_2, O_2, SO_2 at their respective critical points will be :
(A) greater than 3/8 (B) smaller than 3/8 (C) equal to 3/8 (D) nothing can be said

2. Critical temperature of a gas is ______ Boyle temperature :
(A) higher than (B) equal to (C) lower than (D) no relation between them

3. For the four gases A, B, E and D, the value of the excluded volume per mole is same. If the order of the critical temperature is $T_B > T_D > T_A > T_E$, then the order of their liquefaction pressure at a temperature T ($T < T_E$) will be :
(A) $P_A < P_B < P_E < P_D$ (B) $P_B < P_D < P_A < P_E$ (C) $P_E < P_A < P_D < P_B$ (D) $P_D < P_E < P_A < P_B$

4. The critical pressure P_C and critical temperature T_C for a gas obeying Vander Waal's equation are 80 atm and 87°C. Molar mass of the gas is 130 g/mole. The compressibility factor for the above gas will be smaller than unity under the following conditions :
(A) 1 atm and 800 °C (B) 1 atm and 1200 °C (C) 1 atm and 1000 °C (D) 1 atm and 1100 °C

5. Given that the critical temperature of oxygen is 154K and its critical pressure is 50 atm. Which of the following statements is/are true :
I. In a closed container at 154K and 50 atm, the solid, liquid, and gaseous phase of oxygen are in equilibrium.
II. Oxygen gas can be liquefied at room temperature.
III. It can be reasoned that ammonia has a critical temperature above 154 K.
(A) I is true (B) II and III are true (C) III is true (D) I and III are true

6. The virial equation for 1 mole of a real gas is written as : $PV = RT\left[1+\frac{A}{V}+\frac{B}{V^2}+\frac{C}{V^3}+.....\text{to higher power of n}\right]$

Where A,B and C are known as virial cofficients. If Vander waal's equation is written in virial form, then what will be the value of B :

(A) $a - \frac{b}{RT}$ (B) b^3 (C) $b - \frac{a}{RT}$ (D) b^2

7.* Critical temperature for a particular gas is – 177°C. Then for which of the following case, value of compressibility factor of the gas may be more than unity :
(A) at 0°C and 0.01 atm (B) at 0°C and 2000 atm (C) at 60°C and 0.01 atm (D) at 60°C and 10 atm

8. **Match the following :**

Column I	Column II
(A) For a gas, repulsive tendency dominates	(p) Effects of 'a' and 'b' compensate each other.
(B) At T_B = – 3 °C for a gas in high pressure region	(q) There is no difference between physical properties in liquid and gas state.
(C) At T_C	(r) Z > 1
(D) For He gas at 0°C in all pressure region	(s) T_C = 80 K

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 37

Total Marks : 24

Max. Time : 24 min.

Topic : Chemical Equilibrium

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.8	(3 marks, 3 min.)	[24, 24]

1. For the homogeneous gaseous reaction : $4NH_3 + 5O_2 \rightleftharpoons 4NO + 6H_2O$, the equilibrium constant K_c has the units of :

(A) $(Conc.)^{-10}$ (B) $(Conc.)^{1}$ (C) $(Conc.)^{-1}$ (D) It is dimensionless.

2. Select the gaseous reaction for which the equilibrium constant is written as : $[MX_3]^2 = K[MX_2]^2 [X_2]$

(A) $MX_3 \rightleftharpoons MX_2 + \frac{1}{2}X_2$ (B) $2MX_3 \rightleftharpoons 2MX_2 + X_2$

(C) $2MX_2 + X_2 \rightleftharpoons 2MX_3$ (D) $MX_2 + \frac{1}{2}X_2 \rightleftharpoons MX_3$.

3. In order to increase the rate of forward reaction : $2A(g) + 3B(g) \rightleftharpoons$ Product, 32 times, it is necessary to :

(A) Make the conc. of A and B three times (B) Make the conc. of A and B two times

(C) Make the conc. of A and B half (D) Make the conc. of A and B four times

4. For the reaction, $A + 2B \rightleftharpoons 2C$, the rate constants for the forward and the backward reactions are 1×10^{-4} and 2.5×10^{-2} respectively. The value of equilibrium constant, K for the reaction would be :

(A) 1×10^{-4} (B) 2.5×10^{-2} (C) 4×10^{-3} (D) 2.5×10^{2}

5. An equilibrium system for the reaction between hydrogen and iodine to give hydrogen iodide at 765 K in a 5 litre volume contains 0.4 mole of hydrogen, 0.4 mole of iodine and 2.4 moles of hydrogen iodide. The equilibrium constant for the reaction is : $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(A) 36 (B) 15 (C) 0.067 (D) 0.28.

6. For a gasesous reaction, $2A + B \rightleftharpoons 2C$, the partial pressures of A, B and C at equilibrium are 0.3 atm, 0.4 atm and 0.6 atm respectively. The value of K_p for the reaction would be :

(A) $10\ atm^{-1}$ (B) $1/10\ atm^{-1}$ (C) $0.2\ atm^{-1}$ (D) $5\ atm^{-1}$

7. The active mass of 64 g of HI in a two litre flask would be :

(A) 2 (B) 1 (C) 5 (D) 0.25

8. For the reaction , $A + B \rightleftharpoons 3C$, if 'a' moles/litre of each 'A' & 'B' are taken initially , then the incorrect relation about concentrations at equilibrium is :

(A) [A] – [B] = 0 (B) 3 [B] + [C] = 3 a (C) 3 [A] + [C] = 3 a (D) [A] + [B] = 3 [C]

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 38

Total Marks : 31

Max. Time : 35 min.

Topic : Chemical Equilibrium

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.6 to Q.9	(4 marks, 5 min.)	[16, 20]

1. For the equilibrium $PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2(g)$ in a closed vessel, K_p is found to be double of K_c. This is attained when :

(A) T = 2 K (B) T = 12.18 K (C) T = 24.36 K (D) T = 27.3 K

2. K_p / K_c for the reaction $CO(g) + \frac{1}{2} O_2(g) \rightleftharpoons CO_2\,(g)$ will be :

(A) 1 (B) $\sqrt{RT}$ (C) $\frac{1}{\sqrt{RT}}$ (D) R T

3. For the reaction : $N_2O_4\,(g) \rightleftharpoons 2NO_2\,(g)$ at 360 K, the value of K_c = 0.4 mole lit^{-1}. The value of K_p for the reaction at the same temperature would be :

(A) 12 atm (B) 1.2 atm (C) 1.2×10^2 atm (D) 1.2×10^{-3} atm

4. Starting with one mole of nitrogen and 3 moles of hydrogen, at equilibrium 50% of each had reacted according to the reaction : $N_2\,(g) + 3H_2\,(g) \rightleftharpoons 2NH_3\,(g)$

If the equilibrium pressure is P, the partial pressure of hydrogen at equilibrium would be :

(A) P/2 (B) P/3 (C) P/4 (D) P/6

5. For which of the following equilibria, is $K_p = K_c$:

(A) $2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$ (B) $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$

(C) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ (D) $COCl_2(g) \rightleftharpoons CO(g) + Cl_2(g)$

6. For the following chemical equation, write expression for equilibrium constants K_c and K_p

$2NO_2\,(g) \rightleftharpoons N_2O_4\,(g)$

Also write their proper units.

7. PCl_5 dissociates into PCl_3 and Cl_2 in a 2 L flask at about 600ºC. At equilibrium, mixture is found to contain 1 mole PCl_5 and 2 moles each of PCl_3 and Cl_2. Calculate :

(i) equilibrium molar concentrations.

(ii) equilibrium mole fractions.

(iii) equilibrium constant K_c for the chemical equilibrium : $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

8. For an equilibrium A (g) + 2B (g) $\rightleftharpoons$ 2C (g) + D (g), A and B are mixed in a reaction vesel at 300 K. The initial concentration of B was 1.5 times the initial concentration of A. After the equilibrium, the equilibrium concentrations of A and D are same. Calculate K_C for the given reaction .

9. n mole of PCl_3 and n mole of Cl_2 are allowed to react at constant temperature T to have a total equilibrium pressure P, as : $PCl_3\,(g) + Cl_2\,(g) \rightleftharpoons PCl_5\,(g)$

If y mole of PCl_5 are formed at equilibrium, find K_P for the given reaction.

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PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 39

Total Marks : 29

Max. Time : 31 min.

Topic : Chemical Equilibrium

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.8 to Q.9	(4 marks, 5 min.)	[8, 10]

1. In a reaction A (g)+ 2B (g) $\rightleftharpoons$ 2C (g), 2 moles of 'A', 3 moles of 'B' and 1 mole of 'C' are placed in a 2 L flask and the equilibrium concentration of 'C' is 1 mol/L. The equilibrium constant (K_C) for the reaction is :
(A) 0.33 lit/mol (B) 1.33 lit/mol (C) 1.66lit/mol (D) 0.66 lit/mol

2 For the reaction : $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, the equilibrium constant K_p changes with :
(A) total pressure (B) addition of catalyst
(C) the amounts of H_2 and I_2 taken initially (D) temperature

3. In a reversible chemical reaction having two reactants in equilibrium with one product, if the initial concentration of both the reactants is doubled, then the equilibrium constant will :
(A) also be doubled (B) be halved
(C) become one fourth (D) remain the same.

4. For the equilibrium $2H_2O(g) \rightleftharpoons 2H_2\,(g) + O_2(g)$, equilibrium constant is K_1.
For the equilibrium $2CO_2(g) \rightleftharpoons 2CO(g) + O_2\,(g)$, equilibrium constant is K_2.
Then, the equilibrium constant for $CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$ is :

(A) $K_1 K_2$ (B) $\frac{K_1}{K_2}$ (C) $\sqrt{\frac{K_1}{K_2}}$ (D) $\sqrt{\frac{K_2}{K_1}}$

5. For the reaction A(g) + B(g) $\rightleftharpoons$ C(g) at equilibrium, the partial pressure of the species are P_A = 0.15 atm, $P_C = P_B$ = 0.30 atm. If the capacity of reaction vessel is reduced, the equilibrium is re-established. In the new situation, partial pressure A and B become twice. What is the partial pressure of C :
(A) 0.3 atm (B) 0.6 atm (C) 1.2 atm (D) 1.8 atm

6. The equilibrium constant for the reaction

$A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ is 20 at 500 K.

The equilibrium constant for the reaction,

$2AB(g) \rightleftharpoons A_2(g) + B_2(g)$ at 500 K would be :

(A) 20 (B) 0.5 (C) 0.05 (D) 10

7. The value of K_p for the reaction, A(g) + 2B(g) $\rightleftharpoons$ C(g) is 25 atm^{-2} at a certain temperature. The value of K_P for the reaction, $\frac{1}{2}$C(g) $\rightleftharpoons$ $\frac{1}{2}$ A(g) + B(g) at the same temperature would be :

(A) 25 atm^{-1} (B) $\frac{1}{25}$ atm^{-1} (C) $\frac{1}{5}$ atm (D) 5 atm

8. For the gaseous reaction of XO with O_2 to form XO_2, the equilibrium constant at 398 K is 1×10^{-4} lit/mole. If 1 mole of XO and 2 mole of O_2 are placed in a 1 L vessel and allowed to come to equilibrium, what will be the equilibrium concentration of each of the species ?

9. Prove that the pressure at equilibrium obtained upon 50% dissociation of PCl_5 as follows at 250ºC is numerically three times of K_p. $PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 40

Total Marks : 26

Max. Time : 28 min.

Topic : Chemical Equilibrium

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. $CH_3–CO–CH_3(g) \rightleftharpoons CH_3–CH_3(g) + CO(g)$

Initial pressure of CH_3COCH_3 is 100 mm. When equilibrium is set up, mole fraction of CO(g) is 1/3. Hence value of K_p for given reaction is :

(A) 100 mm (B) 50 mm (C) 25 mm (D) 0.6 mm

2. The degree of dissociation of N_2O_4 (α) obeying the equilibrium,

N_2O_4 (g) $\rightleftharpoons$ $2NO_2$ (g), is approximately related to the presure at equilibrium by :

(A) $\alpha \propto P$ (B) $\alpha \propto \frac{1}{\sqrt{P}}$ (C) $\alpha \propto \frac{1}{P^2}$ (D) $\alpha \propto \frac{1}{P^4}$

3. Two moles of HI were heated in a sealed tube at 440°C till the given equilibrium was reached. HI was found to be 20% decomposed. The equilibrium constant for dissociation is :

$$2HI\ (g) \rightleftharpoons H_2\ (g) + I_2\ (g)$$

(A) $\frac{1}{16}$ (B) $\frac{1}{32}$ (C) $\frac{1}{64}$ (D) $\frac{1}{128}$

4. In the following reaction, 3A (g) + B (g) $\rightleftharpoons$ 2C (g) + D (g),

Initial moles of B is double of A. At equilibrium, moles of A and C are equal. Hence % dissociation of B is :

(A) 10% (B) 20% (C) 40% (D) 5%

5. For the equilibrium $N_2O_4 \rightleftharpoons 2NO_2$ in gaseous phase, NO_2 is 50% of the total volume when equilibrium is set up. Hence percent of dissociation of N_2O_4 is :

(A) 50% (B) 25% (C) 66.66% (D) 33.33%

6. PCl_5 is 40% dissociated according to the following reaction, when equilibrium pressure is 2 atm. It will be 80% dissociated, when equilibrium pressure is approximately : PCl_5 (g) $\rightleftharpoons$ PCl_3 (g) + Cl_2 (g)

(A) 0.2 atm (B) 0.5 atm (C) 0.3 atm (D) 0.6 atm

7. The equilibrium constant for the following reaction , H_2 (g) + Br_2 (g) $\rightleftharpoons$ 2 HBr (g) is 1.6×10^5 at 1024 K. Find the equilibrium pressure of all gases if 10 bar of HBr is introduced into a sealed container at 1024 K initially.

8. At a certain temperature, the equilibrium constant (K_c) is 9/4 for the reaction :

$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$

If we take 10 mole of each of the four gases in a one-litre container, what would be the equilibrium mole percent of H_2 (g) ?

PHYSICAL CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 41

Total Marks : 29

Max. Time : 30 min.

Topic : Chemical Equilibrium

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1, 2, Q.4 to Q.8	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.3	(4 marks, 5 min.)	[4, 5]
Multiple choice objective ('–1' negative marking) Q.9	(4 marks, 4 min.)	[4, 4]

1. For A (g) $\rightleftharpoons$ 2B (g), equilibrium constant at total equilibrium pressure p_1 is K_{p_1} & for C (g) $\rightleftharpoons$ D (g) + E (g), equilibrium constant at total equilibrium pressure p_2 is K_{p_2}. If degree of dissociation of A & C are same, then the ratio p_1/p_2, if $K_{p_1} = 2\ K_{p_2}$, is :
(A) 1/2 (B) 1/3 (C) 1/4 (D) 2

2. Match the following : (Take reactants to be in stoichiometric proportions in case of two reactants)

Reaction (Homogeneous gaseous phase)	**Degree of dissociation of reactant in terms of equilibrium constant**
1. A + B $\rightleftharpoons$ 2 C	**(a)** $(\sqrt{K})/(1+\sqrt{K})$
2. 2 A $\rightleftharpoons$ B + C	**(b)** $(\sqrt{K})/(2+\sqrt{K})$
3. A + B $\rightleftharpoons$ C + D	**(c)** 2 K / (1 + 2K)
4. AB $\rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2$	**(d)** $\frac{2\sqrt{K}}{1+2\sqrt{K}}$

(A) 1–d, 2–c, 3–b, 4–a (B) 1–a, 2–c, 3–b, 4–d
(C) 1–b, 2–d, 3–a, 4–c (D) 1–b, 2–a, 3–d, 4–c

3. 0.96 g of HI were heated to attain equilibrium 2HI (g) $\rightleftharpoons$ H_2 (g) + I_2 (g). The equilibrium mixture, on reaction requires 15 mL of M/10 Hypo ($Na_2S_2O_3$) solution. Calculate the degree of dissociation of HI.
$I_2 + Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + NaI$ (unbalanced)

4. In an evacuated closed isolated chamber at 227°C, 0.02 mole PCl_5 and 0.01 mole Cl_2 are mixed and PCl_5(g) $\rightleftharpoons$ PCl_3 (g) + Cl_2(g) equilibrium is attained. At equilibrium, density of mixture was 2.4 g/L and pressure was 1 atm . The number of total moles at equilibrium will be approximately :
(A) 0.012 (B) 0.022 (C) 0.032 (D) 0.0488

5. For NH_4HS(s) $\rightleftharpoons$ NH_3(g) + H_2S(g) reaction started only with NH_4HS(s), the observed pressure for reaction mixture in equilibrium is 1.12 atm at 106°C. What is the value of K_p for the reaction ?

6. For the reaction : $CaCO_3$ (s) $\rightleftharpoons$ CaO(s) + CO_2 (g), K_p = 1 atm at 727°C. If 20 g of $CaCO_3$ were kept in a 10 litre vessel at 727°C, then the percentage of $CaCO_3$ remaining at equilibrium is :
(A) 40% (B) 60% (C) 46% (D) 66%

7. 200 g of $CaCO_3$(s) are taken in a 4 L container at a certain temperature. K_c for the dissociation of $CaCO_3$ at this temperature is found to be 1/4 mole L^{-1}. Then, the concentration of CaO in mole/litre is : [Given ρ_{CaO} = 1.12 g cm^{-3}]
(A) 1/2 (B) 1/4 (C) 0.02 (D) 20

8. The exothermic formation of NH_3 is represented by the equation : N_2 (g) + $3H_2$ (g) $\rightleftharpoons$ $2NH_3$ (g)
Which of the following will increase the quantity of NH_3 in an equilibrium mixture of N_2, H_2 and NH_3 :
(A) Increasing the temperature (B) Increasing the volume of container
(C) Removing N_2 (D) Adding H_2

9.* When $AgNO_3$ is heated mildly in a closed vessel, oxygen is liberated and $AgNO_2$ is left behind. At equilibrium according to reaction $AgNO_3$ (s) $\rightleftharpoons$ $AgNO_2$ (s) + $\frac{1}{2}O_2$ (g) :
(A) addition of $AgNO_2$ favours reverse reaction (B) addition of $AgNO_3$ favours forward reaction
(C) increasing temperature favours forward reaction (D) increasing pressure favours reverse reaction

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 42

Total Marks : 26

Max. Time : 26 min.

Topic : Chemical Equilibrium

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4 to Q.5	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$,

At equilibrium in the above case, 'a' moles of $CaCO_3$, 'b' moles of CaO and 'c' moles of CO_2 are found. Then, identify the wrong statement :

(A) Moles of $CaCO_3$ will decrease with the addition of inert gas at constant pressure.

(B) Moles of $CaCO_3$ will remain constant with the increase in volume.

(C) If volume of the vessel is halved, then moles of $CaCO_3$ will increase.

(D) Moles of CaO will decrease with the increase in pressure.

2. For the equilibrium $CuSO_4.5H_2O(s) \rightleftharpoons CuSO_4.H_2O(s) + 4H_2O(g)$, the equilibrium constant $K_p = 2.56 \times 10^{-10}$ atm^4 at 27ºC. Now, if an air sample 40% saturated with water vapour is exposed to the above reaction at equilibrium, which of the following statements is/are correct :

Given : Saturated vapour pressure of water at 27ºC is 12.5 torr.

(A) Mass of $CuSO_4.5H_2O$ will increase.
(B) Mass of $CuSO_4.5H_2O$ will decrease.
(C) Mass of $CuSO_4.H_2O$ will increase.
(D) Mass of $CuSO_4.H_2O$ will decrease.

3. $2Pb(NO_3)_2(s) \rightleftharpoons 2PbO(s) + 4NO_2(g) + O_2(g)$, $\quad \Delta H > 0$

Above equilibrium is established by taking some amount of $Pb(NO_3)_2$ (s) in a closed container at 1600 K. Then which of the following is the INCORRECT option :

(A) moles of PbO(s) will increase with the increase in temperature

(B) If the volume of the container is doubled at equilibrium, then partial pressure of NO_2(g) will change at new equilibrium.

(C) If the volume of the container is halved, partial pressure of O_2(g) at new equilibrium will remain same

(D) If two moles of He gas is added at constant pressure, then the moles of PbO(s) will increase.

4.* 1 mole each of N_2(g) and O_2(g) are introduced in a 1L evacuated vessel at 523K and equilibrium $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is established. The concentration of NO(g) at equilibrium :

(A) Changes on changing pressure.
(B) Changes on changing temperature.
(C) Changes on changing volume of the vessel.
(D) Remains same even when a platinum gauze is introduced to catalyse the reaction.

5.* For the reaction, $\frac{1}{2}H_2(g) + \frac{1}{2}I_2(g) \rightleftharpoons HI(g)$

If pressure is increased by reducing the volume of the container, then :

(A) Total pressure at equilibrium will change.

(B) Concentration of all the components at equilibrium will change.

(C) Concentration of all the components at equilibrium will remain same.

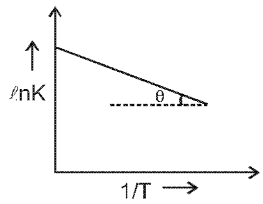
(D) Equilibrium will shift in the forward direction.

Comprehension # (Q. 6 to Q. 8)

Variation of equilibrium constant K with temperature T is given by Vant Hoff's equation as :

$$K = Ae^{-\frac{\Delta H^\circ}{RT}}$$ (A – Pre exponential factor)

For a certain reaction, a graph between ℓn K and 1/T was observed to be straight line as shown in the figure below :



Given : (1) As $T \rightarrow \infty$, ℓnK = 46.06

(2) $\theta = 30°$

(3) Use $\ell n\ K = 2.303 \log_{10} K$

6. The value of $\Delta H°$ (standard enthalpy change) for the given reaction is :

(A) $-\frac{R}{\sqrt{3}}$ (B) $-R\sqrt{3}$ (C) $R\sqrt{3}$ (D) $\frac{R}{\sqrt{3}}$

7. The value of pre-exponential factor A for the given reaction is :

(A) 10^{2} (B) 10^{20} (C) 10^{-2} (D) 10^{-20}

8. Which of the following statements is INCORRECT regarding the given reaction :

(A) The given reaction is an endothermic reaction.

(B) For the given reaction, standard entropy change ($\Delta S°$) is positive.

(C) The value of equilibrium constant K decreases with increase in temperature.

(D) The value of equilibrium constant K is unaffected by pressure changes.

PHYSICAL CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 43

Total Marks : 29

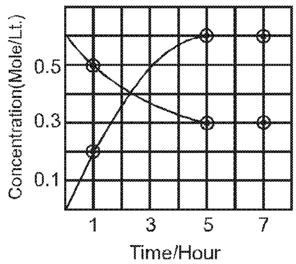
Max. Time : 33 min.

Topic : Chemical Equilibrium

Type of Questions		M.M., Min.
Subjective Questions ('–1' negative marking) Q.1 to Q.4	(4 marks, 5 min.)	[16, 20]
Multiple choice objective ('–1' negative marking) Q.5	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. The equilibrium constant of the reaction A_2 (g) + B_2 (g) $\rightleftharpoons$ 2 AB (g) at 100º C is 50. If a one litre flask containing one mole of A_2 is connected to a two litre flask containing two moles of B_2, how many moles of AB will be formed at 373 K ?

2. The progress of reaction : A(g) $\rightleftharpoons$ nB(g)
with time, is presented in fig. given below. Determine :



(i) the value of n (ii) the equilibrium constant, K_C and

3. One mole of Cl_2(g) and 3 moles of PCl_5(g) are placed in a 100 litre vessel heated to 227ºC.The equilibrium pressure is 2.05 atm. Assuming ideal behaviour, calculate the degree of dissociation of PCl_5(g) and K_P for the reaction, PCl_5 (g) $\rightleftharpoons$ PCl_3 (g) + Cl_2 (g).

4. When equal volumes of 0.2 M $AgNO_3$ and 1 M KCN solutions were mixed then at equilibrium, concentration of Ag^+ was found to be 10^{-6} M. While when equal volumes of 0.2 M $Zn(NO_3)_2$ solution and of 1 M KCN solution were mixed then at equilibrium, concentration of Zn^{2+} ion was found to be 10^{-12} M. Then find the equilibrium constant K_C of following reaction : $2[Ag(CN)_2]^-$ (aq.) + Zn^{2+} (aq.) $\rightleftharpoons$ $[Zn(CN)_4]^{2-}$ (aq.) + $2Ag^+$ (aq.).

5.* Consider two equilibrium $2Cl_2$(g) + $2H_2O$(g) $\rightleftharpoons$ 4HCl(g) + O_2(g) and N_2(g) + O_2(g) $\rightleftharpoons$ 2NO(g) simultaneously established in a closed vessel. When some amount of HCl is added at equilibrium, which of the following statements is correct :
(A) amount of N_2 gas will decrease.
(B) amount of N_2 gas will increase.
(C) amount of O_2 gas will decrease.
(D) nothing can be said with certainty.

Comperhension # (Q.6 to Q.8)

Solid NH_4I rapidly decompose as follows : NH_4I (s) $\rightleftharpoons$ NH_3 (g) + HI (g)
At equilibrium, total pressure = 0.5 atm.
Now, HI starts decomposing as follows : 2HI (g) $\rightleftharpoons$ H_2(g) + I_2 (g)
At final equilibrium, partial pressure of H_2 = $\frac{3}{16}$ atm.
Now answer the following questions :

6. Calculate new total pressure :
(A) 0.9 atm (B) 1 atm (C) 0.6 atm (D) 0.5 atm

7. Calculate K_p for the reaction 2HI(g) $\rightleftharpoons$ H_2(g) + I_2(g) :
(A) $\frac{9}{4}$ (B) $\frac{9}{8}$ (C) $\frac{9}{16}$ (D) None of these

8. Partial pressure of HI at equilibrium is :
(A) 0.05 atm (B) 0.1 atm (C) 0.15 atm (D) 0.125 atm

PHYSICAL CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 44

Total Marks : 28

Max. Time : 32 min.

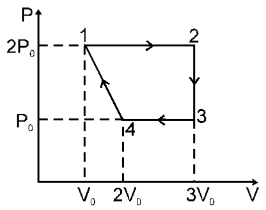
Topic : Thermodynamics & Thermochemistry

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.5 to Q.8	(4 marks, 5 min.)	[16, 20]

1. In thermodynamics, a process is called reversible when :
(A) surrounding and system change into each other.
(B) there is no real boundary between system and surrounding.
(C) the surrounding is always in equilibrium with the system.
(D) the system changes into the surrounding spontaneously.

2. Choose the incorrect statement :
(A) System and surrounding are always separated by a real or imaginary boundary.
(B) Perfectly isolated system can never be created.
(C) In reversible process, energy change in each step can be reversed.
(D) Irreversible process is also called quasi-equilibrium process.

3. For the process on an ideal gas, which of the following statements is true :



(A) v_{mps} at 1 > v_{mps} at 2 > v_{mps} at 3 > v_{mps} at 4.
(B) v_{mps} at 1 = v_{mps} at 4 < v_{mps} at 2 < v_{mps} at 3.
(C) v_{mps} at 1 = v_{mps} at 4 < v_{mps} at 3 < v_{mps} at 2 .
(D) v_{mps} at 2 > v_{mps} at 3 > v_{mps} at 4 = v_{mps} at 1.

4. Two flask A and B have equal volumes. Flask A contains hydrogen at 600 K while flask B has same mass of CH_4 at 300 K. Then choose the correct options :
(A) In flask A, the molecules move faster than in B, on an average.
(B) In flask B, the molecules move faster than in A, on an average.
(C) Flask A contains greater number of molecules than B.
(D) Flask B contains greater number of molecules than A.

5. Categorise the following into state and path functions :
(a) Internal energy (b) Pressure (c) Volume (d) Temperature (e) Heat
(f) Work (g) Free energy (h) Entropy (i) Molar heat Capacity (j) Height of a hill
(k) Distance travelled in climbing the hill

6. Categorise these properties into extensive and intensive property :
(a) Pressure of gas (b) Volume (c) Density (d) Temperature
(e) Heat capacity (f) Specific heat capacity (g) Molar heat capacity (h) Molarity
(i) Dielectric constant (j) Internal energy (k) Specific internal energy (l) Mass

7. Classify the following among closed, open and isolated system :
(a) Pressure cooker (b) Boiler (c) Liquid cooling system of an automobile (d) Thermos flask
(e) Universe (f) Living things (g) Human body (h) Electrochemical cells
(i) A cup of tea (j) A closely packed room in which a split air-conditioner is working.

8. 7.5 KJ heat is added to a closed system and its internal energy decreases by 12 KJ. So, how much energy is transferred as work? For a new process, if the work is zero, then how much heat is transfered for the same changes in state of system?

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 45

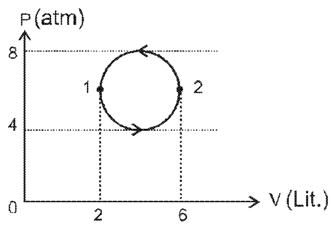
Total Marks : 35

Max. Time : 38 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.3 to Q.4	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.5 to Q.7	(4 marks, 5 min.)	[12, 15]
Comprehension ('–1' negative marking) Q.8 to Q.10	(3 marks, 3 min.)	[9, 9]

1. For a reversible process, calculate magnitude of work done from the following PV diagram :



(A) 4π (B) 6π (C) 2π (D) 0

2. 2 mole of an ideal gas expands isothermally and reversibly from 1 L to 10 L at 300 K. What is the internal energy change :

(A) 4.98 kJ (B) 11.47 kJ (C) –11.47 kJ (D) 0 kJ

3.* For isothermal expansion of an ideal gas sample, the correct relation(s) is/are : (Consider all quantities with sign according to IUPAC convention and the reversible and irreversible processes are carried out between same initial and final states.)

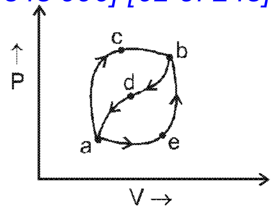
(A) $W_{rev} > W_{irrev}$ (B) $W_{irrev} > W_{rev}$ (C) $q_{rev} < q_{irrev}$ (D) $\Delta E_{rev} = \Delta E_{irrev}$

4.* 1 mole of argon gas is expanded isothermally and reversibly from 10L to 100L. Which of the following options is/are incorrect for the process :

(A) $\Delta E = 0$ (B) $W = 0$

(C) heat supplied (q) = 0 (D) $\Delta T = 0$

5. When a system is taken from state 'a' to state 'b' in fig. along path 'acb', 100 J of heat flows into the system and the system does 40 J of work. How much heat flows into the system along path 'aeb' if work done by the system is 20 J? The system returns from 'b' to 'a' along path 'bda'. If the work done on the system is 30 J, does the system absorb or liberate heat ? How much ?

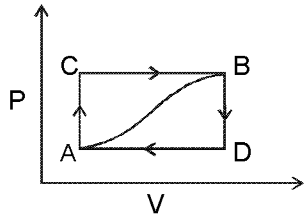


6. Calculate the energy needed to raise the temperature of 20 g iron from 25ºC to 500ºC, if specific heat capacity of iron is 0.45 $J^oC^{-1}g^{-1}$.

7. The energy required to vapourise one mole of benzene at it's boiling point is 31.2 kJ mol^{-1}. For how long a 100 W electric heater has to be operated in order to vaporize a 100 g sample of benzene at it's boiling temperature ?

Comprehension # (Q.8 to Q.10)

When a system is taken from state A to state B along path ACB as shown in figure below, 80 J of heat flows into the system and the system does 30 J of work. Now answer the following questions :



8. How much heat flows into the system along path ADB if the work done by the system is 10 J :
(A) 40 J (B) 60 J (C) 80 J (D) 100 J

9. When the system is returned from state B to A along the curved path, the work done on the system is 20 J. Does the system absorb or liberate heat and how much :
(A) 70 J ; heat is liberated. (B) 60 J ; heat is liberated.
(C) 70 J ; heat is absorbed. (D) 60 J ; heat is absorbed.

10. If $E_D - E_A = -40J$, then the heat corresponding to the processes AD and DB is respectively :
(A) $q_{AD} = 30$ J and $q_{DB} = -90$ J (B) $q_{AD} = -60$ J and $q_{DB} = 30$ J
(C) $q_{AD} = 30$ J and $q_{DB} = 90$ J (D) $q_{AD} = -30$ J and $q_{DB} = 90$ J

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 46

Total Marks : 28

Max. Time : 30 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.6 to Q.8	(4 marks, 5 min.)	[12, 15]
True or False (no negative marking) Q.9	(2 marks, 2 min.)	[2, 2]

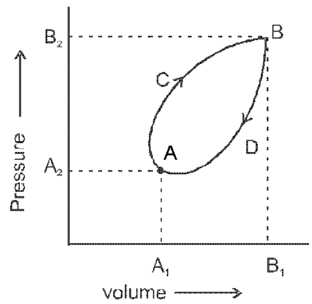
1. In a system, a piston caused an expansion against an external pressure of 1.2 atm giving a change in volume of 32 L for which $\Delta E = -51$ kJ. What was the value of heat involved : (Take 1 L atm = 100 J)
(A) –36 kJ (B) –13 kJ (C) –47 kJ (D) 24 kJ

2. The q value and work done in isothermal reversible expansion of one mole of an ideal gas from initial pressure of 1 bar to final pressure of 0.1 bar at constant temperature 273 K are :
(A) 5.22 kJ, –5.22 kJ (B) –5.22 kJ, 5.22 kJ (C) 5.22 kJ, 5.22 kJ (D) –5.22 kJ, –5.22 kJ

3. What is the difference between change in enthalpy and change in internal energy at constant volume :
(A) 0 (B) VdP (C) –VdP (D) +PdV

4. Calculate work done when 1 mole of an ideal gas is expanded from 10 L to 20 L against a constant 1 atm pressure at constant temperature of 300 K :
(A) 7.78 kJ (B) –1.013 kJ (C) 11.73 kJ (D) –4.78 kJ

5. A thermodynamic system goes in cyclic reversible process as represented in the following P–V diagram :
The net work done during the complete cycle is given by the area :
(A) cycle ACBDA (B) AA_1B_1BDA
(C) AA_2B_2B (D) AA_1B_1BCA



6. The valve on a cylinder containing initially 10 liters of an ideal gas at 25 atm and 25°C is opened to the atmosphere, where the pressure is 760 torr and the temperature is 25°C. Assuming that the process is isothermal, how much work in L atm is done on the atmosphere by the action of expanding gas ?

7. 20 g Ar gas is allowed to expand reversibly and isothermally at 300 K from 5 L to 10 L. Calculate the approximate value of work done. (Take R = 8.3 J/K/mole, at.wt of Ar = 40)

8. A horizontal piston-cylinder arrangement is placed in a constant temperature bath. The piston slides in the cylinder with negligible friction, and an external force holds it in place against an initial gas pressure of 14 bar. The initial gas volume is 0.03 m^3.
(a) The external force on the piston is reduced gradually, allowing the gas to expand until its volume doubles. Calculate the work done by the gas in moving the external force.
(b) How much work would be done if the same expansion is carried out by removing a part of the external force suddenly. Also calculate efficiency of this process as compared with the reversible process.

9. Which of the following statements are correct (T/F) :
(a) Ist law of thermodynamics can be applied on the individual particle enclosed in vessel.
(b) Many thermodynamic properties cannot be measured absolutely, so change in thermodynamic property is required for calculation.
(c) Feasibility of any chemical reaction cannot be explained by thermodynamics.
(d) When surroundings are always in equilibrium with the system, the process is called reversible.
(e) Between same initial and final states, work done by gas in isothermal irreversible expansion is less than the work in isothermal reversible expansion.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 47

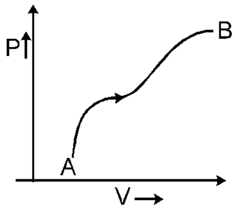
Total Marks : 30

Max. Time : 30 min.

Topic : Thermodynamics & Thermochemistry

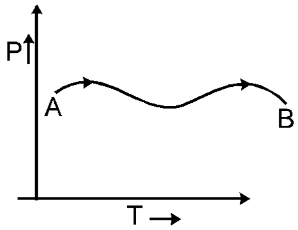
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Comprehension ('–1' negative marking) Q.8 to Q.10	(3 marks, 3 min.)	[9, 9]

1. The graph given below shows the P-V plot for a process on an ideal gas. Select the correct statement :



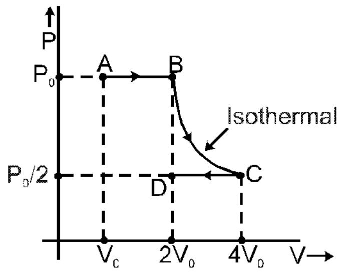
(A) Enthalpy content of the gas is constantly increasing and the process is carried out slowly.
(B) Enthalpy content of the gas first increases, then decreases and the process is carried out quasistaticly.
(C) Enthalpy content of the gas is constant and the process takes infinite time for completion.
(D) Enthalpy content first decreases, then increases and the process is reversible.

2. The P-T graph, as given below, was observed for a process on an ideal gas. Which of the following statement is true :



(A) W = +ve, ΔH = +ve
(B) W = –ve, ΔH = – ve
(C) W = –ve, ΔH = + ve
(D) W = +ve, ΔH = –ve

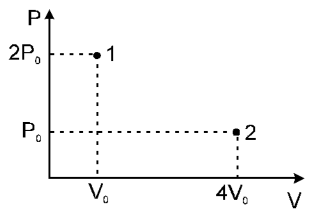
3. q, W, ΔE and ΔH for the following process ABCD on a monoatomic gas are :



(A) $W = -2P_0V_0 \ln 2$, $q = 2P_0V_0 \ln 2$, $\Delta E = 0$, $\Delta H = 0$
(B) $W = -2P_0V_0 \ln 2$, $q = 2P_0V_0 \ln 2$, $\Delta E = 0$, $\Delta H = 2P_0V_0 \ln 2$
(C) $W = -P_0V_0(1+\ln 2)$, $q = P_0V_0(1+\ln 2)$, $\Delta E = 0$, $\Delta H = 0$
(D) $W = -P_0V_0 \ln 2$, $q = P_0V_0 \ln 2$, $\Delta E = 0$, $\Delta H = 0$

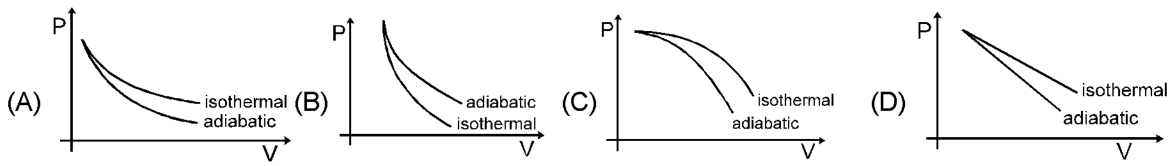
4. A system containing a real gas changes it's state form state-1 to state-2.
State-1 (3 atm, 2L, 300 K)
State-2 (5 atm, 4L, 500 K)
If change in internal energy = 30 L atm, then calculate change in enthalpy :
(A) 44 L atm (B) 35 L atm (C) 40 L atm (D) None of these

5. A liquid which is confined inside an adiabatic piston is suddenly taken from state-1 to state-2 by a single stage irreversible process. If the piston comes to rest at point 2 as shown, then the enthalpy change for the process will be :

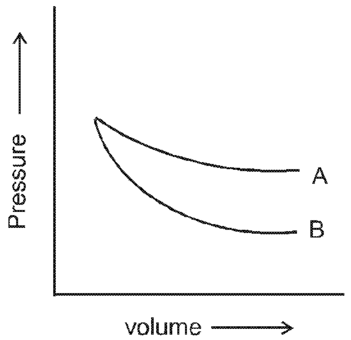


(A) $\Delta H = \frac{2\gamma P_0 V_0}{\gamma - 1}$ (B) $\Delta H = \frac{3\gamma P_0 V_0}{\gamma - 1}$ (C) $\Delta H = -P_0 V_0$ (D) None of these

6. The correct figure representing isothermal and adiabatic expansions of an ideal gas from a particular initial state is :



7. P–V plots for two gases during an adiabatic process are given in the figure :

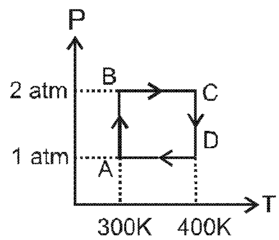


Plot A and plot B should correspond to :

(A) He and O_2 (B) He and Ar (C) O_2 and He (D) O_2 and F_2

Comprehension # (Q. Nos. 8 to 10)

One mole of Helium gas undergoes a reversible cyclic process ABCDA as shown in the figure. Assuming gas to be ideal, answer the following questions:



8. What is the value of ΔH for the overall cyclic process :

(A) $-100\ R\ell n2$ (B) $+100R\ell n2$ (C) $+200R\ell n2$ (D) Zero

9. What is the value of 'q' for the overall cyclic process :

(A) $-100\ R\ell n2$ (B) $+100R\ell n2$ (C) $+200R\ell n2$ (D) $-200R\ell n2$

10. What is the net work involved in the cyclic process :

(A) $-100\ R\ell n2$ (B) $+100R\ell n2$ (C) $+200R\ell n2$ (D) $-200R\ell n2$

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 48

Total Marks : 33

Max. Time : 36 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.8 to Q.10	(4 marks, 5 min.)	[12, 15]

1. A monoatomic ideal gas ($C_V = \frac{3}{2}R$) is allowed to expand adiabatically and reversibly from initial volume of 8L at 300 K to a volume of V_2 at 250 K. V_2 is : (Given $(4.8)^{1/2} = 2.2$)

(A) 10.5 L (B) 23 L (C) 8.5 L (D) 50.5 L

2. A gas is expanded from volume V_0 to $4V_0$ by following two ways : (from same initial state)

(a) I^{st} using reversible isothermal expansion from V_0 to $2V_0$, then using reversible adiabatic expansion from $2V_0$ to $4V_0$.

(b) I^{st} using reversible adiabatic expansion from V_0 to $2V_0$, then from $2V_0$ to $4V_0$ using reversible isothermal expansion.

Then which of the following options is correct :

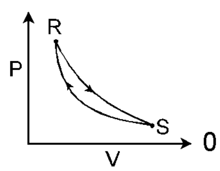
(A) Work done in (a) process > work done is (b) process

(B) Work done in (b) process > work done is (a) process

(C) Work done in (b) process = work done is (a) process

(D) cannot be predicted

3. Consider the cyclic process R $\rightarrow$ S $\rightarrow$ R as shown in the Fig. You told that one of the path is adiabatic and the other one isothermal. Which one of the following is(are) true :



(A) Process R $\rightarrow$ S is isothermal (B) Process S $\rightarrow$ R is adiabatic

(C) Process R $\rightarrow$ S is adiabatic (D) Such a graph is not possible

4. A sample of gas is compressed from an initial volume of $2v_0$ to v_0 using three different processes.

First : Using reversible isothermal

Second : Using reversible adiabatic

Third : Using irreversible adiabatic under a constant external pressure

Then :

(A) Final temperature of gas will be highest in third process.

(B) Final temperature of gas will be highest in second process.

(C) Enthalpy change of sample will be highest in isothermal process. (magnitude wise)

(D) Final pressure of gas will be highest in second process.

5. The magnitude of enthalpy changes for irreversible adiabatic expansion of a gas from 1L to 2L is ΔH_1 and for reversible adiabatic expansion for the same expansion, it is ΔH_2. Then :

(A) $\Delta H_1 > \Delta H_2$

(B) $\Delta H_1 < \Delta H_2$

(C) $\Delta H_1 = \Delta H_2$, enthalpy being a state function

(D) $\Delta H_1 = \Delta E_1$ & $\Delta H_2 = \Delta E_2$

6. In which process, net work done by gas is zero :

(A) Cyclic (B) Isobaric (C) Free expansion (D) Adiabatic

7. The ratio of slopes of P–V plots for reversible adiabatic process and reversible isothermal process of an ideal gas is equal to :

(A) γ (B) $1 - \gamma$ (C) $(\gamma - 1)$ (D) $1/\gamma$

8. 2 moles of an ideal gas A ($\gamma = 4/3$) and 4 moles of an ideal gas B ($\gamma = 5/3$) are taken together in a container and expanded reversibly and adiabatically from 2 L to 8 L starting from initial temperature of 320 K. Calcualte the work done by the gas (in calories) in the above process. (R = 2 calories/K/mol)

9. 1 mole of an ideal gas, initially at 400 K and 10 atm is first expanded at constant pressure till the volume is doubled. Then the gas is made to undergo an isochoric process, in which its temperature is found to decrease. In the last final step, gas was compressed reversibly and adiabatically to initial state. Determine the net work involved in this cyclic process (in terms of R). Given, C_V for gas = 1.5 R, $(4)^{-1/3} = 0.63$.

10. Polytropic process for ideal gas is given as PV^n = constant. Show that for polytropic process for an ideal gas, the expression for work obtained is :

$$W = \frac{P_1V_1\left[\left(\frac{V_2}{V_1}\right)^{1-n} - 1\right]}{(n-1)}$$

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PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 49

Total Marks : 29

Max. Time : 31 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.8 to Q.9	(4 marks, 5 min.)	[8, 10]

1. The species which by definition has zero standard molar enthalpy of formation at 298 K is :
(A) CO_2 (g) (B) H_2O (ℓ) (C) O_2 (g) (D) P_4 (red)

2. Consider the following processes

(i) 1/2 H_2 (g) + aq. $\longrightarrow$ H^+ (aq.) (ii) 2O(g) $\longrightarrow$ O_2(g)

(iii) NH_4^+ (g) + Cl^- (g) $\longrightarrow$ NH_4Cl(s) (iv) P_4 (black) + $5O_2$(g) $\longrightarrow$ P_4O_{10}(s)

Which of the above does not represent $\Delta H_{formation}$ of the product :
(A) I,IV (B) II, IV (C) I, II, III (D) II , III, IV

3. The difference between heat of reaction at constant pressure and constant volume for the reaction given below at 27ºC in kJ is : (Take R = 8.3 J/K/mole) 2 C_6H_6 (ℓ) + 15 O_2 (g) $\longrightarrow$ 12 CO_2 (g) + $6H_2O$ (ℓ)
(A) –7.47 (B) + 3.72 (C) – 3.72 (D) + 7.47

4. For the two reactions given below :

H_2(g) + ½O_2(g) $\longrightarrow$ H_2O (ℓ) + x_1 kJ mol^{-1}

H_2(g) + ½O_2(g) $\longrightarrow$ H_2O (g) + x_2 kJ mol^{-1}

Compare the magnitude of x_1 and x_2 : (x_1 and x_2 are the heat released in above two process.)
(A) $x_1 > x_2$ (B) $x_1 < x_2$ (C) $x_1 = x_2$ (D) $x_2 = 2x_1$

5. The combustion of 0.2 mol of liquid carbon disulphide CS_2 to give CO_2(g) and SO_2(g) releases 215 kJ of heat. What is ΔH_f° for $CS_{2(l)}$ in kJ mol^{-1} :

ΔH_f°	kJ mol^{-1}
$CO_{2(g)}$	–393.5
$SO_{2(g)}$	–296.8

(A) 772.1 (B) 87.9 (C) –385 (D) – 475

6. Consider the following changes

$Na^+(g) \longrightarrow Na^+(aq)$ ΔH_1 .... (1) $Na(s) \longrightarrow Na(g)$ ΔH_2 .... (2)

$Cl^-(g) \longrightarrow Cl^-(aq)$ ΔH_3 .... (3) $Cl_2(g) \longrightarrow 2Cl(g)$ ΔH_4 .... (4)

$Na^+(g) + Cl(g) \longrightarrow NaCl\ (s) + e^-$ ΔH_5 .... (5) $NaCl(s) \longrightarrow Na^+(aq) + Cl^-(aq)$ ΔH_6 .... (6)

Hydration enthalpy of NaCl can be defined by sum of the following :
(A) $\Delta H_1 + \Delta H_4$ (B) $\Delta H_1 + \Delta H_5$ (C) $\Delta H_1 + \Delta H_3$ (D) ΔH_6 only

7. Given that $S_{(s)}$ + 3/2 $O_{2(g)}$ $\longrightarrow$ $SO_{3(g)}$ + 2x Kcal ; $SO_{2(g)}$ + 1/2 $O_{2(g)}$ $\longrightarrow$ $SO_{3(g)}$ + y Kcal
What would be the enthalpy of formation of SO_2 :
(A) – 2x + y (B) 2x + y (C) x + y (D) 2x/y

8. From the follwing data :
(i) $C_{(graphite)}$ + O_2 (g) $\longrightarrow$ CO_2 (g) ; ΔH_1 = – 94.1 KCal
(ii) $C_{(diamond)}$ $\longrightarrow$ $C_{(graphite)}$; ΔH_2 = – 0.5 KCal

Calculate ΔH for burning of diamond to CO_2 .

9. The standard enthalpies of formation at 298 K for CCl_4 (g) , H_2O (g) , CO_2 (g) and HCl (g) are – 25.5 , – 57.8 , – 94.1 & – 22.1 K Cal/mole respectively . Calculate ΔH°_{298} for the reaction :

CCl_4 (g) + 2 H_2O (g) $\longrightarrow$ CO_2 (g) + 4 HCl (g).

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 50

Total Marks : 31

Max. Time : 35 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.6 to Q.9	(4 marks, 5 min.)	[16, 20]

1. For the reaction,

$$\frac{1}{2}A_2\,(g) + \frac{1}{2}B_2\,(g) \longrightarrow AB\,(g)\ ;\ \Delta H = -\,50\ KCal.$$

If the bond energies of A_2, B_2 and 'AB' are respectively x, $\frac{x}{2}$ and x KCal, the value of x is :

(A) 50 (B) 100 (C) 200 (D) 400

2. The enthalpy of neutralization of 40 g of NaOH by 60 g of CH_3COOH will be :

(A) 57.1 kJ $equiv^{-1}$ (B) less than 57.1 kJ $equiv^{-1}$

(C) more than 57.1 kJ $equiv^{-1}$ (D) 13.7 kJ $equiv^{-1}$

3. The heat evolved in neutralizing a solution containing 1mole of HCN with a strong alkali is 3 KCal. The enthalpy of dissociation of HCN is :

(A) 10.2 KCal (B) 13.7 KCal (C) 10.7 KCal (D) 16.7 KCal

4. $\Delta H_f°$ for the chloride ion (aq) from the following data will be :

$$\frac{1}{2}H_2\,(g) + \frac{1}{2}Cl_2\,(g) \longrightarrow HCl(g)\ ; \qquad \Delta H_f° = -\,92.4\ kJ$$

$$HCl(g) + nH_2O \longrightarrow H^+\,(aq) + Cl^-\,(aq.)\ ; \qquad \Delta H° = -\,74.8\ kJ$$

$$\Delta H_f°\ H^+\,(aq.) = 0.0\ kJ$$

(A) 167.2 kJ (B) – 167.2 kJ (C) 334.4 kJ (D) – 334.4 kJ

5. The polymerisation of ethylene to linear polyethylene is represented by the reaction :
$n\,CH_2 = CH_2 \longrightarrow (CH_2 - CH_2)_n$ where *n* has a large integral value. Given that the average enthalpies of bond dissociation for C = C & C – C at 298 K are +590 & + 331 KJ mol^{-1} respectively. Then the enthalpy of polymerisation per mole of ethylene at 298 K will be :

(A) 72 kJ/mol (B) – 72 kJ/mol (C) 36 kJ/mol (D) – 36 kJ/mol

6. Assuming that 50% of the heat is useful, how many kg of water at 15ºC can be heated to 95ºC by burning 280 litre of methane at STP ? The heat of combustion of methane is 240 KCal/mol.

7. One litre sample of a mixture of CH_4 and O_2 measured at 27ºC and 760 torr, was allowed to react at constant pressure in a calorimeter. The complete combustion of CH_4 to CO_2 and water caused a temperature rise in calorimeter of 0.667 K. Calculate mole % of CH_4 in original mixture. (R = 1/12L atm/K/mole)

8. The specific heats of iodine vapour and solid are 0.031 $Calg^{-1}\,°C^{-1}$ and 0.055 $Calg^{-1}\,°C^{-1}$ respectively. If heat of sublimation of iodine is 24 Cal/g at 200ºC, what is its value at 250ºC ?

9. Calculate the heat of formation of HCl (g) from :

$$NH_3(aq) + HCl(aq.) \longrightarrow NH_4Cl(aq.)\ ;\ \Delta H = -\,12.1\ KCal$$

$$\frac{1}{2}N_2(g) + \frac{3}{2}H_2(g) \longrightarrow NH_3(g)\ ; \qquad \Delta H = -\,11.0\ KCal$$

Heat of formation of $NH_4Cl(s)$; $\Delta H = -\,75.3$ KCal

Heat of solution of $NH_3(g)$; $\Delta H = -\,8.8$ KCal

Heat of solution of HCl(g) ; $\Delta H = -\,17.5$ KCal

$NH_4Cl(s) + Aq. \longrightarrow NH_4Cl(aq.)$; $\Delta H = +\,3.8$ KCal

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 51

Total Marks : 41

Max. Time : 49 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.8, 10, 11	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.1 to Q.7, 9	(4 marks, 5 min.)	[32, 40]

1. The standard molar enthalpies of formation of ethane, CO_2 & liquid water are – 21.1, – 94.1 and – 68.3 kCal respectively. Calculate the standard molar enthalpy of combustion of ethane.

2. The enthalpies of combustion of C_2H_4 (g), C_2H_6 (g) & H_2 (g) are – 1409.5 kJ, – 1558.3 kJ and – 285.6 kJ respectively. Calculate the enthalpy of hydrogenation of ethylene.

3. The standard enthalpy of combustion at 25ºC of hydrogen (H_2), cyclohexene (C_6H_{10}) and cyclohexane (C_6H_{12}) are – 241, – 3800 and – 3920 kJ/mole respectively. Calculate the enthalpy of hydrogenation of cyclohexene.

4. Calculate the enthalpy of combustion of carbon monoxide at constant volume, given the following enthalpy of reactions at constant pressure at 17ºC :

(i) $C\ (s) + O_2\ (g) \longrightarrow CO_2\ (g)$; $\Delta H_1 = -97000$ Cal

(ii) $CO_2\ (g) + C\ (s) \longrightarrow 2\ CO\ (g)$; $\Delta H_2 = 39000$ Cal

5. The bond dissociation energies of gaseous H_2, Cl_2 & HCl are 104 , 58 & 103 kCal/mole respectively. Calculate the enthalpy of formation of HCl gas.

6. Determine the enthalpy of hydrogenation of ethylene from the following data .

Bond	Bond energy	Bond	Bond energy
H – H	104 kCal/mol	C – C	80 kCal/mol
C – H	99 kCal/mol	C = C	145 kCal/mol

7. Calculate the bond energy of C = C from the following data. All ΔH units are in kCal.

$2\ C\ (s) + 2\ H_2\ (g) \longrightarrow C_2H_4\ (g)$ $\quad \Delta H = 12.5$

$C\ (s) \longrightarrow C\ (g)$ $\quad \Delta H = 170.9$

$H_2\ (g) \longrightarrow 2\ H\ (g)$ $\quad \Delta H = 104.2$

Bond energy of C – H bond is 99 kCal/mol.

8. Enthalpy of atomisation of NH_3 and N_2H_4 are x kcal mol^{-1} and y kcal mol^{-1} respectively. Calculate average bond energy of N—N bond :

(A) $\frac{4y-3x}{3}$ kCal mol^{-1} (B) $\frac{2y-3x}{3}$ kCal mol^{-1} (C) $\frac{4y-3x}{4}$ kCal mol^{-1} (D) $\frac{3y-4x}{3}$ kCal mol^{-1}

9. From the following bond energy and standard ΔHº values for the formation of elements in gaseous state, calculate the standard enthalpy of formation of acetone(g) :

Standard ΔHº	**Bond energies**
H (g) = 52 kCal/mol	C – H = 99 kCal/mol
O (g) = 59 kCal/mol	C – C = 80 kCal/mol
C (g) = 171kCal/mol	C = O = 81 kCal/mol

10. The enthalpy of neutralization of a strong base and strong acid is 57.0 kJ eq^{-1} . The heat evolved when 0.5 moles of HNO_3 are added to 1 L of 0.2 M NaOH solution is :

(A) 57.0 kJ (B) 28.5 kJ (C) 11.4 kJ (D) 34.9 kJ

11. For strong acid and strong base neutralization, net chemical change is :

$H^+\ (aq) + OH^-\ (aq) \longrightarrow H_2O\ (\ell)$; $\quad \Delta_rH^o = -57.1$ kJ/mol

If enthalpy of neutralization of CH_3COOH by HCl is –50 kJ/mol, then enthalpy of ionisation of CH_3COOH is :

(A) 7.1 kJ/mol (B) –7.1 kJ/mol (C) 107.1 kJ/mol (D) –107.1 kJ/mol

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 52

Total Marks : 35

Max. Time : 40 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Subjective Questions ('–1' negative marking) Q.6 to Q.10	(4 marks, 5 min.)	[20, 25]

1. Given the following standard enthalpies of reaction :
(i) Enthalpy of formation of water = – 68.3 kCal/mol
(ii) Enthalpy of combustion of acetylene = – 310.6 kCal/mol
(iii) Enthalpy of combustion of ethylene = – 337.2 kCal/mol
Calculate the heat of reaction for the hydrogenation of acetylene at constant volume and 25ºC.

2. The internal energy change of the comubstion of C_6H_6 (g) and C_2H_2 (g) at 300 K are – 800 Kcal/mole and – 300 Kcal/mole respectively. What is the enthlapy of polymerisation of C_2H_2 (g) to C_6H_6 (g) per mole of C_6H_6 (g) produced ? C_6H_6 (g), C_2H_2 (g) and C_2H_6 (g) behave ideally. R = 2 cal K^{-1} mol^{-1}.
(A) – 100 K Cal/mol (B) – 101.2 K Cal/mol (C) –98.8 K Cal/mol (D) – 103.6 K Cal/mol

3. The dissociation energy of CH_4 is 360 kCal/mol and of ethane is 620 kCal/mol. Calculate C – C bond energy.

4. Estimate Δ_rH for $2\ C_4H_{10}\ (g) \longrightarrow C_8H_{18}\ (g) + H_2\ (g)$. Given bond energy of C – C and C – H are 347 and 441 $kJmol^{-1}$. The enthalpy of formation of H (g) atom is 217.5 $kJmol^{-1}$.

5. The average energy required to break a P – P bond in P_4 (s) into gaseous atoms is 53.3 kcal mol^{-1}. The bond dissociation energy of H_2(g) is 104.3 $kcalmol^{-1}$; ΔH_f^0 of PH_3(g) from P_4(s) is 5.4 $kcalmol^{-1}$. The P-H bond energy in kcal mol^{-1} is : [Neglect presence of Vanderwaal forces in P_4(s)]
(A) 85.2 (B) 57.6 (C) 77 (D) 63.3

6. Using the data (all values are in kilocalories per mole at 25ºC) given below, calculate the bond energy of C – H and C – C bonds.
$\Delta H^o_{combustion\ (ethane)\ g}$ = – 372 ; $\Delta H^o_{combustion\ (propene)\ g}$ = – 530
ΔH^o for C (graphite) $\longrightarrow$ C (g) = 172 ; Bond energy of H – H bond = 104
ΔH_f^o of H_2O (l) = – 68 ; ΔH_f^o of CO_2 (g) = – 94

7. Determine the enthalpy change of the reaction : $C_3H_8\ (g) + H_2\ (g) \longrightarrow C_2H_6\ (g) + CH_4\ (g)$ at 25 ºC , using the given enthalpy of combustion values under standard condition :

Compound	H_2 (g)	CH_4 (g)	C_2H_6 (g)	C (graphite)
ΔH^o (kJ/mole)	– 286	– 890	– 1560	– 393.5

The standard enthalpy of formation of C_3H_8 (g) is – 104 kJ/mole.

8. The standard molar enthalpies of formation of cyclohexane (ℓ) and benzene (ℓ) at 25° C are –156 and +49 KJ mol^{-1} respectively. The standard enthalpy of hydrogenation of cyclohexene (ℓ) at 25°C is –119 KJ mol^{-1}. Use these data to estimate the resonance energy of benzene in KJ mol^{-1}.

9. The enthalpy of solution of anhydrous $CuSO_4$ is – 15.9 kCal/mol and that of $CuSO_4 . 5\ H_2O$ is 2.8 kCal/mol. Calculate the enthalpy of hydration of $CuSO_4$.

10. Calculate ΔH_f^o for chloride ion (aq) from the following data :

$$\frac{1}{2}\ H_2\ (g) + \frac{1}{2}\ Cl_2\ (g) \longrightarrow HCl\ (g) \qquad \Delta H^o_f = -92.4\ kJ$$

$$HCl\ (g) + n\ H_2O \longrightarrow H^+\ (aq) + Cl^-\ (aq) \quad \Delta H^o_{298} = -74.8\ kJ$$

$\Delta H^o_f\ (H^+)_{aq} = 0.0$ kJ

PHYSICAL CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 53

Total Marks : 30

Max. Time : 33 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.2 to Q.4	(4 marks, 5 min.)	[12, 15]
Comprehension ('–1' negative marking) Q.5 to Q.9	(3 marks, 3 min.)	[15, 15]

1. For a gas having molar mass M, specific heat at constant pressure can be given as :

(A) $\frac{\gamma R}{M(\gamma-1)}$ (B) $\frac{\gamma}{RM}$ (C) $\frac{M}{R(\gamma-1)}$ (D) $\frac{\gamma RM}{\gamma+1}$

2. 1 mole of ice at 0ºC and 4.6 mm Hg pressure is converted to water vapour at constant temperature and pressure. Find ΔH and ΔE if the latent heat of fusion of ice is 80 Cal/g and latent heat of vaporisation of liquid water at 0ºC is 596 Cal/g and the volume of ice in comparison to that of water vapour is neglected.

3. Calculate q, W and ΔE when 100 g of calcite form of $CaCO_3$ is converted into its aragonite form at 100 bar pressure. Given density of calcite = 2 g/cc, density of aragonite = 2.5 g/cc and

$$\underset{\text{Calcite}}{CaCO_3} \rightleftharpoons \underset{\text{Aragonite}}{CaCO_3} \qquad \Delta H = 2 \text{ kJ/mole}$$

4. A person inhales 640 g of O_2 per day. If all the O_2 is used for converting sugar into CO_2 and H_2O, how much sucrose ($C_{12}H_{22}O_{11}$) is consumed in the body in one day and what is the heat evolved ? ΔH (combustion of sucrose) = – 5472 kJ/mol.

Comprehension # (Q.5 to Q.9)

Enthalpy of sublimation may be determined experimentally, but instead of that let us explore an easier route for its calculation. Figure-1 shows the three phases of water on an enthalpy scale. Since enthalpy is a state function, enthalpy changes depend only on the initial and the final states and not on the path. Therefore, we must find the same value for enthalpy change whether the system goes directly from solid to gas or through the intermediate state of liquid. Therefore, $\Delta H_{sub} = \Delta H_{fus} + \Delta H_{vap}$ ....(1)

There is a small oversight in the way we obtained ΔH_{sub} . Equation (1) is true only if enthalpies are independent of temperature or if their values are measured or deduced at the same temperature. Suppose we have enthalpy data at different temperatures as is usually the case. How do we proceed then?

We will illustrate the procedure with an estimate of ΔH_{sub} at 0°C from ΔH_{vap} at 100°C and ΔH_{fus} at 0°C. In order to calculate ΔH_{sub} at 0°C, figure-2 shows that the heat absorbed in the process

$$\text{Solid (0°C)} \longrightarrow \text{Gas (0° C)}$$

is equal to the heat absorbed in the process

$$\text{Solid (0°C)} \longrightarrow \text{Liquid (0°C)} \longrightarrow \text{Liquid (100°C)} \longrightarrow \text{Gas (100 °C)} \longrightarrow \text{Gas (0°C)}$$

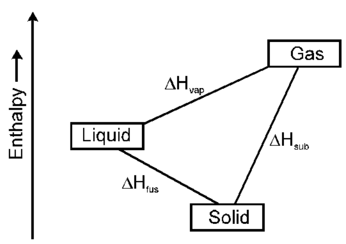


Figure-1

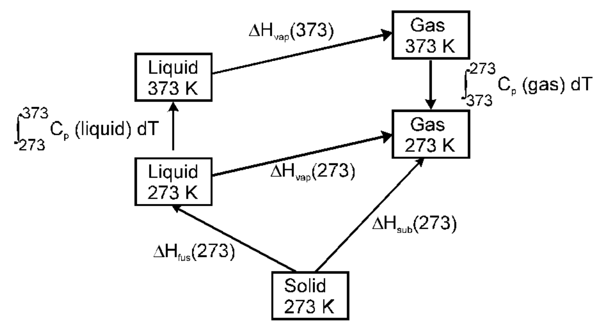


Figure-2

The enthalpy of sublimation at 0°C is therefore given by :

$$\Delta H_{sub}\ (0°C) = \Delta H_{fus}\ (0°\ C) + \int_{273}^{373} C_p(\text{liquid})\ dT + \Delta H_{vap}\ (100°C) + \int_{373}^{273} C_p(\text{gas})\ dT$$

During chemical reactions also, we may not obtain the products at the temperature at which reactant were present initially. Then too, we can calculate the enthalpy change during the reaction at temperature of reactants. The basis of Kirchoff's equations in thermodynamics is also the same. The Kirchoff's equations are :

At constant pressure : $\Delta H_2^o = \Delta H_1^o + \int_{T_1}^{T_2} \Delta C_P\ dT$

Where ΔH_1^o is enthalpy change of reaction at temperature T_1,
and ΔH_2^o is enthalpy change of reaction at temperature T_2.
ΔC_P is difference in molar heat capacities at constant pressure of products and reactants.
Similarly

At constant volume : $\Delta E_2^o = \Delta E_1^o + \int_{T_1}^{T_2} \Delta C_V\ dT$

USE THE FOLLOWING DATA :

Molar heat capacity of

H_2O (solid) = 40 J K^{-1} mol^{-1}
H_2O (liquid) = 75 J K^{-1} mol^{-1}
H_2O(vapour) = 30 J K^{-1} mol^{-1}
Latent heat of vaporisation = 40 kJ mol^{-1}
Latent heat of fusion of H_2O = 6 kJ mol^{-1}

5. Molar enthalpy of vaporisation of H_2O at 0°C is :
(A) 44 kJ $mole^{-1}$ (B) 44.5 kJ $mole^{-1}$ (C) 50.5 kJ $mole^{-1}$ (D) – 44.5 kJ $mole^{-1}$

6. Molar enthalpy of sublimation of H_2O at 223 K is :
(A) 48 kJ $mole^{-1}$ (B) 40 kJ $mole^{-1}$ (C) 51 kJ $mole^{-1}$ (D) 53 kJ $mole^{-1}$

7. If enthalpy change of reaction :

$H_2O(\ell) \longrightarrow H_2O$ (g) at 300 K is 43285 J $mole^{-1}$, then enthalpy change at 400 K will be :
(A) 34285 J $mole^{-1}$ (B) 43285 J $mole^{-1}$ (C) 47785 J $mole^{-1}$ (D) 38785 J $mole^{-1}$

8. For a chemical reaction, ΔC_P is negative ($\Delta C_P < 0$).
The heat required to increase temperature of reactants of this reaction by a certain amount = q_1 and heat required to increase temperature of products of the same reaction by same amount = q_2. Then :
(A) $q_1 > q_2$
(B) $q_1 < q_2$
(C) $q_1 = q_2$
(D) q_1 may or may not be equal to q_2 and it will depend on nature of reactants and products.

9. If for reaction :

N_2 (g) + $3H_2$ (g) $\longrightarrow$ $2NH_3$ (g),ΔH_1^o = – 30 kJ/mole at temperature 300 K and if specific heat capacities of different species are $s_{P,\,N_2}$ = 1 J/g°C, $s_{P,\,H_2}$ = 10 J/g°C and $s_{P,\,NH_3}$ = 2 J/g °C, then ΔH_2^o at 400 K for the same reaction will be : (assume heat capacities to be constant in given temperature range)
(A) – 32 kJ/mole (B) – 28 kJ/mole (C) – 32.7 kJ/mole (D) – 27.3 kJ/mole

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 54

Total Marks : 32

Max. Time : 33 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4, 6, 7, 9, 10	(8 marks, 8 min.)	[24, 24]
Multiple choice objective ('–1' negative marking) Q.5	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. In which of the following cases, generally entropy decreases :

(A) Solid changing to liquid (B) Expansion of a gas

(C) Crystal dissolves (D) Polymerisation

2. Predict which of the following reaction(s) have a positive entropy change ?

I. $Ba^{2+} (aq) + SO_4^{2-} (aq) \longrightarrow BaSO_4 (s)$

II. $CaCO_3 (s) \longrightarrow CaO (s) + CO_2 (g)$

III. $2SO_3 (g) \longrightarrow 2SO_2 (g) + O_2 (g)$

(A) I and II (B) III (C) II and III (D) II

3. Which of the following reactions is expected to have the most negative change in entropy ?

(A) $N_2 (g) + 3H_2 (g) \longrightarrow 2NH_3 (g)$ (B) $C_2H_2 (g) + 2H_2 (g) \longrightarrow C_2H_6 (g)$

(C) $C (s) + O_2 \longrightarrow CO_2(g)$ (D) $2NO_2 (g) \longrightarrow N_2O_4 (s)$

4. Which statement regarding entropy is correct ?

(A) A completely ordered deck of cards has more entropy than a shuffled deck in which cards are arranged randomly.

(B) A perfect ordered crystal of solid nitrous oxide has more entropy than a disordered crystal in which the molecules are oriented randomly.

(C) 1 mole N_2 gas at STP has more entropy than 1 mole N_2 gas at 273 K in a volume of 11.2 litre.

(D) 1 mole N_2 gas at STP has more entropy than 1 mole N_2 gas at 273 K and 0.25 atm.

5*. Select the correct option(s) :

(A) Specific volume and molar heat capacity are intensive parameters.

(B) For an irreversible adiabatic compression process, entropy change of surrounding will be equal to zero.

(C) Change in internal energy for an ideal gas for an isobaric process is expresed as $\Delta U = nC_V (T_2 - T_1)$, where the terms used have their usual meaning.

(D) Free expansion is a reversible process.

6. Two moles of an ideal gas ($\gamma = 4/3$) is made to expand reversibly and adiabatically to 4 times its initial volume. The change in entropy of the system during expansion is : (Given : R = 2 cal/K/mole, $\log_{10}2 = 0.3$, $\log_{10}3 = 0.48$)

(A) 5.6 cal/k (B) 11.2 cal/k (C) 2.8 cal/k (D) None of these

7. Two moles of an ideal monoatomic gas expands isothermally against a constant external pressure of 2 atm from an initial volume of 22.4 L to a state where its final pressure becomes equal to external pressure. If the initial temperature of gas is 273°C, then the entropy change of system in the above process is :
[Given : 1 mole of an ideal gas occupies 22.4 L at STP conditions]
(A) R ln 16 (B) R ln 4 (C) R ln 8 (D) Zero

8. The enthalpy of vapourisation of liquid diethyl ether is 26 kJ/mol at its boiling point (52°C). Calculate ΔS for conversion of : (a) liquid to vapour, and (b) vapour to liquid at 52°C.

9. When two equal sized pieces of the same metal, each of mass m at different temperatures T_h (hot piece) and T_C(cold piece) are brought into contact and isolated from surrounding, the total change in entropy of system is given by : (Specific heat capacity of metal = s)

(A) $ms \ln \frac{T_C + T_h}{2T_C}$ (B) $ms \ln \frac{T_h}{T_C}$ (C) $ms \ln \frac{(T_C + T_h)^2}{2T_hT_C}$ (D) $ms \ln \frac{(T_C + T_h)^2}{4T_hT_C}$

10. One mole of an ideal monoatomic gas at 27ºC is subjected to a reversible isoentropic compression until final temperature reached to 327ºC. If the initial pressure was 1.0 atm, then find the value of ln P_2:
(Given : ln 2 = 0.7).
(A) 1.75 atm (B) 0.176 atm (C) 1.0395 atm (D) 2.0 atm

PHYSICAL CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 55

Total Marks : 37

Max. Time : 42 min.

Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.1, 2, 5, 9, 10	(4 marks, 5 min.)	[20, 25]
Multiple choice objective ('–1' negative marking) Q.3 to Q.4	(4 marks, 4 min.)	[8, 8]

1. A sample of certain mass of an ideal polyatomic non-linear gas is expanded against constant pressure of 1 atm adiabatically from volume 2 L, pressure 6 atm and temperature 300 K to a state, where its final volume is 8 L. Then calculate entropy change of system (in J / K) in the process : (Neglect vibrational degrees of freedom) [1L atm = 100 J, log 2 = 0.3, log 3 = 0.48, log e = 2.3]

2. 2 moles of an ideal monoatomic gas undergo a reversible process for which P^2V = constant. The gas sample is made to expand from initial volume of 1L to final volume of 4L starting from initial temperature of 300K. Find the value of ΔS_{sys} for the above process. Report your answer as 'X' where $\Delta S_{sys} = XR\ell n2$.

3.* For Isothermal expansion against constant external pressure of an ideal gas :
(A) $\Delta S_{univ} > 0$
(B) $\Delta S_{sys} > 0$
(C) $\Delta S_{surr} < 0$
(D) $\Delta S_{surr} = 0$

4.* For an adiabatic free expansion of an ideal gas against vacuum, which of the following parameters has/have zero value :
(A) q
(B) ΔH
(C) $\Delta S_{surr.}$
(D) $\Delta S_{sys.}$

5. How many of the given statements are correct :
I : Molar entropy of a substance follows the order $(S_m)_{Solid} < (S_m)_{liquid} < (S_m)_{gas}$
II: Entropy change of system for the reaction $H_2(g) \longrightarrow 2H(g)$ is +ve.
III: Molar entropy of a non-crystalline solid will be zero at absolute zero.
IV: If the path of an irreversible process is reversed, then both system and surroundings shall be restored to their orginal states.
V : Refractive index and molarity are intensive properties.

6. The spontaneous nature of a reaction is impossible if :
(A) ΔH is +ve and ΔS is also +ve
(B) ΔH is – ve and ΔS is also – ve
(C) ΔH is – ve ; ΔS is + ve
(D) ΔH is + ve ; ΔS is – ve

7. If a chemical reaction is non-spontaneous at high temperatures and spontaneous at low temperatures, then:
(A) $\Delta H > 0$ and $\Delta S > 0$
(B) $\Delta H > 0$ and$\Delta S < 0$
(C) $\Delta H < 0$ and $\Delta S > 0$
(D) $\Delta H < 0$ and $\Delta S < 0$

8. For the process $H_2O(\ell)$ (1 bar, 373 K) $\rightleftharpoons$ $H_2O(g)$ (1 bar, 373 K), the correct set of thermodynamic parameters is:
(A) $\Delta G = 0$
(B) $\Delta S > 0$
(C) $\Delta H > 0$
(D) ΔG = –ve

9. For a perfectly crystalline solid, $(C_P)_m = aT^3$, where a is a constant. If $(C_P)_m$ at 10K is 0.375 J/K-mol, then find the value of molar entropy at 20K (in J/K-mol).

10. What is the free energy change (ΔG) in KCal, when 144 g of water at 100ºC and 1 atm pressure in converted into steam at 100ºC and 4 atm pressure ? (Take R = 2 Cal/K/mole, ℓn 2 = 0.7).
Give your answer rounding it off to the nearest whole number.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 56

Total Marks : 120

Max. Time : 120 min.

Topic : Mole Concept and Atomic Structure

Type of Questions		M.M., Min.
Topic : Mole Concept		
Single choice Objective ('–1' negative marking) Q.1 to Q.20	(3 marks, 3 min.)	[60, 60]
Topic : Atomic Structure		
Single choice Objective ('–1' negative marking) Q.1 to Q.20	(3 marks, 3 min.)	[60, 60]

1. The weight of a molecule of the compound $C_6H_{12}O_6$ is about :
(A) 180 g (B) 3×10^{-22} g (C) 22×10^{-23} g (D) 132 g

2. A person adds 1.71 gram of sugar ($C_{12}H_{22}O_{11}$) in order to sweeten his tea. The number of carbon atoms added are : (Mol. mass of sugar = 342)
(A) 3.6×10^{22} (B) 3×10^{21} (C) 3.6×10^{23} (D) 3×10^{22}

3. If V ml of the vapours of substance at NTP weight W mg, then mol. wt. of substance in amu is :
(A) (W/V) × 22400 (B) $\frac{V}{W} \times 22.4$ (C) (V/W) × 22400 (D) $\frac{W}{V} \times 22.4$

4. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight. Then min. mol. wt. of peroxidase anhydrous enzyme is : (at. wt. of Se = 78.4 amu)
(A) 1.568×10^4 (B) 1.568×10^3 (C) 15.68 (D) 1.568×10^2

5. Caffine has a molecular weight of 194. It contains about 30% by mass of nitrogen. The number of atoms of nitrogen in one molecule of it is :
(A) 2 (B) 3 (C) 4 (D) 5

6. Vapour density of a gas, if its density is $\frac{1}{5.6}$ g/L at NTP, is :
(A) 1 (B) 2 (C) 4 (D) 8

7. Assuming that petrol is iso-octane (C_8H_{18}) and has a density 0.8 g ml^{-1}, 1.425 litre of petrol on complete combustion will consume what amount of oxygen :
(A) 250 L (B) 125 L (C) 125 mole (D) 250 mole

8. The volume of gas at NTP produced by reaction of 128 g of CaC_2 with excess of water is :
(A) 44.8 litre (B) 89.6 litre (C) 67.2 litre (D) 22.4 litre

9. If 0.5 mole of $BaCl_2$ is mixed with 0.1 mole of Na_3PO_4, the maximum number of mole of $Ba_3(PO_4)_2$ that can be formed is :
(A) 0.166 (B) 0.05 (C) 0.6 (D) 0.1

10. A 21.6 g silver coin is dissolved in HNO_3. When NaCl is added to this solution, all silver is precipitated as AgCl. The weight of AgCl is found to be 14.35 g. Then % of silver in coin is :
(A) 50% (B) 75% (C) 100% (D) 15%

11. What is the concentration of nitrate ions if equal volumes of 0.1 M $AgNO_3$ and 0.1 M NaCl solutions are mixed together :
(A) 0.1 M (B) 0.2 M (C) 0.05 M (D) 0.25 M

12. 300 ml of 3.0 M NaCl is added to 200 ml of 4.0 M $BaCl_2$ solution. The concentration of Cl^- ions in the resulting solution is :
(A) 4.5 M (B) 3.4 M (C) 6 M (D) 5 M

13. One mole of potassium chlorate is thermally decomposed and excess of aluminium is burnt in the gaseous product. How many mole of aluminium oxide are formed :
(A) 1 (B) 1.5 (C) 2 (D) 3

14. Calculate the mole of FeO produced from 1.34 g VO & 4.8 g Fe_2O_3 :
$VO + Fe_2O_3 \longrightarrow FeO + V_2O_5$ (At. wt. of V = 51)
(A) 0.06 (B) 0.03 (C) 0.12 (D) 0.015

15. Mole fraction of A in aqueous solution is 0.2. The molality of solution is :
(A) 13.9 (B) 15.5 (C) 14.5 (D) 16.8

16. What is the quantity of water that should be added to 16 g methanol to make the mole fraction of methanol in solution as 0.25 :
(A) 27 g. (B) 12 g. (C) 18 g. (D) 36 g.

17. If 100 ml of 1M H_2SO_4 solution is mixed with 100 ml of 9.8%(w/w) H_2SO_4 solution (d = 1 g/ml), then :
(A) concentration of solution increases (B) concentration of solution decreases
(C) mass of H_2SO_4 in the solution is 1.96 g (D) mass of H_2SO_4 in the solution is 19.6 g

18. Match List-I (Compounds) with List-II (Oxidation states of Nitrogen) and select answer using the codes given below the lists :

	List-I		List-II
(a)	NaN_3	(1)	+5
(b)	N_2H_2	(2)	+2
(c)	NO	(3)	–1/3
(d)	N_2O_5	(4)	–1

(Code) :

	(a)	(b)	(c)	(d)
(A)	3	4	1	2
(B)	4	3	2	1
(C)	3	4	2	1
(D)	4	3	1	2

19. The incorrect order of decreasing oxidation number of S in compounds is :
(A) $H_2S_2O_7 > Na_2S_4O_6 > Na_2S_2O_3 > S_8$
(B) $H_2SO_5 > H_2SO_3 > SCl_2 > H_2S$
(C) $H_2SO_4 = H_2S_2O_8 > SO_2 > H_2S$
(D) $SO_3 > SO_2 > H_2S > S_8$

20. For the redox reaction $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$,
the correct whole number stoichiometric coefficients of MnO_4^-, $C_2O_4^{2-}$ and H^+ are respectively :
(A) 2, 5, 16 (B) 5, 2, 8 (C) 2, 5, 8 (D) 5, 2, 16

Topic : Atomic Structure

1. The charge-to-mass ratio for A^{3+} ion is about $\frac{1}{9} \times 10^8$ C kg^{-1}. Calculate the approximate mass of A atom :
(A) 4.5×10^{-26} kg (B) 1.5×10^{-26} kg (C) 1.5×10^{-28} kg (D) 4.5×10^{-28} kg

2. Which of the following is isoelectronic with P^{3-} :
(A) Cl^- (B) Mg^{2+} (C) Both (A) & (B) (D) None of these

3. Light of wavelength λ falls on metal having work function hc/λ_0. Photoelectric effect will take place only if :
(A) $\lambda \geq \lambda_0$ (B) $\lambda \geq 2\lambda_0$ (C) $\lambda \leq \lambda_0$ (D) $\lambda \leq \lambda_0/2$

4. A photon of X region is more energetic than of the visible region. X may be :
(A) Infrared (B) Ultra violet (C) Microwave (D) Radio wave

5. A bulb of 40 W is producing a light of wavelength 620 nm with 80% of efficiency. Then the number of photons emitted by the bulb in 20 seconds are :
(A) 2×10^{18} (B) 10^{18} (C) 10^{21} (D) 2×10^{21}

6. The ionization energy of He^+ is 19.6×10^{-18} J ion^{-1}. The energy of the first stationary state of Be^{3+} will be :
(A) 15.68×10^{-17} J/ion (B) 78.4×10^{-18} J/ion (C) 4.9×10^{-18} J/ion (D) 39.2×10^{-18} J/ion

7. Which of the following electron transition in a hydrogen atom will require the largest amount of energy :
(A) From n = 1 to n = 2 (B) From n = 2 to n = 3 (C) From n = ∞ to n = 1 (D) From n = 3 to n = 5

8. S_1 **:** Potential energy of the two opposite charge system increases with the decrease in distance.
S_2 **:** When an electron make transition from higher orbit to lower orbit, its kinetic energy increases.
S_3 **:** When an electron make transtition from lower energy to higher energy state, its potential energy increases.
S_4 **:** 11eV photon can free an electron from the 1st excited state of He^+ ion.
(A) T T T F (B) F T T F (C) F T F T (D) T F F T

9. If r_1 is the radius of the first orbit of hydrogen atom, then the radii of second, third and fourth orbits in terms of r_1 are :
(A) r_1^2, r_1^3, r_1^4 (B) $8r_1, 27r_1, 64r_1$ (C) $4r_1, 9r_1$ $16r_1$ (D) $2r_1, 3r_1, 4r_1$

10. If the series limit wavelength of the Lyman series for the hydrogen atom is 912 Å, then the series limit wavelength for the Balmer series of the Li^{2+} ion is :
(A) $912 \times \frac{9}{4}$ Å (B) $912 \times \frac{4}{9}$ Å (C) $912 \times \frac{2}{9}$ Å (D) $912 \times \frac{4}{3}$ Å

11. In hydrogen spectrum, which of the following has some of its lines in the wavelength range 350 –700 nm :
(A) Balmer series (B) Lyman series (C) Brackett series (D) Paschen series

12. In a sample of H-atom, electrons make transition from 5th excited state upto ground state, producing all possible types of photons. Then, maximum number of lines in infrared region are :
(A) 4 (B) 5 (C) 6 (D) 3

13. Calculate wavelength of 3rd line of Bracket series in hydrogen spectrum :
(A) $\frac{33}{784R}$ (B) $\frac{33R}{784}$ (C) $\frac{784R}{33}$ (D) $\frac{784}{33R}$

14. A ball weighs 25 g and moves with a velocity of 6.6×10^4 cm/sec. Then find out the de Broglie wavelength :
(A) 0.4×10^{-33} cm (B) 0.4×10^{-31} cm (C) 0.4×10^{-35} cm (D) 0.4×10^{-37} cm

15. Calculate the de-Broglie wavelength of the electron in the ground state of hydrogen atom :
(A) 3.3284×10^{-10} m (B) 1.6642×10^{-10} m (C) 6.6568×10^{-10} m (D) Cannot be determined.

16. The uncertainity in position and velocity of an object are 10^{-10} m and 5.27×10^{-24} ms^{-1} respectively. Calculate the mass of the object :
(A) 0.1 g (B) 1 g (C) 10 g (D) 100 g

17. A given orbital is labelled by the magnetic quantum number m = –1. This could be :
(A) p-orbital (B) d-orbital (C) f-orbital (D) All of these

18. An electron with n = 3 is in an orbital with only one radial node. The orbital angular momentum of the electron will be :
(A) 0 (B) $\sqrt{6}\,\frac{h}{2\pi}$ (C) $\sqrt{2}\,\frac{h}{2\pi}$ (D) $\sqrt{6}\,\frac{h}{\pi}$

19. After np orbitals are filled, the next orbital filled will be :
(A) nd (B) (n + 1) p (C) (n + 1) s (D) (n – 1) s

20. The correct set of four quantum numbers for the valence electron of Rubidium (Z = 37) is :
(A) n = 6, ℓ = 0, m = 0, s = + $\frac{1}{2}$ (B) n = 5, ℓ = 1, m = 0, s = + $\frac{1}{2}$
(C) n = 6, ℓ = 1, m = 1, s = + $\frac{1}{2}$ (D) n = 5, ℓ = 0, m = 0, s = + $\frac{1}{2}$

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 57

Total Marks : 64

Max. Time : 65 min.

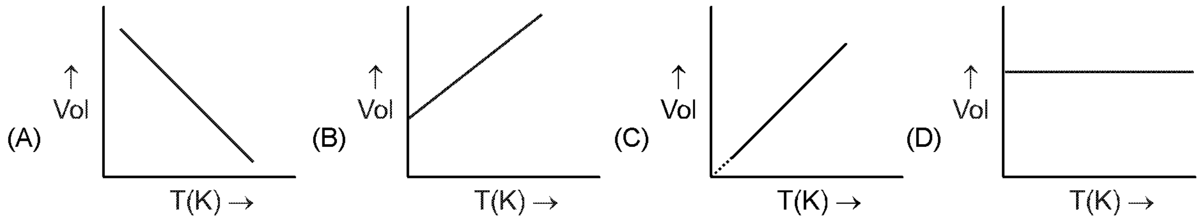
Topic : Gaseous State

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.20	(3 marks, 3 min.)	[60, 60]
Subjective Questions ('–1' negative marking) Q.21	(4 marks, 5 min.)	[4, 5]

1. At constant temperature, if pressure of an ideal gas increases by 1 %, the percentage decrease of volume is :
(A) 1 % (B) 100/101% (C) 1/101% (D) 1/100%

2. A sample of ideal gas occupies 100 ml at 27°C and 740 mm pressure. When its volume is changed to 80 ml at 740 mm pressure, the temperature of the gas will be :
(A) 21.6 °C (B) 33°C (C) – 33°C (D) – 21.6°C

3. The correct representation of Charles' law is given by :



4. The ratio of fraction pressure of a gaseous component to the total pressure of the gas mixture is equal to :
(A) mass fraction of the component (B) mole fraction of the component
(C) mass % of the component (D) mole % of the component

5. Same mass of CH_4 and H_2 is taken in a container. The partial pressure caused by H_2 (where total pressure is P) is:
(A) $\frac{8}{9}P$ (B) $\frac{1}{9}P$ (C) $\frac{1}{2}P$ (D) $\frac{3P}{4}$

6. The molecular weight of a gas which diffuse through a porous plug at 1/6th of the speed of hydrogen under identical conditions is :
(A) 12 (B) 72 (C) 36 (D) 24

7. The densities of hydrogen and oxygen are 0.09 and 1.44 g L^{-1} under same T and P conditions. If the rate of diffusion of hydrogen is 1, then that of oxygen in the same units will be :
(A) 4 (B) 1/4 (C) 16 (D) 1/16

8. 50 ml of hydrogen diffuses out through a small hole from a vessel in 20 minutes. The time needed for 40 ml of oxygen to diffuse out under identical conditions is :
(A) 4 min (B) 64 min (C) 96 min (D) 48 min

9. At the same temperature and pressure, which of the following gases will have the highest average translational kinetic energy per mole ?
(A) Hydrogen (B) Oxygen (C) Methane (D) All have the same value

10. The ratio among most probable speed, average speed and root mean square speed is given by :
(A) $2 : 8/\pi : 3$ (B) $8/\pi : 2 : 3$ (C) $\sqrt{8/\pi} : \sqrt{2} : \sqrt{3}$ (D) $\sqrt{2} : \sqrt{8/\pi} : \sqrt{3}$

11. The average translational kinetic energy for 14 grams of nitrogen gas at 127°C is nearly :
(A) 25 J (B) 50 J (C) 2500 J (D) 5000 J

12. The temperature at which rms speed of SO_2 molecules is half that of He molecules at 300 K is :
(A) 75 K (B) 600 K (C) 2400 K (D) 1200 K

13._ A real gas most closely approaches the behaviour of an ideal gas at :
(A) 15 atm and 200 K (B) 1 atm and 273 K (C) 0.5 atm and 500 K (D) 15 atm and 500 K

14. An ideal gas can't be liquefied because :
(A) its critical temperature is always above 0°C.
(B) its molecules are relatively smaller in size.
(C) it solidifies before becoming a liquid.
(D) forces operative between its molecules are zero.

15._ The compressibility factor for an ideal gas is :
(A) 0 (B) 1 (C) 3/8 (D) ∞

16._ The Vander Waal's parameters for gases W,X,Y and Z are :

Gas	a (atm L^2 mol^{-2})	b (L mol^{-1})
W	4.0	0.027
X	8.0	0.030
Y	6.0	0.032
Z	12.0	0.027

Which of these gases has the highest critical temperature ?
(A) W (B) X (C) Y (D) Z

17. Densities of two ideal gas samples containing same gas are in the ratio 1 : 2 and their temperatures are in the ratio 2 : 1. Then the ratio of their respective pressure is :
(A) 1 : 1 (B) 1 : 2 (C) 2 : 1 (D) 4 : 1

18. The root mean square speed of an ideal gas at constant pressure varies with density (d) as :
(A) d^2 (B) d (C) $\sqrt{d}$ (D) $1/\sqrt{d}$

19. A 4 : 1 molar ratio mixture of helium and methane is contained in a vessel at 10 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. The molar ratio composition of the mixture effusing out initially is :
(A) 8 : 1 (B) 16 : 1 (C) 32 : 1 (D) 6 : 1

20. A 4.0 dm^3 flask containing N_2 at 4.0 bar was connected to a 6.0 dm^3 flask containing helium at 6.0 bar, and the gases were allowed to mix isothermally. Then the total pressure of the resulting mixture will be :
(A) 4.8 bar (B) 5.2 bar (C) 5.6 bar (D) 5.4 bar

21. A mixture of formic acid and oxalic acid is heated with concentrated H_2SO_4. The gases produced are collected and on its treatment with KOH solution, the volume of the gas decreased by one-sixth. Calculate the molar ratio of the two acids in the original mixture.

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 58

Total Marks : 60

Max. Time : 60 min.

Topic : Chemical Equilibrium

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.20	(3 marks, 3 min.)	[60, 60]

1. The equilibrium constant of the reaction $SO_2(g) + ½O_2(g) \rightleftharpoons SO_3(g)$ is 4×10^{-3} $atm^{-1/2}$. The equilibrium constant of the reaction $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$ would be :
(A) 250 atm (B) 6.25×10^3 atm (C) 0.25×10^4 atm (D) 6.25×10^4 atm

2. $\log\frac{K_p}{K_c} + \log RT = 0$ is the relationship for the following gaseous phase reaction :
(A) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ (B) $2SO_2 + O_2 \rightleftharpoons 2SO_3$ (C) $H_2 + I_2 \rightleftharpoons 2HI$ (D) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

3. For the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, the value of K_C does not depends upon :
(a) Initial concentration of the reactants (b) Pressure (c) Temperature (d) Catalyst
(A) Only c (B) Only a,b (C) Only a,b,d (D) Only b,d

4. When alcohol (C_2H_5OH) and acetic acid are mixed together in equimolar ratio at 27ºC, 33% is converted into ester. Then the K_C for the following equilibrium is :

$$C_2H_5OH(\ell) + CH_3COOH(\ell) \rightleftharpoons CH_3COOC_2H_5(\ell) + H_2O(\ell).$$

(A) 4 (B) 1/4 (C) 9 (D) 1/9

5. The equilibrium constant (K_p) for the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ is 16 atm. If the volume of the container is reduced to one half its original volume, the value of K_p for the reaction at the same temperature will be :
(A) 32 atm (B) 64 atm (C) 16 atm (D) 8 atm

6. 'a' moles of PCl_5 undergo thermal dissociation as : $PCl_5 \rightleftharpoons PCl_3 + Cl_2$. At equilibrium, the mole fraction of PCl_3 is 0.25 and the total pressure is 2 atm. The value of K_p in atm is :
(A) 0.25 (B) 1 (C) 0.5 (D) Data insufficient

7. A reaction mixture containing H_2, N_2 and NH_3 has their partial pressure 2 atm, 1 atm and 3 atm respectively at 725 K. If the value of K_P for the reaction : $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is 1.25 atm^{-2} at 725 K, in which direction will the net reaction go :
(A) Forward (B) Backward
(C) No net reaction (D) Direction of reaction cannot be predicted

8. The extent of dissociation of PCl_5 at a certain temperature is 20 % at one atm equilibrium pressure. Calculate the equilibrium pressure in atm at which this substance is half dissociated at the same temperature :
(A) 0.125 (B) 0.1 (C) 2.5 (D) 0.25

9. Consider the following reactions :
(i) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
(ii) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$
The addition of an inert gas at constant volume :
(A) will increase the dissociation of PCl_5 as well as HI.
(B) will reduce the dissociation of PCl_5 and not affect the dissociation of HI.
(C) will increase the dissociation of PCl_5 and not affect the dissociation of HI.
(D) will not disturb the equilibrium of the reactions.

10. The vapour density of N_2O_4 at a certain temperature is 30. What is the percentage dissociation of N_2O_4 at this temperature ?
(A) 7.5% (B) 10% (C) 15% (D) 20%

11. $aA + bB \rightleftharpoons cC + dD$
In above gaseous phase reaction, low pressure and high temperature shift the equilibrium in backward direction. So correct set is :
(A) $(a + b) > (c + d), \Delta H > 0$
(B) $(a + b) < (c + d), \Delta H > 0$
(C) $(a + b) < (c + d), \Delta H < 0$
(D) $(a + b) > (c + d), \Delta H < 0$

12. On decomposition of NH_4HS, the following equilibrium is established :
$$NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S\ (g)$$
If the total pressure is P atm, then the equilibrium constant K_P is equal to :
(A) P atm (B) P^2 atm^2 (C) $P^2 / 4$ atm^2 (D) $P^2 / 9$ atm^2

13. At room temperature, the equilibrium constant for the reaction $P + Q \rightleftharpoons R + S$ was calculated to be 4.32. At 425°C, the equilibrium constant became 1.24×10^{-2}. This indicates that the reaction :
(A) is exothermic
(B) is endothermic
(C) could be exothermic or endothermic
(D) is not possible

14. Consider the reaction :
$$A(s) \rightleftharpoons 2B(g) + 3C(g)$$
If the concentration of C at equilibrium is doubled, then after the equilibrium is re-established, the concentration of B will be :
(A) 4/3 times the original value
(B) 3/4 times the original value
(C) $1 / 2\sqrt{2}$ times the original value
(D) $2\sqrt{2}$ times the original value

15. **Statement-1 :** For $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, if more Cl_2 is added, the equilibrium will shift in backward direction and hence equilibrium constant will decrease.
Statement-2 : Addition of a product to the equilibrium mixture always cause the equilibrium to shift backward.
(A) Statement-1 is True, Statement-2 is True ; Statement -2 is a correct explanation for Statement-1
(B) Statement-1 is True, Statment-2 is True ; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True
(E) Statement-1 and Statement-2 both are False.

16. 500 ml vessel contains 1.5 moles each of A,B, C and D at equilibrium. If 0.5 mole each of C and D are taken out, the value of K_C for $A + B \rightleftharpoons C + D$ will be :
(A) 1 (B) 1/9 (C) 4/9 (D) 8/9

17. On adding 0.01 M HCl in some amount in aqueous solution of acetic acid :
(A) Equlibrium conc. of CH_3COOH decreases.
(B) Equlibrium conc. of CH_3COO^- decreases.
(C) Equlibrium conc. of CH_3COO^- increases.
(D) No change will occur.

18. 9.2 gram of N_2O_4 (g) is taken in a closed one litre vessel and heated, till the following equilibrium is reached :
$$N_2O_4(g) \rightleftharpoons 2\ NO_2(g)$$
At equilibrium, 50% N_2O_4 (g) is dissociated. What is the equilibrium constant (in mol lit^{-1}) :
(A) 0.1 (B) 0.2 (C) 0.4 (D) 2

19. A quantity of PCl_5 was heated in a 10 dm^3 vessel at 250°C : $PCl_5\ (g) \rightleftharpoons PCl_3(g) + Cl_2(g)$. At equilibrium, the vessel contains 0.1 mole of PCl_5 and 0.2 mole of Cl_2. The equilibrium constant of the reaction is :
(A) 0.04 mol/L (B) 0.4 mol/L (C) 4 mol/L (D) cannot be determined

20. For the equilibrium :
$$H_2O(l) \rightleftharpoons H_2O(g),$$
what happens if pressure is applied :
(A) More water evaporates
(B) The boiling point of water is increased
(C) No effect on boiling point
(D) The boiling point of water is decreased

PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 59

Total Marks : 69

Max. Time : 69 min.

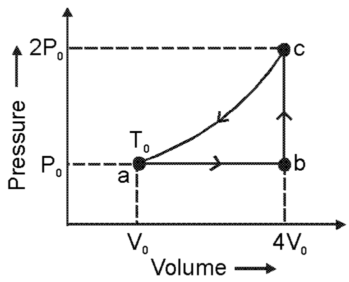
Topic : Thermodynamics & Thermochemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.14	(3 marks, 3 min.)	[42, 42]
Multiple choice objective ('–1' negative marking) Q.15 to Q.17	(4 marks, 4 min.)	[12, 12]
Assertion and Reason (no negative marking) Q.18 to Q.22	(3 marks, 3 min.)	[15, 15]

1. An isolated system is that system in which :
(A) there is exchange of energy with the surroundings.
(B) there is exchange of mass and energy with the surroundings.
(C) There is no exchange of mass and energy with the surroundings.
(D) There is exchange of mass but not energy with surroundings.

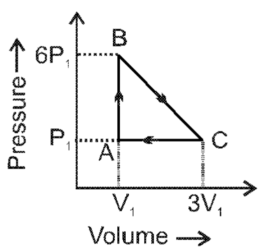
2. As per the First Law of thermodynamics, which of the following statement would be appropriate :
(A) Energy of the system remains constant.
(B) Energy of the surroundings remains constant.
(C) Entropy of the universe is always increasing in an irreversible process.
(D) Energy of the universe remains constant.

3. One mole of an ideal monoatomic gas is caused to go through the cycle shown in figure. Then the change in the internal energy of gas from a to b and b to c is respectively :



(A) $\frac{9P_0V_0}{2}$, 6 RT_0 (B) $\frac{9P_0V_0}{2}$, 10 RT_0 (C) $\frac{15P_0V_0}{2}$, 6 RT_0 (D) $\frac{15P_0V_0}{2}$, 10 RT_0

4. An ideal gas is taken around the cycle ABCA as shown in P-V diagram. The net work done during the cycle is equal to :



(A) 7 P_1V_1 (B) –5 P_1V_1 (C) 5 P_1V_1 (D) –7 P_1V_1

5. 1 mole of SO_2 gas at 27° C is expanded in reversible adiabatic condition to make volume 8 times. Final temperature and work done respectively are: (take $2^{1.2}$ = 2.3)
(A) 150 K, 900 cal (B) 150 K, 750 cal (C) 130.5 K, 847.5 cal (D) 130.5 K, 508.5 cal

6. The work done in an adiabatic process on an ideal gas by a constant external pressure would be :
(A) Zero (B) ΔE (C) ΔH (D) q

7. One mole of an ideal monoatomic gas at temperature T and volume 1L expands to 2L against a constant external pressure of one atm under adiabatic conditions. Then final temperature of gas will be :

(A) $T + \dfrac{2}{3 \times 0.0821}$ (B) $T - \dfrac{2}{3 \times 0.0821}$ (C) $\dfrac{T}{2^{5/3-1}}$ (D) $\dfrac{T}{2^{5/3+1}}$

8. One mole of an ideal gas $\left(C_V = \frac{3}{2}R\right)$ at 300 K and 5 atm is expanded adiabatically to a final pressure of 2 atm against a constant pressure of 2 atm. Final temperature of the gas is :
(A) 228 K (B) 240 K (C) 248.5 K (D) 200 K

9. The enthalpy of formation of ammonia = 46.0 kJ mol^{-1}. The enthalpy change for following reaction is :

$$2NH_3 \longrightarrow N_2 + 3H_2$$

(A) –92.0 kJ (B) 46.0 kJ (C) –46.0 kJ (D) 92.0 kJ

10. The standard enthalpy of formation of B_2O_3 is equal to :
(A) ΔH°_C (B(s)) (B) 1/2 ΔH°_C (B(s))
(C) $2\Delta H^\circ_C$ (B(s)) (D) 3/2 ΔH°_C (B(s))

11. Calculate the average O–H bond energy in H_2O with the help of following data :

(1) $H_2O_{(\ell)} \longrightarrow H_2O_{(g)}$; ΔH = + 40.5 KJ mol^{-1}

(2) $2H_{(g)} \longrightarrow H_{2\,(g)}$; ΔH = – 435.0 KJ mol^{-1}

(3) $O_{2(g)} \longrightarrow 2O_{(g)}$; ΔH = + 489.5 KJ mol^{-1}

(4) $2H_{2\,(g)} + O_{2\,(g)} \longrightarrow 2H_2O(\ell)$; ΔH = – 571.5 KJ mol^{-1}

(A) 217.75 KJ mol^{-1} (B) 217.25 KJ mol^{-1} (C) 462.5 KJ mol^{-1} (D) 925 KJ mol^{-1}

12. For the equations :
C(diamond) + $2H_2$(g) $\rightarrow$ CH_4(g) ; ΔH_1 and C(g) + 4H(g) $\rightarrow$ CH_4(g) ; ΔH_2
Select the correct option :
(A) $\Delta H_1 = \Delta H_2$ (B) $\Delta H_1 > \Delta H_2$
(C) $\Delta H_1 < \Delta H_2$ (D) Nothing can be said with certainty.

13. Enthalpy of polymerisation of ethylene, as represented by the reaction, $nCH_2{=}CH_2 \longrightarrow (-CH_2-CH_2-)_n$ is –100 kJ per mole of ethylene. Given that bond enthalpy of C=C bond is 600 kJ mol^{-1}. Enthalpy of C–C bond (in kJ mol) will be :
(A) 500 (B) 350 (C) 400 (D) indeterminate

14. 1 mole of a diatomic ideal gas at 25°C is subjected to expand reversibly and adiabatically to ten times of its initial volume. Calculate the change in entropy of gas during expansion (in JK^{-1} mol^{-1}) :
(A) R ln 10 (B) 1.5 R ln 10 (C) 2.5 R ln 10 (D) None of these

15.* If a process is both endothermic and spontaneous, then :
(A) $\Delta S_{sys} > 0$ (B) $\Delta S_{sys} < 0$ (C) $\Delta S_{univ} > 0$ (D) $\Delta S_{univ} < 0$

16.* The enthalpy change for a given reaction at 298 K is – x J mol^{-1} (x being positive). If the reaction occurs spontaneously at 298 K, the entropy change at that temperature :
(A) can be negative but numerically larger than x/298.
(B) can be negative but numerically smaller than x/298.
(C) cannot be negative.
(D) can be positive.

17.* The value of $\Delta H_{transition}$ of C (graphite) $\longrightarrow$ C (diamond) is 1.9 kJ/mol at 25ºC entropy of graphite is higher than entropy of diamond. This implies that :
(A) C (diamond) is more thermodynamically stable than C (graphite) at 25ºC.
(B) C (graphite) is more thermodynamically stable than C (diamond) at 25ºC.
(C) Diamond will provide more heat on complete combustion at 25ºC.
(D) $\Delta G_{transition}$ of C (diamond) $\longrightarrow$ C (graphite) is –ve.

Assertion / Reason

DIRECTIONS :

The following questions consist of two statements one labelled ASSERTION and the another labelled REASON . Select the correct answers to these questions from the codes given below :
(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(B) Both Assertion and Reason are true but Reason is not correct explanation of Assertion.
(C) Assertion is true but Reason is false.
(D) Assertion is false but Reason is true.

18. **Assertion :** The increases in internal energy (ΔE) for the vaporisation of one mole of water at 1 atm and 373 K is zero.
Reason : For all isothermal processes on perfect gases, $\Delta E = 0$.

19. **Assertion :** The enthalpy of formation of $H_2O(\ell)$ is greater than that of H_2O (g) in magnitude.
Reason : Enthalpy change is negative for the condensation reaction :

$$H_2O\,(g) \longrightarrow H_2O(\ell)$$

20. **Assertion :** Enthalpy of neutralisation of $HClO_4$ with NaOH is same as that of HCl with NaOH.
Reason : Both HCl and $HClO_4$ are strong acids.

21. **Assertion :** Decrease of free energy during a process under constant temperature and pressure provides a criteria of its spontaneity.
Reason : A spontaneous change must have positive sign of ΔS_{system}.

22. The standard molar enthalpies of formation of cyclohexane (l) and benzene (l) at 25º C are –156 and + 49 KJ mol^{-1} respectively. The standard enthalpy of hydrogenation of cyclohexene (l) at 25º is –119 kJ mol^{-1}. Use these data to estimate the resonance energy of benzene.

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 1

Total Marks : 27

Max. Time : 28 min.

Topic : Periodic Table and Periodicity

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.7	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Li resembles Mg due to diagonal relationship which is attributed to :
(A) nearly similar polarising power (B) same value of electron affinity
(C) penetration of sub-shells (D) identical effective nuclear charge

2. Atomic number of 15, 33, 51 represents the following family :
(A) carbon family (B) nitrogen family (C) oxygen family (D) None

3. The element with atomic number Z = 118 will be :
(A) noble gas (B) transition metal (C) alkali metal (D) alkanline earth metal

4. What is the position of the element in the Modern periodic table satisfying the electronic configuration $(n - 1)\ d^1\ ns^2$ for n = 4 :
(A) 3rd period and 3rd group (B) 4th period and 4th group
(C) 3rd period and 2nd group (D) 4th period and 3rd group

5.* Which of the following statement(s) is/are correct ?
(A) An element with three electrons in the outer most subshell belongs to nitrogen family.
(B) An element that would tend to lose two electrons belongs to alkaline earth metal group i.e. 2nd group.
(C) An element that would tend to gain two electrons belongs to chalcogen family i.e. 16th group.
(D) 17th group have only non-metals which may exist as solid, liquid as well as gas at room temp.

6.* Which of the following statements are correct ?
(A) In the long form of periodic table, the number of period indicates the value of principal quantum number.
(B) There are four d-block series comprising of total 40 elements in the long form of periodic table.
(C) s-block, d-block and f-block elements are metals.
(D) All p-block elements are non-metal.

7. **Comprehension #**

Read the following comprehension carefully and answer the questions (a) to (c).

Two friends Rohit and John, students of chemistry once discussing on periodic table, reach to a conclusion that because of Aufbau rule and other principles their thoughts are restricted for further discussion on electronic arrangements of atoms. They decided not to obey Aufbau rule and capacity of each orbital is increased to three electrons i.e. instead of two each orbital can take maximum of three electrons. Now on the basis of new arrangement of rohit and john answer the following questions assuming the total no. of elements is 112.

(a). What is the number of elements in third period and fifth period respectively ?
(A) 12, 27 (B) 27, 22 (C) 12, 22 (D) 22, 27

(b). What is the block of the elements with atomic number 9, 28, 44 ?
(A) s, p, d (B) p, s, d (C) p, d, s (D) d, p, s

(c). What is electric configuration of the element with atomic number 43 ?
(A) $1s^2 2s^3 3p^9 3s^3 3p^9 3d^{13}$ (B) $1s^3 2s^3\ 2p^9 3s^3 3p^9 3d^{15} 4s^1$
(C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 5s^2 4d^2$ (D) $1s^2 2s^3 2p^9 3s^2 3p^9 3d^{15} 4s^1$

8. Total Number of elements which are belong to same period (II).
Li, Na, Mg, F, Ne,Sc, P, Ar

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 2

Total Marks : 27

Max. Time : 28 min.

Topic : Periodic Table and Periodicity

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.7	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Which of the following species will have the smallest size ?
(A) Li^+ (B) Mg^{2+} (C) Al^{3+} (D) K^+

2. In the isoelectronic species, the ionic radii (Å) of N^{3-}, O^{2-} and F^- are respectively given by :
(A) 1.36, 1.40, 1.71 (B) 1.36, 1.71, 1.40 (C) 1.71, 1.40, 1.36 (D) 1.71, 1.36, 1.40

3. The first ionisation energy of Al is smaller than that of Mg because :
(A) the atomic number of Al is greater than that of Mg.
(B) the atomic size of Al is less than that of Mg.
(C) Penetration of s-subshell electrons in case of Mg is greater than that of p-subshell in Al
(D) Mg has incompletely filled s-orbital.

4. The correct order of second ionization potential of carbon, nitrogen, oxygen and fluorine is :
(A) C > N > O > F (B) O > N > F > C (C) O > F > N > C (D) F > O > N > C

5.* Which of the following are isoelectronic series ?
(A) Cl^-, P^{3-}, Ar (B) N^{3-}, Ne, Mg^{2+} (C) B^{3+}, He, Li^+ (D) N^{3-}, S^{2-}, Cl^-

6.* In which of the following pairs, the first members has higher first ionization energy ?
(A) N, O (B) B, Be (C) Al , Ga (D) F , Cl

7. **Comprehension #**
Read the following comprehension carefully and answer the questions (a) to (c).
The minimum amount of energy required to remove the most loosely bound electron from an isolated atom in the gaseous state is known as ionisation energy or first ionisation energy or ionisation enthalpy (IE_1) of the element. The energy required to remove the second electron from the monovalent cation is called second ionisation enthalpy (IE_2). Similarly, we have third, fourth .... ionisation enthalpies. The values of ionisation energy depends on a number of factors such as (i) size of the atom (ii) screening effect (iii) nuclear charge (iv) half filled and fully filled orbitals (v) shape of orbital. In periodic table, ionisation energy increases from left to right except few exceptions and decreases from top to bottom in the group. Inert gas has the highest value of I.E. in the period.

IONISATION ENERGIES OF THREE HYPOTHETICAL ELEMENTS ARE GIVEN BELOW (in kJ/mole):

	I	II	III
X.	122	340	1890
Y.	99	931	1100
Z.	118	1220	1652

(a). Which of the following is likely to be 2nd group element :
(A) X (B) Z (C) Y (D) Both X & Y

(b). Which of the following pair represents elements of the same group :
(A) Y, Z (B) X, Y (C) X, Z (D) X, Y, Z

(c). Energy (in kJ/mole) required for the process $Z \longrightarrow Z^{2+} + 2e^-$ will be :
(A) 118 (B) 1220 (C) 1338 (D) 2872

8. Arrange the following in increasing radii :
(a) Li^+, Na^+, K^+ (b) Mg, Mg^+, Mg^{2+} (c) O^{2-}, N^{3-}, F^- (d) O, O^-, O^{2-}
(e) Mg^{2+}, Ca^{2+} (f) P^{3-}, N^{3-} (g) K^+, Ca^{2+} (h) I^+, I^-

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 3

Total Marks : 27

Max. Time : 28 min.

Topic : Periodic Table and Periodicity

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Comprehension ('–1' negative marking) Q.7	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. For an element 'A', the first ionisation energy will be numerically equal to :
(A) EA of A^+ (B) EA of A^{2+} (C) IE of A^{2+} (D) None of these

2. Which of the following relation is correct if EN value is on Mulliken scale and IP & EA are in eV :
(A) 2 I.P. – E.A. – E.N. = 0
(B) 2 I.P. – E.A. + E.N. = 0
(C) 2 E.N. – I.P. – E.A. = 0
(D) E.N. – I.P. – E.A. = 0

3. The five successive ionisation energies of an element 'X' are 800, 1427, 2658, 25024 and 32824 KJ $mole^{-1}$ respectively. The valency of 'X' is :
(A) 1 (B) 2 (C) 3 (D) 4

4. Number of elements which has value of electronegative is less than 3.
H, N, Li, B, O, P, F
(A) 3 (B) 4 (C) 5 (D) 6

5.* Which of the following statements are correct :
(A) F is the most electronegative and Cs is the most electropositive element in periodic table.
(B) The EN of halogens decreases from F to I.
(C) The E.A. of Cl is higher than that of F, though their EN values are in the reverse order.
(D) The E.A. of noble gases is low.

6.* For electron affinity of halogens which of the following is correct ?
(A) Br > F (B) F < Cl (C) Br < Cl (D) F < I

7. **Comprehension #**
Read the following comprehension carefully and answer the questions (a) to (c).
The properties of the elements (atomic/ionic radii, electron gain enthalpy, ionization enthalpy, electronegativity, valency, oxidising/reducing power, acid/base character, etc.) which are directly or indirectly related to their electronic configurations are called periodic properties. These properties show a regular gradation on moving from left to right in a period or from top to bottom in a group. Down a group, the atomic/ ionic radii, metallic character and reducing character increases while ionization enthalpy and electronegativity decreases. Along a period from left to right, atomic/ionic radii and metallic character decreases while ionization enthalpy, electronegativity, non-metallic character and oxidising power increases. However, electron gain enthalpy becomes less negative down a group but more negative along a period. In contrast, inert gases have positive electron gain enthalpies which do not show any regular trend.

(a). Which of the following isoelectronic ions has the lowest first ionization enthalpy :
(A) K^+ (B) Ca^{2+} (C) Cl^- (D) S^{2-}

(b). The outermost electronic configuration of the most electronegative element is :
(A) $ns^2\ np^3$ (B) $ns^2\ np^4$ (C) $ns^2\ np^5$ (D) $ns^2\ np^6$

(c). Amongst the following elements (whose electronic configurations are given below), the one having the highest ionization enthalpy is :
(A) [Ne] $3s^2\ 3p^1$ (B) [Ne] $3s^2\ 3p^3$ (C) [Ne]$3s^2\ 3p^2$ (D) [Ar] $3d^{10}\ 4s^2\ 4p^3$

8. Among the elements with atomic numbers 9,12, 36, identify by atomic number, an element which is :
(a) highly electronegative (b) an inert gas (c) highly electropositive

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 4

Total Marks : 26

Max. Time : 27 min.

Topic : Periodic Table and Periodicity

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.7	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. An element with atomic number 107 has recently been discovered. Its block, group number, period and outershell electronic configuration respectively are :

(A) s-block, group 2, period 6, $6s^2$
(B) p-block, group 13, period 5, $5s^2\ 5p^4$
(C) d-block, group 7, period 7, $7s^2$
(D) f-block, group 3, period 6, $6s^2$

2. What is atomic number of Ununhexium ?

(A) 106 (B) 96 (C) 116 (D) 118

3. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign for the elements O, S, F and Cl ?

(A) O < S < F < Cl
(B) F < S < O < Cl
(C) S < O < Cl < F
(D) Cl < F < O < S

4. The electronegativity of H and Cl are 2.1 and 3.0 respectively. The correct statement about the nature of HCl is:

(A) 17% ionic
(B) 83% ionic
(C) 50% ionic
(D) 100% ionic

5. Among the following oxides, the least acidic is :

(A) P_4O_6
(B) P_4O_{10}
(C) As_4O_6
(D) As_4O_{10}

6. The correct order of acidic strength is :

(A) $Cl_2O_7 > SO_3 > P_4O_{10}$
(B) $CO_2 > N_2O_5 > SO_3$
(C) $Na_2O > MgO > Al_2O_3$
(D) $K_2O > CaO > MgO$

7.* Which one of the following statements are correct ?

(A) The elements like F, Cl, Br, O etc having high values of electron affinity act as strong oxidising agent.
(B) The elements having low values of ionisation energies act as strong reducing agent.
(C) The formation of $S^{2-}(g)$ is an exothermic process.
(D) If an element A having EN = 7 on Mulliken scale makes an oxide, then its nature will be acidic.

8. How does EN difference between bonded atoms affect the % ionic character of the bond and the bond length? Compare the bond lengths of N–O and C–O bonds using EN values.

(Given $r_N \Rightarrow 0.75$ Å; $r_0 \Rightarrow 0.74$ Å; $r_c \Rightarrow 0.77$Å)

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 5

Total Marks : 32

Max. Time : 40 min.

Topic : Basic Inorganic Chemistry

Type of Questions		M.M., Min.
Subjective Questions ('–1' negative marking) Q.1 to Q.8	(4 marks, 5 min.)	[32, 40]

1. Write down the chemical name of following compounds :

(i) $NaAlO_2$ (ii) $NaBO_2$ (iii) $K_4P_2O_7$ (iv) Na_2ZnO_2
(v) $Hg_2(BO_2)_2$ (vi) $K_2Cr_2O_7$ (vii) NaH_2PO_4 (viii) Na_2HPO_4
(ix) Na_3PO_4 (x) $Ca(H_2PO_4)_2$ (xi) $CaHPO_4$ (xii) $Ca_3(PO_4)_2$
(xiii) $Mg(ClO_3)_2$ (xiv) NaOBr (xv) $Ca(ClO_2)_2$ (xvi) $CuPbO_2$
(xvii) $KClO_3$ (xviii) $(NH_4)_2MoO_4$ (xix) $BaCrO_4$ (xx) Na_2SnO_3
(xxi) $FeWO_4$ (xxii) K_2MnO_4 (xxiii) KH_2PO_2

2. Write the chemical formula of following compounds :

(i) Magnesium phosphate (ii) Calcium nitrite (iii) Calcium metaborate
(iv) Ferric phosphate (v) Calcium hypochlorite (vi) Meta phosphate ion
(vii) Ammonium pyroantimonate (viii) Arsenous oxide (ix) Sodium pyrosulphate
(x) Potassium perchlorate (xi) Silver sulphite (xii) Silver arsenite
(xiii) Lead(II) dichromate (xiv) Zinc nitrate (xv) Silver plumbate
(xvi) Sodium ammonium hydrogen phosphate

3. Write the name of following acidic radicals :

CO_3^{2-} SO_3^{2-} S^{2-} NO_2^- CH_3COO^- Cl^- Br^-
I^- NO_3^- $C_2O_4^{2-}$ BO_3^{3-} PO_4^{3-} SO_4^{2-}

4. If you are given that $2Na_2HPO_4 \xrightarrow{\Delta} Na_4P_2O_7 + H_2O$, then predict this reaction :

$$MgHPO_4 \xrightarrow{\Delta} A + B?$$

5. It is given that, $2FeCl_3 \xrightarrow{\Delta} 2FeCl_2 + Cl_2$.
Can you predict the product if we heat $CuBr_2$? Write the chemical name of $CuBr_2$ and product.

6. It is given that, $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$.

Then, $Mg(HCO_3)_2 \xrightarrow{\Delta}$?

Write the chemical formula and name of solid product, if the chemical name of Na_2CO_3 is Sodium carbonate.

7. James Bond has reveived a case involving an intricate murder. The element (A) responsible for poisoning forms a compound (B) with sodium. (A) also forms two chlorides (C) and (D), covalent in nature. Both (B) and (C) contain four atoms per molecular formula of the substance. If (A) is neither a pure metal nor a pure non-metal, identify (A) to (D) and help Mr. Bond solving the case. Suggest all possibilities if more than one such possibilities exist.

8. Certain elements combine with oxygen as well as halides to form oxyhalides. e.g. (i) Bi^{3+} can form BiOCl (obtained by replacing two Cl atoms in $BiCl_3$ by one O atom) (ii) S (VI) can form SO_2Cl_2 (obtained by replacing one O atom in SO_3 by two Cl atoms). In a similar fashion, write the oxyhalide formulae containing:

(a) S (IV), O and Cl (b) Xe (VI), O and F (two possibilities)
(c) S (VI), O and F (two possibilities) (d) V (V), O and Cl (two possibilities) (e) N(III), O and Cl

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 6

Total Marks : 16

Max. Time : 20 min.

Topic : Basic Inorganic Chemistry

Type of Questions		M.M., Min.
Subjective Questions ('–1' negative marking) Q.1 to Q.4	(4 marks, 5 min.)	[16, 20]

1. Write the name of the following :

(a) Ca_3P_2 (b) $Ba(CN)_2$ (c) Na_2S

(d) ClF_3 (e) SF_4 (f) $Co(BO_2)_2$

(g) $Sc_2Si_2O_7$ (h) $Na_2S_2O_7$ (i) $Ba(NO_3)_2$

(j) Na_2SiO_3 (k) $Na_2H_2P_2O_5$ (l) $Al_2(SO_4)_3$

2. Write down the formula of the following :

(a) Sulphur hexafluoride (b) Lithium nitride (c) stroncium chloride

(d) dioxygen di fluoride (e) barium azide (f) barium perchlorate

(g) sodium hypochlorite (h) calcium phosphate (i) magnesium pyro phosphate

(j) Copper (II) metaborate (k) Sodium pyrosulphite (l) Ferric nitrate

3. Write the name of the following :

(a) H_3BO_3 (b) H_4SiO_4 (c) H_2CrO_4

(d) H_4xeO_6 (e) H_3PO_3 (f) HPO_3

(g) H_2SO_3 (h) $H_2S_2O_4$ (i) $H_2S_2O_3$

(j) H_2SO_5 (k) $HClO_3$ (l) $H_2N_2O_2$

(m) HBr (n) HN_3

4. Write down the formula of the following :

(a) Carbonic acid (b) Pyro silicic acid (c) Meta boric acid

(d) Manganic acid (e) Xenic acid (f) Hypophosphorus acid

(g) Phosphoric acid (h) Pyrosulphurous acid (i) Dithionic acid

(j) Chlorous acid (k) Nitrous acid (l) Peroxy nitric acid

(m) Hydroiodic acid (n) Hydrocyanic acid

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 7

Total Marks : 27

Max. Time : 28 min.

Topic : Periodic Table and Periodicity

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6 to Q.7	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. If the value of IE_1 for He-atom is 24.6 eV, then the energy required for the reaction :

$$He\ (g) \longrightarrow He^{2+}\ (g) + 2e^-\ \text{is :}$$

(A) 79 eV
(B) 38.2 eV
(C) 147 eV
(D) Cannot be determined since data is insufficient.

2. Which of the following is the strongest oxy-acid among the following :

(A) H_2SO_4 (B) H_3PO_4 (C) $HClO_4$ (D) H_2SiO_3

3. Which of the following is the anhydride of Nitric acid (HNO_3) :

(A) NO_2 (B) N_2O_3 (C) N_2O_5 (D) N_2O

4. Which of the following statement is incorrect ?

(A) Oxide of aluminium (Al_2O_3), and arsenic (As_2O_3) are amphoteric.
(B) Oxide of chlorine (Cl_2O_7) is less acidic than oxide of nitrogen (N_2O_5).
(C) Oxide of carbon (CO_2) is more acidic than oxide of silica (SiO_2).
(D) The correct increasing order of basic character of various oxides is $H_2O < CuO < MgO < CaO$.

5. Which of the following is the **INCORRECT** order of acidic strength :

(A) $H_2O < H_2S < H_2Se < H_2Te$
(B) $HIO_4 < HBrO_4 < HClO_4$
(C) $HNO_2 < HNO_3$
(D) $HI < HBr < HCl < HF$

6.* Select equations having endothermic step :

(A) $S^-(g) + e^-\ (g) \longrightarrow S^{2-}\ (g)$
(B) $Ne\ (g) + e^-\ (g) \longrightarrow Ne^-\ (g)$
(C) $N(g) + e^-\ (g) \longrightarrow N^-\ (g)$
(D) $Al^{2+}(g) \longrightarrow Al^{3+}\ (g) + e^-\ (g)$

7.* Which is correct order for the properties specified ?

(A) I < Br < Cl < F (oxidising character)
(B) K > Mg > Al > B (metallic character)
(C) C < O < N < F (Non-metallic character)
(D) Li > Na > K > Rb > Cs (chemical reactivity)

8. The ionisation potentials of atoms A and B are 400 and 300 kcal mol^{-1} respectively. The electron affinities of these atoms are 80.0 and 85.0 kcal mol^{-1} respectively. Prove that which of the atoms have higher electronegativity

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 8

Total Marks : 25

Max. Time : 26 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. What is the nature of chemical bonding between Cs and F ?
(A) Ionic (B) Covalent (C) Coordinate (D) Metallic

2. The lattice energy of sodium chloride crystal is the energy released when one mole of NaCl(s) is formed from:
(A) Na(g) and Cl(g) atoms
(B) Na^+(g) and Cl^-(g) ions
(C) Na(s) and Cl_2(g)
(D) crystallization from aqueous solution of sodium chloride.

3. Which does not favour the formation of ionic compound :
(A) the ionization energy of the metal atom should be low.
(B) the lattice energy of the compound formed must be low.
(C) the electron affinity of the non-metal should be high.
(D) the lattice energy of the compound formed must be high.

4. Octet configuration cannot be achieved through :
(A) loss of electrons
(B) gain of electrons
(C) sharing of electrons
(D) exchange of electrons

5. In which of the following molecules, bonding is not taking place in excited state :
(A) CH_4 (B) BF_3 (C) IF_7 (D) PCl_3

6. The bonds present in N_2O are :
(A) only ionic
(B) covalent and co-ordinate
(C) only covalent
(D) covalent and ionic

7. Which of the following species does not obey octet rule :
(A) SiF_4 (B) PCl_5 (C) ICl (D) BF_4^-

8. Answer the following :

(i) What is the covalency of Carbon in C_2H_4 ?

(ii) What types of bonds and how many of each are present in NH_4^+ ion ?

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 9

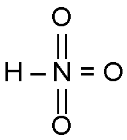
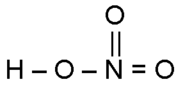
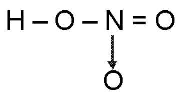
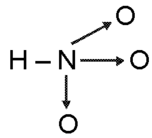
Total Marks : 32

Max. Time : 36 min.

Topic : Chemical Bonding

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Match the Following (no negative marking) Q.5	(8 marks, 10 min.)	[8, 10]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. The correct representation of Lewis dot structure of HNO_3 is :

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

2. Species not obeying octet rule is/are :

(A) CO_3^{2-} (B) BF_3 (C) NO_2^- (D) PCl_3

3. PCl_5 exists but NCl_5 does not, because :

(A) Nitrogen has no vacant 2d-orbitals
(B) N and Cl have almost same EN
(C) N-atom is much smaller than P-atom
(D) Nitrogen is highly inert

4. The molecular without any lone pair around the centred atom is :

(A) XeO_3 (B) XeO_4 (C) XeF_6 (D) XeO_2F_2

5. Match the species in column (I) with their characteristics in column (II) :

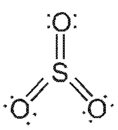
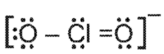
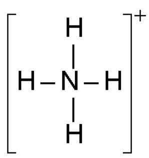
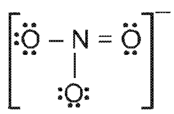
Column-I	**Column-II**
(P) BH_4^-	(1) 2 bond pair and 3 lone pair on central atom
(Q) ICl_2^+	(2) 4 bond pair and no lone pair on central atom
(R) ICl_2^-	(3) 3 bond pair and 1 lone pair on central atom
(S) ICl_4^-	(4) 2 bond pair and 2 lone pair on central atom
	(5) 4 bond pair and 2 lone pair on central atom

(A) P = 2; Q = 4; R = 3; S = 1
(B) P = 2; Q = 4; R = 1; S = 5
(C) P = 2; Q = 1; R = 5; S = 4
(D) P = 2; Q = 1; R = 3; S = 4

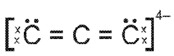
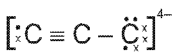
6.* The odd electron molecules among the following is/are :

(A) NO_2 (B) NO (C) ClO_2 (D) CO

7. Assign formal charges to all atoms in the given species :

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

8. Explain on the basis of formal charge, which of the following is a more appropriate structure for C_3^{4-} ion :

 or 

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 10

Total Marks : 26

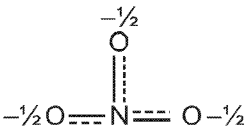
Max. Time : 26 min.

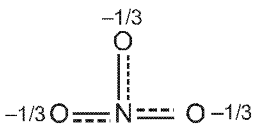
Topic : Chemical Bonding

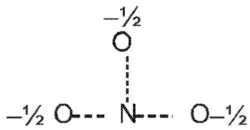
Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.7 to Q.8	(4 marks, 4 min.)	[8, 8]

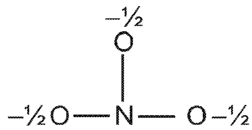
1. Resonating structures have different :
(A) Atomic arrangements
(B) Electronic arrangements
(C) Functional groups
(D) Sigma bond

2. Resonance hybrid of nitrate ion is :

(A) 

(B) 

(C) 

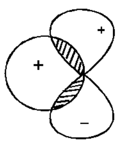
(D) 

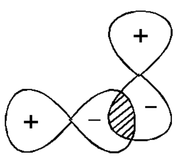
3. The correct order of C–N bond length in the given compounds is :
P : CH_3CN Q : HNCO R : CH_3CONH_2
(A) P > Q > R
(B) P = Q = R
(C) R > Q > P
(D) R > P > Q

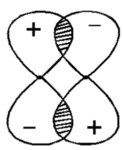
4. Correct order of bond length is :
(A) $CO_3^{2-} > CO_2 > CO$
(B) $CO_2 > CO > CO_3^{2-}$
(C) $CO > CO_2 > CO_3^{2-}$
(D) None of these.

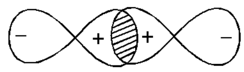
5. The strength of bonds by $s-s, p-p, s-p$ overlap is generally in the order :
(A) $s-s > s-p > p-p$
(B) $s-s > p-p > s-p$
(C) $s-p > s-s > p-p$
(D) $p-p > s-s > s-p$

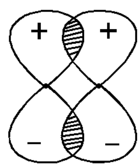
6. Which of the following atomic orbital overlappings are not allowed :

(i) 

(ii) 

(iii) 

(iv) 

(v) 

(A) All
(B) (i) (ii) (iii)
(C) (i) (iii) (v)
(D) (ii) only

7.* Indicate the wrong statement according to VBT :
(A) A sigma bond has no free rotation about the inter-nuclear axis.
(B) p-orbitals always have only sidewise overlapping.
(C) s-orbitals never form π - bonds.
(D) There can be more than one sigma bond between two atoms.

8.* Which of the following overlaps is/are incorrect [assuming X-axis to be the internuclear axis] :
(a) $2p_y + 2p_y \rightarrow \pi$
(b) $2p_z + 2p_z \rightarrow \sigma$
(c) $2p_x + 2p_x \rightarrow \pi$
(d) $1s + 2p_y \rightarrow \pi$
(e) $2p_y + 2p_z \rightarrow \pi$
(f) $1s + 2s \rightarrow \sigma$
(A) 'a' & 'b'
(B) 'b' & 'd'
(C) 'd' & 'f'
(D) 'c' & 'e'

INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 11

Total Marks : 31

Max. Time : 34 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q.8	(8 marks, 10 min.)	[8, 10]

1. Hybridization of orbitals of carbon in CH_4 is necessary to explain which of the following :
(A) Equality of strength of all C-H bonds (B) Methane is non-polar
(C) Tetravalency of Carbon (D) Carbon has complete octet

2. In which of the following, 'N' atom is sp^2 hybridised :
(A) NH_3 (B) NH_4^+ (C) NH_2^- (D) NOCl

3. The hybridization of carbon atoms in $C_2 - C_3$ single bond of $H\overset{4}{C} \equiv \overset{3}{C} - \overset{2}{C}H = \overset{1}{C}H_2$ is :
(A) $sp^3 - sp^3$ (B) $sp^2 - sp$ (C) $sp - sp^2$ (D) $sp^3 - sp$

4. In C_3O_2, the hybridization state of Carbon is :
(A) sp (B) sp^2 (C) sp^3 (D) Both sp and sp^2

5. Shape of NH_3 is very similar to :
(A) BF_3 (B) CH_3^- (C) SO_3 (D) $CH_3^{\oplus}$

6.* Which starred carbon atom in the following molecules show sp^2 hybridisation :
(A) $CH_3\overset{*}{C}HO$ (B) $CH_3\overset{*}{C}OCl$ (C) $(\overset{*}{C}H_3)_3N \rightarrow O$ (D) $CH_3COCH_2\overset{*}{C}OOC_2H_5$

7. In how many of the following species, the central atoms have two lone pairs of electrons ?

XeF_4	XeF_5^-	F_2SeO_2
XeF_3^+	$XeOF_4$	$ClOF_3$
ICl_4^-	SCl_2	OSF_4

8. Match the following :

Column (I) **Species**	**Column (II)** **Characteristics of central atom**
(A) IBr_2^-	(p) sp^3d^2, 2 lone pairs
(B) XeF_5^-	(q) sp^3d, 1 lone pair
(C) ICl_4^-	(r) sp^3d^3, 1 lone pair
(D) IF_6^-	(s) sp^3d^3, 2 lone pair
	(t) sp^3d, 3 lone pairs

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 12

Total Marks : 26

Max. Time : 27 min.

Topic : Chemical Bonding

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.7	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Carbon atoms in $C_2(CN)_2$ are :
(A) All sp-hybridised (B) All sp^2-hybridised (C) All sp^3-hybridised (D) sp and sp^2 –hybridised.

2. $BF_3 + F^- \rightarrow BF_4^-$
What is the hybridiation state of B in BF_3 and BF_4^- :
(A) sp^2, sp^3 (B) sp^3, sp^3 (C) sp^2, sp^2 (D) sp^3, sp^3d

3. The hybridisation of P in phosphate ion (PO_4^{3-}) is the same as :
(A) I in ICl_4^- (B) S in SO_3 (C) N in NO_3^- (D) S in SO_3^{2-}

4. Specify the hybridisations of central atom in the following species respectively {N_3^-, NOCl, N_2O}
(A) sp , sp^2 , sp (B) sp , sp , sp^3 (C) sp^2 , sp , sp (D) sp^2 , sp^2 , sp.

5. The correct order of increasing s character (in percentage) in the hybrid orbitals in below molecules / ions is (assume all hybrid orbitals are exactly equivalent) :

CO_3^{2-}	XeF_4	I_3^-	NCl_3	$BeCl_2$ (g)
I	II	III	IV	V

(A) II < III < IV < I < V (B) II < IV < III < V < I
(C) III < II < I < V < IV (D) II < IV < III < I < V

6. Consider the following statements :

In $\overset{I}{C}H_2 = \overset{II}{C}H - \overset{III}{C} \equiv \overset{IV}{C} - H$

1. There are 6 σ and 3 π bonds.
2. Carbon I & II are sp^2 hybridised.
3. Carbon III & IV are sp hybridised.

The above statements 1, 2, 3 respectively are (T = True, F = False) :
(A) T T T (B) F T T (C) F T F (D) T F T

7.* Which of the following species have linear shape with central atom sp hybridised :
(A) NO_2^+ (B) SCN^- (C) $HgCl_2$ (D) C_2H_2

8. Predict the hybridisation of the central atom in following molecules :

1.	BeH_2 (g)	....	2.	BeF_2	....
3.	CO_2	....	4.	$HC \equiv CH$	....
5.	O_3	....	6.	BF_3	....
7.	$CH_2=CH_2$	....	8.	CH_3^+	....
9.	HNO_3	....	10.	HNO_2	....
11.	SO_2	....	12.	SO_3	....
13.	HCO_3^-	....	14.	$HCOO^-$	....
15.	$SnCl_2$	....	16.	$AlCl_3$	....
17.	AlH_4^-	....	18.	NF_3	....
19.	PF_3	....	20.	$AsCl_3$	....
21.	CH_3^-	....	22.	OF_2	....
23.	SCl_2	....	24.	SF_4	....
25.	$[SiF_6]^{2-}$	....	26.	PCl_6^-	....
27.	ICl_2^-	....	28.	ICl_5	....
29.	ICl_4^-	....	30.	XeF_6	....

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 13

Total Marks : 31

Max. Time : 33 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6 to Q.7	(4 marks, 4 min.)	[8, 8]
Match the Following (no negative marking) Q.8	(8 marks, 10 min.)	[8, 10]

1. Which of the following is V-shaped :

(A) S_3^{2-} (B) I_3^- (C) N_3^- (D) none of these

2. Which of the following should have pyramidal shape :

(A) $[ClOF_2]^+$ (B) ICl_3 (C) $[BrICl]^-$ (D) SO_3

3. Accroding to VSEPR theory in $[IO_2F_2]^-$ ion the $F\hat{I}F$ bond angle will be nearly

(A) 120° (B) 90° (C) 109°–28′ (D) 180°

4. Among the following, the pair in which the two species are not isostructural is

(A) IO_3^- and XeO_3 (B) $A\ell H_4^-$ and PH_4^+ (C) AsF_6^- and SF_6 (D) SiF_4 and SeF_4

5. Consider the structures of the following two molecules :

X : $F_2C = C = CF_2$

Y : $F_2B - C \equiv C - BF_2$

In which of these two, it is impossible for all the four F atoms to lie in the same plane :

(A) X (B) Y (C) both (D) none

6.* Which is/are true according to VSEPR theory :

(A) The order of repulsion between different pair of electrons is $\ell p - \ell p > \ell p - bp > bp - bp$

(ℓp = lone pair electrons, bp = bond pair electrons)

(B) Lone pair and double bond occupy equitorial position in trigonal bipyramidal structure.

(C) More electronegative atoms occupy axial position in trigonal bipyramidal structure.

(D) Bigger atoms occupy axial positions in trigonal bipyramidal structure.

7.* In which of the following species, one of bond angle is expected to be more than 120º.

(A) N_2O (B) NO_2^- (C) NO_2^+ (D) XeF_3^+

8. Match the isostructural pairs :

(a) SF_4	(i) IF_6^+
(b) PCl_5	(ii) ClF_4^+
(c) ICl_3	(iii) $SnCl_5^-$
(d) I_3^-	(iv) ClF_3
(e) ICl_4^-	(v) ClF_2^-
(f) PCl_6^-	(vi) XeF_4

INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 14

Total Marks : 32

Max. Time : 35 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Match the Following (no negative marking) Q.7	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Which of the following is ionic solid :
(A) XeF_6 (s) (B) PBr_5(s) (C) CaC_2(s) (D) All of these

2. Which of the following statements are correct :
(1) The number of sigma bonds in $CH_2 = C = C = CH_2$ is 7.
(2) All the hydrogen atoms in $CH_2 = C = C = CH_2$ lie in the same plane.
(A) Only (1) (B) Only (2) (C) Both (1) and (2) (D) Neither (1) nor (2)

3. Match the list-I with List–II and select the correct answer using the codes given below with the lists.

List–I (Compounds)	**List-II (Shape)**
(a) XeF_4	(i) Tetrahedral
(b) XeO_3	(ii) Square planar
(c) XeO_4	(iii) Trigonal bipyramidal
(d) XeO_3F_2	(iv) Pyramidal

(A) a – iv, b – iii, c – i, d – ii (B) a – ii, b – iv, c – i, d – iii
(C) a – i, b – iv, c – ii, d – iii (D) a – ii, b – i, c – iii, d – iv

4. Gaseous SO_3 molecule :
(A) is planar triangular in shape with three σ bonds from $sp^2 – p$ overlap and three π-bonds formed by two $p\pi – p\pi$ overlap and one $p\pi – d\pi$ overlap.
(B) is planar triangular in shape with three σ-bonds from $sp^2 – p$ overlap and three π-bonds formed by one $p\pi – p\pi$ overlap and two $p\pi – d\pi$ overlap.
(C) is a pyramidal molecule with one double bond and two single bonds
(D) is planar triangular in shape with two double bonds between S and O and one single bond

5.* Which of the following is a planar molecule :
(A) XeF_4 (B) $\dot{N}H_3$ (C) BrO_3^- (D) $C\ell F_3$

6.* Identify pairs containing isomorphous species :
(A) $MgCO_3$, $NaNO_3$ (B) Na_2CO_3 , Na_2SO_3 (C) $BaSO_4$, $KMnO_4$ (D) $NaNO_3$, $KClO_3$

7. Match the following :

	Molecule/ion		**Hybridisation of central atom**
(A)	$IO_2F_2^-$	(p)	sp^3d
(B)	F_2SeO	(q)	sp^3
(C)	$ClOF_3$	(r)	sp^2
(D)	XeF_5^+	(s)	sp^3d^2

8. There will be three different flourine-flourine distances in molecule $F_2C=C=C=CF_2$. Assuming ideal bond angles for a particular hybridisation (assume no distortion due to double bonds), find out the two smaller flourine-flourine distances (in pm).

(Given that C–F bond length = 134 pm, C = C bond length = 134 pm, $\sqrt{3}$ = 1.7)

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 15

Total Marks : 27

Max. Time : 28 min.

Topic : Chemical Bonding

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6 to Q.7	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Correct order of bond length is

(A) $SO_3^{2-} > SO_4^{2-} > SO_3$ (B) $SO_4^{2-} > SO_3^{2-} > SO_3$

(C) $SO_3 > SO_3^{2-} > SO_4^{2-}$ (D) None of these.

2. Which of the following molecule contains shortest N–O bond ?

(A) NOF (B) NO_2^- (C) NO_3^- (D) NH_2OH

3. How many types of bond length are there in SO_4^{2-} ?

(A) one (B) two (C) three (D) four

4. Select the correct order for bond angle.

(A) $PH_3 < AsH_3 < NH_3 < SbH_3$ (B) $F_2O < H_2O < Cl_2O$

(C) $SbI_3 < SbBr_3 < SbCl_3$ (D) $BF_3 > BCl_3 > BBr_3$

5. Select the correct order of bond angle of the following species.

ClO_3^-, BrO_3^-, IO_3^-

(A) $BrO_3^- > IO_3^- > ClO_3^-$ (B) $ClO_3^- > BrO_3^- > IO_3^-$

(C) $IO_3^- > BrO_3^- > ClO_3^-$ (D) $IO_3^- < BrO_3^- > ClO_3^-$

6.* Which of the following order is/are correct about the bond angle.

(A) $OF_2 < H_2O < Cl_2O < ClO_2$ (B) $COF_2 < COCl_2 < COBr_2 < COI_2$ ($X\hat{C}X$ bond angle)

(C) $PH_3 > PF_3$ (D) $KrF_4 < SF_2 < N_2H_2$

7.* CO_3^{2-} anion has which of the following charcteristics

(A) Bonds of unequal length (B) sp^2 hybridisation of C atom

(C) Resonance stabilization (D) Same bond angles.

8. Compare bond angles in the following pairs :

(a) F_2O and H_2O (b) NH_3 and PH_3 (c) SO_2 and SO_3 (d) NO_2^+ and NO_2^-

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 16

Total Marks : 25

Max. Time : 25

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Multiple choice objective ('–1' negative marking) Q.8	(4 marks, 4 min.)	[4, 4]

1. Hydrogen forms bridge in the chemical structure of :
(A) Hydrogen peroxide (B) Lithium hydride (C) Diborane (D) Sodium peroxide

2. In B_2H_6 :
(A) There is a direct boron-boron bond.
(B) The structure is similar to that of C_2H_6.
(C) The boron atoms are linked through hydrogen bridges.
(D) All the atoms are in one plane.

3. The hybridization of central atom and shape of $(SiH_3)NCO$ is :
(A) sp^2, planner (B) sp^3, tetrahedral (C) sp^3, pyramidal (D) sp, linear

4. The main factor responsible for weak Lewis acid nature of BF_3 among all boron trihalides is :
(A) Large electronegativity of F (B) Three centred-two electron bonds in BF_3
(C) $p\pi$-$d\pi$ back bonding (D) $p\pi$-$p\pi$ back bonding

5. Which is not true about B_2H_6
(A) Both 'B' atoms are sp^3 hybridised (B) Boron atom is in ground state
(C) Two hydrogens occupy special positions (D) There are two, three centre two electron bonds

6. **Statement-1 :** Geometry of $(CH_3)_3N$ is pyramidal but in case of $(SiH_3)_3$ N, it is planar.
Statement-2 : Silicon is less electronegative than Carbon.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

7. **Statement-1 :** Calculated bond length of B–F bond in BF_3 is 152 pm, whereas observed bond length is 130 pm.
Statement-2 : B–F bond in boron trifluoride possesses partial double bond character due to $p\pi$-$p\pi$ back bonding.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

8.* BCl_3 does not exist as dimer but BH_3 exist as dimer (B_2H_6) because:
(A) Chlorine is more electronegative than hydrogen
(B) There is $p\pi$-$p\pi$ back bonding in BCl_3 but BH_3 does not contain such bonding
(C) Large sized chlorine atoms do not fit between the small boron atoms whereas small sized hydrogen atoms get fitted between boron atoms
(D) None of these

DPP No. 17

Total Marks : 25

Max. Time : 26 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.7	(3 marks, 3 min.)	[21, 21]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Diamond is a hard substance because :
(A) it has ionic bond.
(B) it has planar arrangement of carbon atoms.
(C) it has sp^3 hybridized carbon atoms which are arranged tetrahedrally in a cross-network structure.
(D) it has sp^2 hybridized carbon atoms arranged in a planar geometry.

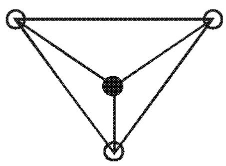
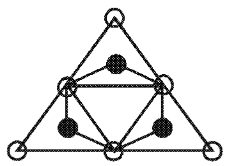
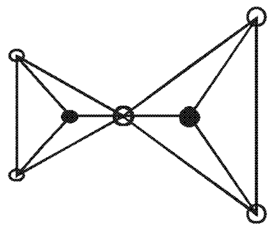
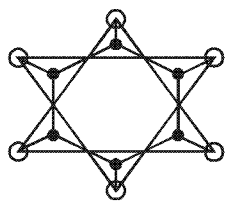
2. Graphite is a good conductor of heat and electricity, while diamond is not because :
(A) graphite has ionic bonds and diamond has covalent bonds.
(B) graphite has covalent bonds and diamond has ionic bonds.
(C) graphite has delocalized electrons whereas diamond has not.
(D) graphite has sp^3 hybridized carbon atoms and diamond has sp^2 hybridized carbon atoms.

3. Most recently developed carbon allotrope 'C-60' Buckminster Fullerene has shape of :
(A) football (B) thin sheet of steel (C) diamond (D) none of these

4. Two types of carbon-carbon covalent bond lengths are present in :
(A) diamond (B) graphite (C) C_{60} (D) benzene

5. The fundamental unit found in silicates is :
(A) SiO_2 (B) SiO_4^{4-} (C) SiO_3 (D) $Si_2O_5^{2-}$

6. Which of the following represents a pyrosilicate structure :
○ — Oxygen ● — Silicon

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

7. On the basis of structure of graphite, which of the following is/are true for it :
(A) It is a diamagnetic substance.
(B) It behaves like metallic conductor as well as semiconductor upon changes in temperature.
(C) It is less dense than diamond.
(D) All C–C bond lengths are same and intermediate between single and double bonds.

8. Answer the following questions.
(i) What is the hybridisation of B and N in inorganic benzene ?
(ii) How many position isomers are possible for dichloro substituted inorganic benzene ?
(iii) How many B–H bonds are there in inorganic benzene ?
(iv) How many N–B bonds are there in inorganic benzene ?

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 18

Total Marks : 26

Max. Time : 28 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. Which is the hybridization of the central atom of SiO_2 :

(A) sp (B) sp^2 (C) sp^3 (D) sp^3d

2. In SO_2 molecule, there are two σ-bonds and two π-bonds. The two π-bonds are formed by :

(A) $p\pi - p\pi$ overlap between S and O atoms

(B) $sp^2 - p$ overlap between S and O atoms

(C) one by $p\pi - p\pi$ overlap and other by $p\pi - d\pi$ overlap

(D) both by $p\pi - d\pi$ overlap

3. White phosphours has :

(A) six P – P single bonds (B) four lone pairs of electrons

(C) PPP angle of 60ºC (D) all of these

4. **STATEMENT-1 :** NO_2 and ClO_2 both being odd electron molecules dimerise.

STATEMENT-2 : On dimerisation, NO_2 is converted to stable N_2O_4 molecule with even number of electrons.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

5. In P_4O_{10} molecule

(A) There are 4 P–P bond (B) There are 8 P–O bond

(C) The $P\hat{O}P$ bond angle is 180° (D) The phosphorus atom is in excited state

6. In P_4S_3 how many P–P bonds are present.

(A) 3 (B) 4 (C) 5 (D) 2

7. Nitrogen exists as diatomic molecule and phosphorus as P_4 . Why ?

8. In SiO_2, each silicon atom is covalently bonded in a tetrahedral manner to four oxygen atoms and each oxygen atom in turn is covalently bonded to another two silicon atoms giving a three dimensional network solid. Find the total number of atoms comprising each ring forming the three dimensional network solid.

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 19

Total Marks : 29

Max. Time : 30 min.

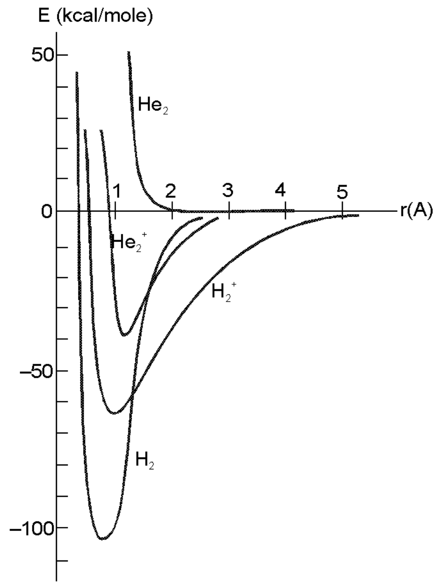
Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Which of the following forms only π-bond using Molecular orbital theory :
(A) Li_2 (B) C_2 (C) N_2 (D) O_2

2. Which of the following statements is not correct from the point of view of molecular orbital theory :
(A) Be_2 is not a stable molecule.
(B) He_2 is not stable, but He_2^+ is expected to exist.
(C) Bond strength of N_2 is maximum amongst the homonuclear diatomic molecules.
(D) The order of energies of molecular orbitals in F_2 molecule is :
$E(\sigma 2s) < E(\sigma^*2s) < E(\pi 2p_x) = E(\pi 2p_y) < E(\sigma 2p_z) < E(\pi^*2p_x) = E(\pi^*2p_y) < E(\sigma^*2p_z)$

3. The following graph is given between total energy and distance between the two nuclei for species H_2^+, H_2, He_2^+ & He_2. Which of the following statements is correct :



(A) He_2^+ is more stable than H_2^+.
(B) Bond dissociation energy of H_2^+ is more than bond dissociation energy of He_2^+.
(C) Since bond orders of He_2^+ and H_2^+ are equal, hence both will have equal bond dissociation energy.
(D) Bond length of H_2^+ is less than bond length of H_2 .

4.*_ Which of the following is/are gerade molecular orbitals :
(A) σ (B) σ^* (C) π (D) π^*

Comprehension # (Q.5 to Q.7)

In principle, Schrondinger equation can be written for any molecule. However, since it cannot be solved exactly for any system containing more than one electron, molecular orbitals which are one electron wave functions for molecules are difficult to obtain directly from the solution of the Schrondinger equation. This difficulty is overcome by resorting to an approximation method called linear combination of atomic orbitals (LCAO) method to form molecular orbitals.

The molecular orbtial formed by the addition of atomic orbtials is called the bonding molecular orbital and the molecular orbital formed by the substration of atomic orbitals is called antibonding molecular orbital. Qualitaively, the formation of molecular orbitals can be understood in terms of the constructive or destructive interference of the electron waves of the combining atoms. In the formation of bonding molecular orbital, the two electron waves of the bonding atoms reinforce each other (constructive interference) while in the formation of antibonding molecular orbtial, these electron waves cancel each other (destructive interference). The result is that in a bonding molecular orbital most of the electron density is located between the nuclei of the bonded atoms and hence the repulsion between the nuclei is very low while in an antibonding molecular orbital, most of the electron density is located away from the space between the nuclei, as a matter of fact there is a nodal plane (i.e., plane in which the electron density is zero)

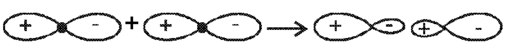
5. How many nodal plane is/are present in σ_{1s} bonding molecular orbital :

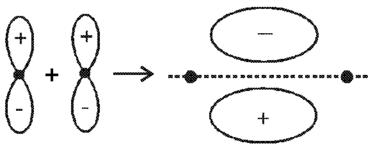
(A) zero (B) 1 (C) 2 (D) 3

6. Which of the following combination of orbitals is correct :

(A) 

(B) 

(C) 

(D) 

7. Which of the following statements is not correct regarding bonding molecular orbitals :

(A) Bonding molecular orbtials possess less energy than the atomic orbitals from which they are formed.

(B) Bonding molecular orbtials have low electron density between the two nuclei.

(C) Every electron in bonding molecular orbitals contibutes to the attraction between atoms

(D) They are formed when the lobes of the combining atomic orbtials have the same sign i.e. proper symmetry of electron waves.

8. Predict whether the He_2^+ ion in its electronic ground state is stable toward dissociation into He and He^+.

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 20

Total Marks : 27

Max. Time : 29 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. Which of the following pairs of species would you expect to have largest difference in spin magnetic moment:

(A) O_2 , O_2^+ (B) O_2 ,O_2^{2-} (C) O_2^+, O_2^{2-} (D) O_2^- , O_2^+

2. According to Molecular orbital theory, HOMO in O_2^- is :

(A) π $2p_x$ = π $2p_y$ (B) π^* $2p_x$ = π $^*2p_y$ (C) σ $2p_z$ (D) σ^* $2p_z$

3. Order of stability of N_2, N_2^+ and N_2^- is :

(A) $N_2 > N_2^+ > N_2^-$ (B) $N_2^+ > N_2 > N_2^-$ (C) $N_2^- > N_2 > N_2^+$ (D) $N_2^- = N_2^+ > N_2$

4. The bond order in NO is 2.5 while that in NO^+ is 3. Which of the following statements is true for these two species :

(A) Bond length comparison is unpredictable. (B) Bond length in NO is greater than in NO^+.

(C) Bond length in NO^+ is equal to that in NO. (D) Bond length in NO^+ is greater than in NO.

5. According to Molecular orbital theory, which of the following statement about the magnetic character and bond order of O_2^+ is correct :

(A) Paramagnetic and bond order less than that of O_2

(B) Paramagnetic and bond order greater than that of O_2 .

(C) Diamagnetic and bond order less than that of O_2

(D) Diamagnetic and bond order greater than that of O_2 .

6.* Which of the following is/are correct :

(A) Carbon-carbon bond length in CaC_2 will be more than in CH_2CCH_2

(B) O–O bond length in KO_2 will be more than in Na_2O_2.

(C) O–O bond length in $O_2[PtF_6]$ will be less than that in KO_2

(D) N–O bond length in NO gaseous molecule will be smaller than in NOCl gaseous molecule.

7. Of the following species, which has the highest bond order and shortest bond length : NO, NO^+, NO^{2+}, NO^-

8. Explain why NO^+ is more stable towards dissociation than NO, whereas CO^+ is less stable towards dissociation than CO.

INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 21

Total Marks : 120

Max. Time : 120 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Choose the compounds of maximum and minimum ionic character from LiCl, RbCl, $BeCl_2$ and $MgCl_2$:
(A) LiCl and RbCl (B) RbCl and $BeCl_2$ (C) RbCl and $MgCl_2$ (D) $MgCl_2$ and $BeCl_2$

2. An ion without pseudo-inert gas configuration is :
(A) Ag^+ (B) Cd^{2+} (C) Zn^{2+} (D) Fe^{3+}

3. Correct order of increasing solubility in water of RbI, CdI_2 and PbO_2 is :
(A) PbO_2, CdI_2, RbI (B) RbI, CdI_2, PbO_2 (C) CdI_2, PbO_2, RbI (D) PbO_2, RbI, CdI_2

4. AgCl is colourless whereas AgI is yellow, because :
(A) Ag^+ possesses 18 electrons in shell to screen the nuclear charge.
(B) Ag^+ shows pseudo inert gas configuration.
(C) Distortion of I^- is more pronounced than Cl^- ion.
(D) Existence of d-d transition.

Comprehension # (Q.5 to Q.7)

Fajan's Rule

When anions and cation approach each other, the valence shell of anions are pulled towards cation nucleus and thus, shape of anion is deformed. The phenomenon of deformation of anion by a cation is known as polarization and the ability of the cation to polarize the anion is called as polarizing power of cation. Due to polarization, sharing of electrons occurs between two ions to some extent and the bond shows some covalent character.

The magnitude of polarization depends upon a number of factors. These factors were suggested by Fajan and are known as Fajan's rules.
(i) Greater is the polarization in a molecule, more is covalent character.
(ii) As the charge on cation increases, its tendency to polarize the anion increases.
(iii) As the size of the cation decreases or size of the anion increases, the polarization increases.
(iv) The cations with 18 electrons in the outermost shell bring greater polarization of the anion than those with inert gas configuration even if both the cation have same size and same charge.
Many important properties of ionic compounds like solubility, melting point, thermal stability, etc. can be explained on the basis of Fajan's rule.

5. Arrange the following in decreasing order of melting point : $BeCl_2$, $MgCl_2$, $CaCl_2$ and $BaCl_2$
(A) $BeCl_2 > MgCl_2 > CaCl_2 > BaCl_2$ (B) $BaCl_2 > MgCl_2 > CaCl_2 > BeCl_2$
(C) $BeCl_2 > CaCl_2 > MgCl_2 > BaCl_2$ (D) $BaCl_2 > CaCl_2 > MgCl_2 > BeCl_2$

6. Which among the following has maximum covalent character :
(A) NaCl (B) $MgCl_2$ (C) $A\ell Cl_3$ (D) $CaCl_2$

7. Which of the following statements is INCORRECT :
(A) AgI is less soluble in water than AgF due to more polarisation of I^- in comparison to F^- ion.
(B) LiI is less soluble in water than LiF due to more polarisation of I^- in comparison to F^- ion.
(C) Colour of some compounds can also be explained on the basis of polarisation of anion.
(D) The greater covalent character of AgCl as compared to NaCl can be explained on the basis of Fajan's rule.

8. Answer the following question :
(a) Among LiF and LiI, which has more covalent character ?
(b) LiI is soluble in water but LiF is not. Why ?

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 22

Total Marks : 31

Max. Time : 35 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
True or False (no negative marking) Q.5	(2 marks, 2 min.)	[2, 2]
Subjective Questions ('–1' negative marking) Q.6 to Q.7	(4 marks, 5 min.)	[8, 10]
Match the Following (no negative marking) Q.8	(8 marks, 10 min.)	[8, 10]

1. Which of the following molecule is/are non polar :

(A) XeF_2 (B) PCl_3F_2 (C) XeF_4 (D) All of these

2. The dipole moments of the given molecules are such that :

(A) $BF_3 > NF_3 > NH_3$ (B) $NF_3 > BF_3 > NH_3$ (C) $NH_3 > NF_3 > BF_3$ (D) $NH_3 > BF_3 > NF_3$.

3. In which type of molecule, the dipole moment may be non-zero :

(where A – Central atom, B – Bonded atom, L – Lone pair)

(A) AB_2L_2 (B) AB_2L_3 (C) AB_4L_2 (D) AB_4

4.* Which is incorrect order for net dipole moment :

(A) HF > HCl > HBr > HI

(B) $CH_3 – F > CD_3 – F$

(C) $SO_3 > SO_2$

(D) $CH_3 – CH = CHCl$ (cis)> $CH_3 – CH = CHCl$ (trans)

5. **True or False**

(a) The dipole moment of HCl molecule is 1.05 D and its internuclear separation is 1.25 Å. The charge effectively held by the chlorine atom is 7/40 times the electronic charge.

(Given : charge of an electron = 4.8×10^{-10} esu)

(b) All the N–N bond lengths are same in azide ion and hydroazoic acid.

6. Arrange in order of increasing dipole moment : BF_3, H_2S, H_2O.

7. The gaseous Potassium chloride molecule has a measured dipole moment of 9.6 D, which indicates that it is a very polar molecule. The separation between the nuclei in this molecule is 2.67×10^{-8} cm. Calculate the percentage ionic character in KCl molecule.

8. **Match the following :**

Column I (Species)		**Column II (Characteristics)**
(A) NH_3	(p)	Non-polar molecule
(B) PF_2Cl_3	(q)	Polar molecule
(C) XeF_2	(r)	Bonding taking place in ground state
(D) H_2S	(s)	Bonding taking place in excited state.

INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 23

Total Marks : 26

Max. Time : 27 min.

Topic : Chemical Bonding

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.5 to Q.7	(3 marks, 3 min.)	[9, 9]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. The order of strength of hydrogen bond is :
(A) Cl–H....Cl > N–H....N > O–H....O > F–H....F
(B) N–H....N > Cl–H....Cl > O–H....O > F–H....F
(C) O–H....O > N–H....N > Cl–H....Cl > F–H....F
(D) F–H....F > O–H....O > N–H....N > Cl–H....Cl

2. Which one among the following does not have hydrogen bonds :
(A) boric acid (solid)
(B) N_2H_4 (liquid)
(C) H_2O_2 (liquid)
(D) C_6H_6 (liquid)

3. When two ice cubes are pressed over each other, they unite to form one cube. Which of the following force is responsible for holding them together :
(A) Vander Waal's forces
(B) Hydrogen bond
(C) Covalent attraction
(D) Dipole-dipole attraction.

4.* Correct order of boiling point is/are :
(A) $CH_3 — O — CH_3 < CH_3 — CH_2 — OH$
(B) $F_2 < Cl_2 < Br_2 < I_2$
(C) HF < HCl < HBr < HI
(D) $NH_3 > PH_3 > AsH_3$

Comprehension # (Q.5 to Q.7)

When a H-atom is bonded to a highly electronegative atom with lone pair of electron (say, Z) by a covalent bond, the bond pair of electrons is displaced towards the electronegative atom. When solitary electron of hydrogen atom lies away from it, its nucleus gets exposed and behaves as a bare proton. Such a bare hydrogen nucleus exerts a strong electrostatic attraction on the electronegative atom of the adjacent molecule. This interaction

$$\cdots\cdots \overset{\delta+}{H} — \overset{\delta-}{\ddot{Z}}: \cdots\cdots \overset{\delta+}{H} — \overset{\delta-}{\ddot{Z}}: \cdots\cdots \overset{\delta+}{H} — \overset{\delta-}{\ddot{Z}}: \cdots\cdots$$

between hydrogen atom of one molecule and the electronegative atom of the other molecules is referred to as hydrogen bond.

Larger the electronegativity of the other atom, greater is the strength of hydrogen bond. For example, electronegativities of F, O and N decrease as F > O > N consequently, strengths of H-bonds decreases. If the size of electronegative atom is large, its attractive force with hydrogen atom will be less and consequently, strength of H–bond will be less. Strength of H-bond increases with the increase in availability of lone pair of electron on the electronegative element. The order of the availability of lone pair of electron is N > O > F.

The presence of two hydrogen atoms and two lone pair of electrons in each water molecule results in a three dimensional tetrahedral cage like structure. This accounts for the fact that ice is less dense than water at 0°C. If temperature is increased hydrogen bond starts breaking and molecule come closer. Which increases the density but after 4°C density of water decreases with increase in temperature due to normal thermal expansion.

5. Which of the following substances does not form H-bond with water :

(A) CH_3CH_2OH (B) $CH_3-\overset{\overset{O}{||}}{C}-OH$ (C) $CH_3-CH_2-CH_3$ (D) $CH_3-\overset{\overset{O}{||}}{C}-NH_2$

6. Which of the above statement is true :

I. When ice is melted, hydrogen bond starts breaking & molecule of water come closer by moving into vacant space. As a result, density of water decreases upto 4°C.

II. Due to open cage like structure, ice has a relatively large volume for a given mass of liquid water.

III. In ice, there are four water molecules attached tetrahedrally.

(A) I, II and III (B) I and III (C) II and III (D) II only

7. Which of the following conditions is required for the formation of hydrogen bond :

(A) Hydrogen atom should be bonded to a highly electronegative atom.

(B) The size of electronegative atom should be small.

(C) There should be a lone pair of electron on the electronegative atom.

(D) All of the above.

8. State the type of force of attraction existing in the sample of following compounds :

(i) $CH_3 — O — CH_3$ (ii) sugar (iii) ice (iv) CH_3COCH_3

(v) $CH_3 — OH$ (vi) $N(CH_3)_3$ (vii) gold (viii) $CH_3 — NH_2$

(ix) H_2S (x) Na^+(aq.) (xi) CCl_4 (xii) diamond

(xiii) Cl_2 (xiv) NH_4Cl (xv) HCl and Cl_2 (xvi) Ar

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 24

Total Marks : 28

Max. Time : 30 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. Among the following compounds the one that is polar and has central atom with sp^3 hybridisation is

(A) H_2CO_3 (B) SiF_4 (C) BF_3 (D) $HClO_2$

2. Which of the following compounds are electron deficient ?

(A) B_2H_6 (B) BF_4^- (C) $BeCl_2(s)$ (D) Al_2Cl_6

3. Identify incorrect order of bond angles

(A) $Cl_2O > F_2O$ and $F_2O < H_2O$

(B) $AsI_3 > AsBr_3 > AsCl_3$

(C) $NO_2^+ > NO_2^-$

(D) $H_b\hat{B}H_b > H_t\hat{B}H_t$; where H_t is terminal Hydrogen of B_2H_6 and H_b is the bridging Hydrogen of B_2H_6

4. **Statement-1 :** LiCl is predominantly a covalent compound.

Statement-2 : Electronegativity difference between Li and Cl is too small.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

5.* The correct set/s of order is/are

(A) $LiCl < BeCl_2 < BCl_3 < CCl_4$ (Covalent character)

(B) $Be(OH)_2 < Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < Ba(OH)_2$ (water solubility)

(C) $XeF_4 < H_2O < NH_3 < BF_3$ (bond angle)

(D) $sp^3 < sp^2 < sp$ (% s–character)

6.* On the basis of MOT which is **correct** :

(A) The bond order for C_2 molecule is two and both bonds are π-bonds

(B) The LUMO in this molecule is $\sigma 2p$ anti bonding type of molecular orbital

(C) The HOMO in this molecule are π type of antibonding molecular orbital containing total 4 electrons

(D) None of the above is correct

7. ICl_3 is an orange colored solid that dimerizes in solid state as I_2Cl_6. Based on VSEPR theory, number of 90 degree Cl – I – Cl bond angles is .... in the dimeric species.

Neglect any minor deviations from ideal bond angle.

8. Sum of antibonding π electrons (π^* electrons) in species O_2, O_2^- and O_2^{2-} are .

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 25

Total Marks : 53

Max. Time : 56 min.

Topic : s-block Elements

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.11	(3 marks, 3 min.)	[33, 33]
Subjective Questions ('–1' negative marking) Q.12 to Q.14	(4 marks, 5 min.)	[12, 15]
True or False (no negative marking) Q.16	(2 marks, 2 min.)	[2, 2]
Short Subjective Questions ('–1' negative marking) Q.17	(3 marks, 3 min.)	[3, 3]
Assertion and Reason (no negative marking) Q.18	(3 marks, 3 min.)	[3, 3]

1. Sodium and potassium react with water much more vigorously than lithium because :
(A) sodium and potassium have high values of hydration energy as compared to that of lithium.
(B) sodium and potassium have higher melting point than that of lithium.
(C) sodium and potassium have lower melting point than that of lithium.
(D) sodium and potassium have lower hydration energy than that of lithium.

2. Which of the following statements is not true about the dilute solutions of alkali metals in liquid ammonia ?
(A) They are deep blue coloured solutions.
(B) They are highly conducting in nature.
(C) They are diamagnetic in nature.
(D) Ammoniated cation and solvated electron are formed in the solution.

3. The following compounds have been arranged in order of their increasing thermal stabilities. Identify the correct order. K_2CO_3 (I), $MgCO_3$ (II), $CaCO_3$ (III), $BeCO_3$(IV)
(A) I < II < III < IV (B) IV < II < III < I
(C) IV < II < I < III (D) II < IV < III < I.

4. Identify the correct statement :
(A) Sodium metal can be prepared by the electrolysis of an aqueous solution of NaCl.
(B) Sodium metal can be kept under ethyl alcohol.
(C) Sodium metal is insoluble in liquid NH_3 at low temperature.
(D) Elemental sodium is easily oxidised.

5. Which of the following statements are true about the alkali metals ?
(1) All alkali-metal salts impart a characteristic colour to the Bunsen flame.
(2) The correct order of increasing thermal stability of the carbonates of alkali metals is $Li_2CO_3 < Na_2CO_3 < K_2CO_3 < Rb_2CO_3 < Cs_2CO_3$.
(3) Among the alkali metals, cesium is the most reactive.
(4) The reducing character of the alkali metal hydrides follow the order : LiH > NaH > KH > RbH > CsH.
(A) (1), (2) and (3) (B) (1), (3) and (4)
(C) (2), (3) and (4) (D) (1), (2), (3) and (4)

6. **Statement - 1 :** Solubilities of alkali metal fluorides and carbonates increase down the group.
Statement - 2 : Hydration energies of alkali metal halides decrease down the group with increase in size of cations.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

7. The melting point of lithium (180°C) is almost double the melting point of sodium (97°C) because :
(A) down the group, the hydration energy decreases
(B) down the group, the ionization energy decreases
(C) down the group, the cohesive energy decreases
(D) none of these

8. Which of the following statement (s) is/are true for the solutions of alkali metals and alkaline earth metals in ammonia (ℓ) ?
(A) Concentrated solutions of alkali metals in ammonia are copper - bronzed coloured and have a metallic lusture.
(B) Dilute solutions of alkaline earth metals are deep bule-black in colour due to the spectrum from the solvated electron.
(C) Concentrated solutions of the alkaline earth metals in ammonia are bronze coloured.
(D) Evaporation of the ammonia from solutions of alkali metals yields the metal, but with alkaline earth metals evaporation of ammonia gives hexammoniates of the metals.

9. **STATEMENT-1 :** Lithium is the most powerful reducing agent and sodium is the least powerful reducing agent amongst the alkali metals in aqueous solutions.
STATEMENT-2 : Lithium has the highest hydration enthalpy and the sodium the least value.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

10. Which of the following statements is incorrrect ?
(A) The superoxide ion (i.e. O_2^-) is stable only in presence of larger cations such as K^+, Rb^+, Cs^+.
(B) Alkali metals are normally kept in kerosene oil.
(C) All the alkali metal hydrides are ionic solids with high melting points.
(D) The concentrated solution of alkali metals in liquid ammonia is paramagnetic in nature.

11. Property of the alkaline earth metals that increases with their atomic number is :
(A) Ionisation energy
(B) solubility of their hydroxides
(C) solubility of their sulphates
(D) Electronegativity

12. Why is sodium chloride added during electrolysis of fused anhydrous magnesium chloride ?

13. Explain the difference in the nature of bonding in LiF and LiI.

14. Arrange the following sulphates of alkaline earth metals in order of decreasing thermal stability :
$BeSO_4$, $MgSO_4$, $CaSO_4$, $SrSO_4$

15. Fill in the blanks :
(i) Ca^{2+} has a smaller ionic radius than K^+ because it has ....

(ii) A solution of sodium in liquid ammonia at – 33ºC conducts electricity. On cooling, the conductivity of this solution ....

16. **True/False :**
(a) The softness of group I metals increases down the group with increasing atomic number.
(b) Sodium when burnt in excess of oxygen mainly gives sodium monoxide.

17. Calcium is obtained by :
(A) electrolysis of molten $CaCl_2$
(B) electrolysis of solution of $CaCl_2$ in water
(C) chemical reduction of $CaCl_2$
(D) roasting of lime stone.

18. Read the following statement and explanation and answer as per the options given below :
Statement : The alkali metals can form ionic hydrides which contain the hydride ion H^-.
Explanation : The alkali metals have low electronegativity; their hydrides conduct electricity when fused and on electrolysis liberate hydrogen at the anode.
(A) Both S and E are true and E is the correct explanation of S.
(B) Both S and E are true but E is not correct explanation of S.
(C) S is true but E is false.
(D) S is false but E is true.

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 26

Total Marks : 67

Max. Time : 75 min.

Topic : s-block Elements

Type of Questions			M.M., Min.
Single choice Objective ('–1' negative marking) Q.1,2,4, 5,6,8 to 10, 12		(3 marks, 3 min.)	[27, 27]
Fill in the Blanks ('–1' negative marking) Q.3, Q.7,		(3 marks, 3 min.)	[6, 6]
True or False (no negative marking) Q.11		(2 marks, 2 min.)	[2, 2]
Match the Following	(no negative marking) Q. 13	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('–1' negative marking) Q.14 to Q.19		(4 marks, 5 min.)	[24, 30]

1. Which of the following statements is true for all the alkali metals ?
(A) Their nitrates decompose on heating to give the corresponding nitrites and oxygen.
(B) Their chlorides are deliquescent and crystallise as hydrates.
(C) They react with water to form hydroxide and hydrogen.
(D) They readily react with halogens to form ionic halides, M^+X^-.

2. Which of the following gives propyne on hydrolysis ?
(A) Al_4C_3 (B) Mg_2C_3 (C) B_4C (D) La_4C_3

3. COMPLETE THE FOLLOWING REACTIONS :

(i) $Na_2S + Na_2O_2 \longrightarrow$

(ii) $Na + O_2(excess) \xrightarrow{350°C}$

(iii) $Na_2O_2 + CO \longrightarrow$; $Na_2O_2 + CO_2 \longrightarrow$

(iv) $Cr(OH)_3 + Na_2O_2 \longrightarrow$

(v) $MnSO_4 + Na_2O_2 \longrightarrow$

(vi) $Na_2O + NH_3 \longrightarrow$

(vii) $Na_2O_2 + H_2O \xrightarrow{Cold}$

4. Which of the following has the highest solubility in water ?
(A) LiOH (B) KOH (C) CsOH (D) RbOH

5. Which of the following compounds on thermal decomposition yields a basic as well as an acidic oxide ?
(A) $KClO_3$ (B) $NaNO_3$ (C) K_2CO_3 (D) $MgCO_3$

6. Which of the following reactions of potassium superoxide supply oxygen gas in the breathing equipments used in space and submarines ?
(1) reaction of superoxide with nitrogen in the exhaled air
(2) reaction of superoxide with moisture in the exhaled air
(3) reaction of superoxide with carbon dioxide in the exhaled air
(A) (1), (2) and (3) (B) (2) and (3) only (C) (2) only (D) (1) and (2) only

7. COMPLETE THE FOLLOWING REACTIONS :

(i) $NaOH + NO_2 \longrightarrow$; $NaOH + SO_3 \longrightarrow$

(ii) NaOH (hot & conc.) + $Br_2 \longrightarrow$; NaOH (hot & conc.) + $F_2 \longrightarrow$

(iii) $NaOH + S \longrightarrow$ **(iv)** $B + NaOH \longrightarrow$ **(v)** $NaOH + Si + H_2O \longrightarrow$

(vi) Reaction of NaOH with amphoteric oxides :
$PbO + NaOH \longrightarrow$; $PbO_2 + NaOH \longrightarrow$

(vii) Reaction of NaOH with amphoteric metals (e.g. Al, Pb, Sn, Zn etc.) :
$NaOH + H_2O + Al \longrightarrow$

(viii) Reaction of NaOH with salts of Cr, Ni, Fe, Mn, Cu etc., :
$CrCl_3 + NaOH \longrightarrow$; $CuCl_2 + NaOH \longrightarrow$

(ix) Reaction of NaOH with salts of Hg and Ag :
$HgCl_2 + NaOH \longrightarrow$; $Hg(OH)_2 \longrightarrow$
$AgNO_3 + NaOH \longrightarrow$; $AgOH \longrightarrow$

(x) $NaOH + CO \xrightarrow[5-10\,atm]{150-200°C}$

8. A substance absorbs CO_2 and violently reacts with water. The substance is :
(A) $CaCO_3$ (B) CaO (C) H_2SO_4 (D) ZnO

9. HCl is added to following oxides. Which one would give H_2O_2?
(A) MnO_2 (B) PbO_2 (C) $BaO_2.8H_2O$ (D) NO_2

10. The pair of compounds which cannot exist together in solution is :
(A) $NaHCO_3$ and NaOH (B) Na_2CO_3 and $NaHCO_3$
(C) Na_2CO_3 and NaOH (D) $NaHCO_3$ and NaCl

11. **S_1 :** Plaster of paris is a hemihydrate of calcium sulphate obtained by heating the gypsum above 393 K.
S_2 : Sodium carbonate is used in water softening.
S_3 : The order of mobilities of the alkali metal ions in aqueous solutions is $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$.
(A) T T F (B) T T T (C) F T F (D) F F F

12. Chemical A is used for water softening to remove temporary hardness. A reacts with Na_2CO_3 to generate caustic soda. When CO_2 is bubbled through A, it turns cloudly. What is the chemical formula of A?
(A) $CaCO_3$ (B) CaO (C) $Ca(OH)_2$ (D) $Ca(HCO_3)_2$

13.

Column I	**Column II**
(A) $Na_2SO_4 + C + CaCO_3 \xrightarrow{\Delta}$	(P) One of the products has sp^2 hybridisation of central atom.
(B) $NaCl + NH_4HCO_3 \longrightarrow$	(Q) One of the products has sp^3 hybridisation of central atom:
(C) $Na_2CO_3 + Ca(OH)_2 \longrightarrow$	(R) One of the products is insoluble as precipitate.
(D) KOH + NO (2 : 4 by mole ratio)	(S) One of the products is a neutral oxide.

14. When gas (A) is passed through dry KOH at low temperature, a deep red coloured compound (B) and a gas (C) are obtained. The gas (A) on reaction with but–2-ene followed by treatment with Zn/H_2O yields acetaldehyde. Identify (A), (B) and (C).

15. Write down the balanced equation for the reaction when :
Carbon dioxide is passed through a suspension of lime stone in water.

16. Give reasons for the following :
Magnesium oxide is used for the lining of steel making furnace.

17. Work out the following using chemical equations :
Chlorination of calcium hydroxide produces bleaching powder.

18. Complete and balance the following reaction :
$Ca_5(PO_4)_3F + H_2SO_4 + H_2O \xrightarrow{Heat}$ .... + $5CaSO_4.2H_2O$ +................

19. When zeolite, which is hydrated sodium aluminium silicate, is treated with hard water, the sodium ions are exchanged with
(A) H^+ ions (B) Ca^{2+} ions (C) SO_4^{2-} ions (D) Mg^{2+} ions (E) OH^- ions

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 27

Total Marks : 59

Max. Time : 61 min.

Topic : p-Block Element (Boron & Carbon Family)

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to 3, 5 to 12, 14 to 17	(3 marks, 3 min.)	[45, 45]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
Match the Following (no negative marking) Q. 13	(8 marks, 10 min.)	[8, 10]
True or False (no negative marking) Q.18	(2 marks, 2 min.)	[2, 2]

1. **Statement-1 :** $T\ell^{3+}$ acts as an oxidising agent.

Statement-2 : $T\ell^{+}$ is more stable than $T\ell^{3+}$ due to inert pair effect.

(A) Statement : 1 is True, Statement-2 is True ; Statement -2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statment-2 is True ; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

2. How many (maximum) of the 8 atoms of B_2H_6 can be taken in a plane :

(A) 4 (B) 6 (C) 8 (D) None of these

3. The number of possible isomers for disubstituted borazine, $B_3N_3H_4X_2$ is :

(A) 3 (B) 4 (C) 6 (D) 2

4.* Which species exist :

(A) $[BF_6]^{3-}$ (B) $[AlF_6]^{3-}$ (C) $[GaF_6]^{3-}$ (D) $[InF_6]^{3-}$

5. Which of the following is only acidic in nature :

(A) $Be(OH)_2$ (B) $Mg(OH)_2$ (C) $B(OH)_3$ (D) $Al(OH)_3$

6. In the following reaction : $B(OH)_3 + H_2O \rightarrow [B(OH)_4]^- + H^+$:

(A) $B(OH)_3$ is a Lewis acid. (B) $B(OH)_3$ is a Lewis base.

(C) $B(OH)_3$ is amphoteric. (D) none is correct.

7. On the addition of mineral acid to an aqueous solution of borax, the compound formed is :

(A) borodihydride (B) orthoboric acid (C) metaboric acid (D) pyroboric acid

8. Aqueous solution containing 1 mole of borax reacts with 2 mole of acid. This is because of :

(A) formation of 2 mole of $B(OH)_3$ only.

(B) formation of 2 mole of $[B(OH)_4]^-$ only.

(C) formation of 1 mole each of $B(OH)_3$ and $[B(OH)_4]^-$.

(D) formation of 2 mole each of $[B(OH)_4]^-$ and $B(OH)_3$, of which only $[B(OH)_4]^-$ reacts with acid.

9. Pick up the wrong statement :

(A) Borax is used in the manufacture of optical glasses. (B) Borax is used as a flux.

(C) Borax is used as a water softener. (D) Borax is used as a fuel in rockets.

10. Which of the following statement is correct for diborane :

(A) Small amines like NH_3, CH_3NH_2 give unsymmetrical cleavage of diborane.

(B) Large amines such as $(CH_3)_3N$ and pyridine gives symmetrical cleavage of diborane.

(C) Small as well as large amines both gives symmetrical cleavage of diborane.

(D) (A) and (B) both

11. From B_2H_6, all the following can be prepared except :

(A) H_3BO_3 (B) $[BH_2(NH_3)_2]^+ [BH_4]^-$ (C) $B_2(CH_3)_6$ (D) $NaBH_4$

12. The product obtained in the reaction of diborane with excess of ammonia at low temperature is :

(A) $B_2H_6 . NH_3$ (B) $B_2H_6 . 2NH_3$ (C) $(BN)_x$ (D) Borazine

13. Match the reactions listed in column-I with the product(s) listed in column-II :

	Column – I		Column – II
(A)	$B_2O_3 + H_2O$	(p)	H_3BO_3
(B)	$B_2H_6 + H_2O$	(q)	H_2
(C)	$B_3N_3H_6 + H_2O$	(r)	HCl
(D)	$BCl_3 + H_2O$	(s)	NH_3
		(t)	N_2

14. Aluminium does not react with :

(A) NaOH (B) conc. HCl (C) N_2 (D) conc. HNO_3

15. Aluminium vessels should not be washed with materials containing washing soda because :

(A) washing soda is expensive.

(B) washing soda is easily decomposed.

(C) washing soda reacts with aluminium to form soluble aluminate.

(D) washing soda reacts with aluminium to form insoluble aluminium oxide.

16. **Statement-1 :** Al $(OH)_3$ is amphoteric in nature.

Statement-2 : Al–O and O–H bonds can be broken with equal ease in $Al(OH)_3$.

(A) Statement : 1 is True, Statement-2 is True ; Statement -2 is a correct explanation for Statement-1

(B) Statement-1 is True, Statment-2 is True ; Statement-2 is NOT a correct explanation for Statement-1

(C) Statement-1 is True, Statement-2 is False

(D) Statement-1 is False, Statement-2 is True

17. Aqueous solution of potash alum is :

(A) alkalline (B) acidic (C) neutral (D) soapy

18. **True / False**

(i) Ethyl borate, $B(OC_2H_5)_3$ burns with green edged flame.

(ii) In sodium peroxoborate, each boron is sp^3 hybridised.

(iii) H_3BO_3 does not dissolve in aqueous HF.

(iv) The basic nature of the hydroxides of Group 13 decreases progressively down the group.

(v) Elemental Boron cannot be obtained from Van Arkel method.

INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 28

Total Marks : 62

Max. Time : 67 min.

Topic : p-Block Element (Boron & Carbon Family)

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to 7, 9 to 12	(3 marks, 3 min.)	[33, 33]
Subjective Questions ('–1' negative marking) Q.13 to Q.15	(4 marks, 5 min.)	[12, 15]
Multiple choice objective ('–1' negative marking) Q.8	(4 marks, 4 min.)	[4, 4]
Match the Following (no negative marking) Q. 16	(8 marks, 10 min.)	[8, 10]
Fill in the Blanks ('–1' negative marking) Q.17	(3 marks, 3 min.)	[3, 3]
True or False (no negative marking) Q.18	(2 marks, 2 min.)	[2, 2]

1. Diamond and graphite are :
(A) isomers (B) isotopes (C) allotropes (D) none of the above

2. Thermodynamically, the most stable form of carbon is :
(A) diamond (B) graphite (C) fullerenes (D) coal

3. Moderate electrical conductivity is shown by :
(A) silica (B) graphite (C) diamond (D) carborundum

4. The oxide which is not a reducing agent is :
(A) CO_2 (B) CO (C) SO_2 (D) Both (A) & (C)

5. Which one of the following oxides is neutral :
(A) CO (B) SnO_2 (C) ZnO (D) SiO_2

6. A colourless gas which burns with blue flame and reduces CuO to Cu is :
(A) N_2 (B) CO (C) CO_2 (D) NO_2

7. An oxide of carbon (X) reacts with ammonia to produce urea, an important fertilizer. Which of the following combinations will not yield (X) :
(A) $CO_3^{2-} + HCl \xrightarrow{\Delta}$ (B) $CaO + C \xrightarrow{\Delta}$
(C) $C + \text{Excess } O_2 \xrightarrow{\Delta}$ (D) $HCO_3^- + HCl \xrightarrow{\Delta}$

8.* The compounds used as refrigerant are :
(A) NH_3 (B) CCl_4 (C) CF_4 (D) CF_2Cl_2 (E) CH_2F_2

9. The material used in the solar cells contains :
(A) Cs (B) Si (C) Sn (D) Ti

10. The butter of tin is represented by :
(A) $SnCl_2 . 5H_2O$ (B) $SnCl_2$ (C) $SnCl_4$ (D) $SnCl_4 . 5H_2O$

11. When PbO_2 reacts with concentrated HNO_3, the gas evolved is :
(A) NO_2 (B) O_2 (C) N_2 (D) N_2O

12. Red lead is :
(A) PbO (B) PbO_2 (C) Pb_3O_4 (D) Pb_2O_3

13. Give reasons for the following :
Carbon acts as an abrasive and also as a lubricant.

14. Draw the structure of a cyclic silicate, $(Si_3O_9)^{6-}$ with proper labelling.

15. What happens when Pb_3O_4 is treated with nitric acid ?

16.

Column – I	**Column – II**
(A) Cyclic silicates	(p) Tetrahedral hybridisation.
(B) Single chain silicates	(q) Si – O bonds are 50% ionic and 50% covalent.
(C) Pyro silicates	(r) General formula is $(SiO_3)_n^{2n-}$
(D) Sheet silicates (two dimensional)	(s) Two oxygen atoms per tetrahedron are shared.

17. Fill in the blanks :

(i) One recently discovered allotrope of carbon (e.g., C_{60}) is commonly known as........ ..

(ii) A liquid which is permanently supercooled is frequently called a................

(iii) Compounds that formally contain Pb^{4+} are easily reduced to Pb^{2+}. The stability of the lower oxidation state is due to...........

(iv) Hydrogen gas is liberated by the action of aluminium with concentrated solution of.........

(v) The formula of litharge is _________ and that of red lead is _________ & both are used as ________ in paints.

(vi) Carbon monoxide is absorbed in a solution of _______ under pressure, while carbon dioxide is absorbed in a solution of ————.

(vii) In drinking soda, ___________ gas is present under high pressure in water.

(viii) Glass is attacked by ___________ acid.

(ix) Solid form of carbon dioxide is known as __________.

(x) Carbon monoxide combines with chlorine in the presence of sunlight to produce ___________.

(xi). A mixture of ___________ and CO_2 is obtained when oxalic acid is heated with concentrated H_2SO_4 .

18. **True/False**

(i) When PbO_2 reacts with a dilute acid, it gives hydrogen peroxide.

(ii) Graphite is better lubricant on the moon than on the earth.

(iii) The tendency for catenation is much higher for C, than for Si.

(iv) Aqueous solution of $AlCl_3$ is acidic due to hydrolysis.

(v) CO_2 can be prepared by dehydration of formic acid.

(vi) Carbon suboxide (C_3O_2) is produced by the reaction of P_4O_{10} with malonic acid.

(vii) Carbon monoxide reduces I_2O_5 to I_2.

(viii) Graphite is less denser than diamond

(ix) Silicones are strongly water repellent.

(x). Silicones are synthetic organosilicon compounds having repeated R_2SiO units held by Si-Si linkages.

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 1

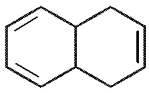
Total Marks : 32

Max. Time : 35 min.

Topic : IUPAC Nomenclature & Isomerism

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q.8	(8 marks, 10 min.)	[8, 10]

1. Number of hydrogen atoms in the given compound is :



(A) 8 (B) 10 (C) 12 (D) 14

2. Ketene $CH_2 = C = O$ has

(A) Only sp^2 carbon atom (B) Only sp carbon atom

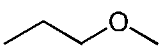
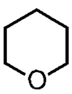
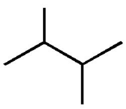
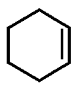
(C) sp^2 and sp carbon atoms (D) sp^3, sp^2 and sp carbon atoms

3. Which of the following is not an unsatrurated compound.

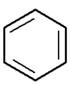
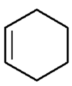
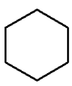
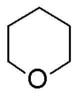
(A) $CH_3 - CH = CH - CH_3$ (B) $HC \equiv C - C \equiv CH$

(C) $CH_3 - CH_2 - CH_2 - HC\langle$ CH_2 / CH_2 (D) $CH_2 = CH - CH = CH_2$

4. Which of the following is homocyclic compound.

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

5.* The alicyclic compound/s is / are

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

6.* The correct options for a homologous series

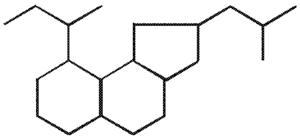
(A) All members have same general formula

(B) All members have same chemical properties

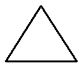
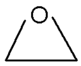
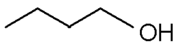
(C) All members have same physical properties

(D) All members have same functional groups

7. How many secondary carbon atom are present in the compound ?



8. **Match the following :**

	I Compounds	II Class of compounds
(A)		(p) Saturated compound
(B)		(q) Heterocyclic compound
(C)		(r) Unsaturated compound
(D)		(s) Hydrocarbon

ORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 2

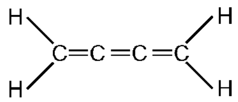
Total Marks : 31

Max. Time : 34 min.

Topic : IUPAC Nomenclature & Isomerism

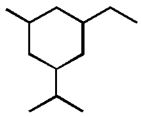
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q. 8	(8 marks, 10 min.)	[8, 10]

1. Number of sp^2–sp sigma bonds in the given compound is :



(A) 1 (B) 2 (C) 3 (D) 4

2. How many tertiary carbon atom are present in the compound :

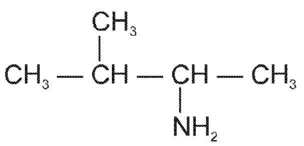


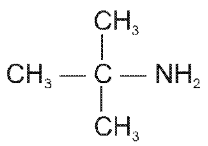
(A) 2 (B) 3 (C) 4 (D) 5

3. Which statement is incorrect :

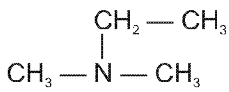
(A) C_nH_{2n-2} is the general formula of alkyne
(B) $C_nH_{2n+2}O$ is the general formula of alkanol
(C) C_nH_{2n} is the general formula of alkene
(D) C_nH_{2n+2} is the general formula of cycloalkane

4. Which of the following is 3º-Amine :

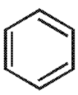
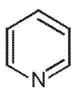
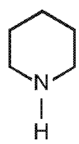
(A) 

(B) 

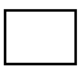
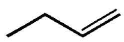
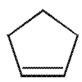
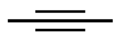
(C) $CH_3 - CH_2 - NH - CH_2 - CH_3$

(D) 

5. Which of the following is heteroaromatic compound :

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

6.* Which of the following has C_nH_{2n} general formula :

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

7. Calculate molecular weight of the lowest alkane containing a sequence of 1^0, 2^0, 3^0 and 4^0 carbon atoms.

8. **Match the following :**

Column I	Column II
(A) 4 carbon atoms alkane	(P) Molecular weight = 26
(B) 2 carbon atoms alkyne	(Q) Molecular weight = 42
(C) 3 carbon atoms alkene	(R) Molecular weight = 40
(D) 3 carbon atoms alkyne	(S) Molecular weight = 58

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 3

Total Marks : 32

Max. Time : 35 min.

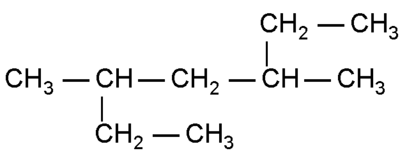
Topic : IUPAC Nomenclature & Isomerism

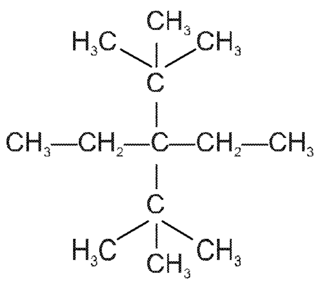
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q. 8	(8 marks, 10 min.)	[8, 10]

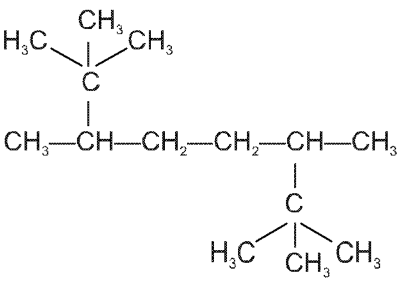
1. Which of the following alkanes contains primary, secondary, tertiary and quaternary carbon atoms together.

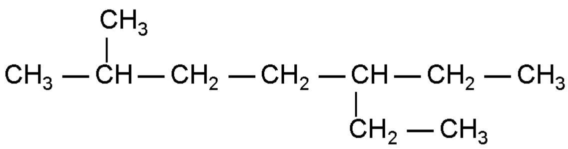
(A) $(CH_3)_3CH$ (B) $(C_2H_5)_3CH$ (C) $(CH_3)_3CCH_2CH(CH_3)_2$ (D) $(CH_3)_4C$

2. Which of the following has longest chain of carbon :

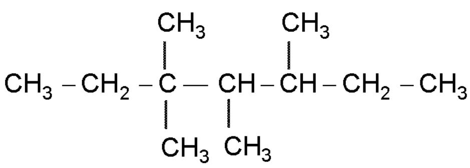
(A) 

(B) 

(C) 

(D) 

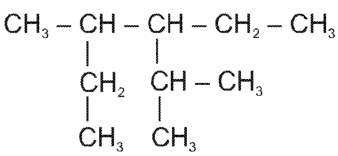
3. In following compound -



The correct lowest set of locants are

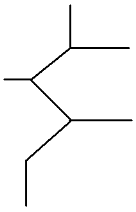
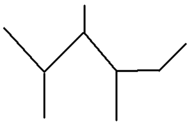
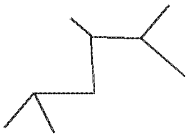
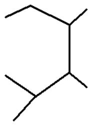
(A) 3,3,4,5 (B) 3,4,5,5 (C) 4,5,3,3 (D) 5,5,4,3

4. The correct IUPAC name of the following compound is



(A) 4–Ethyl–3,5–dimethylhexane (B) 2,4–Dimethyl–3–ethylhexane
(C) 3–Isopropyl–4–methyhexane (D) 3–Ethyl–2,4–dimethylhexane

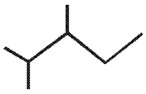
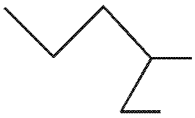
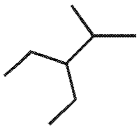
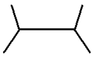
5.* The correct structure of 2,3,4-Trimethylhexane is :

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

6.* Choose the correct option's according to given IUPAC name :
(A) Neohexane is 2,2-Dimethylbutane.
(B) Isobutane is 2-Methylpropane.
(C) Isopentane is 2-Methylbutane.
(D) Neopentane is Dimethylpropane.

7. Calculate the molecular weight of the lowest hydrcarbon which contains sp & sp^2 hybridised carbon atoms only.

8. **Match the following :**

Column-I	**Column-II**
(A) 	(p) 3-Ethyl-2-methylpentane
(B) 	(q) 3-Methylhexane
(C) 	(r) 2,3–Dimethylbutane
(D) 	(s) 2,3–Dimethylpentane

DPP No. 4

Total Marks : 27

Max. Time : 28 min.

Topic : IUPAC Nomenclature & Isomerism

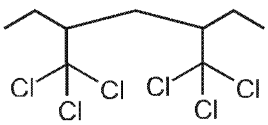
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.8	(3 marks, 3 min.)	[3, 3]

1. The correct IUPAC name of $H_3C-\underset{F}{\overset{Br}{C}}-\underset{C_2H_5}{CH}-\underset{I}{\overset{Br}{C}}-CH_3$

(A) 2,4-Dibromo-3-ethyl-2-fluoro-4-iodopentane (B) 2,4-Dibromo-3-ethyl-4-fluoro-2-iodopentane

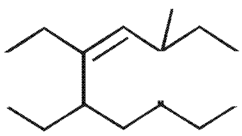
(C) 2,4-Dibromo-4-fluoro-2-iodo-3-ethylpentane (D) 2,4-Dibromo-2-fluro-4-iodo-3-ethylpentane

2. The correct IUPAC name of the following compound is :



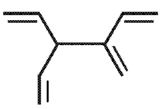
(A) 1,1,1,5,5,5-Hexachloro-2,4-diethylpentane. (B) 3,5-Hexachlorodimethylheptane.
(C) 3,3,3,5,5,5-Hexachloromethylheptane. (D) 3,5-Bis(trichloromethyl)heptane.

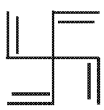
3. The correct IUPAC name of the following compound is :

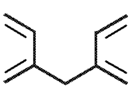


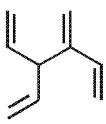
(A) 5,6-Diethyl-8-methyldec-6-ene (B) 5,6-Diethyl-3-methyloct-4-ene
(C) 5,6-Diethyl-3-methyldec-4-ene (D) 2,4,5-Triethylnon-3-ene

4. Diethenyl pentadiene is :

(A) 

(B) 

(C) 

(D) 

5.* Which IUPAC name is **correct** :

(A) $CH_3-\underset{C_2H_5}{CH}=\underset{C_2H_5}{CH}-CH_3$ 2,3–Diethylbutene

(B) $HC\equiv C-\underset{HC=CH_2}{CH}-CH=CH_2$ 3-Ethynylpenta-1, 4-diene

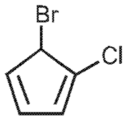
(C) $HC\equiv C-CH=CH_2$ Butenyne

(D) $CH_3-CH=CH-C\equiv CH$ Pent–3–en–1–yne

6.* Which of the given is/are correct IUPAC names :

(A) 2,3-Dichlorocyclohex-1-ene
(B) 2,5-Dimethyloct-4-ene
(C) 4-Bromo-1-chloropentane
(D) 6-Ethyl-2,3-dimethylnonane

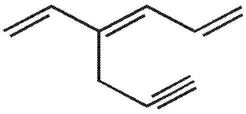
7. Write the sum of locant in the following compound is:



8. **Comprehension #**

While naming unsaturated hydrocarbons, lowest locant is alloted for multiple bond than any substituent, since the priorty of multiple bond is more than any substituent present. When the locant for unsaturated is same from either side then double bond is given priority over triple bond. For main chain selection if the size of main chain and number of unsaturation are equal, then priority is given to the lowest set of locants for unsaturation.

(a) IUPAC name of the following compound is



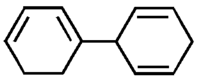
(A) 3-(Prop-2-ynl)hexe-1,3,5-triene
(B) 4-Ethenylhepta-1, 3-dien-6-yne
(C) 4-Ethenylhexa-4, 6-dien-1-yne
(D) 4-(Prop-2-ynyl) hexa-1,3,5-triene

(b) IUPAC name of the following compound is

$$F-\underset{\underset{Me}{|}}{C}=CH-C\equiv C-OCH_3$$

(A) 4–Fluoro–1–methoxypent–1–yn–4–ene
(B) 1–Fluoro–1–methyl–4–methoxybut–1–en–3–yne
(C) 4–Fluoro–1–methoxypent–3–en–1–yne
(D) 2–Fluro–5–methoxypent–2–en–4–yne

(c) IUPAC name of the following compound is



(A) 3–(cyclohexa–1, 3-dienyl)cyclohexa-1,4-diene
(B) 4–(cyclohexa–2, 5-dienyl)cyclohexa-1,3-diene
(C) 2–(cyclohexa–1, 3-dienyl)cyclohexa-1,3-diene
(D) 1–(cyclohexa–2, 5-dienyl)cyclohexa-1,3-diene

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

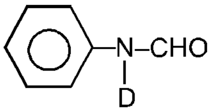
DPP No. 5

Total Marks : 31

Max. Time : 34 min.

Topic : IUPAC Nomenclature & Isomerism

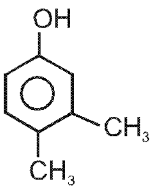
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Assertion and Reason (no negative marking) Q.4	(3 marks, 3 min.)	[3, 3]
Multiple choice objective ('–1' negative marking) Q.5	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.6	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q.8	(8 marks, 10 min.)	[8, 10]

1. IUPAC name of 

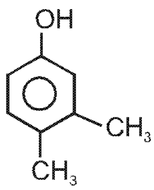
is

(A) N-Deutero-N-formylbenzenamine
(B) N-Phenylamino-N-deuteromethanal
(C) N-Deutero-N-phenylmethanamide
(D) N-Deuterobenzene carboxamide

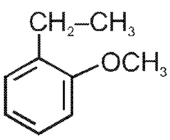
2. Which of the following is correct IUPAC name :

(A) 

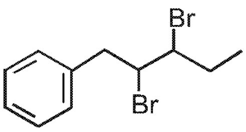
3,4-Dimethylphenol.

(B) 

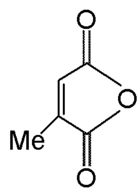
4-Hydroxy-2-methyltoluene.

(C) 

1-Ethyl-2-anisole.

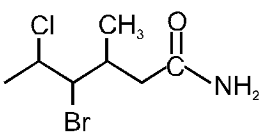
(D) 

1-(2,3-Dibromopentyl) benzene.

3. Correct IUPAC name of the compound 

is

(A) 2-Methylbutenedioic anhydride
(B) 3-Methylbutenedioic anhydride
(C) 2-Methyl-1,4-diketobutene epoxy
(D) 2-Methylcyclopentanoxy-1,4-dione

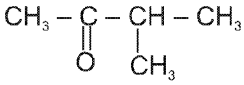
4. **Statement-1 :** 

3-Bromo-2-chloro-4-methylpentanamide is incorrect IUPAC name.

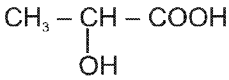
Statement-2 : In case of chain terminating senior most functional group numbering starts from itself.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement-1 is True, Statement-2 is False.
(D) Statement-1 is False, Statement-2 is True.

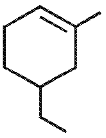
5.* Which of the following is/ are incorrect IUPAC name :

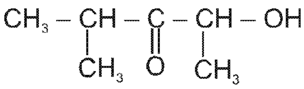
(A) 

2-Methylbutan -3-one

(B) 

2-Hydroxypropanoic acid

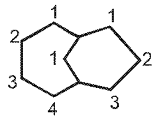
(C) 
5-Ethyl-1-methylcyclohex-1-ene

(D) 

4-Methyl-3-oxopentan-2-ol

6. **Comprehension #**

Bicyclo compounds are named by using the alkane name to designate the total number of carbon and bicyclo is used as prefix. While naming the bicycloalkane we write an expression between the word bicyclo and alkane (in square bracket), that denotes the number of carbon atoms in each bridge. The numerals are written in descending order and the numbers are separated by full stops.

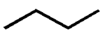
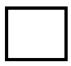
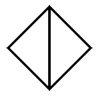
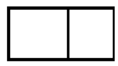


Bicyclo [4. 3. 1] decane

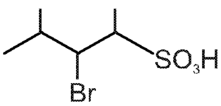
(a) The compound  is known by which of the following name :

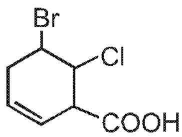
(A) Bicyclo [2. 2. 2] octane
(B) Bicyclo [2. 2. 1] octane
(C) Bicyclo [2. 2. 1] heptane
(D) Bicyclo [2. 1. 2] heptane

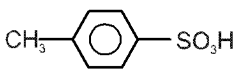
(b) The structure of bicyclo [1. 1. 0] butane is :

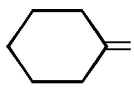
(A) 
(B) 
(C) 
(D) 

7. Write the IUPAC name of the following compound :

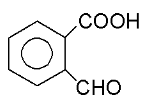
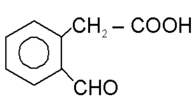
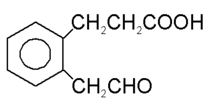
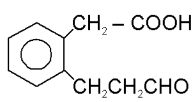
(i) 

(ii) 

(iii) 

(iv) 

8. Match the following compound with their IUPAC name :

Compound	IUPAC Name
(P) 	(W) 3-[2-(2-Oxoethyl)phenyl]propanoic acid
(Q) 	(X) 2-[2-(3-Oxopropyl)phenyl]ethanoic acid
(R) 	(Y) 2-(2-Formylphenyl)ethanoic acid
(S) 	(Z) 2-Formylbenzenecarboxylic acid

ORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

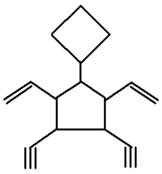
DPP No. 6

Total Marks : 32

Max. Time : 35 min.

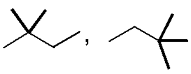
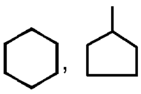
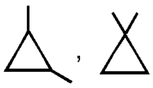
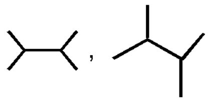
Topic : IUPAC Nomenclature & Isomerism, Structural Isomerism

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q. 8	(8 marks, 10 min.)	[8, 10]

1. Degree of unsaturation in  is :

(A) 6 (B) 8 (C) 7 (D) 10

2. Which of the following pair is the chain isomer ?

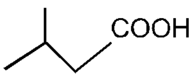
(A) 
(B) 
(C) 
(D) 

3. Molecular formula C_4H_8 which type of isomerism will not show :

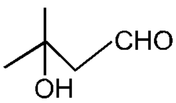
(A) Chain (B) Metamerism (C) Position (D) Geometrical

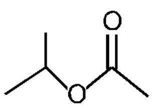
4. Minimum carbon atoms are required to ketone to show position isomerism :

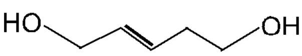
(A) 3 (B) 4 (C) 5 (D) 6

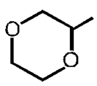
5.* 

have functional isomer relation with

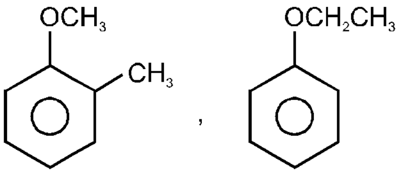
(A) 

(B) 

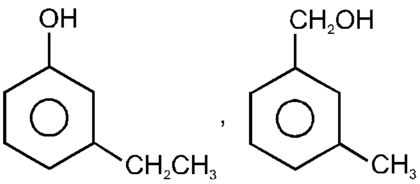
(C) 

(D) 

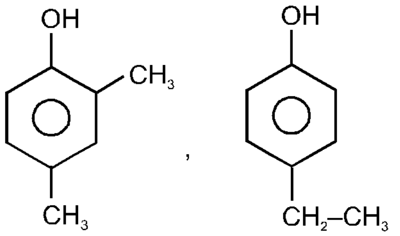
6.* Which is/are correctly matched.

(A) 

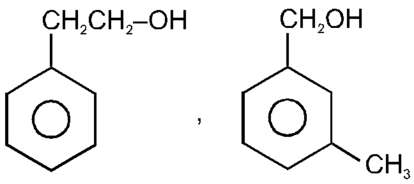
Metamers

(B) 

Functional group isomers

(C) 

Chain isomers

(D) 

Positional isomers

7. Fill the correct type of isomerism

(A) $CH_3 - CH_2 - CH_2 - CH_2 - NH_2$

(B) $CH_3 - CH_2 - NH - CH_2 - CH_3$

(C) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{N}} - CH_3$

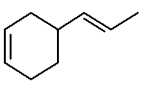
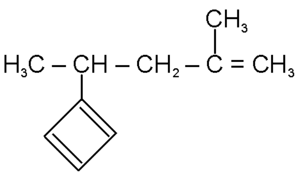
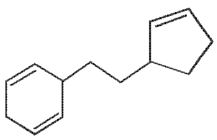
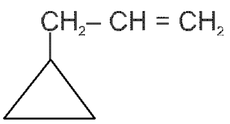
(D) $CH_3 - CH_2 - CH_2 - NH - CH_3$

(E) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - NH_2$

(i) A & B are__________ (ii) B & C are__________ (iii) A & C are__________

(iv) B & D are__________ (v) A & E are__________ (vi) C & E are__________

8. **Match the following:**

Column I **Compound**	**Column II** **Degree of unsaturation**
(A) 	(p) 2
(B) 	(q) 5
(C) 	(r) 4
(D) 	(s) 3

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 7

Total Marks : 27

Max. Time : 28 min.

Topic : IUPAC Nomenclature & Isomerism

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6 to Q.7	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. In allene (C_3H_4), the type(s) of hybridisation of the carbon atoms is (are) :
(A) sp and sp^3
(B) sp and sp^2
(C) only sp^3
(D) sp^2 and sp^3

2. The carboxyl functional group (– COOH) is present in :
(A) picric acid
(B) barbituric acid
(C) ascorbic acid
(D) aspirin

3. Aspirin is known as :
(A) Acetyl salicylic acid
(B) Phenyl salicylate
(C) Acetyl salicylate
(D) Methyl salicylic acid

4._ How many benzylic hydrogen are present in cumene :
(A) 1 (B) 2 (C) 3 (D) 6

5._ How many allylic hydrogen are present in Methylbut-2-ene.
(A) 6 (B) 8 (C) 9 (D) 10

6._* Which of the following is/are allylic alcohols ?
(A) But-3-en-1-ol
(B) But-3-en-2-ol
(C) But-2-en-1-ol
(D) But-1-en-1-ol

7._* Which name/names is/are correct ?
(A) CH_2Cl_2 ; Methylene chloride
(B) $CH_3–CHCl_2$; Ethylidene chloride
(C) $CH_2 = CH – Cl$; Vinyl chloride
(D) $HC \equiv C – CH_2 – Cl$; Propargyl chloride

8._ Write the structure of the following.
(a) Benzoquinone
(b) m-Xylene
(c) Succinic acid
(d) Lactic acid

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 8

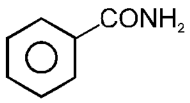
Total Marks : 30

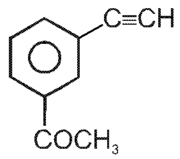
Max. Time : 33 min.

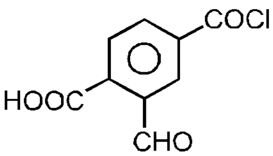
Topic : Structural Determination

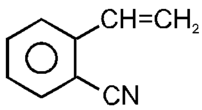
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Comprehension ('–1' negative marking) Q.6	(3 marks, 3 min.)	[3, 3]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) Q.8	(8 marks, 10 min.)	[8, 10]

1._ Which of the following is correctly matched with degree of unsaturation ?

(A)  , 4

(B)  , 7

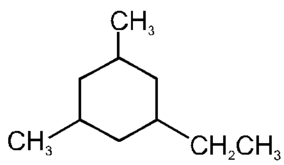
(C)  , 8

(D)  , 5

2. How many alkene isomers will produce 1-Ethyl-3-methylcyclopentane on catalytic hydrogenation ?

(A) 6 (B) 7 (C) 8 (D) 9

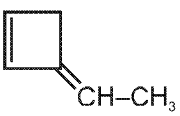
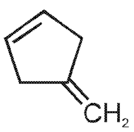
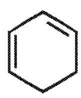
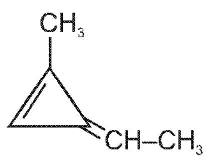
3. How many products (structural isomers) are formed by monochlorination of ?



(A) 6 (B) 7 (C) 8 (D) 9

4. $$X \xrightarrow{O_3/Zn,\ H_2O} H-\overset{O}{\overset{||}{C}}-CH_2-\overset{O}{\overset{||}{C}}-CH_2-\overset{O}{\overset{||}{C}}-H + HCHO$$

The structure of X will be :

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

5. [X] — O_3 , Zn / H_2O → 3-Oxobutanal only

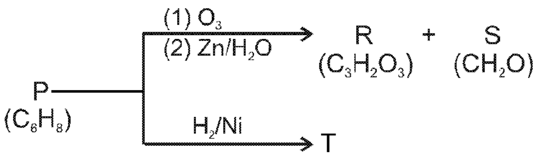
[X] — H_2 / Ni → Y — Cl_2 / hν → Four monochloro structural isomeric products

Compound 'X' is :

(A) 1-Methylcyclopropene (B) 1, 4-Dimethylcyclohexa-1,4-diene

(C) 1, 4-Dimethylcyclohexa-1,3-diene (D) 1, 2-Dimethylcyclohexa-1,4-diene

6. **Comprehension #**



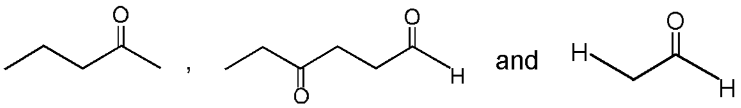
(a). Total number of monochloro structural products are formed on chlorination of " T " :

(A) 2 (B) 3 (C) 4 (D) 5

(b). How many alkyne can give " T " on catalytic hydrogenation :

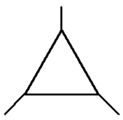
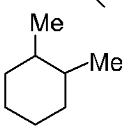
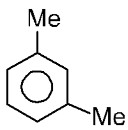
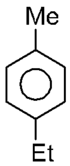
(A) 1 (B) 2 (C) 3 (D) Not possible

7. A compound with molecular formula $C_{13}H_{24}$ absorbs two molar equivalents of hydrogen to form 3-Ethyl-7-methyldecane. On reductive ozonolysis it forms following three products.



Assign the structure of the compound.

8. **Match the column :**

Column (I) (Compound)		Column (II) (No. of monochloro structural product)
(A) 	$\xrightarrow{Cl_2/h\nu}$	(p) = 1
(B) 	$\xrightarrow{Cl_2/h\nu}$	(q) = 2
(C) 	$\xrightarrow{Cl_2/h\nu}$	(r) = 3
(D) 	$\xrightarrow{Cl_2/h\nu}$	(s) = 4

ORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 9

Total Marks : 39

Max. Time : 39 min.

Topic : General Organic Chemistry (electronic effect)

Type of Questions		**M.M., Min.**
Fill in the Blanks ('–1' negative marking) Q.1 (1 to 7)	(3 marks, 3 min.)	[21, 21]
Short Subjective Questions ('–1' negative marking) Q.2(1 to 6)	(3 marks, 3 min.)	[18, 18]

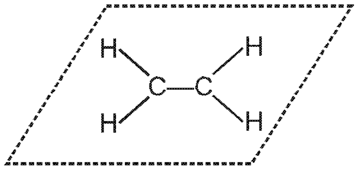
1. Fill up the hybridisation & the ideal bond angles for the respective atoms in blank space.

	No. of $sp^2–sp^2$ σ-bonds	No. of $sp^2–sp$ σ-bonds
Hyb. : ☐ ☐ ☐ **1.** $CH_3– CH_2–CH_3$ B. A : ☐ ☐ ☐ Hyb.: ☐ ☐ ☐ **2.** $CH_3– CH= CH_2$ B. A : ☐ ☐ ☐ Hyb.: ☐ ☐ ☐ **3.** $CH_3– C \equiv CH_2$ B. A : ☐ ☐ ☐ Hyb. : ☐ ☐ ☐ ☐ **4.** $CH_2 = CH – CH = CH_2$ B. A : ☐ ☐ ☐ ☐ Hyb. : ☐ ☐ ☐ ☐ **5.** $CH_2 = CH – CH \equiv CH$ B. A : ☐ ☐ ☐ ☐ Hyb. : ☐ ☐ ☐ **6.** $CH_2 = C = CH_2$ B. A : ☐ ☐ ☐ Hyb. : ☐ ☐ ☐ ☐ ☐ ☐ **7.** $CH_2 = CH – CH_2 – HC = C = CH_2$ B. A : ☐ ☐ ☐ ☐ ☐ ☐ Hyb.: ☐ ☐ ☐		

2. Draw the orbital diagrams for the following important structures.

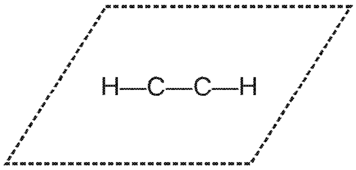
1. $CH_2 = CH_2$

Ethyne



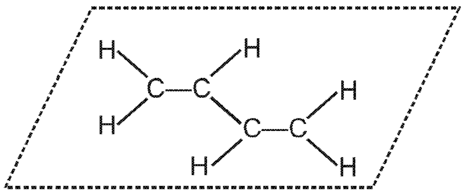
2. $HC \equiv CH$

Ethyne



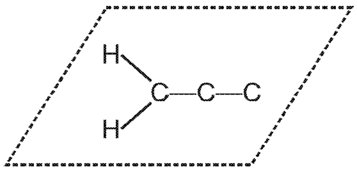
3. $H_2C = CH–CH = CH_2$

Buta-1,3-diene



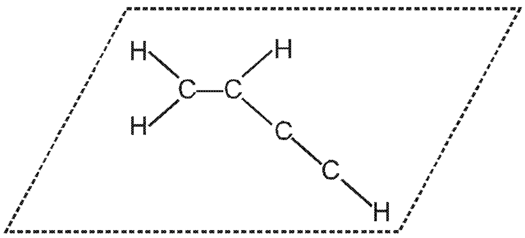
4. $CH_2 = C = CH_2$

Propadiene



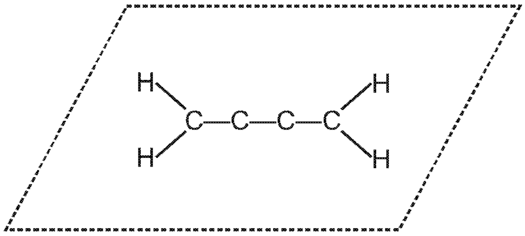
5. $CH_2 = CH – C \equiv CH$

Butenyne



6. $H_2C = C = C = CH_2$

Buta-1,2,-3-triene



DPP No. 10

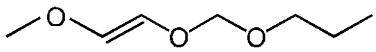
Total Marks : 49

Max. Time : 50 min.

Topic : General Organic Chemistry

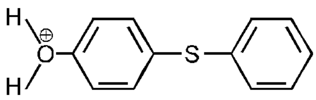
Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.15	(3 marks, 3 min.)	[45, 45]
Subjective Questions ('–1' negative marking) Q.16	(4 marks, 5 min.)	[4, 5]

1. How many lone pairs of electrons are there in the given compound ?



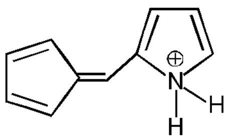
(A) 4 (B) 2 (C) 8 (D) 6

2. How many lone pairs of electrons are there in the given compound ?



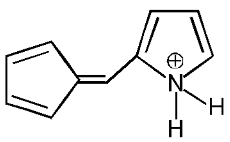
(A) 4 (B) 3 (C) 8 (D) 6

3. What is the hybridisation of positively charged nitrogen atom ?



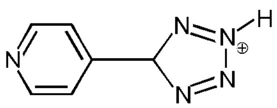
(A) sp (B) sp^2 (C) sp^3 (D) None of these

4. How many sp^2 hybridised atoms are there in the given cation ?



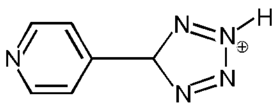
(A) 8 (B) 9 (C) 10 (D) 12

5. How many lone pairs are present in the given cation ?



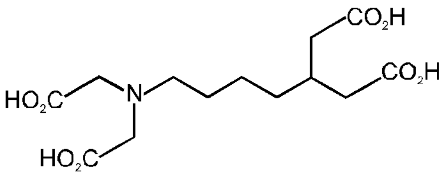
(A) 3 (B) 4 (C) 5 (D) 6

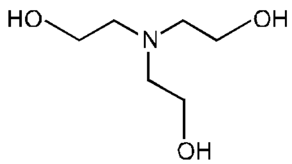
6. How many N atoms are sp^2 hybridised in the given cation ?

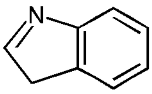


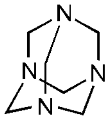
(A) 3 (B) 4 (C) 5 (D) 6

7. In which of the following molecules is the nitrogen atom sp^2 hybridised ?

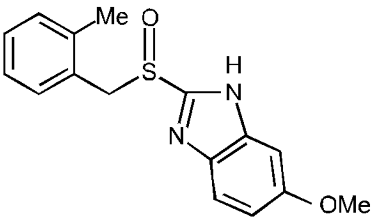
(A) 

(B) 

(C) 

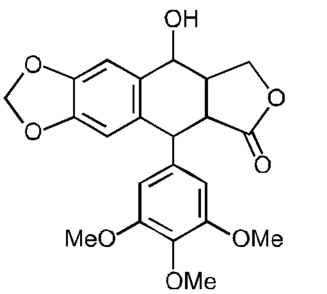
(D) 

8. Geometry around how many carbon atoms is tetrahedral in the given structure ?



(A) 4 (B) 2 (C) 3 (D) 5

9. How many sp^3 hybridised carbon atoms are there in the given anti-cancer compound (podophyllotoxin) ?



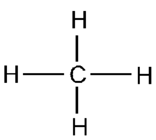
the anti-cancer compound
podophyllotoxin

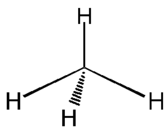
(A) 6 (B) 7 (C) 9 (D) 8

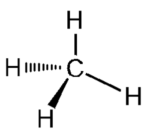
10. Bond order of C–C bond in benzene  is :

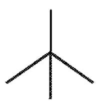
(A) 1 (B) 2 (C) 1.5 (D) two of above

11. Which of the following is correct three dimentional representation of CH_4 ?

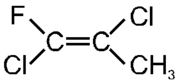
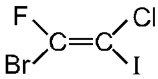
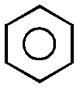
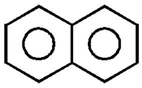
(A) 

(B) 

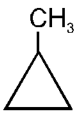
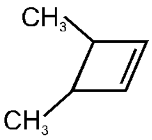
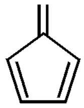
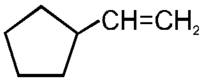
(C) 

(D) 

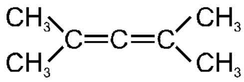
12. In which of the following all atoms do not present in the same plane ?

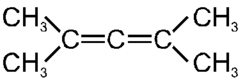
(A) 
(B) 
(C) 
(D) 

13. In which of the following all carbon atoms are present in the same plane ?

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

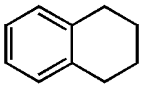
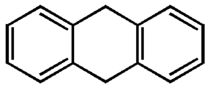
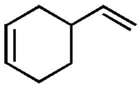
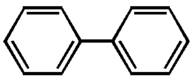
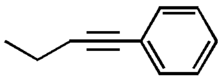
14. In which of the following are all C atoms linearly arranged ?

(A) $CH_2=CH-C\equiv CH$ (B) $CH\equiv C-CH_2-CH_3$ (C)  (D) $CH_3-C\equiv C-CH_3$

15. In  How many carbon atoms are linearly arranged ?

(A) 1 (B) 8 (C) 3 (D) 7

16. A maximum of how many (i) atoms (ii) carbon atoms must lie in same plane in each of the following molecule?

(a) 
(b) 
(c) 
(d) 
(e) 
(f) 

No. of sp^2–sp^2 σ-bonds

No. of sp^2–sp σ-bonds

ORGANIC CHEMISTRY
DPP
DAILY PRACTICE PROBLEMS

DPP No. 11

Total Marks : 27

Max. Time : 29 min.

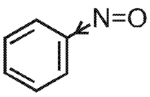
Topic : General Organic Chemistry

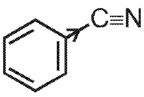
Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

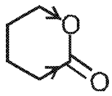
1. Inductive effect is a permanent effect and is distance dependent.
(A) Always (B) Some time (C) never (D) Can not decide

2. Which of the following statement is CORRECT regarding the inductive effect ?
(A) electron-donating inductive effect(+I effect) is generally more powerful than electron-withdrawing inductive effect(-I effect)
(B) it implies the shifting of σ electrons from more electronegative atom to the lesser electronegative atom in a molecule
(C) it implies the shifting of σ electrons from less electronegative atom to the more electronegative atom in a molecule
(D) it increases with increase in distance.

3. In which of the following species, incorrect direction of Inductive effect is/are shown ?

(A) 

(B) 

(C) 

(D) $CH_3 - CH_2 \leftarrow MgBr$

4. Maximum –I effect is exerted by the group
(A) C_6H_5 (B) $-OCH_3$ (C) –Cl (D) $-NH_2$

5. Which order of I effect is incorrect.

(I) $-\overset{\oplus}{N}(CH_3)_3 > -\overset{\oplus}{S}(CH_3)_2$ [–I] (II) $-OCH_3 > -OH$ [–I]

(III) –F > –Cl [–I] (IV) $-CH_3 > -\overset{\ominus}{O}$ [+I]

(A) II, III & IV (B) III & IV (C) IV only (D) all

6.* Which of the following statement/s is/are correct for the inductive effect ?
(A) It is a permanent effect (B) It transmits through sigma electrons
(C) It is represented by $\longleftrightarrow$ (D) It is represented by $\rightarrow$ or $\leftarrow$.

7. In which C – C bond of $\overset{3}{C}H_3-\overset{2}{C}H_2-\overset{1}{C}H_2-Br$, the inductive effect is expected to be the least.

8. How many groups show –I effect?

$-CH_3$, $-\overset{\oplus}{N}H_3$, –OH, $-O^{\ominus}$, $-N(CH_3)_2$, $-SO_3H$, –CHO, –Cl, $-COO^{\ominus}$

ORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 12

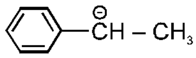
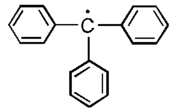
Total Marks : 34

Max. Time : 37 min.

Topic : General Organic Chemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.4 to Q.5	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.1 to Q.3 & Q.6	(4 marks, 4 min.)	[16, 16]
Match the Following (no negative marking) Q.7	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1.* Resonance is possible/s in

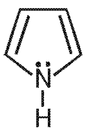
(A) $CH_2=\overset{\oplus}{N}H_2$ (B) $CH_3CH=C=\overset{\ominus}{C}H$ (C)  (D) 

2.* Which of the following is/are acceptable resonating structures of Buta-1, 2, 3-triene.

(A) $\overset{\ominus}{\ddot{C}}H_2-C\equiv C-\overset{\oplus}{C}H_2$ (B) $CH_2=C=C=CH_2$

(C) $\overset{\oplus}{C}H_2-C\equiv C-\overset{\ominus}{\ddot{C}}H_2$ (D) $\dot{C}H_2-C\equiv C-\dot{C}H_2$

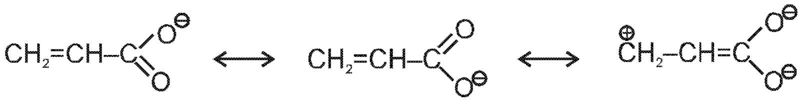
3.* In which case the unshared pair (lone pair) of electrons are delocalized.

(A)  (B) $H_2C=\ddot{N}-CH_3$ (C) $H_2C=\overset{\oplus}{N}=\overset{\ominus}{\ddot{N}}:$ (D) $:\overset{\ominus}{\ddot{N}}=\overset{\oplus}{N}=\overset{\ominus}{\ddot{N}}:$

4. The most stable resonating structure is –

(A) $H_2N-\overset{\oplus}{C}H-CH=CH-OCH_3$ (B) $H_2\overset{\oplus}{N}=CH-CH=CH-OCH_3$

(C) $H_2N-CH=CH-CH=\overset{\oplus}{O}CH_3$ (D) $H_2\overset{\oplus}{N}=CH-\overset{\oplus}{C}H=\overset{+}{O}CH_3$

5. 

I II III

The correct statement about the above structures is :

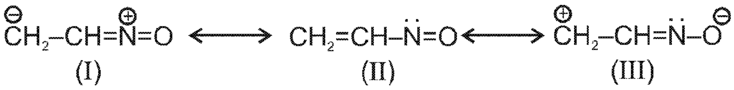
(A) II is the minor contributor to the real hybrid.

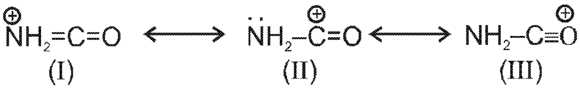
(B) III is most stable structure

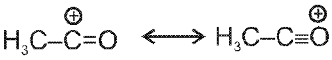
(C) I contributes more to the real hybrid than that of II.

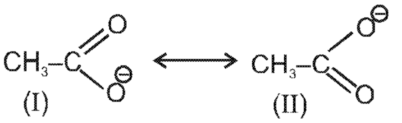
(D) I and II are equal contributors and III is a minor contributor.

6.* Which of the following are correctly orderd for resonance stability

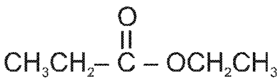
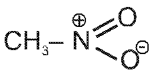
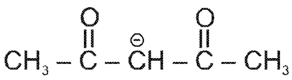
(A)  (II > I > III)

(B)  (I > III > II)

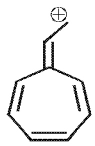
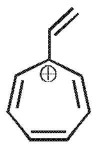
(C)  (I > II)

(D)  (II = I)

7. Match the resonance contributors in Column I with their attributes (properties) mentioned in Column II

Column I	Column II
(A) 	(p) Equal contributor
(B) 	(q)major contributor
(C) 	(r) minor contributor

8. Give stability order in the following pairs.

(a) $CH_2 = \overset{\oplus}{N}H_2$ $\quad$ $\overset{\oplus}{C}H_2 - NH_2$ (b)  

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 13

Total Marks : 30

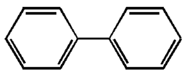
Max. Time : 33 min.

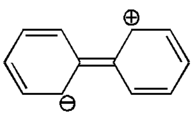
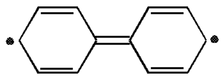
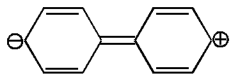
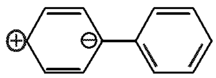
Topic : General Organic Chemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Assertion and Reason (no negative marking) Q.6	(3 marks, 3 min.)	[3, 3]
Match the Following (no negative marking) Q.7	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Which of the following is/are resonating structures of diazomethane (CH_2N_2).

(A) HN=C=NH (B) $CH_2=\overset{+}{N}=N^{-}$ (C) $\overset{-}{C}H_2-\overset{+}{N}\equiv N$ (D) all of these

2. Which of the following does not represent the resonating structure of 

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

3. Decreasing + m-power of given group is :

(I) – NH_2 (II) – OH (III) – $O^{\ominus}$ (IV) – NH – CO – CH_3

(A) I > III > IV > II (B) III > II > I > IV (C) III > I > II > IV (D) II > I > IV > III

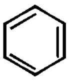
4. The stability order of the following species is :

I : $\overset{\ominus}{C}H_2-\overset{O}{\overset{||}{C}}-CH_2-\overset{O}{\overset{||}{C}}-CH_3$ II : $CH_2=\overset{O^{\ominus}}{\overset{|}{C}}-CH_2-\overset{O}{\overset{||}{C}}-CH_3$ III : $CH_3-\overset{O}{\overset{||}{C}}-\overset{\ominus}{C}H-\overset{O}{\overset{||}{C}}-CH_3$ IV :

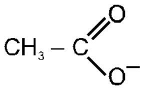
$CH_3-\overset{O^{\ominus}}{\overset{|}{C}}=CH-\overset{O}{\overset{||}{C}}-CH_3$

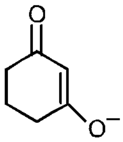
(A) I > II > III > IV (B) III > I > II > IV (C) IV > II > III > I (D) IV > III > II > I

5. Identify the correct statements

(i) All C – C bonds in  are equal.

(ii) All C – C bonds in $CH_2 = CH - CH = CH_2$ are equal.

(iii) All C – O bonds in  are equal.

(iv) All C – O bond in  are equal.

(A) i, ii, iii, iv (B) i, iii, iv (C) i, ii, iii (D) ii, iii, iv

6. **STATEMENT -1** : Bond length of double bond in benzene is more than the bond length of double bond in buta-1,3-diene.

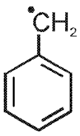
STATEMENT -2 : Increase in delocalisation of π electrons increases the bond length of double bond.

(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

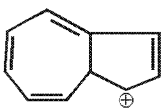
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

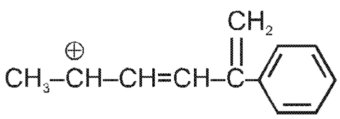
(C) Statement-1 is True, Statement-2 is False (D) Statement-1 is False, Statement-2 is True

7. **Match the column :**

	Column-I		**Column-II**
(A)	$\overset{\oplus}{C}H_2-CH=CH_2$	(p)	Resonance possible
(B)	$H_2N-CH=CH_2$	(q)	Even number of p-electrons
(C)		(r)	localized lone pair of e^-.
(D)	$H_2N-\underset{\underset{NH}{\|\|}}{C}-NH_2$	(s)	Delocalized lone pair of e^-.
		(t)	2 e^- in p orbitals

8._ Find the total number of carbon where positive charge can be delocalised by true resonance [Including the given structure] :

(a) 

(b) 

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 14

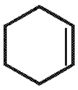
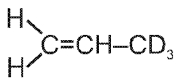
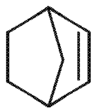
Total Marks : 30

Max. Time : 33 min.

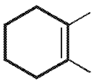
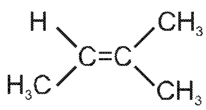
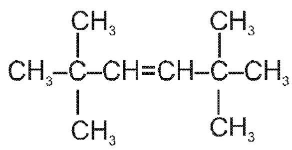
Topic : General Organic Chemistry

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Assertion and Reason (no negative marking) Q.6	(3 marks, 3 min.)	[3, 3]
Match the Following (no negative marking) Q.7	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('–1' negative marking) Q.8	(4 marks, 5 min.)	[4, 5]

1. Which of the following species will show hyperconjugation :

(A) $C_6H_5—CH_3$ (B)  (C)  (D) 

2. Which of the following alkenes will show maximum number of hyperconjugation forms ?

(A)  (B) $CH_3–CH=CH–CH_3$ (C)  (D) 

3. Which of the following groups in aromatic compounds is/are electron releasing group (s) ?

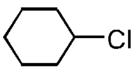
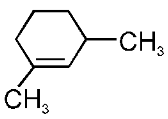
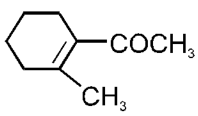
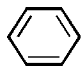
(A) – CH_3 (B) – $\overset{+}{N}H_3$ (C) – NO_2 (D) – OCH_3

4. Which of the following molecule has longest C=C bond length.

(A) $CH_3–CH=CH–CH=CH–CH_3$ (B) $CH_2=CH–CH=CH_2$

(C) $CH_3–CH=CH–CH_3$ (D) $CH_2=CH_2$

5. In which of the following molecules all the effects namely inductive, mesomeric and hyperconjugation operate :

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

6. **Statement-1 :** Vinyl chloride will show both –I effect as well as + M due to chlorine.

Statement-2 : –I & +M can never be shown by any molecule.

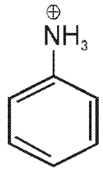
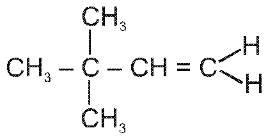
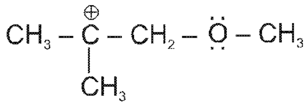
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

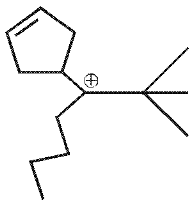
(C) Statement-1 is True, Statement-2 is False.

(D) Statement-1 is False, Statement-2 is True.

7. Match the compounds given in column I with their electronic effects mentioned in column II

	Column I		**Column II**
(A)		(p)	Inductive effect
(B)		(q)	Delocalisation of π electron
(C)	$CH_3-CH=CH-\ddot{O}H$	(r)	Hyperconjugation
(D)		(s)	Mesomeric effect

8. The total number of contributing structures showing hyperconjugation (involving C–H bonds) for the following molecule is



ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 15

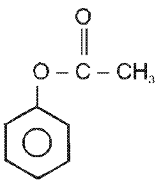
Total Marks : 34

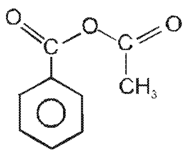
Max. Time : 40 min.

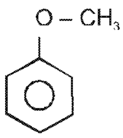
Topic : General Organic Chemistry

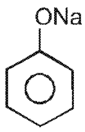
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.2	(3 marks, 3 min.)	[6, 6]
Multiple choice objective ('–1' negative marking) Q.3	(4 marks, 4 min.)	[4, 4]
Match the Following (no negative marking) Q.4	(8 marks, 10 min.)	[8, 10]
Subjective Questions ('–1' negative marking) Q.5 to Q.8	(4 marks, 5 min.)	[16, 20]

1. The reactvity order of benzene ring for the given reaction is (benzene ring with highest π electron density will be most reactive) [Aromatic compound] $\xrightarrow{E^{\oplus}}$


I

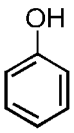

II

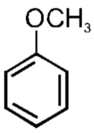

III

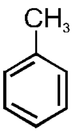

IV

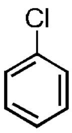
(A) III > I > IV > II
(B) I > III > IV > II
(C) III > IV > II > I
(D) IV > III > I > II

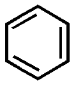
2. Arrange the following compounds in the order of decreasing reactivity towards electrophilic substitution


(I)


(II)


(III)

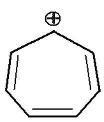

(IV)

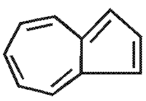

(V)

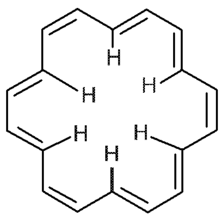
(A) V > IV > III > II > I
(B) I > II > III > V > IV
(C) I > II > IV > III > V
(D) I > III > IV > II > V

3.* Which of the following are Aromatic in nature.

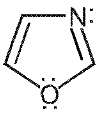
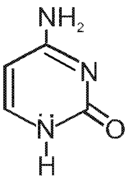
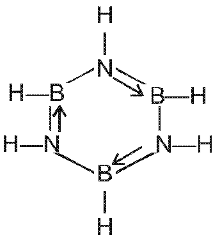
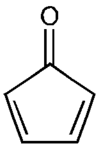
(A) 

(B) 

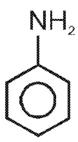
(C) 

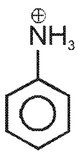
(D) 

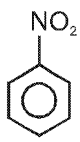
4. Match the following :

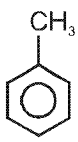
Column – I	**Column – II**
(A) 	(p) Aromatic
(B) 	(q) Non aromatic
(C) 	(r) Anti aromatic
(D) 	(s) Heterocyclic

5. How many of the following compounds are more reactive than benzene towards electrophilic substitution.

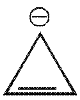
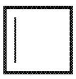
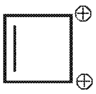
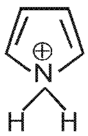
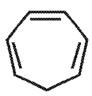
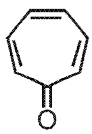








6. How many species out of the following are aromatic ?

 ,  ,  ,  ,  , 

7. Explain the terms Inductive and Electromeric effects.

8. Which bond is more polar in the following pairs of molecules?

(a) $H_3C - H$ $\quad H_3C - Br$ $\quad$ (b) $H_3C - NH_2$ $\quad H_3C - OH$ $\quad$ (c) $H_3C - OH$ $\quad H_3C - SH$

ORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 16

Total Marks : 120

Max. Time : 120 min.

Topic : General Organic Chemistry

Type of Questions		**M.M., Min.**
Fill in the Blanks ('–1' negative marking) Q.1	**(3 marks, 3 min.)**	**[3, 3]**

1. Classify the following groups as +m, –m, +I, –I, +HC, –HC.

S.No.	Species	+ I	– I	+ m	– m	+ H.C.	– H.C.
1	$-NO_2$						
2	$-CN$						
3	$-CHO$						
4	$-\underset{\underset{O}{\|}}{C}-R$						
5	$-\underset{\underset{O}{\|}}{C}-OR$						
6	$-\overset{\overset{O}{\|}}{C}-O^-$						
7	$-\underset{\underset{O}{\|}}{C}-F$						
8	$-\overset{\overset{O}{\|}}{C}-NH_2$						
9	$-NH-\overset{\overset{O}{\|}}{C}-CH_3$						
10	$-O-\underset{\underset{O}{\|}}{C}-CH_3$						
11	$-ONO$						
12	$-O-NO_2$						
13	$-SO_3H$						
14	$-O-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-O-R$						
15	$-\overset{\overset{O}{\|}}{\underset{\underset{O}{\|}}{S}}-O-R$						
16	$-NO$						
17	$-F$						
18	$-Cl$						
19	$-Br$						

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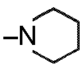
S.No.	Species	+ I	– I	+ m	– m	+ H.C.	– H.C.
20	–I						
21	$-\overset{\oplus}{N}\equiv N:$						
22	$-C\equiv\overset{\oplus}{O}:$						
23	–S–R						
24	$-\overset{O}{\overset{\|}{\underset{\underset{O}{\|}}{S}}}-R$						
25	$-\overset{\oplus}{P}R_3$						
26	$-\overset{\oplus}{N}R_3$						
27	$-CH_3$						
28	$-\overset{\oplus}{S}R_2$						
29	$-CMe_3$						
30	$-CF_3$						
31	$-CCl_3$						
32	–Ph						
33	$-CH=CH_2$						
34	–COOH						
35	$-O-CH_3$						
36	$-\ddot{\underset{\cdot\cdot}{O}}H$						
37	$-\ddot{N}H_2$						
38							
39	$-\overset{\ominus}{\ddot{C}}R_2$						
40	$-\overset{\square}{C}R_2$						

Answer Key

PHYSICAL CHEMISTRY

DPP No. # 1

1.* (BC) **2.*** (CD) **3.** 4

4.

S.No.	Sample	Relative Atomic Mass for the element	Gram Atomic mass of sample	Moles of sample	No. of atoms of sample	Mass removed from the sample	Mole removed	Atoms removed	Mass of same no. of C atom as no. of atoms present in the original sample
1.	8 g **O**	16	– – –	– – –	– – –	– – –	– – –	– – –	– – –
	For Example	16	16 g	½ Mole	$\frac{N_A}{2}$	2 g	⅛ Mole	$\frac{N_A}{8}$	6 g
2.	230 g **Na**	23	23g	10 Mole	10 N_A	46 g	2 Mole	2 N_A	120 g
3.	60 g **Ca**	40	40 g	3/2 Mole	3/2 N_A	40 g	1 Mole	N_A	18 g
4.	20 g **He**	4	4 g	5 Mole	5 N_A	12 g	3 Mole	3 N_A	60 g
5.	56 g **N**	14	14 g	4 Mole	4 N_A	7 g	½ Mole	$\frac{N_A}{2}$	48 g
6.	12 g **Mg**	24	24 g	½ Mole	$\frac{N_A}{2}$	6 g	¼ Mole	$\frac{N_A}{4}$	6 g
7.	128 g **S**	32	32 g	4 Mole	4 N_A	32 g	1 Mole	N_A	48 g
8.	93 g **P**	31	31 g	3 Mole	3 N_A	46.5 g	3/2 Mole	$\frac{3N_A}{2}$	36 g

5. (C) **6.** (A) **7.** (A - p, s, r), (B - p, q, r), (C - p, q, r), (d - r).
8. (D)

DPP No. # 2

1. (B) **2.** (D) **3.** (A) **4.** (B) **5.** (A)
6. (B) **7.** (D) **8.** (A) **9.** (A) **10.** (C)
11. (B)

DPP No. # 3

1. (C) **2.** (B) **3.** (A – r ; B – p, s ; C – q ; D – p). **4.** (A)
5. (B) **6.** (A) **7.** (A) **8.** (A) **9.** (C)
10. 5. **11.** (B) **12.** (A)

DPP No. # 4

1.* (C,D) **2.** 4 **3.** (B) **4.** (D)
5. [A — r] ; [B — p] ; [C — s] ; [D — p, q]. **6.** (A) **7.** (A) **8.*** (A,B,D)

DPP No. # 5

1. (B) **2.** (B) **3.** (A) **4.*** (B,C) **5.** (A)
6.* (A,C) **7.** 5 **8.** (D) **9.** (A) **10.** (B)

DPP No. # 6

1.	(A)	**2.**	(D)	**3.**	(B)	**4.**	(C)	**5.**	(C)
6.*	(A,B,C)	**7.**	(D)	**8.**	8	**9.**	(B)	**10.***	(C, D)

DPP No. # 7

1. (C) **2.** (D) **3.** (D)

4. (a) $\overset{(+7)}{KMnO_4}$ (oxidant) ; $\overset{(-1)}{KCl}$ (reductant) (b) $\overset{(+2)}{FeCl_2}$ (reductant) ; $\overset{(-1)}{H_2O_2}$ (oxidant)

(c) $\overset{(0)}{Cu}$ (reductant) ; $H\overset{+5}{N}O_3$ (oxidant) (d) $Na_2H\overset{+3}{As}O_3$ (reductant) ; $K\overset{+5}{Br}O_3$ (oxidant)

(e) $\overset{0}{I_2}$ (oxidant) ; $Na_2\overset{+2}{S_2}O_3$ (reductant)

5. (i) $K_2Cr_2O_7 + 3H_2O_2 + 4H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3O_2$.

(ii) $4Zn + NaNO_3 + 7NaOH = 4Na_2ZnO_2 + 2H_2O + NH_3$.

(iii) $2OH^- + 6H_2O + 2Al \longrightarrow 3H_2 + 2(Al(OH)_4]^-$.

(iv) $6Cu_3P + 11Cr_2O_7^{-2} + 124H^+ \longrightarrow 18Cu^{+2} + 6H_3PO_4 + 22Cr^{+3} + 53H_2O$.

(v) $6H^+ + ClO_3^- + 6Fe^{2+} \longrightarrow Cl^- + 6Fe^{3+} + 3H_2O$.

(vi) $3N_2O_4 + BrO_3^- + 3H_2O \longrightarrow 6NO_3^- + Br^- + 6H^+$.

(vii) $3S_2O_3^{2-} + 2Sb_2O_5 + 6H^+ + 3H_2O \longrightarrow 4SbO + 6H_2SO_3$

(viii) $Cr_2O_7^{2-} + 6I^- + 14H^+ \longrightarrow 2Cr^{3+} + 3I_2 + 7H_2O$.

(ix) $IO_4^- + 7I^- + 8H^+ \longrightarrow 4I_2 + 4H_2O$.

DPP No. # 8

1.	(B)	**2.**	1	**3.**	(B)	**4.**	(C)	**5*.**	(A,B,D)
6*.	(A,D)	**7.**	(A)	**8.**	(B)	**9.**	(C)	**10.**	(B)

DPP No. # 9

1. 4 **2.** (B) **3.** 9 N_A **4.** (A) **5.** (B)

6. (i) False (ii) True (iii) True (iv) True **7.** OsO_4 **8.** 9.2 g

9. (A - p,s) ; (B - p,r) ; (C - r) ; (D - q). **10.** 80%. **11.** (D) **12.** (C) **13.** (A)

DPP No. # 10

1. 3.3 N_A. **2.** 2.38 g **3.** 73.6 g **4.** (D) **5.** (C)

6. (B) **7.** 0.3375 g. **8.** 60 mL **9.** 2 : 5

10. 12 M, 16.66 mL **11.** 147.2 mL

12. (i) % w/w = 10% (ii) % w/v = 12% (iii) mole fraction of NaOH = 1/21
(iv) molarity (M) = (3M) (v) molality (m) = (2.78 m)

13. Both have equal no. of Cl^- ions per ml. **14.** (A - p, q, r) ; (B - q, r) ; (C - q, r) ; (D - p, s)

DPP No. # 11

1.	(B)	**2.**	(A)	**3.**	(D)	**4.**	11, 23, 11, $^{23}_{11}Na$
5.	8, 10, 7	**6.**	(C)	**7.**	(C)	**8.**_	40, Calcium

DPP No. # 12

1.	(D)	**2.***	(BD)	**3.**	(A)	**4.***	(BD)	**5.**	(D)
6.*	(ABCD)	**7.**	(C)	**8.**	(B)	**9.**	(C)		
10.	6.32×10^6 m/s.	**11.**	[A – q] ; [B – r] ; [C – s] ; [D – p].			**12.**	1000 m		

DPP No. # 13

1.	7500 Å.	**2.**	4	**3.**	(a) n =1 ; (b) 2.5×10^6 m^{-1}			**4.**	(B)
5.	n = 16.	**6.**	750 nm	**7.**	1.125×10^{22}	**8.**	25 %	**9.**(A)	

DPP No. # 14

1.	75%	**2.**	1000 Å	**3.**	(D)	**4.**	(B)	**5.**	(C)
6.	(C)	**7.**	(A)	**8.**	(D)	**9.**	(C)		
10.	(A – s) ; (B – s) ; (C – p) ; (D – q, r).								

DPP No. # 15

1.	(B)	**2.**	(D)	**3.**	(B)	**4.**	(B)	**5.**	(D)
6.	(A)	**7.**(A,B,D)		**8.**	(B)				

DPP No. # 16

1.	(A)	**2.**	(D)	**3.**	(C)	**4.***	(A,B,C)		
5.	8.2×10^6	**6.**	-4.41×10^{-17} J.	**7.**	[A – q] ; [B – p] ; [C – s] ; [D – r].				
8.	I induced = 1026 Å , II induced = 1216 Å, III induced = 6568 Å					**9.**	2.65×10^{-11} m.		

DPP No. # 17

1.	(A)	**2.**	(D)	**3.**	(D)	**4.**	(D)	**5.**	(A, B)
6.	(C)	**7.**	(D)	**8.**	(B)				
9.	[A $\rightarrow$ r, s] ; [B $\rightarrow$ p, s] ; [C $\rightarrow$ q, r, s] ; [D $\rightarrow$ p, q, s].					**10.**	(D)		

DPP No. # 18

1.	(C)	**2.**	(A)	**3.**	(C)	**4.**	(C)	**5.**	4
6.	n = 5, Z = 3.	**7.**	(C)	**8.**	(D)	**9.**	0.529 Å		

DPP No. # 19

1.	(D)	**2.**	(D)	**3.**	(D)	**4.**	(B)	**5.**	(C)
6.	(D)	**7.**	(A)	**8.**	(B)	**9.**	(A)		

DPP No. # 20

1. (D) **2.** (A) **3.** (C) **4.** (C) **5.** (D)
6. (D) **7.** (D) **8.** (C) **9.** (A) **10.** 32
11. (a) 0 × (± 1/2) = 0 (b) 0 × (± 1/2) = 0 (c) 1 × (± 1/2) = ± 1/2 (d) 3 × (± 1/2) = ± 3/2 (e) 5 × (± 1/2) = ± 5/2.

DPP No. # 21

1. (C) **2.** (C) **3.** (C) **4.** (B)
5. (a) 21 (b) 8 (c) 12 (d) 1 (e) 1. **6.** (a) $\sqrt{24}$ or 4.9 BM (b) 1 (c) 11 (d) $\frac{\sqrt{6}\,h}{2\pi}$
7. (a) a = 4 moles. **8.** $_{23}V^{4+}$: $1s^2$, $2s^2\ 2p^6$, $3s^2\ 3p^6\ 3d^1$

DPP No. # 22

1. (A) **2.** (B) **3.** (B) **4.** (C)
5.* (ACD) **6.*** (BCD) **7.*** (AC)
8. A and D are isotpes. B, C and D are isobars.
9. (i) p,s (ii) q,r (iii) p,s (iv) q,r
10. (A) **11.** $_{82}Y^{206}$; (Atomic no. 82, Mass no. 206), Pb
12. (a) $2\,{}_0^1n$, (b) **13.** (C) **14.** 8 **15.** 3

DPP No. # 23

1. (C) **2.** (A) **3.** (A) **4.** (B) **5.** (A)
6. (ABC) **7.** 5.26 **8.** (A) **9.** (C)

DPP No. # 24

1. (B) **2.** 31 cm of Hg. **3.** x = 6 cm **4.** ≈ 101.3 cm.
5. x = 26.84 cm **6.** 18 cm **7.** 550 cm **8.** 19 cm.

DPP No. # 25

1. (B) **2.** (D) **3.** (C) **4.** (D)
5. 25 mL. **6.** 273ºC. **7.** 33.3 mL. **8.** (a) No, (b) 55 ºC.
9. **(a)** 50.5 cm **(b)** 55 cm **(c)** 45 cm.

DPP No. # 26

1. (B) **2.** (C) **3.** (A,B,C,D) **4.** 0.6
5. – 23ºC **6.** 245.7 mL **7.** (a) 1 : 3(b) 12.3 litre **8.** (D)

DPP No. # 27

1. (C) **2.** (D) **3.** (B) **4.** (C) **5.** (B)
6. (C) **7.** (B) **8.** (B,D) **9.** (B) **10.** (B)
11. (D) **12.** (B)

DPP No. # 28

1.	(D)	**2.**	(C)	**3.**	(B)	**4.**	(A)	**5.**	(A)
6.	(A)	**7.**	88.67 cm of Hg	**8.**	4 atm	**9.**	5 atm		

DPP No. # 29

1.	(A)	**2.**	(B)	**3.**	(D)	**4.**	0.28 atm		
5.	p_A = 500 mm, p_B = 250 mm.			**6.**	3434Kg	**7.**	(D)	**8.**	11 amu.

DPP No. # 30

1.	(A)	**2.**	(A)	**3.**	(A)	**4.**	(CD)		
5.	**2.5 ml.**	**6.**	(B)	**7.**	(B)	**8.**	(C)	**9.**	9/46

DPP No. # 31

1.	(C)	**2.**	(A)	**3.**	(D)	**4.**	(C)	**5.**	(A)
6.	(D)	**7.**	(B)	**8.**	(D)	**9.**	(A)	**10.**	(C)

DPP No. # 32

1.	(B)	**2.**	(C)	**3.**	(D)	**4.**	(A,B,C,D)	**5.**	(B)
6.	(D)	**7.**	(B)	**8.**	4	**9.**	(C)	**10.**	(C)
11.	(C,D)								

DPP No. # 33

1.	(C)	**2.**	(B)	**3.**	(C)	**4.**	(D)	**5.**	(D)
6.	(B)	**7.**	CO= 0.4L	**8.**	896 mL.				

DPP No. # 34

1.	(A)	**2.**	(C)	**3.**	(A)	**4.***	(ACD)
5.*	(ACD)	**6.***	(CD)	**7.**	2000	**8.**	80000 K

DPP No. # 35

1.	(A)	**2.**	(A)	**3.**	(B)	**4.**	(B)	**5.**	(A)
6.*	(B,C,D)		**7.**	(i) Z = 1.2 (ii) repulsive forces					

DPP No. # 36

1.	(C)	**2.**	(C)	**3.**	(B)	**4.**	(A)	**5.**	(C)
6.	(D)	**7.***	(B,C,D)	**8.**	[A – r] ; [B – r,s] ; [C – q] ; [D – r].				

DPP No. # 37

1.	(B)	**2.**	(C)	**3.**	(B)	**4.**	(C)	**5.**	(A)
6.	(A)	**7.**	(D)	**8.**	(D)				

DPP No. # 38

1. (C) 2. (C) 3. (A) 4. (A) 5. (C)

6. $K_c = \frac{[N_2O_4]}{[NO_2]^2} = \left(= \frac{\text{mol } L^{-1}}{(\text{mol } L^{-1})^2}, K_c \text{ has unit of L mol}^{-1}\right)$ $K_p = \frac{p_{N_2O_4}}{p^2_{NO_2}}$ $\left(= \frac{\text{atm}}{\text{atm}^2}, K_p \text{ has unit of atm}^{-1}\right)$

7. (i) $[PCl_5]$ = 0.5 mol L^{-1} ; $[PCl_3]$ = 1.0 mol L^{-1} ; $[Cl_2]$ = 1.0 mol L^{-1} (ii) X_{PCl_5} = 0.2 ; X_{PCl_3} = 0.4 ; X_{Cl_2} = 0.4

(iii) K_c = 2 L mol^{-1} 8. K_C = 4.0. 9. $\frac{(2n-y)y}{(n-y)^2.P}$

DPP No. # 39

1. (B) 2 (D) 3. (D) 4. (D) 5. (C)
6. (C) 7. (C)

8. [XO] = 0.985 M ; $[O_2]$ = 1.992 M ; $[XO_2]$ = 0.0141 M 9. $K_p = \frac{1}{3}.p$ or p = $3K_p$.

DPP No. # 40

1. (B) 2. (B) 3. (C) 4. (A) 5. (D)

6. (A) 7. $p_{H_2} = 2.5 \times 10^{-2}$ bar ; $p_{Br_2} = 2.5 \times 10^{-2}$ bar ; $p_{HBr} \approx 10$ bar 8. 30%

DPP No. # 41

1. (A) 2. (C) 3. 0.2. 4. (D)

5. 0.3136 atm^2 6. (A) 7. (D) 8. (D) 9.* (C,D)

DPP No. # 42

1. (B) 2. (A,D) 3. (B) 4.* (A,B,C,D) 5.* (A,B)

6. (D) 7. (B) 8. (C)

DPP No. # 43

1. 1.868 2. (i) 2, (ii) 1.2 mol/L 3. α = 0.33, K_p = 0.41 atm. 4. 810

5.* (BC) 6. (B) 7. (A) 8. (D)

DPP No. # 44

1. (C) 2. (D) 3. (C) 4.* (AC)

5. State function : a, b, c, d, g, h, j ; Path function : e, f, i, k

6. Intensive : a, c, d, f, g, h, i, k ; Extensive : b, e, j, l

7. Open system : b, f, g, i, j ; Closed system : a, c, h ; Isolated system : d, e

DPP No. # 45

1.	(A)	**2.**	(D)	**3.***	(BD)	**4.**	(BC)	**5.**	**– 90 J**
6.	4275 J.	**7.**	6.66 min. (400 sec)	**8.**	(B)	**9.**	(A)	**10.**	(D)

DPP No. # 46

1.	(C)	**2.**	(A)	**3.**	(B)	**4.**	(B)	**5.**	(A)
7.	– 859 J **9.**	(a) F	(b) T	(c) F	(d) T	(e) T	**6.**	W = 240 L atm.	

DPP No. # 47

1.	(A)	**2.**	(C)	**3.**	(A)	**4.**	(A)	**5.**	(C)
6.	(A)	**7.**	(C)	**8.**	(D)	**9.**	(B)	**10.**	(A)

DPP No. # 48

1.	(A)	**2.**	(A)	**3.**	(D)	**4.**	(A)	**5.**	(B)
6.	(C)	**7.**	(A)	**8.**	3840 calories	**9.**	– 178 R		

DPP No. # 49

1.	(C)	**2.**	(D)	**3.**	(A)	**4.**	(A)	**5.**	(B)
6.	(C)	**7.**	(A)	**8.**	- 94.6 KCal	**9.**	- 41.4 KCal		

DPP No. # 50

1.	(C)	**2.**	(B)	**3.**	(C)	**4.**	(B)	**5.**	(B)
6.	8.33 kg.	**7.**	10%.	**8.**	22.8 Cal/g.	**9.**	– 22.1 KCal		

DPP No. # 51

1.	- 372.0 kCal.	**2.**	- 136.8 kJ.	**3.**	- 121 kJ/mole.	**4.**	DH = –67710 Cal
5.	- 22 kCal/mol.	**6.**	- 29 kCal/mol	**7.**	141.7 kCal	**8.**	$= \frac{3y - 4x}{3}$ kCal mol^{-1}.
9.	49 kCal/mol.	**10.**	(C)	**11.**	(A)		

DPP No. # 52

1.	- 41.104 kCal.	**2.**	(B)	**3.**	80 kCal/mol.	**4.**	100 kJ/mol.	**5.**	(C)
6.	C - H = 99 kCal ; C - C = 82 kCal			**7.**	- 56.5 kJ.	**8.**	–152 KJ mol^{-1}		
9.	- 18.7 kCal	**10.**	- 167.2 kJ/mol.						

DPP No. # 53

1.	(A)	**2.**	DH = 12.168 Kcal ; DE = 11.622 Kcal.						
3.	W = 0.1 KJ, q = 2KJ, DE = 2.1 KJ.			**4.**	570 g of sucrose ; 9120 kJ.			**5.**	(B)
6.	(C)	**7.**	(D)	**8.**	(A)	**9.**	(A)		

DPP No. # 54

1.	(D)	**2.**	(C)	**3.**	(D)	**4.**	(C)		
5.*	(ABC)	**6.**	(D)	**7.**	(B)				
8.	(a) 80 JK^{-1} mol^{-1}		(b) – 80 JK^{-1} mol^{-1}			**9.**	(D)	**10.**	(A)

DPP No. # 55

1.	3.312 J/K	**2.**	7	**3.***	(A,B,C)	**4.***	(A,B,C)	**5.**	3
6.	(D)	**7.**	(D)	**8.**	(A,B,C)	**9.**	1	**10.**	8

DPP No. # 56

1.	(B)	**2.**	(A)	**3.**	(D)	**4.**	(A)	**5.**	(C)
6.	(B)	**7.**	(C)	**8.**	(A)	**9.**	(B)	**10.**	(A)
11.	(C)	**12.**	(D)	**13.**	(A)	**14.**	(A)	**15.**	(A)
16.	(A)	**17.**	(D)	**18.**	(C)	**19.**	(D)	**20.**	(A)

Topic : Atomic Structure

1.	(A)	**2.**	(A)	**3.**	(C)	**4.**	(B)	**5.**	(D)
6.	(B)	**7.**	(A)	**8.**	(B)	**9.**	(C)	**10.**	(B)
11.	(A)	**12.**	(C)	**13.**	(D)	**14.**	(A)	**15.**	(A)
16.	(D)	**18.**	(C)	**19.**	(C)	**20.**	(D)		

DPP No. # 57

1.	(B)	**2.**	(C)	**3.**	(C)	**4.**	(B)	**5.**	(A)
6.	(B)	**7.**	(B)	**8.**	(B)	**9.**	(D)	**10.**	(D)
11.	(C)	**12.**	(D)	**13.**	(C)	**14.**	(D)	**15.**	(B)
16.	(D)	**17.**	(A)	**18.**	(D)	**19.**	(A)	**20.**	(B)
21.	4 : 1								

DPP No. # 58

1.	(D)	**2.**	(B)	**3.**	(C)	**4.**	(B)	**5.**	(C)
6.	(A)	**7.**	(A)	**8.**	(A)	**9.**	(D)	**10.**	(C)
11.	(D)	**12.**	(C)	**13.**	(A)	**14.**	(C)	**15.**	(E)
16.	(A)	**17.**	(B)	**18.**	(B)	**19.**	(A)	**20.**	(B)

DPP No. # 59

1.	(C)	**2.**	(D)	**3.**	(A)	**4.**	(C)	**5.**	(A)
6.	(B)	**7.**	(B)	**8.**	(A)	**9.**	(D)	**10.**	(C)
11.	(C)	**12.**	(B)	**13.**	(B)	**14.**	(D)	**15.**	(AC)
16.	(BD)	**17.**	(BCD)	**18.**	(D)	**19.**	(A)	**20.**	(A)
21.	(C)	**22.**	–152 kJ $mole^{-1}$						

INORGANIC CHEMISTRY

DPP No. # 1

1.	(A)	**2.**	(B)	**3.**	(A)	**4.**	(D)		
5.*	(ABCD)	**6.***	(ABC)	**7.**	**(a).** (B)	**(b).**	(C)	**(c).**	(B)
8.	3								

DPP No. # 2

1.	(C)	**2.**	(C)	**3.**	(C)	**4.**	(C)		
5.*	(A,B,C)	**6.***	(A,D)	**7.**	**(a).** (A)	**(b).**	(A)	**(c).**	(C)

8. (a) $Li^+ < Na^+ < K^+$ (b) $Mg^{2+} < Mg^+ < Mg$ (c) $F^- < O^{2-} < N^{3-}$ (d) $O < O^- < O^{2-}$
(e) $Mg^{2+} < Ca^{2+}$ (f) $N^{3-} < P^{3-}$ (g) $Ca^{2+} < K^+$ (h) $I^+ < I^-$

DPP No. # 3

1.	(A)	**2.**	(C)	**3.**	(C)	**4.**	(B)		
5.*	(A,B,C,D)	**6.***	(B,C)	**7.**	**(a).** (D)	**(b).**	(C)	**(c).**	(B)

8. (a) $_{9}F$ (b) $_{36}Kr$ (c) $_{12}Mg$

DPP No. # 4

1.	(C)	**2.**	(C)	**3.**	(A)	**4.**	(A)	**5.**	(C)
6.	(A)	**7.***	(A,B,D)	**8.**	$d_{C-O} < d_{N-O}$				

DPP No. # 5

1. (i) Sodium meta aluminate (ii) Sodium metaborate
(iii) Potassium pyrophosphate (iv) Sodium zincate
(v) Mercurous metaborate (vi) Potassium dichromate
(vii) Sodium dihydrogen phosphate (ortho) (viii) Sodium monohydrogen phosphate (ortho)
(ix) Sodium phosphate (ortho) (x) Calcium dihydrogen phosphate (ortho)
(xi) Calcium monohydrogen phosphate (ortho) (xii) Calcium phosphate (ortho)
(xiii) Magneisum chlorate (xiv) Sodium hypobromite
(xv) Calcium chlorite (xvi) Cupric plumbite
(xvii) Potassium chlorate (xviii) Ammonium molybdate
(xix) Barium chromate (xx) Sodium stannate
(xxi) Ferrous tungstate (xxii) Potassium manganate
(xxiii) Potassium hypophosphite

2. (i) $Mg_3(PO_4)_2$ (ii) $Ca(NO_2)_2$ (iii) $Ca(BO_2)_2$ (iv) $FePO_4$ (v) $Ca(ClO)_2$ (vi) PO_3^-
(vii) $(NH_4)_4Sb_2O_7$ (viii) As_2O_3 (ix) $Na_2S_2O_7$ (x) $KClO_4$ (xi) Ag_2SO_3
(xii) Ag_3AsO_3 (xiii) $PbCr_2O_7$ (xiv) $Zn(NO_3)_2$ (xv) Ag_2PbO_3 (xvi)$NaNH_4HPO_4$

3.

Carbonate :	CO_3^{2-} ;	Sulphite :	SO_3^{2-} ;	Sulphide :	S^{2-}
Nitrite :	NO_2^- ;	Acetate :	CH_3COO^- ;	Chloride :	Cl^-
Brominde :	Br^- ;	Iodide :	I^- ;	Nitrate :	NO_3^-
Oxalate :	$C_2O_4^{2-}$;	Orthoborate :	BO_3^{3-} ;	(ortho) Phosphate :	PO_4^{3-}
Sulphate :	SO_4^{2-}				

4. $MgHPO_4 \longrightarrow Mg_2P_2O_7 + H_2O$

5. CuBr and Br_2, Cupric bromide , Cuprous bromide.

6. $MgCO_3$, Magnesium carbonate.

7. (A) : As/Sb ; (B) : Na_3As/Na_3Sb ; (C) : $AsCl_3/SbCl_3$; (D) : $AsCl_5/SbCl_5$

8. (a) $SOCl_2$ (b) XeO_2F_2, $XeOF_4$ (c) SO_2F_2, SOF_4 (d) $VO_2Cl, VOCl_3$ (e) NOCl

DPP No. # 6

1. (a) Calcium phosphide (b) Barium cyanide (c) Sodium sulphide
(d) Chlorine trifluoride (e) Sulphur tetrafluoride (f) Cobalt (II) metaborate
(g) Scandium pyrosilicate (h) Sodium pyrosulphate (i) Barium nitrate
(j) Sodium metasilicate (k) Sodium pyrophosphite (l) Aluminium sulphate

2. (a) SF_6 (b) Li_3N (c) $SrCl_2$ (d) O_2F_2 (e) $Ba(N_3)_2$ (f) $Ba(ClO_4)_2$
(g) NaOCl (h) $Ca_3(PO_4)_2$ (i) $Mg_2P_2O_7$ (j) $Cu(BO_2)_2$ (k) $Na_2S_2O_5$ (l) $Fe(NO_3)_3$

3. (a) Ortho boric acid (b) Ortho silicic acid (c) Chromic acid
(d) Perxenic acid (e) Phosphorus acid (f) Metaphosphoric acid
(g) Sulphurous acid (h) Dithionous acid (i) Thiosulphuric acid
(j) Peroxymonosulphuric acid (k) Chloric acid (l) Hyponitrous acid
(m) Hydrobromic acid (n) Hydrazoic acid

4. (a) H_2CO_3 (b) $H_6Si_2O_7$ (c) HBO_2 (d) H_2MnO_4 (e) H_2XeO_4 (f) H_3PO_2
(g) H_3PO_4 (h) $H_2S_2O_5$ (i) $H_2S_2O_6$ (j) $HClO_2$ (k) HNO_2 (l) HNO_4
(m) HI (n) HCN

DPP No. # 7

1. (A) **2.** (C) **3.** (C) **4.** (B) **5.** (D)
6.* (A,B,C,D) **7.*** (A,B)
8. A = 3.84 ; B = 3.08 Therefore A has higher electronegativity.

DPP No. # 8

1. (A) **2.** (B) **3.** (B) **4.** (D) **5.** (D)
6. (B) **7.** (B) **8.** (i) four (ii) three covalent and one coordinate.

DPP No. # 9

1. (C) **2.** (B) **3.** (A) **4.** (B) **5.** (B)
6.* (A,B,C)
7. (a) All zero
(b) All have zero except single bonded oxygen (–1)
(c) All have zero except nitrogen (+1)
(d) Both single bonded O-atoms have (–1), N-atom has (+1) and double bonded O-atom has zero.

8. $[\ddot{C} = C = \ddot{C}]^{4-}$

DPP No. # 10

1. (B) **2.** (B) **3.** (C) **4.** (A) **5.** (A)
6. (B) **7.*** (ABD) **8.*** (BD)

DPP No. # 11

1. (A) **2.** (D) **3.** (B) **4.** (A) **5.** (B)
6.* (ABD) **7.** 5 **8.** (A – t) ; (B – s) ; (C – p) ; (D – r).

DPP No. # 12

1. (A) **2.** (A) **3.** (D) **4.** (A) **5.** (A)
6. (B) **7.*** (ABCD)

DPP No. # 13

1.	(A)	**2.**	(A)	**3.**	(D).	**4.**	(D)	**5.**	(A)
6.*	(ABC)	**7.***	(ACD)	**8.**	(a-ii) (b-iii) (c- iv) (d-v) (e-vi) (f-i).				

DPP No. # 14

1.	(D)	**2.**	(C)	**3.**	(B)	**4.**	(B)	**5.***	(AD)
6.*	(AC)	**7.**	(A – p, B – q, C – p, D – s)			**8.**	**228 pm , 536 pm**		

DPP No. # 15

1.	(A)	**2.**	(A)	**3.**	(A)	**4.**	(B)	**5.**	(B)
6.*	(ABD)	**7.***	(BCD)						

8. (a) $F_2O < H_2O$ (b) $NH_3 > PH_3$ (c) $SO_2 < SO_3$ (d) $NO_2^+ > NO_2^-$

DPP No. # 16

1.	(C)	**2.**	(C)	**3.**	(D)	**4.**	(D)	**5.**	(B)
6.	(B)	**7.**	(A)	**8.***	(BC)				

DPP No. # 17

1.	(C)	**2.**	(C)	**3.**	(A)	**4.**	(C)	**5.**	(B)
6.	(C)	**7.**	(ABCD)	**8.**	**(i)** sp^2	**(ii)** 4		**(iii)** 3	**(iv)** 6

DPP No. # 18

1.	(C)	**2.**	(C)	**3.**	(D)	**4.**	(D)	**5.**	(D)
6.	(A)								

7. (i) Nitrogen $\rightarrow p\pi - p\pi$ multiple bond (very high bond enthalpy). (ii) In phosphorus their atomic orbitals are so large and diffuse that they cannot have effective over lapping. **8.** 8

DPP No. # 19

1.	(B)	**2.**	(D)	**3.**	(B)	**4.***	(A)	**5.**	(A)
6.	(C)	**7.**	(B)						

DPP No. # 20

1.	(B)	**2.**	(B)	**3.**	(A)	**4.**	(B)	**5.**	(B)
6.*	(CD)	**7.**	NO^+.						

8. NO has lost an antibonding electron to form NO^+. So NO^+ is more stable.
CO has lost a bonding electron to form CO^+. So CO^+ is less stable.

DPP No. # 21

1.	(B)	**2.**	(D)	**3.**	(A)	**4.**	(C)	**5.**	(D)
6.	(C)	**7.**	(B)						

8. (a) Electronegativity difference Li and iodine is less than Li and F. Thus, LiI is more covalent.
(b) Although Li^+ is same in both the compounds yet difference in the size of F^- and I^- is not same. Since F^- is smaller than I^- hence lattice energy of LiF is more than that of LiI. Similarly heat of hydration of F^- is more than that of I^-. But the decrease of L.E. from LiF to LiI is much more than the decrease in heat of hydration from LiF to LiI. Hence solubility increases from LiF to LiI.

DPP No. # 22

1. (D) **2.** (C) **3.** (A) **4.*** (BCD)

5. (a)True (b) False

6. $BF_3 < H_2S < H_2O$. BF_3 has a zero dipole moment because of its symmetry. H_2S has a lower dipole moment than H_2O because of the much lower bond polarity of H–S bond compared to H–O bond.

7. 75%. **8.** (A – q, r) ; (B – p, s) ; (C – p, s) ; (D – q, r).

DPP No. # 23

1. (D) **2.** (D) **3.** (B) **4.*** (AB) **5.** (C)

6. (C) **7.** (D)

8.

(i) dipole-dipole attraction. (ii) H – bonding (iii) H – bonding (iv) dipole-dipole attraction.

(v) H–bonding (vi) dipole-dipole attraction. (vii) metallic bonding (viii) H–bonding.

(ix) dipole-dipole attraction. (x) ion-dipole attraction. (xi) dispersion forces (xii) covalent bond.

(xiii) disperison forces (xiv) ionic bond (xv) dipole - induced dipole attraction.

DPP No. # 24

1. (D) **2.** (A) **3.** (D) **4.** (C)

5.* (ABCD) **6.*** (AB) **7.** 8 **8.** 9

DPP No. # 25

1. (C) **2.** (C) **3.** (B) **4.** (D) **5.** (A)

6. (B) **7.** (C) **8.*** (ABCD) **9.** (C) **10.** (D)

11. (B)

12. The anhydrous magnesium chloride is fused with NaCl to provide conductivity to the electrolyte and to lower the fusion temperature of anhydrous $MgCl_2$.

13. LiF has more ionic character while LiI has more covalent character. The latter is due to the greater polarizability of larger iodide ion than the lithium ion.

14. $SrSO_4 > CaSO_4 > MgSO_4 > BeSO_4$ **15.** **(i)** higher effective nuclear charge **(ii)** decreases

16. **(a)** T **(b)** F **17.** (A) **18.** (A)

DPP No. # 26

1. (C) **2.** (B)

3. (i) $Na_2S + 4Na_2O_2 \longrightarrow Na_2SO_4 + 4Na_2O$. (ii) $2Na + O_2(\text{excess}) \xrightarrow{350°C} Na_2O_2$.

(iii) $Na_2O_2 + CO \longrightarrow Na_2CO_3$; $2Na_2O_2 + 2CO_2 \longrightarrow 2Na_2CO_3 + O_2$.

(iv) $2Cr(OH)_3 + 3Na_2O_2 \longrightarrow 2Na_2CrO_4 + 2NaOH + 2H_2O$.

(v) $MnSO_4 + 2Na_2O_2 \longrightarrow Na_2MnO_4 + Na_2SO_4$.

(vi) $Na_2O + NH_3 \longrightarrow NaNH_2 + NaOH$ (vii) $Na_2O_2 + 2H_2O \xrightarrow{\text{Cold}} 2NaOH + H_2O_2$.

4. (C) **5.** (D) **6.** (B)

7. (i) $2NaOH + 2NO_2 \longrightarrow NaNO_2 + NaNO_3 + H_2O$; $2NaOH + SO_3 \longrightarrow Na_2SO_4 + H_2O$.

(ii) $6NaOH + 3Br_2 \longrightarrow 5NaBr + NaBrO_3 + 3H_2O$. ; $4NaOH + 2F_2 \longrightarrow 4NaF + O_2 + 2H_2O$.

(iii) $6NaOH + 4S \longrightarrow 2Na_2S + Na_2S_2O_3 + 3H_2O$. (iv) $2B + 6NaOH \longrightarrow 2Na_3BO_3 + 3H_2$

(v) $2NaOH + Si + H_2O \longrightarrow Na_2SiO_3 + 2H_2$.

(vi) $PbO + 2NaOH \longrightarrow Na_2PbO_2 + H_2O$; $PbO_2 + NaOH \longrightarrow Na_2PbO_3 + H_2O$.

(vii) $4NaOH + 2H_2O + 2Al \longrightarrow 2NaAlO_2 + 3H_2$.

(viii) Form insoluble hydroxides.

$CrCl_3 + 3NaOH \longrightarrow Cr(OH)_3\downarrow$ (Green) + 3NaCl. ; $CuCl_2 + 2NaOH \longrightarrow Cu(OH)_2\downarrow$ (blue) + 2NaCl.

(ix) $HgCl_2 + 2NaOH \longrightarrow Hg(OH)_2\downarrow + 2NaCl$; $Hg(OH)_2 \longrightarrow HgO\downarrow$ (yellow or brown) + H_2O.

$2AgNO_3 + 2NaOH \longrightarrow 2AgOH\downarrow + 2NaNO_3$; $2AgOH \longrightarrow Ag_2O\downarrow$ (black) + H_2O.

(x) $NaOH + CO \xrightarrow[5-10\,atm]{150-200°C} HCOONa$.

8. (B) **9.** (C) **10.** (A) **11.** (C) **12.** (C)

13. (A→P,Q,R) ; (B→P,Q,R) ; (C→P,Q) ; (D→P,Q,S) **14.** (A) = O_3, (B) = KO_3, (C) = O_2

15. $CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$ (calcium bicarbonate).

18. $Ca_5(PO_4)_3F + 5H_2SO_4 + 10H_2O \xrightarrow{\Delta} 3H_3PO_4 + 5CaSO_4.2H_2O + HF$ **19.** (B, D)

DPP No. # 27

1. (A) **2.** (B) **3.** (B) **4.*** (BCD) **5.** (C)

6. (A) **7.** (B) **8.** (D) **9.** (D) **10.** (D)

11. (C) **12.** (B)

13. (A – p) ; (B – p, q) ; (C – p, q, s) ; (D – p, r). **14.** (D) **15.** (C)

16. (A) **17.** (B)

18. **(i)** True **(ii)** True **(iii)** False **(iv)** False **(v)** **False**

DPP No. # 28

1. (C) **2.** (B) **3.** (B) **4.** (A) **5.** (A)

6. (B) **7.** (B) **8.*** (AD) **9.** (B) **10.** (D)

11. (B) **12.** (C)

16.(A → p, q, r, s) ; (B → P , Q , R , S) ; (C → P , Q) ; (D → P , Q)

17. **(i)** Fullerene **(ii)** Glass **(iii)** Inert pair effect.

(iv) NaOH. **(v)** PbO, Pb_3O_4, pigments

(vi) ammonical copper (I) chloride, KOH or NaOH **(vii)** CO_2

(viii) hydrofluoric **(ix)** dry ice

(x) carbonyl chloride (phosgene) **(xi).** carbon monoxide

18. **(i)** False **(ii)** True **(iii)** True **(iv)** True **(v)** False

(vi) True. **(vii)** True **(viii)** True **(ix)** True **(x).** False

ORGANIC CHEMISTRY

DPP No. # 1

1. (C) **2.** (C) **3.** (C) **4.** (D) **5*.** (BCD)

6*. (ABD) **7.** 9 **8.** (A → p, s) ; (B → p, q) ; (C → r, s) ; (D →p)

DPP No. # 2

1. (B) **2.** (C) **3.** (D) **4.** (D) **5.** (B)

6. (A,B) **7.** 114. **8.** A → S, B → P, C → Q, D → R

DPP No. # 3

1. (C) **2.** (C) **3.** (A) **4.** (D)

5.* (A,B,D) **6.*** (A,B,C,D)

7. $H_2C = C = CH_2$
M. W. = 40.

8. [A – s] ; [B – q] ; [C – p] ; [D – r]

DPP No. # 4

1. (A) **2.** (D) **3.** (C) **4.** (B)

5. (B,C,D) **6.** (B,C,D) **7.** 6

8. **(a)** (B) **(b)** (C) **(c)** (D)

DPP No. # 5

1. (C) **2.** (A) **3.** (A) **4.** (A) **5.*** (A, D)

6. **(a)** (C) **(b)** (C) **8.** (P → Z) ; (Q → Y) ; (R → W) ; (S → X).

DPP No. # 6

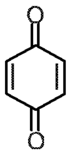
1. (B) **2.** (B) **3.** (B) **4.** (C)

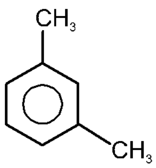
5. (ABCD) **6.** (ABC) **8.** (A → s) ; (B → r) ; (C → q) ; (D → p)

DPP No. # 7

1. (B) **2.** (D) **3.** (A) **4.** (A) **5.** (C)

6. (B C) **7.** (ABCD)

8. (a) 

(b) 

(c) $\begin{array}{l} CH_2-COOH \\ | \\ CH_2-COOH \end{array}$

(d) $CH_3-\underset{OH}{\underset{|}{C}H}-COOH$

DPP No. # 8

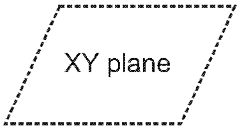
1. (B) **2.** (C) **3.** (B) **4.** (B) **5.** (D)

6. **(a).** (C) **(b).** (A) **8.** (A → q) ; (B → s) ; (C → p) ; (D → r)

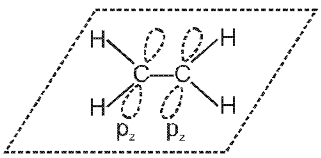
DPP No. # 9

	No. of sp^2–sp^2 σ-bonds	No. of sp^2–sp σ-bonds
Hyb. : sp^3 sp^3 sp^3 **1.** CH_3— CH_2— CH_3 B. A 109° 109° 109°	0	0
Hyb. sp^3 sp^2 sp^2 **2.** CH_3—CH = CH_2 B. A 109° 120° 120°	1	0
Hyb.: sp^3 sp sp **3.** CH_3– C ≡ CH B. A 109° 180° 180°	0	0
Hyb. : sp^2 sp^2 sp^2 sp^2 **4.** CH_2 = CH —CH = CH_2 B. A 120° 120° 120° 120°	3	0
Hyb. : sp^2 sp^2 sp sp **5.** CH_2 = CH — C ≡ CH B. A 120° 120° 180° 180°	1	1
Hyb. : sp^2 sp sp^2 **6.** CH_2 = C = CH_2 B. A 120° 180° 120°	0	2
Hyb. : sp^2 sp^2 sp^3 sp^2 sp sp^2 **7.** CH_2 = CH — CH_2 — HC = C = CH_2 B. A 120° 120° 109° 120° 180° 120°	1	2

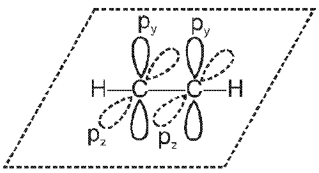
2.



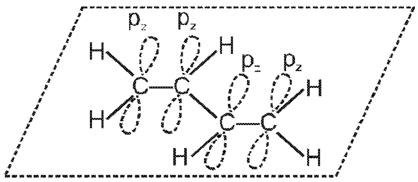
1.



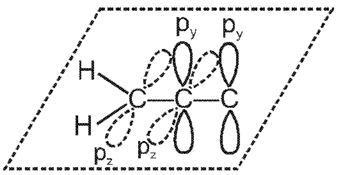
2.



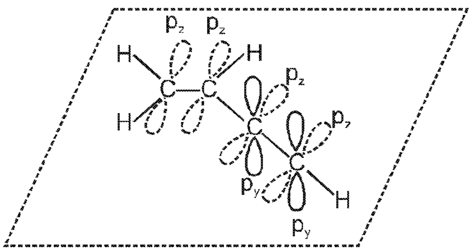
3.



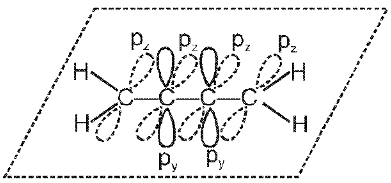
4.



5.



6.



DPP No. # 10

1. (D) **2.** (B) **3.** (C) **4.** (C) **5.** (B)

6. (C) **7.** (C) **8.** (C) **9.** (C) **10.** (C)

11. (C) **12.** (A) **13.** (C) **14.** (D) **15.** (C)

16. **(a)** (i) 12, (ii) 6. **(b)** (i) 12, (ii) 8. **(c)** (i) 12, (ii) 8. **(d).** (i) 6, (ii) 4.

(e) (i) 14, (ii) 8. **(f)** (i) 14, (ii) 9.

DPP No. # 11

1. (A) **2.** (C) **3.** (A) **4.** (C) **5.** (C)

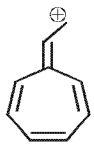
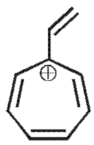
6.* (ABD)

7. Inductive effect is expected to be the least in the bond between cabon 3 and carbon 2. **8.** 6

DPP No. # 12

1.* (ABCD) **2.*** (ABC) **3.*** (ACD) **4.** (B) **5.** (D)

6.* (ABD)

7. (A – q) ; (B – p) ; (C – r) **8.** (a) $\overset{\oplus}{C}H_2 - NH_2 < CH_2 = \overset{\oplus}{N}H_2$; (b)  < 

DPP No. # 13

1. (B) **2.** (B) **3.** (C) **4.** (D) **5.** (B)

6. (A) **7.** (A) – p,q,t ; (B) – p,q,s (C) – p (D) – p,q,r,s **8.** (a) 5 (b) 3

DPP No. # 14

1.* (ABC) **2.** (A) **3.*** (A,D) **4.** (A) **5.** (C)

6. (C) **7.** (A → p, q), (B → p), (C → p, q, r, s), (D → p, r) **8.** 7

DPP No. # 15

1. (D) **2.** (B) **3.** (BCD)

4. (A - p,s) ; (B - p,s) ; (C - p,s) ; (D - r) **5.** 3 **6.** 2

Hints & Solutions

PHYSICAL CHEMISTRY

DPP No. # 1

1.* Molecular mass of $P_4 = 4 \times 31 = 124$ amu
$\therefore$ 124 amu of P_4 contains 1 molecule of P_4
1 molecule of P_4 contains 4 atoms of P.

2.* (A) No. of molecules (N_2O) = $\frac{1}{44} \times N_A$; No. of molecules (CO) = $\frac{1}{28} \times N_A$

(B) No. of molecules (N_2) = $\frac{1}{28} \times N_A$; No. of molecules (C_3O_2) = $\frac{1}{68} \times N_A$

(C) No. of molecules (N_2) = $\frac{1}{28} \times N_A$; No. of molecules (CO) = $\frac{1}{28} \times N_A$

(D) No. of molecules (N_2O) = $\frac{1}{44} \times N_A$; No. of molecules (CO_2) = $\frac{1}{44} \times N_A$

4.

S.No.	Sample	Relative Atomic Mass for the element	Gram Atomic mass of sample	Moles of sample	No. of atoms of sample	Mass removed from the sample	Mole removed
1.	8 g O	16	– – –	– – –	– – –	– – –	– – –
	For Example	16	16 g	½ Mole	$\frac{N_A}{2}$	2 g	⅛ Mole
2.	230 g Na	23	23g	10 Mole	10 N_A	46 g	2 Mole
3.	60 g Ca	40	40 g	3/2 Mole	3/2 N_A	40 g	1 Mole
4.	20 g He	4	4 g	5 Mole	5 N_A	12 g	3 Mole
5.	56 g N	14	14 g	4 Mole	4 N_A	7 g	½ Mole
6.	12 g Mg	24	24 g	½ Mole	$\frac{N_A}{2}$	6 g	¼ Mole
7.	128 g S	32	32 g	4 Mole	4 N_A	32 g	1 Mole
8.	93 g P	31	31 g	3 Mole	3 N_A	46.5 g	3/2 Mole

5. Mass of 0.25 N_A atoms of X is 2.25 gram

so, mass of 1 atom is = $\frac{2.25}{0.25N_A}$ gram $= 1.5 \times 10^{-23}$ gram

6. $w_{H_2SO_4} = 392 \text{ mg} = 392 \times 10^{-3}$ g

$M_{H_2SO_4} = 98$

Left moles = Total moles – removed moles = $\frac{392 \times 10^{-3}}{98} - \frac{1.204 \times 10^{21}}{6.022 \times 10^{23}}$

Left moles = $4 \times 10^{-3} - 2 \times 10^{-3} = 2 \times 10^{-3}$ moles.

7. (A - p, s, r), (B - p, q, r), (C - p, q, r), (d - r).

8. Total number of moles of O-atoms = $2 \times n_{CO_2} + 5 \times n_{N_2O_5} + 1 \times n_{CO} + 2 \times n_{SO_2}$

$$= 2 \times \left(\frac{4.4}{44}\right) + 5 \times \left(\frac{6.022 \times 10^{22}}{N_A}\right) + 1 \times 0.2 + 2 \times \frac{1.12}{22.4} = 1$$

$\therefore$ Moles of O_2 gas = $\frac{1}{2}$

$\therefore$ Vol. of O_2 gas at NTP = $\frac{1}{2} \times 22.4 = 11.2$ L

DPP No. # 2

2. No. of atoms of gold recovered = Moles of gold $\times N_A$

$$= \left(\frac{39.4 \times 10^3}{197}\right) \times N_A$$

$$= 1.2044 \times 10^{26}$$

5. Mole of element $\times$ At. Mass of element = Mass of element

$\left(\frac{1.5 \times 10^{22}}{N_A}\right) \times$ At. Mass of element = 0.9

$\therefore$ At. Mass of element = 36 u.

8. 6×10^{23} molecules has mass = 18gm

1 molecules has mass = $\frac{18}{6 \times 10^{23}} = 3 \times 10^{-23}$ gm

= 3×10^{-26} kg.

10. (A) No. of molecules = $\frac{28}{28} \times N_A = N_A$ (B) No. of molecules = $\frac{46}{46} \times N_A = N_A$

(C) No. of molecules = $\frac{36}{18} \times N_A = 2N_A$ (max) (D) No. of molecules = $\frac{54}{108} \times N_A = 0.5N_A$

11. Molecular mass of $P_4 = 4 \times 31 = 124$ amu

$\therefore$ 124 g of P_4 contains 1 mole of $P_4 = N_A$ molecules of Phosphorus.

1 mole of P_4 contains $4N_A$ atoms of P.

DPP No. # 3

1. For 24 carat, no of gold atoms $= \frac{300 \times 10^{-3}}{197} \times N_A$

For 20 carat, no of gold atoms $= \frac{300 \times 10^{-3}}{197} \times \frac{20 \times N_A}{24}$

$= 7.64 \times 10^{20}$ परमाणु

2. Removed mass = $\frac{11.2}{22.4} \times 32 + \frac{6.02 \times 10^{23}}{6.02 \times 10^{23}} \times 16 = 32$ g

mass left = 64 – 32 = 32 g.

3. (A) 32 g each of O_2 and S = $\frac{32}{32}$ = 1 mole

(B) 2 gram-molecule of $K_3[Fe(CN)_6]$ $\Rightarrow$ has 2 moles of Fe $\Rightarrow$ and 12 moles of C-atom

(C) 144 g of oxygen atom = $\frac{144}{16}$ = 9 mole of 'O' atom ; $\therefore$ Moles of $O_3 = \frac{9}{3} = 3$

7 (D) from 168 g i.e. 3 moles Fe $\Rightarrow$ 1 mole Fe is removed i.e. $\Rightarrow$ 2 moles of Fe is left.

4. In $Fe_2(SO_4)_3$:
Moles of O– atoms : Moles of S– atoms = 12 : 3

Moles of S– atoms = $\frac{3}{12} \times 7.2 = 1.8$

No. of S– atoms = 1.8 N_A

5. Mass of C = Moles of C $\times$ At. mass of C
= Moles of $CO_2 \times$ At. mass of C
= $10 \times 12 = 120$ g

Moles of O– atoms = $2 \times n_{CO_2}$
= 2×10
= 20 = g – atoms of O.

No. of O– atoms = $20 \times N_A$ = 1.2044×10^{25}
No. of molecules of CO_2 = Moles of $CO_2 \times N_A = 10 \times N_A$

6. Let atomic mass of X is 'a' amu
(4a + 96) g X_4O_6 ———————— 4a g X

$\therefore$ 10 g X_4O_6 has ———————— $\left(\frac{4a \times 10}{4a + 96}\right)$ g X

$\frac{4a \times 10}{4a + 96} = 5.72$ $\Rightarrow$ a = 32.

7. Mass of Ca = $5 \times \frac{40}{100}$ = 2g.

8.

N $\rightarrow$	1g	2g	3g
O $\rightarrow$	0.57g	2.24g	5.11g
O $\rightarrow$	$\frac{0.57}{1}$	$\frac{2.24}{2}$ g	$\frac{5.11}{3}$ g
O $\rightarrow$	$\frac{0.57}{1}$	$\frac{0.57 \times 2}{1}$	$\frac{0.57 \times 3}{1}$

So, the mass ratio of oxygen combined with 1 g of nitrogen is simple ratio 1,2,3.

9. Ratio of weight of oxygen in samples = Ratio of valency of Cu in two compounds
= 2 : 1

10. R.D. = $\frac{M_{SO_3}}{M_{CH_4}} = \frac{80}{16} = 5.$

11. Molar mass of air at STP = 0.001293 g mL^{-1} × 22400 mL = 28.7 g

so V.D. = $\frac{28.7}{2} \approx 14.3$

12. Element must be Al

Hence, volatile chloride will be $AlCl_3$ so V.D. = $\frac{M_{AlCl_3}}{2} = \frac{133.5}{2} = 66.75$

DPP No. # 4

1.* Weigh of 11.2 L gas at S.T.P. ———— 14 g

Weigh of 22.4 L gas at S.T.P. ———— $\frac{14}{11.2} \times 22.4 = 28$ g

$M_{N_2} = M_{CO} = 28$

The gas could be N_2 or CO.

2. Let the molar mass of compound be 'M'

Hence $\frac{M \times 6}{100} = 24$

M = 400 g /mole

3. Mole of Zn $= \frac{9.81}{65}$ $= 0.15$ Mole of Cr $= \frac{1.8 \times 10^{23}}{6.023 \times 10^{23}}$ $= 0.3$

Mole of O = 0.6

$\therefore$ simple ratio Zn = $\frac{0.15}{0.15}$ = 1 Cr = $\frac{0.3}{0.15}$ = 2 O = $\frac{0.6}{0.15}$ = 4

So $ZnCr_2O_4$.

4. $\frac{\text{Mass of sulphur}}{\text{Mol. mass of compound}} \times 100 = \%$ of sulphur

$\therefore$ $\left(\frac{2 \times 32}{M}\right) \times 100 = 0.032$

$\therefore$ M = 2,00,000

5. For S and O,

$S \Rightarrow \frac{5}{32}$ $O \Rightarrow \frac{5}{16}$

Simple ratio $S \Rightarrow \frac{\frac{5}{32}}{\frac{5}{32}} \Rightarrow 1$ $O \Rightarrow \frac{\frac{5}{16}}{\frac{5}{32}} \Rightarrow 2$

i.e. SO_2

For CH_2,

$\% C = \frac{12}{14} \times 100 = \frac{600}{7}$ $\Rightarrow$ $H \% = \frac{2}{14} \times 100 = \frac{100}{7}$

For C_2H_4,

$\%$ of C $= \frac{24}{28} \times 100 = \frac{600}{7}$ $\Rightarrow$ $\%$ of H $= \frac{4}{28} \times 100 = \frac{100}{7}$

For CO_2,

$\%$ of C $= \frac{12}{44} \times 100 = \frac{300}{11}$ $\Rightarrow$ $\%$ of O $= \frac{32}{44} \times 100 = \frac{800}{11}$

6. 0.1 mole of carbohydrate with E.F. CH_2O contains 1 g of hydrogen.

$\therefore$ 1 mole of carbohydrate will contain hydrogen

= 10 g = 10 g atoms

In CH_2O, g atomic ratio of C : H : O = 1 : 2 : 1.

$\therefore$ With 10 g atoms of H, g atoms of C combined = 5 and g atoms of O combined = 5. Hence, actual formula (molecular formula) will be $C_5H_{10}O_5$.

7. Water is electrolysed as follows

$$2H_2O \xrightarrow{\text{elec.}} 2H_2 + O_2$$

36 g 1 mol

36 g H_2O yield = 1 mol of oxygen

1 g of H_2O will yield = $\frac{1}{36}$ mol of O_2

$\therefore$ 90 g of water will yield = $\frac{1}{36} \times 90$ mol of O_2

8.* According to stoichiometry of reaction option A, B and D are correct.

DPP No. # 5

1. For I[st] reaction $\frac{\text{Mole of } S_8}{1} = \frac{\text{Mole of } SO_2}{8}$

Mole of SO_2 = $\frac{1 \times 8}{1}$ = 8

For II[nd] reaction $\frac{\text{Mole of } SO_2}{2} = \frac{\text{Mole of } SO_3}{2} = 8$

wt of SO_3 = 8 × 80 = 640 g.

2.
$$N_2\,(g) + 3H_2\,(g) \longrightarrow 2NH_3\,(g)$$

Vol. 3 6 ($\because V \propto n$)

L.R. $\frac{6 \times 2}{3}$ = 4 L.

3. LR $\rightarrow$ HCl, so Mole of H_2 = $\frac{\text{Mole of HCl}}{2} = \frac{0.52}{2} = 0.26$

4.* Moles of C_2H_6 = 3

moles of C_2H_6 mixed = $\frac{60}{30}$ = 2

total mole of C_2H_6 = 5

moles removed = $\frac{2.4 \times 10^{24}}{6 \times 10^{23}}$ = 4

$\therefore$ moles of C_2H_6 left = 1

Now, $C_2H_6 + 7/2\, O_2 \longrightarrow 2CO_2 + 3H_2O$

clearly 3 moles of H_2O or 54 gm H_2O will be formed

volume of H_2O = 54 ml **Ans. 54**

5. Let the mass of $CaCO_3$ = x g

then ,mass of $MgCO_3$ = (3.68 – x) g

moles of $CaCO_3$ = $\frac{x}{100}$

moles of $MgCO_3$ = $\frac{3.68 - x}{84}$

Applying POAC for C-atoms

$$\frac{x}{100} + \frac{3.68 - x}{84} = 0.04$$

x = 2 g

$\therefore$ $n_{CaCO_3} = \frac{2}{100} = 0.02$ and $n_{MgCO_3} = \frac{1.68}{84} = 0.02$

$\therefore$ mole % of $CaCO_3$ = $\frac{0.02}{0.04} \times 100 = 50\%$

$\therefore$ mole % of $MgCO_3$ = $\frac{0.02}{0.04} \times 100 = 50\%$

6.* **(A)** Limiting reagent may neither have the least mass nor the least moles among all the reactants available in a chemical reaction.

(B) : $4Al + 3O_2 \longrightarrow 2Al_2O_3$

	$4Al$	$3O_2$
Mass	m	m
Mole	$\left(\frac{m}{27}\right)$	$\left(\frac{m}{32}\right)$
$\frac{\text{mole}}{\text{st. coeff.}}$	$\frac{m}{27\times4}$ $\left(=\frac{m}{108}\right)$ (LR)	$\frac{m}{32\times3}$ $\left(=\frac{m}{96}\right)$

(C) $Na_2CO_3 \xrightarrow{\Delta}$ Does not decomposes upon heating.

$MgCO_3 \xrightarrow{\Delta} MgO + CO_2$

$\frac{3}{5}\times1$ mole $\qquad$ $\frac{3}{5}\times1$ mole

So, moles of CO_2 produced = $\frac{3}{5} \times 1 = 0.6$ mole.

7. $Mg + \frac{1}{2}O_2 \longrightarrow MgO$, $3Mg + N_2 \longrightarrow Mg_3N_2$

a $\qquad$ a $\qquad$ (5 – a) $\qquad$ $\frac{(5-a)}{3}$

$MgO + 2HCl \longrightarrow MgCl_2 + H_2O$ $\qquad$ $Mg_3N_2 + 8HCl \longrightarrow 2NH_4Cl + 3MgCl_2$

a $\qquad$ a $\qquad$ $\frac{5-a}{3}$ $\qquad$ $\frac{2(5-a)}{3}$ $\qquad$ (5 – a)

$\therefore$ Total moles of $MgCl_2$ = a + (5 – a) = 5 moles

Alternatively :

Apply POAC on Mg

$Mg \longrightarrow MgCl_2$

5 moles $\qquad$ x moles

$1 \times 5 = x \times 1 \Rightarrow x = 5$ moles

DPP No. # 6

1. ON of S in $S_8 = 0$; $\qquad$ ON of S in $S_2F_2 = +1$; $\qquad$ ON of S in $H_2S = -2$.

2. In all these three compounds

H_2SO_4, H_2SO_5, $H_2S_2O_8$, 'S' is in +6 state which is it's maximum oxidation state.

6.* $\overset{(+6)}{Cr}\overset{(-2)}{O_4}{}^{-2} \longrightarrow \overset{(+6)}{Cr_2}\overset{(-2)}{O_7}{}^{-2}$

Oxidation number of both element Cr & O does not change.

7. Those reaction in which oxidation number of any element do not change not a redox reaction.

$AgCl + NH_3 \longrightarrow [Ag(NH_3)_2]Cl$.

8. $\overset{+5}{N}O_3^- \longrightarrow \overset{-3}{N}H_4^+$

$8e^- + 10H^+ + NO_3^- \longrightarrow NH_4^+ + 3H_2O$.

9. $12e^- + As_4O_6 + 12H^+ \longrightarrow As_4 + 6H_2O$

$Sn^{2+} \longrightarrow Sn^{4+} + 2e^-$

$12H^+ + As_4O_6 + 6Sn^{2+} \longrightarrow 6Sn^{4+} + As_4 + 6H_2O$

DPP No. # 7

1. $\overset{(0)}{P_4} + 6NaOH \longrightarrow \overset{(-3)}{PH_3} + 3Na_2\overset{(+1)}{H}PO_2$.

Disproportionation reaction. In this reaction, P element present in intermediate oxidation state and P udergoes both oxidation and reduction.

2. $\overset{(+6)}{Cr}\overset{(-2)}{O_4}{}^{-2} \longrightarrow \overset{(+6)}{Cr_2}\overset{(-2)}{O_7}{}^{-2}$

Oxidation number of both element Cr & O does not change.

3. Those reaction in which oxidation number of any element do not change not a redox reaction.

$AgCl + NH_3 \longrightarrow [Ag(NH_3)_2]Cl$.

4. (a) $K\overset{(+7)}{Mn}O_4 + K\overset{(-1)}{Cl} + H_2SO_4 \longrightarrow \overset{(+2)}{Mn}SO_4 + K_2SO_4 + H_2O + \overset{(0)}{Cl_2}$.

$K\overset{(+7)}{Mn}O_4$ (oxidant) $\longrightarrow \overset{(+2)}{Mn}SO_4$ (reduction half).

$K\overset{(-1)}{Cl}$ (reductant) $\longrightarrow \overset{(0)}{Cl_2}$ (oxidant half).

(b) $\overset{(+2)}{Fe}Cl_2 + H_2\overset{(-1)}{O_2} + HCl \longrightarrow \overset{(+3)}{Fe}Cl_3 + H_2\overset{(-2)}{O}$ (oxidation half)

$\overset{(+2)}{Fe}Cl_2$ (reductant) $\longrightarrow \overset{(+3)}{Fe}Cl_3$ (oxidation half).

$H_2\overset{(-1)}{O_2}$ (oxidant) $\longrightarrow H_2O^{2-}$ (reduction half).

(c) $\overset{(0)}{Cu} + H\overset{(+5)}{N}O_3$ (dil) $\longrightarrow \overset{2+}{Cu}(NO_3)_2 + H_2O + \overset{2+}{N}O$.

$\overset{(0)}{Cu}$ (reductant) $\longrightarrow \overset{2+}{Cu}(NO_3)_2$ (oxidation half).

$H\overset{+5}{N}O_3$ (oxidant) $\longrightarrow \overset{+2}{N}O$ (reduction half).

(d) $Na_2H\overset{+3}{As}O_3 + K\overset{+5}{Br}O_3 + HCl \longrightarrow NaCl + K\overset{-1}{Br} + H_3\overset{+5}{As}O_4$

$Na_2H\overset{+3}{As}O_3$ (reductant) $\longrightarrow H_3\overset{+5}{As}O_4$ (oxidation half).

$K\overset{+5}{Br}O_3$ (oxidant) $\longrightarrow K\overset{-1}{Br}$.

(e) $\overset{0}{I_2} + Na_2\overset{+2}{S_2}O_3 \longrightarrow Na_2\overset{+2.5}{S_4}O_6 + Na\overset{-1}{I}$.

$\overset{0}{I_2}$ (oxidant) $\longrightarrow Na\overset{-1}{I}$ (reductant half).

$Na_2\overset{+2}{S_2}O_3$ (reductant) $\longrightarrow Na_2\overset{+2.5}{S_4}O_6$ (oxidant half).

5.

(i) $K_2Cr_2O_7 + H_2O_2 + H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + H_2O + O_2$

Mass Balance and Charge Balance :

Remove the spectator ion — $2K^+$, SO_4^{2-}.

$Cr_2O_7^{2-} + H_2O_2 + 2H^+ \longrightarrow 2Cr^{3+} + H_2O + O_2$.

Oxidation Half :

$H_2O_2 \longrightarrow O_2 + 2H^+ + 2e^-$.

Reduction Half :

$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$.

Total loss electrons = total gain electrons.

$3H_2O_2 + Cr_2O_7^{2-} + 8H^+ \longrightarrow 2Cr^{3+} + 7H_2O + 3O_2$.

Add the spectator ion — $2K^+$, SO_4^{2-}.

$3H_2O_2 + K_2Cr_2O_7 + 4H_2SO_4 \longrightarrow Cr_2(SO_4)_3 + K_2SO_4 + 7H_2O + 3O_2$.

(ii) $Zn + NaNO_3 + NaOH \longrightarrow Na_2ZnO_2 + H_2O + NH_3$

$4Zn + NaNO_3 + 7NaOH = 4Na_2ZnO_2 + 2H_2O + NH_3$.

Mass Balance and Charge Balance :

Remove the spectator ion — Na^+

$Zn + NO_3^- + OH^- \longrightarrow ZnO_2^{2-} + H_2O + NH_3$.

Oxidation Half :

$Zn + 4OH^- \longrightarrow ZnO_2^{2-} + 2H_2O + 2e^-$.

Reduction Half :

$NO_3^- + 6H_2O + 8e^- \longrightarrow NH_3 + 9OH^-$.

Total loss electrons = total gain electrons.

$4Zn + 7OH^- + NO_3^- \longrightarrow 4ZnO_2^{2-} + 2H_2O + NH_3$.

Add the spectator ion — Na^+ .

$4Zn + 7NaOH + NaNO_3 \longrightarrow 4Na_2ZnO_2 + 2H_2O + NH_3$.

(iii) $Al \longrightarrow [Al(OH)_4]^- + H_2$ (basic)

$2OH^- + 6H_2O + 2Al \longrightarrow 3H_2 + 2(Al(OH)_4]^-$.

Mass Balance and Charge Balance :

Oxidation Half :

$Al + 4OH^- \longrightarrow [Al(OH)_4]^- + 3e^-$.

Reduction Half :

$2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$.

Total loss electrons = total gain electrons.

$2Al + 2OH^- + 6H_2O \longrightarrow 2[Al(OH)_4]^- + 3H_2$.

Note : If H_2 or O_2 formed in reaction. It is means H_2 or O_2 produced from H_2O molecule.

(iv) $Cu_3P + Cr_2O_7^{2-} \longrightarrow Cu^{2+} + H_3PO_4 + Cr^{3+} + H_2O$

$Cu_3P + Cr_2O_7^{2-} \longrightarrow Cu^{2+} + H_3PO_4 + Cr^{3+} + H_2O$

$6Cu_3P + 11Cr_2O_7^{-2} + 124H^+ \longrightarrow 18Cu^{+2} + 6H_3PO_4 + 22Cr^{+3} + 53H_2O$.

Mass Balance and Charge Balance :

Oxidation Half :

$Cu_3P + 4H_2O \longrightarrow 3Cu^{2+} + H_3PO_4 + 5H^+ + 11e^-$.

Reduction Half :

$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$.

Total loss electrons = total gain electrons.

$6Cu_3P + 11Cr_2O_7^{2-} + 124H^+ \longrightarrow 18Cu^{2+} + 6H_3PO_4 + 22Cr^{3+} + 53H_2O$.

(v) $ClO_3^- + Fe^{2+} + H^+ \longrightarrow Cl^- + Fe^{3+} + H_2O$

$6H^+ + ClO_3^- + 6Fe^{2+} \longrightarrow Cl^- + 6Fe^{3+} + 3H_2O$.

Mass Balance and Charge Balance :

Oxidation Half :

$Fe^{2+} \longrightarrow Fe^{3+} + 1e^-$.

Reduction Half :

$ClO_3^- + 6H^+ + 6e^- \longrightarrow Cl^- + 3H_2O$.

Total loss electrons = total gain electrons.

$6Fe^{2+} + 6H^+ \longrightarrow 6Fe^{3+} + Cl^- + 3H_2O$.

(vi) $N_2O_4 + BrO_3^- \longrightarrow NO_3^- + Br^-$ (in acidic medium)

$N_2O_4 + BrO_3^- \longrightarrow NO_3^- + Br^-$ (अम्लीय माध्यम में)

$3N_2O_4 + BrO_3^- + 3H_2O \longrightarrow 6NO_3^- + Br^- + 6H^+$.

Mass Balance and Charge Balance :

Oxidation Half :

$N_2O_4 + 2H_2O \longrightarrow 2NO_3^- + 4H^+ + 2e^-$.

Reduction Half :

$BrO_3^- + 6H^+ + 6e^- \longrightarrow Br^- + 3H_2O$.

Total loss electrons = total gain electrons.

$3N_2O_4 + 3H_2O + BrO_3^- \longrightarrow 6NO_3^- + 6H^+ + Br^-$.

(vii) $S_2O_3^{2-} + Sb_2O_5 \longrightarrow SbO + H_2SO_3$

$3S_2O_3^{2-} + 2Sb_2O_5 + 6H^+ + 3H_2O \longrightarrow 4SbO + 6H_2SO_3$

Mass Balance and Charge Balance :

Oxidation Half :

$S_2O_3^{2-} + 3H_2O \longrightarrow 2H_2SO_3 + 2H^+ + 4e^-$.

Reduction Half :

$Sb_2O_5 + 6H^+ + 6e^- \longrightarrow 2SbO + 3H_2O$.

Total loss electrons = total gain electrons.

$6S_2O_3^{2-} + 4Sb_2O_5 + 6H_2O + 12H^+ \longrightarrow 8SbO + 12H_2S_2O_3$.

(viii) $Cr_2O_7^{2-} + I^- + H^+ \longrightarrow Cr^{3+} + I_2 + H_2O$

$Cr_2O_7^{2-} + 6I^- + 14H^+ \longrightarrow 2Cr^{3+} + 3I_2 + 7H_2O$.

Mass Balance and Charge Balance :

Oxidation Half :

$2I^- \longrightarrow I_2 + 2e^-$.

Reduction Half :

$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$.

Total loss electrons = total gain electrons.

$6I^- + Cr_2O_7^{2-} + 14H^+ \longrightarrow 3I_2 + 2Cr^{3+} + 7H_2O$.

(ix) $IO_4^- + I^- + H^+ \longrightarrow I_2 + H_2O$

$IO_4^- + 7I^- + 8H^+ \longrightarrow 4I_2 + 4H_2O$.

Mass Balance and Charge Balance :

Oxidation Half :

$2I^- \longrightarrow I_2 + 2e^-$.

Reduction Half :

$2IO_4^- + 16H^+ + 14e^- \longrightarrow I_2 + 8H_2O$.

Total loss electrons = total gain electrons.

$14I^- + 2IO_4^- + 16H^+ \longrightarrow 8I_2 + 8H_2O$.

DPP No. # 8

1. $M = \dfrac{n_{solute}}{V_{solution}}$

$\dfrac{0.8}{1000} = \dfrac{100 \times 10^{-3}}{\text{vol. of solution}}$

vol. of solution = 125 ml

(Here n_{solute} = mole of solute, $V_{solution}$ = vol. of solution).

2. Volume = $\dfrac{\text{No. of moles}}{\text{Molarity}} = \dfrac{36.5/36.5}{1} = 1$

3. $M = \dfrac{\dfrac{2.8}{56}}{100} \times 1000 = \dfrac{1}{2}$ M

4. $M_1V_1 = M_2V_2$

$\dfrac{49}{98} \times 1.18 \times 10 \times 75 = M_2 \times 590$

5*. (A) Molarity of second solution is = $\dfrac{10 \times d \times x}{M}$ = 1 M

(B) Volume = 100 + 100 = 200 ml

(D) Mass of H_2SO_4 = $\dfrac{200 \times 1}{1000} \times 98$ = 19.6 gm.

6*. Molarity of cation = $\frac{M_1V_1 + M_2V_2}{V_1 + V_2} = \frac{0.2 \times 100 + 0.1 \times 400}{500} = \frac{0.6}{5} = 0.12$ M

Molarity of Cl^- = $\frac{3(0.2)100 + 0.1 \times 400}{500} = \frac{0.6 + 0.4}{5} = 0.2$ M

7. mass of NaCl in Ist solution = 120 × 0.4 = 48 g
mass of NaCl in IInd solution = 200 × 0.15 = 30 g
Total mass of NaCl = 30 + 48 = 78 g
Total mass of solution = 120 + 200 = 320 g

mass % of NaCl = $\frac{78}{320} \times 100$ = 24.375 %

8. mass of solvent = 320 – 78 = 242 g.

molality = $\frac{\frac{78}{58.5}}{242} \times 1000 = 5.5$ m

9. Mole fraction of solute = $\frac{\frac{78}{58.5}}{\frac{78}{58.5} + \frac{242}{18}} = 0.09$

10. Molarity = $\frac{\frac{78}{58.5}}{\frac{320}{1.6}} \times 1000 = 6.66$ M

DPP No. # 9

1. 1.66×10^{-24} g $\longrightarrow$ 1 amu

$\therefore$ 6×10^{-23} g $\longrightarrow \frac{6 \times 10^{-23} \times 1}{1.66 \times 10^{-24}}$ = 36 amu

$\therefore$ Atomic mass of X = 36 amu

$\therefore$ Moles of X = $\frac{144}{36}$ = 4

2. Molecular wt. of gas = 3a

no. of moles of gas = $\frac{w}{3a}$.

3. Total number of protons = $\frac{11.2}{22.4} \times 18 \times N_A = 9N_A$.

4. 1×10^3 kg/m^3 = 1 g/mL. [Since, 1m^3 = 10^6 cm^3 = 10^6 mL].
= 1 gm/cc
6.022×10^{23} H_2O molecule weigh ———— 18 g

1 H_2O molecule weigh ———— $\frac{18}{6.022 \times 10^{23}}$ g = 3×10^{-23} g

d = $\frac{\text{mass}}{\text{volume}}$, So, volume = $\frac{3 \times 10^{-23}\,g}{1(g/mL)}$ = 3×10^{-23} mL.

5. molecular weight of air at STP = 0.001293 g mL^{-1} × 22400 mL = 28.7 g

so V.D. = $\frac{28.7}{2} \approx 14.3$

6.

(i) False

According to law of definite proportions, two elements always combine in the same ratio by mass, only if they form the same compound.

(ii) True Refer notes.

(iii) True

$\frac{2.8}{22.4} \times M_{(g)} = 5.5$ g.

So, $M_{(g)} = 44$. (CO_2 or N_2O).

(iv) True

Total number of atoms = $\frac{5}{60} \times N_A \times 8 = \frac{2N_A}{3}$ (in both cases).

7. wt. of compound = 2.89 g

wt. of osmium = 2.16 g

wt. of oxygen = 2.89 – 2.16 = 0.73 g

Mole of osmium = $\frac{2.16}{190}$ = 0.01136 and mole of oxygen = $\frac{0.73}{16}$ = 0.04562

so relative mole of osmium = $\frac{0.01136}{0.01136} = 1$

relative mole of oxygen = $\frac{0.045625}{0.01136} = 4$

so, empirical formula = OsO_4 .

8. $N_2O_5(s) \xrightarrow{\Delta} 2NO_2(s) + \frac{1}{2}O_2$ (Balanced reaction)

$\frac{\text{Mole of } O_2}{1/2} = \frac{\text{Mole of } NO_2}{2}$

$\frac{1.6}{32} \times 2 \times 2 = \text{Mole of } NO_2 = 0.2$

wt of NO_2 = 0.2 × 46 = 9.2 g.

9. (A) $PCl_5\,(g) \xrightarrow{\Delta} PCl_3\,(g) + Cl_2(g)$

1 mole   1 mole   1 mole

2 mole molecule $\equiv 2N_A$ molecule

$\equiv 22.4 \times 2 = 44.8$ L at STP

(B) $CaCO_3\,(s) \xrightarrow{\Delta} CaO(s) + CO_2\,(g)$

1 mole   0   0

0   1   1

2 mole molecule $\equiv 2N_A$ molecule

1 mole gas of $CO_2 \equiv 22.4$ L at STP

(C) $2HCl\,(g) \xrightarrow{\Delta} H_2\,(g) + Cl_2\,(g)$

1 mole   0   0

$\frac{1}{2}$ mole $\frac{1}{2}$ mole

1 mole $\equiv$ 22.4L at STP

(D) $NH_4COONH_2\,(s) \xrightarrow{\Delta} 2NH_3(g) + CO_2(g)$

1 mole   0   0

0   2   1

Total mole = 3

volume = 3 × 22.4 L = 67.2 L at STP

10. $2Fe(s) + 3H_2SO_4(aq) \longrightarrow Fe_2(SO_4)_3(aq) + 3H_2(g)$

Moles of $H_2 = \frac{6}{2} = 3$ mole

Moles of Fe $= \frac{3}{3} \times 2 = 2$

mass of Fe $= 2 \times 56 = 112$ g.

मिश्र धातु में Fe का प्रतिशत $= \frac{112}{140} \times 100 = 80\%$.

11. Moles of I_2 produced $= \frac{381 \times 10^3}{254} = \frac{3 \times 10^3}{2}$

for this much moles of I_2, moles of $AgNO_3$ required $= \frac{3}{2} \times 2 \times 10^3$

$\therefore$ mass of $AgNO_3$ required $= 3 \times 170 \times 10^3 = 510$ kg

12. moles of NaI $= \frac{150}{150} \times 10^3 = 10^3$

moles of $AgNO_3 = \frac{85}{170} \times 10^3 = 5 \times 10^2$

clearly $AgNO_3$ is limiting reagent

$\therefore$ moles of I_2 formed $= \frac{\text{moles of } AgNO_3}{2} = \frac{5 \times 10^2}{2} = 250$

13. Moles of Ag recovered $= \frac{324}{108} = 3$

Hence moles of NaI required to produce this Ag = 3

$\therefore$ mass of NaI $= 3 \times 150 = 450$ g

DPP No. # 10

1. Volume of cyllnder $= \pi r^2 h$

$= \frac{22}{7} \times (2.1)^2 \times 10$

$= 138.6\ cm^3$

Mass of cylinder $= V \times d = 138.6 \times \frac{100}{21} = 660$ g

Mass of cobalt $= \frac{29.5}{100} \times 600 = 194.7$ g.

Moles of cobalt $= \frac{194.7}{59} = 3.3$

$\therefore$ Number of atoms of cobalt $= 3.3\ N_A$

2. Balance equation is $Re_2O_7 + 17CO \longrightarrow Re_2(CO)_{10} + 7CO_2$

3. 100 g haemoglobin has = 0.25 g Fe

89600 g --------- " -------- " -------- $= \frac{0.25 \times 89600}{100} = 224$ g Fe

∴ 1 mol of Haemoglobin has = $\frac{224}{56}$ mol Fe atoms = 4 mol Fe.

Now mole of haemoglobin given = $\frac{4480g}{89600g/mol}$ = 0.05 mol

mol. wt of $K_4[Fe(CN)_6]$ = 368 g/mol

Applying POAC for Fe atoms – mole of Haemoglobin × 4 = mole of $K_4[Fe(CN)_6]$ × 1

$0.05 \times 4 = \frac{\text{weight of } K_4[Fe(CN)_6]}{368g/mol} \times 1$

weight of $K_4[Fe(CN)_6]$ = 0.05 × 4 × 368 g = 73.6 g

4. $4NH_3\,(g) + 5O_2\,(g) \longrightarrow 4\,NO + 6\,H_2O$

mole (मोल) 5×10^3 10^4 mole (मोल) 5×10^3

$2NO(g) + O_2\,(g) \longrightarrow 2NO_2\,(g)$

5×10^3 5×10^3

$3NO_2 + H_2O\,(\ell) \longrightarrow 2HNO_3\,(g) + NO(g)$

5×10^3 $\frac{2}{3} \times 5 \times 10^3$

molarity (मोलरता) = $\frac{2}{3} \times \frac{5 \times 10^3}{500}$ = 6.66 M.

5. Moles of water reacted = $\frac{180 \times 10^3}{18} = 10^4$

∴ moles of NO_2 required = 30×10^3 = mole of NH_3 required

∴ volume of air at STP = $\frac{30 \times 10^3 \times 22.4}{0.2} = 3.36 \times 10^6$ L.

6. Moles of NH_3 = $\frac{170}{17} = 10 \times 10^3$

∴ moles of H_2O formed = $\frac{6}{4} \times 10 \times 10^3$

∴ mass of H_2O formed = $\frac{6}{4} \times 10 \times 10^3 \times 18$

∴ volume of H_2O formed = 15 × 18 L = 270 L.

7. Molarity (मोलरता)= 0.025 = $\frac{\text{Mole}}{50} \times 1000$

Mole(मोल) = $\frac{50 \times 0.025}{1000}$

wt. of $Na_2Cr_2O_7$(का भार) = $\frac{50 \times 0.025}{1000} \times 270$ = 0.3375 gm.

8. $2HNO_3(aq) + Na_2CO_3(aq) \longrightarrow 2NaNO_3(aq) + H_2O(\ell) + CO_2(g)$

$\frac{\text{Millmole of } HNO_3}{2} = \frac{\text{Millmole of } Na_2CO_3}{1}$

$0.25 \times V_{ml} = 2 \times 50 \times 0.15$

$V_{ml} = \frac{2 \times 50 \times 0.15}{0.25}$ = 60 mL.

9. $N_1V_1 + N_2V_2 = N_TV_T$

$2.5\ V_1 + 0.4\ V_2 = 3 \times 1$

$2.5\ V_1 + 0.4\ (3 - V_1) = 3$

$2.5\ V_1 + 1.2 - 0.4\ V_1 = 3$

$2.1\ V_1 = 1.8$

$V_1 = \frac{1.8}{2.1} = \frac{6}{7}$

$V_2 = 3 - \frac{6}{7} = \frac{15}{7}$

$\frac{V_1}{V_2} = \frac{6}{7} \times \frac{7}{15} = 2 : 5$

10. $M = \frac{86 \times 1.787}{98} \times 10 = 15.68\ M$

$M_1V_1 = M_2V_2$

$15.68 \times V_1 = 0.2 \times 1000$

$V_1 = 12.75$ ml.

11. For neutralisation

m moles of H_2SO_4 = 2 × m moles of NaOH

$\frac{98}{98} \times 1.84 \times 10 \times 10 = 2 \times 2.5 \times V$

V = 147.2 ml

12. (i) % (w/w) = $\frac{10}{90+10} \times 100 = 10\%$

(ii) % (w/v) = $\frac{10}{\frac{(90+10)}{1.2}} \times 100 = 12\%$

(iii) Mole fraction of NaOH = $\frac{\frac{10}{40}}{\frac{10}{40}+\frac{90}{18}} = \frac{1}{21}$

(iv) Molarity = $\frac{\frac{10}{40}}{\frac{(90+10)}{1.2}} \times 1000 = 3\ M$

(v) Molality = $\frac{\frac{10}{40}}{90} \times 1000 = 2.78$ M.

13. 5.85% (w/v) $\rightarrow$ 5.85 g NaCl / 100 ml

NaCl

So, Mole/ ml = $\frac{5.85}{58.5}$ = 0.1/100 ml

Cl^- / ml = $\frac{0.1 \times 1}{100}$

5.55 % (w/v) $\rightarrow$ 5.55 g $CaCl_2$ / 100 ml

$CaCl_2$

So, Mole/ ml = $\frac{5.55}{111}$ = 0.05 ml

Cl^- / ml = $\frac{0.05 \times 2}{100} = \frac{0.1}{100}$

14. (A) 1 M glucose solution $\equiv$ 1mole of solute/L

$\equiv$ 180 g solute/L

$\equiv$ (180 g/1000)× 100 = 18% (w/v)

(B) 3 M urea solution (NH_2CoNH_2) $\equiv$ 3 mole of solute/L

$\equiv$ (60 × 3)g of solute/L

$\equiv$ (180 g/1000)× 100 = 18% (w/v)

(C) 3 M CH_3COOH solution $\equiv$ 3 mole of solute/L

$\equiv$ (3 × 60)g of solute/L

$\equiv$ (180 g/1000)× 100 = 18% (w/v)

(D) 1 M H_2SO_4 solution $\equiv$ 1 mole of solute/L

$\equiv$ 98g of solute/L

$$\equiv \frac{98}{1000} \times 100 = 9.8\ \%\ (w/v)$$

DPP No. # 11

1. Mass of a neutron = 1.675×10^{-24} g mass of a proton $=1.672 \times 10^{-24}$

2. Carbon is ${}_{6}C^{12}$ and silicon is ${}_{14}Si^{28}$.

3. No change by doubling mass of electrons, however by reducing mass of neutron to half total atomic mass becomes 6 + 3 instead of 6 + 6. Thus reduced by 25%.

4. ${}_{Z}X^{A}$, A = N + P

6. NO_3^- = 7 + 8 × 3 + 1 = 32

7. $$\text{fraction} = \frac{\text{vol. of nucleus}}{\text{vol. of atom}} = \frac{\frac{4}{3}\pi (10^{-13})^3}{\frac{4}{3}\pi (10^{-8})^3} = 10^{-15}.$$

8._ 2 (p + n) + 3p = 140 $\therefore$ 7x = 140 $\therefore$ x = 20
$\therefore$ p = e = n = 20 $\therefore$ Total number of nucleons = n + p = 40
$\therefore$ Element = Calcium

DPP No. # 12

1. $PE = -\frac{KZe^2}{r}$.

2.* Isotopes have same atomic number but different mass number.

3. Isobars have same mass number.

4.* Isotones have same number of neutrons.

5. Each has 10 electrons.

In CH_3^+ = 6 + 3 – 1 = 8 e

In H_3O^+ = 3 + 8 – 1 = 10 e

6.* Isoelectronic specis have same number of electrons.

7. $\frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3}$

$\Rightarrow \quad \frac{1}{2} = \left(\frac{A_1}{A_2}\right)^{1/3}$

$\Rightarrow \quad \frac{A_1}{A_2} = \frac{1}{8}$

ratio of atomic mass number.

8. $r_0 = \frac{4KZe^2}{M_0 v_0^2}$

$\Rightarrow \quad 2r_0 = \frac{4KZe^2}{M_0 v'^2}$

$\Rightarrow \quad r_0 v_0^2 = 2 r_0 v'^2$

$\Rightarrow \quad v' = \frac{v_0}{\sqrt{2}}$

9. Given $R = \frac{4KZe^2}{M_0 v_0^2}$

$\therefore \quad R' = \frac{4KZe^2}{M_0\left(\frac{v_0}{2}\right)^2} = 4R$

$\therefore \quad \%\ error = \frac{4R - R}{R} \times 100 = 300\ \%.$

10. Use $R = \frac{4Kze^2}{m_\alpha v_\alpha{}^2}$.

11. Definition

12. In one second, wave can travel distance = $\nu \times \lambda$ = 10 × 2.5 m = 25 m

In 40 seconds, it will travel = 25 × 40 m = **1000 m**.

DPP No. # 13

1. Maximum wave length will correspond to minimum frequency as $\lambda \propto \frac{1}{\nu}$, and that is given for red light in the spectrum.

$\lambda_{max.} = \frac{C}{\nu_{min.}} = \frac{3\times10^8 m/s}{4\times10^{14} m} = 750 \times 10^{-9}$ m.

$\Rightarrow$ 7500 Å.

2. $\lambda = \frac{C}{\nu} = \frac{3\times10^8\ m/s}{1200\times10^3\ s^{-1}}$ = 250 m = 0.25 km.

$\bar{\nu}$ = Wave no. = $\frac{1}{\lambda} = \frac{1\ km}{0.25\ km}$ = 4 wave per km.

3. **(a)** $R = R_0A^{1/3}$ $\therefore$ $\frac{4}{3}\pi R^3 = \frac{4}{3}\pi R_0^3 A$

$\therefore$ $V \propto A$ $\therefore$ n =1

(b) $\bar{\nu} = \frac{\nu}{c} = \frac{7.5\times10^{14}}{3\times10^{8}} = 2.5 \times 10^6\ m^{-1}$

4. $\frac{E_1}{E_2} = \frac{\lambda_2}{\lambda_1} = \frac{6000}{3000} = 2.$

5. Use $E = \frac{nhc}{\lambda}$, Here n is number of protons.

6. Photon absorb = $\frac{hc}{300\times10^{-9}} = \frac{6.6\times10^{-34}\times3\times10^{8}}{300\times10^{-9}} = 6.6 \times 10^{-19}$ Joule

One re-emitted photon energy = $\frac{hc}{500\times10^{-9}} = 3.96 \times 10^{-19}$ Joule

other photon have energy = $6.6 \times 10^{-19} - 3.93 \times 10^{-19} = 2.65 \times 10^{-19}$ Joule.

7. Use $E = \frac{nhc}{\lambda}$

$60 \times 60 = \frac{n\times6.64\times10^{-34}\times3\times10^{8}}{620\times10^{-9}}$

$n = 1.125 \times 10^{22}$

8. Energy of one photon = $\frac{12400}{6200} = 2\ eV = 2 \times 96 = 192\ KJ\ mol^{-1}$

$\therefore$ % of energy of photon converted to K.E. of A atoms $= \frac{192-144}{192} \times 100 = \frac{48}{192} \times 100 = 25\%$

9. $E_{emitted} = \frac{50}{100} \times E_{absorbed}$

No. of emitted photons × Energy of emitted photon = $\frac{50}{100}$ × No. of absorbed photon × Energy of absorbed photon.

$\therefore$ $5x \times \frac{12400}{5000} = \frac{50}{100} \times 8x \times \frac{12400}{\lambda(Å)}$.

$\lambda(Å) = 4000$ Å

DPP No. # 14

1. For I experiment, $h\nu_1 = W + KE_{max1}$ .... (1)

For II experiment, $h\nu_2 = W + KE_{max2}$ .... (2)

here, $\nu_2 = 2\nu_1$ and $KE_{max2} = 3\ KE_{max1}$

$\therefore$ $2h\nu_1 = W + 3\ KE_{max1}$ .... (3)

From (1) and (3) : $h\nu_1 = 2KE_{max1}$ or $h\left(\frac{\nu_2}{2}\right) = 2\left(\frac{KE_{max\,2}}{3}\right)$

$\therefore$ % of incident energy converted into max KE in II experiment

$= \frac{KE_{max\,2}}{h\nu_2} \times 100 = \frac{3}{4} \times 100 = 75\%.$

2. The maximum KE of potoelectron is corresponding to maximum stopping = 18.6 eV

$\therefore \quad E_{incident} = W + KE_{max}$

$\frac{12400}{400}$ eV = W + 18.6 eV

W = 12.4 eV

$\therefore \quad \lambda_0 = \frac{12400}{12.4}$ Å = 1000 Å

3. Only for Single electron species.

4. $\frac{1}{\lambda_1} = RZ^2\left[\frac{1}{n_C} - \frac{1}{n_A}\right]$ .... (1)

$\frac{1}{\lambda_1} = RZ^2\left[\frac{1}{n_C} - \frac{1}{n_B}\right]$ .... (ii)

$\frac{1}{\lambda_3} = RZ^2\left[\frac{1}{n_B} - \frac{1}{n_A}\right]$

$\frac{1}{\lambda_3} = \frac{1}{\lambda_1} - \frac{1}{\lambda_2} = \frac{\lambda_2 - \lambda_1}{\lambda_1\lambda_2} = \frac{1}{3000}$

λ_3 = 3000 Å.

5. For $\quad r = 0.52$ Å $\times \frac{12}{1}$

For $\quad L^{2+}\ r_1 = 0.529 \times \frac{12}{3}$

$\frac{r}{r_1} = 3 \quad \Rightarrow \quad r_1 = \frac{r}{3}$

6. $r_4 - r_3 = 7 \times r_1$

7. Use $V_n = 2.185 \times 10^8 \left(\frac{z}{n}\right)$ cm/sec.

8. $PE = -\frac{KZe^2}{r}$.

9. $\frac{nh}{2\pi} = \frac{2h}{\pi} \quad \Rightarrow n = 4,$

P.E. = 2(T.E.) = $2\left(-13.6 \times \frac{2^2}{4^2}\right) = -6.8$ eV.

10. (A) $E_n^{-y} \propto r_n / Z$

$\left(\frac{Z^2}{n^2} \times 13.6 \text{ eV}\right)^{-y} \propto \frac{1}{z}\left(\frac{n^2}{Z} \times 0.529 \text{ Å}\right)$

y = 1

(B) $\ell_n \propto n^x \Rightarrow \frac{nh}{2\pi} \propto n^x \Rightarrow \quad x = 1$

(C) Potential energy = 2 (total energy)

(D) $T_n \propto \frac{n^3}{z^2} \quad \Rightarrow \quad t = -2 \quad \Rightarrow \quad m = -3.$

DPP No. # 15

1. $E_{I\ Photon} + E_{II\ Photon} = E_{single\ Photon}$

$hc\bar{v}_1 + hc\bar{v}_2 = \frac{hc}{\lambda}$

$\therefore \lambda = \frac{1}{\bar{v}_1 + \bar{v}_2} = \frac{1}{5.25 \times 10^8 + 7.25 \times 10^8} = \frac{1}{12.5 \times 10^8} = 8 \times 10^{-10}$ m = 8 Å

2. Use : $E_1 - E_2$ / $E_2 - E_3$

3. $\frac{r_1}{r_2} = \frac{1}{4}$ ⇒ $\frac{r_3}{r_4} = \frac{9}{16}$ ⇒ $\frac{r_2}{r_4} = \frac{1}{4}$

So corresponding energy of ratio $\frac{1}{4}$ is $E_2 - E_1$ and $E_4 - E_2$.

4. $\frac{R_1}{R_2} = \frac{4}{9} = \frac{n_1^2}{n_2^2}$, hence $\frac{n_1}{n_2} = \frac{2}{3}$ .So, $\frac{f_1}{f_2} = \frac{n_2^3}{n_1^3} = \frac{27}{8}$.

5. Electrostatic force of attraction F $\propto \frac{Z^3}{n^4}$

$\therefore \frac{(F_{n=3})_{He^+}}{(F_{n=2})_{Li^{2+}}} = \frac{2^3/3^4}{3^3/2^4} = \left(\frac{2}{3}\right)^7 = \left(\frac{3}{2}\right)^{-7}$ $\therefore$ x = –7 $F = \frac{KZe^2}{R^2}$

6. Order of energy → Violet > Blue > yellow > red
Order of energy → $E_{2\to1} > E_{5\to2} > E_{6\to3} > E_{4\to3}$
$\therefore$ Violet (2 → 1), Blue (5 → 2), yellow (6 → 3), Red (4 → 3)

7.* BE for (n = 3) = 1.51 Z^2 = 12 eV (given)
$\therefore Z^2 = 12/1.51$
I Excitation potential = 10.2 Z^2 = 10.2 × (12/1.51) = 81V
II Excitation potential = 12.09 Z^2 = 12.09 × (12/1.51) = 96eV
Ionisation potential = 13.6 Z^2 = 13.6 (12/1.51) = 108 V
BE of (n = 2) = 3.4 Z^2 = 3.4 x (12/1.51) = 27eV

8. Let the given transition for both the species is $n_1 \to n_2$

Then $X_{cm}^{-1} = R \times 2^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$ For He^+ ..... (i)

and (wave no.) $Be^{3+} = R \times 4^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$ For Be^{3+} ..... (ii)

From eq. (i) and (ii) (wave no.) Be^{3+} = 4x cm^{-1}.

DPP No. # 16

1. $\lambda = \frac{h}{p} = \frac{h}{mv} = \frac{h}{v^2}$

but $v^2 = \frac{2KE}{m}$ therefore $\lambda = \frac{hm}{2KE}$

2. Use $C = \upsilon\lambda$ ⇒ $\bar{u} = \frac{1}{\lambda}$

3. $K.E._{proton}$ = 1 + (1) (3) = 4 eV $\therefore \lambda_p = \frac{h}{\sqrt{2m_p(KE)_p}}$ & $KE_{\alpha\text{-particle}}$ = 20 – (2) (2) = 16 eV $\therefore \lambda_\alpha = \frac{h}{\sqrt{2m_\alpha(KE)_\alpha}}$

$\therefore \frac{\lambda_p}{\lambda_\alpha} = \sqrt{\frac{m_\alpha(KE)_\alpha}{m_p(KE)_p}} = \sqrt{\frac{4 \times 16}{1 \times 4}} = \frac{4}{1}$

4.* $4.25 = (W_0)_A + (K.E.)_A$
$4.70 = (W_0)_B + (K.E.)_A - 1.5$
So $(W_0)_B - (W_0)_A = 0.45 + 1.5$
$= 1.95$
Now, $\lambda_B = 2\lambda_A$

$$\frac{h}{\sqrt{2m(K.E)_B}} = \frac{2h}{\sqrt{2m(K.E)_A}}$$

So $(K.E)_A = 4\,(K.E)_B$
$4.25 - (W_0)_A = 4\,[\,4.7 - (W_0)_B]$
$4(W_0)_B - (W_0)_A = 14.55$
So $(W_0)_B = 4.2\text{eV}$
So $(W_0)_A = 2.25$ eV
$(K.E.)_A = 2\text{eV}$
$(K.E)_B = 0.5\text{eV}$

5. number of revolutions per second

$$= \frac{V}{2\pi r} = \frac{2.18\times10^6\left(\frac{Z}{n}\right)}{2\times3.14\times0.529\times\left(\frac{n^2}{Z}\right)\times10^{-10}} = \frac{2.18\times10^6\left(\frac{1}{2}\right)}{2\times3.14\times0.529\times\left(\frac{2^2}{1}\right)\times10^{-10}}$$

Number of revolution in 10^{-8} second $= \dfrac{2.18\times10^6\left(\frac{1}{2}\right)}{2\times3.14\times0.529\times\left(\frac{2^2}{1}\right)\times10^{-10}} \times 10^{-8} = 8.2 \times 10^6$.

6. The ionisation energy of He^+ is 19.6×10^{-18} J.
∴ Energy of the first orbit of He^+ (Z = 2) = 19.6×10^{-18} J.

∴ Energy of the first orbit of H^+ (Z = 1) = $\dfrac{19.6\times10^{-18}}{4}$ J

∴ Energy of the first orbit of Li^{2+} (Z = 3) = $\dfrac{19.6\times10^{-18}}{4}\times 9 = 4.41 \times 10^{-17}$ J.

7. **(A)** Transition n ® 6 to n ® ∞ For Li^{2+} sample
(B) Transition $n \to 1$ to $n \to 2$ For H-atom sample
(C) Transition $n \to 1$ to $n \to 3$ For He^+ sample
(D) Transition $n \to 1$ to $n \to \infty$ For H-atom sample

8. $\Delta E = \dfrac{12400}{1026} = 12.09$ eV.
So, $\Delta E = E_3 - E_1$.
Hence, induced radiations will be correspond to following energy transition
$E_3 \to E_1$, $E_3 \to E_2$ and $E_2 \to E_1$.

9. $-13.6\,\dfrac{Z^2}{n^2} = 4R = 4 \times 2.2 \times 10^{-18}$ J.

$Z^2 = \dfrac{4\times2.2\times10^{-18}\,J}{13.6\times1.6\times10^{-19}} = 4$; $Z = 2$.

$r = 0.529\,\dfrac{n^2}{Z} \times 10^{-10}$ m. $r = 0.529 \times 10^{-10} \times \dfrac{1}{2} = 2.645 \times 10^{-11}$ m.

DPP No. # 17

1. $Z = 2 \quad n_1 = 2 \quad n_2 = \infty$

$$\bar{\nu} = R(2)^2 \left(\frac{1}{2^2} - \frac{1}{\infty^2}\right) = R$$

2. $h\nu_1 = 13.6$ eV

$h\nu_2 = 13.6 \times 2^2$ eV

$h\nu_3 = 13.6 \times 2^2 \times \frac{3}{4}$ eV

$\Rightarrow h\nu_2 = h\nu_1 + h\nu_3$

$\Rightarrow \nu_2 = \nu_1 + \nu_3$

3. (i) Series limit of Lyman series $\Rightarrow n = \infty$ to $n = 1$.

(ii) Series limit of Balmer series $\Rightarrow n = \infty$ to $n = 2$.

$E_{n = 2 \text{ to } n = 1} = E_{n = \infty \text{ to } n = 1} - E_{n = \infty \text{ to } n = 2}$

$$\frac{hC}{\lambda} = \frac{hC}{\lambda_1} - \frac{hC}{\lambda_2}$$

$$\frac{1}{\lambda} = \frac{1}{\lambda_1} - \frac{1}{\lambda_2} \qquad \Rightarrow \qquad \lambda = \frac{\lambda_1\lambda_2}{\lambda_2 - \lambda_1}$$

4. Both the photons will not be absorbed by the electron of H-atom as the energy levels are quantised.

Sum of energies of both photons = $\frac{12400}{1240} + \frac{12400}{2000} = 10 + 6.2 = 16.2$ eV > $(IE)_H$

5. (A) Only first four spectral lines belonging to Balmer series in hydrogen spectrum lie in visible region.

(B) If a light of frequency ν falls on a metal surface having work functional $h\nu$, photoelectric effect will take place only if $\nu \geq \nu_0$, since ν_0 is the minimum frequency required for photoelectric effect.

6. $\frac{\Delta n(\Delta n + 1)}{2} = 15$

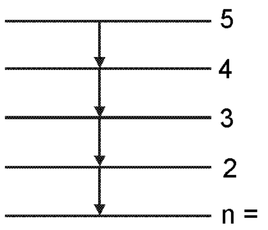
$\Rightarrow \Delta n = 5 \qquad \Rightarrow n - 2 = 5 \qquad \Rightarrow n = 7$

7. $\bar{\nu}_1 = R \times 3^2 \left(\frac{1}{2^2} - \frac{1}{3^2}\right) = \frac{5R}{4}$

$\bar{\nu}_2 = R \times \frac{3^2}{3^2} = R$

$\bar{\nu}_2 - \bar{\nu}_1 = \frac{5R}{4} - R = \frac{R}{4}$

8.



$$\frac{n_1}{n_3} = \frac{n_2}{n_4} = \frac{z_1}{z_2}$$

Clearly 2nd lowest energy is $4 \rightarrow 3$ transition

hence transition is Li^{2+} having same energy is $9 \rightarrow 12$

9. (A) $6 \to 3$ $\Delta n = 3$

$\therefore$ no. of lines = $\frac{3(3+1)}{2}$ = 6. All lines are in infrared region

(B) $7 \to 3$ $\Delta n = 4$

$\therefore$ no. of lines = $\frac{4(4+1)}{2}$ = 10. All lines are in infrared region

(C) $5 \to 2$ $\Delta n = 3$

no. of lines = $\frac{3(3+1)}{2}$ = 6. All lines are in visible region

(D) $6 \to 2$ $\Delta n = 4$

no. of lines = $\frac{4(4+1)}{2}$ = 10. All lines are in visible region.

10. $\nu = RcZ^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

For $2 \to 1$ transition in H– atom sample, $\nu = Rc(1)^2\left[\frac{1}{1^2} - \frac{1}{2^2}\right] = \frac{3Rc}{4}$

$\therefore (H)_{2 \to 1} = (He^+)_{4 \to 2} = (Li^{2+})_{6 \to 3}$

Thus, given photon is not emitted from $8 \to 3$ transition in He^+ ion sample.

DPP No. # 18

1. Total spectral lines obtained from H-atom = 6

Total spectral lines obtained from He^+-ion = 6

One line is common between them so total number of lines are 11.

2. Balmer series lines lies in visible region.

3. $n_2 \to n_1$, max different spectral lines = 10

$\therefore \Delta n = n_2 - n_1 = 4$

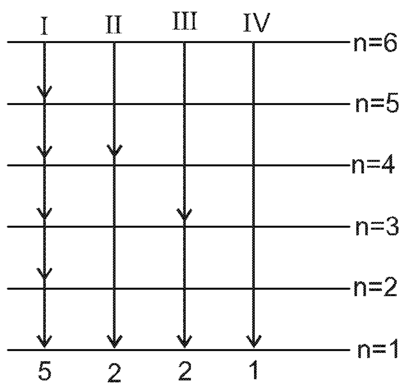
$\therefore$ change in angular momentum = $(\Delta n)\frac{h}{2\pi} = 4\left(\frac{h}{2\pi}\right) = 8\left(\frac{h}{4\pi}\right)$

$\therefore$ y = 8

4. $(Li^{2+})_{12 \to 3} = (H)_{4 \to 1}$

$\therefore$ No. of lines in infrared region = 1 $(4 \to 3)$ paschen series

5.



$\therefore$ Minimum number of atoms required = 4

6. Let excited state be n.

Case - I : There is a transition to first exited state i.e. 2nd level from n^{th} level.

$$10.20 + 17.00 = 13.6\, Z^2 \left[\frac{1}{2^2} - \frac{1}{n^2}\right] \qquad ..... (1)$$

Case - II : There is a transition to second excited state i.e. 3rd levle from n^{th} level.

$$4.25 + 5.95 = 13.6\, Z^2 \left[\frac{1}{3^2} - \frac{1}{n^2}\right] \qquad ..... (2)$$

on dividing (1) to (2), we have n^{th} level is **= 6.**

So, excited state is 5^{th}.

So, **n = 5.**

7. $n\lambda = 2\pi r \quad \Rightarrow \quad$ so $\quad \lambda = \frac{2\pi r}{3} = \frac{2\pi}{3} \times (53\text{ pm}) \times \frac{9}{2} \simeq 5\text{Å}$

8. Use formula $2\pi r_n = n\,\lambda$

We can't apply Bohr radius formula for Be^{2+}

$2\pi r_n = n\,\lambda$ सूत्र का उपयोग करें

9. $\frac{4}{n} = \frac{6}{3} \Rightarrow n = 2$ electron is present in 2^{nd} orbit of Be^{3+}. (Be^{3+} के द्वितीय कक्ष में उपस्थित इलेक्ट्रॉन)

$2\pi r = 2\,\lambda \quad \Rightarrow \quad \lambda = \pi r \quad \Rightarrow \quad r = 0.529 \times 10^{-10} \times \frac{2^2}{4} = 0.529 \times 10^{-10} = 0.529\text{Å}.$

DPP No. # 19

1. Only Spin quantum number (s) is not derived from Schrodinger wave equation.

5. number of electrons in subshells = 2 (2l + 1)

7. For n = 8 to n = 6, energy difference is minimum and $\lambda \propto \frac{1}{\text{Energy}}$

8. **S_1 :** Photoelectric effect can be explained on the basis of particle nature of electromagnetic radiations.

S_2 : n = 2, ℓ = 1 ∴ 2p-orbital ∴ dumb-bell shaped.

S_3 : d_{xy} orbital has its lobes directed at an angle of 45º from X-axis and Y-axis. So, it has zero probability of finding electrons along X-axis and Y-axis.

9. **S_1 :** Angular momentum = mvr = $n\left(\frac{h}{2\pi}\right)$ $\qquad$ ∴ Angular momentum ∝ n.

S_2 : An orbital can only accomodate 2 electrons with opposite spin.

S_3 : s-orbital is non-directional in nature, rest all orbitals are directional.

DPP No. # 20

1. n = 4, m = – 3 $\quad$ ∴ only possible value of ℓ is 3.

∴ Orbital angular momentum = $\sqrt{\ell(\ell+1)}\,\frac{h}{2\pi} = \frac{2\sqrt{3}\,h}{2\pi} = \frac{\sqrt{3}\,h}{\pi}$.

2. Z = 26 → $[Ar]4s^2 3d^6$

$\sqrt{n(n+2)} = \sqrt{24} \quad \Rightarrow \quad n = 4$

In d orbital number of unpaired electron = 4 , but element have charge so 4s electron have to be removed hence n+ = 2.

3. V (Z = 23), [Ar] $4s^2 3d^3$ unpaired electron = 3 ;
Cr (Z = 24), [Ar] $4s^1 3d^5$ unpaired electron = 6
Mn (Z = 25), [Ar] $4s^2 3d^5$ unpaired electron = 5

4. For n = 4, $\ell \neq 4$, for $\ell = 3$, $m \neq 4$

5. Total spin = 3 $\Rightarrow \frac{n}{2} = 3 \quad \Rightarrow n = 6$

i.e. magnetic moment = $\sqrt{n(n+2)} = \sqrt{6(6+2)} = \sqrt{48}$ B.M.

6. $_{25}Mn$ – [Ar] $3d^5 4s^2$

↑	↑	↑	↑	↑		↑↓

Given $\sqrt{n(n+2)} = \sqrt{15} \Rightarrow n = 3$
Hence to have '3' unpaired electrons Mn must be in '+4' state.

7. Magnetic moment = $\sqrt{n(n+2)}$

8. Orbital angular momentum of electron

$= \sqrt{\ell(\ell+1)}\,\frac{h}{2\pi} \Rightarrow \sqrt{\ell(\ell+1)}\,\frac{h}{2\pi} = \sqrt{3}\,\frac{h}{\pi} \Rightarrow \ell = 3$

$\therefore$ number of orientations = $2\ell + 1 = 2 \times 3 + 1 = 7$

9. Configuration of the following elements
Cr^{3+} – [Ar] $3d^3$ clearly
Mn^{4+} – [Ar] $3d^3$ Fe^{3+} has 5 unpaired electrons and
Fe^{3+} – [Ar] $3d^5$ Cr^{3+}, Mn^{4+} has 3 unpaired electrons

10. Maximum possible number of electrons in an atom with ($n + \ell = 7$) = 7s (2) + 6p (6) + 5d (10) + 4f (14) = 32

11. total spin = **± 1/2** × No. of Unpaired e^-

DPP No. # 21

1. Definition

2. $\lambda = \frac{12.3}{\sqrt{V}}$.

3. $_{16}S^{32}$ = $e^- = 16$

x^{+2} = $e^- = 16$
($\because$ A = Z+ N)

4. (B) has same number of electrons i.e., 18.
$[NH_3 \rightarrow BH_3]$ = 10 + 8 = 18.

5. E.C. $\rightarrow 1s^2,2s^2,2p^6,3s^2,3p^6,3d^1,4s^2$

6. (a) Co^{3+} : $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^6\, 3d^6$ $\therefore$ 4 unpaired electrons $\therefore \mu = \sqrt{4(4+2)} = \sqrt{24}$ = 4.9 BM
(b) Number of radial nodes = $n - \ell - 1$
Number of radial nodes in 3p orbital = 3 – 1 – 1 = 1
(c) Number of electrons with (m = 0) in Mn^{2+} ($1s^2 2s^2\, 2p^6\, 3s^2\, 3p^6\, 3d^5$) ion = 1s (2) + 2s (2) + 2p (2) + 3s (2) + 3p (2) + 3d (1) = 11
(d) Orbital angular momentum for the unpaired electron in V^{4+} lies in 3d orbital. $\therefore \ell = 2$

$\therefore$ Orbital angular momentum = $\sqrt{\ell(\ell+1)}\,\frac{h}{2\pi} = \frac{\sqrt{6}\,h}{2\pi}$

7. (a) $x + e^- \rightarrow x^-$

energy released = $E.A_1$ = 30.87 eV/atom

Let no. of moles of X be a

$\therefore$ $a \times N_A \times 30.87 = 4 \times N_A \times 4.526 + 4 \times N_A \times 13.6 + 4 \times N_A \times 12.75$ $\Rightarrow$ a = 4 moles.

8. Number of unpiared electron are given by

Magnetic moment = $\sqrt{[n(n+2)]}$ B.M.

where n is number of unpaired electrons

or $1.73 = \sqrt{[n(n+2)]}$ or $1.73 \times 1.73 = n^2 + 2n$ $\therefore$ n = 1

Now Vanadium atom must have one unpaired electron and thus its configuration is

$_{23}V^{4+}$: $1s^2$, $2s^2\ 2p^6$, $3s^2\ 3p^6\ 3d^1$

DPP No. # 22

8. A and D are isotpes. B, C and D are isobars.

9. **(i) p,s (ii) q,r (iii) p,s (iv) q,r**

10. Isotopic ($_{11}Na^{24}$) is less stable than $_{11}Na^{23}$ because it show radioactive decays. (Less stability of Na^{24} w.r.t. Na^{23} is also based upon $\frac{13}{11}\left(\frac{n}{p}\right)$. Higher value of $\frac{n}{p}$, higher will be unstability so it is disintegrated to attain the stability).

$$\underset{\text{Less stable}}{_{11}Na^{24}} \longrightarrow \underset{\text{stable}}{_{11}Na^{23}} + \underset{\text{neutron}}{_{0}n^{1}}$$

This neutron on decomposition to give proton and β^- particle ($_{-1}e^0$)

$$_{0}n^{1} \longrightarrow \underset{\text{Proton}}{_{1}H^{1}} \text{ or } {_{1}p^{1}} + \underset{(\beta^-\text{ particle})}{_{-1}e^{0}}$$

Hence, isotopic sodium is changed into sodium by means of emission of β^- emission.

11. (i) The atomic mass of an element reduces by 4 and atomic number by 2 on emission of an α-particle.

(ii) The atomic mass of an element remains unchanged and atomic number increses by 1 on emission of a β-particle.

Thus change in atomic mass on emission of 8α–particles will be $8 \times 4 = 32$

New atomic mass = old atomic mass – 32 = 238 – 32 = 206

Similarly change in atomic number on emission of 8α-particle will be : $8 \times 2 = 16$

i.e., New atomic number = old atomic number – 16 = 92 – 16 = 76

On emission of 6β-particles the atomic mass remains unchanged thus, atomic mass of the new element will be 206.

The atomic number increases by 6 unit thus new atomic nubmer will be 76 + 6 = 82

Thus, the equation looks like : $_{92}X^{238} \xrightarrow[-6\beta]{-8\alpha} {_{82}Y^{206}}$

12. (a) $^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{87}_{38}Sr + ^{147}_{54}Xe + 2\,^{1}_{0}n$

(b) $^{84}_{34}Se \longrightarrow ^{84}_{36}Kr + 2\ ^{0}_{-1}e$

13. $^{23}_{11}Na \longrightarrow ^{23}_{10}Ne + ^{0}_{+1}e$; So ratio of atomic mass and atomic number = $\frac{23}{10}$.

14. $^{238}_{92}U \longrightarrow ^{214}_{82}Pb + 6(^{4}_{2}He) + 2(_{-1}e^0)$

$\alpha = 6$, $\beta = 2$

Total = 8

15. $^{235}_{92}U + \underset{\text{(slow neutron)}}{^{1}_{0}n} \longrightarrow ^{142}_{54}Xe + ^{90}_{38}Sr + 4\,^{1}_{0}n$

DPP No. # 23

2. $P_1 V_1 = P_2 V_2$

$\therefore P_2 = \frac{1 \times 20}{50}$ atm = 0.4 atm **Ans.**

3. $P_1 V_1 = P_2 V_2 \Rightarrow 750 \times 120 = P_2 \times 180$

$\therefore P_2$ = 500 mm **Ans.**

4. $P_2 = \frac{1 \times 2.5}{0.5} = 5$ atm $\Rightarrow$ $\therefore$ % increase $= \frac{5-1}{1} \times 100 = 400\%$

7. Given, $P_1 = P, V_1 = V, T_1 = T$ $\Rightarrow$ $P_2 = P_2, V_2 = V - \frac{5V}{100}, T_2 = T$

$P \times V = P_2 \times \left(V - \frac{5V}{100}\right)$; $P_2 = \frac{100}{95} P$ $\Rightarrow$ $\therefore P_2 = 1.0526\ P$

$\therefore$ Increase in P = 0.0526 $\Rightarrow$ $\therefore$ % increase in P = 0.0526 x 100 = 5.26 **Ans.**

DPP No. # 24

2. $P_{gas} = 76 - 45 = 31$ cm of Hg

3. x = 6 cm

4. ≈ 101.3 cm.

5. x = 26.84 cm

6. $(75 + 15)\rho g \times 15A = 75\rho g \times hA$

$\therefore$ h = 18 cm **Ans.**

7. 550 cm

8. 19 cm.

DPP No. # 25

5. 25 mL.

6. 273ºC.

7. Suppose at T = 27°C = 300 K, V = 1 litre; $T_1 = 37°C = 310$ K, $V_1 = ?$

at constant pressure $\frac{V}{T} = \frac{V_1}{T_1}$

$$\frac{1}{300} = \frac{V_1}{310}$$

$$V_1 = \frac{310}{300} = 1.0333 \text{ litre}$$

Since, capacity of flask is 1 litre.

$\therefore$ Volume of air escaped out = 1.0333 – 1 = 0.0333 litre = **33.3 mL Ans.**

8. (a) No, (b) 55 ºC.

9. **(a)** 50.5 cm **(b)** 55 cm **(c)** 45 cm.

DPP No. # 26

3. (A) Temperature should be increased continuously.

4. At $T_1 = 300$ K, mole of air = n_1 ; At $T_2 = 750$ K, mole of air = n_2

$\therefore$ at constant P, V $n_1T_1 = n_2T_2$; $\therefore$ $n_1 \times 300 = n_2 \times 750$

or $n_2 = \frac{300}{750} \times n_1$; or $n_2 = 0.4\ n_1$

$\therefore$ moles of air escaped out $= n_1 - n_2 = n_1 - 0.4\ n_1 = 0.6\ n_1$ **or** fraction of air escaped out = **0.6 Ans.**

5. **– 23ºC**

6. Given, initially $V_2 = \frac{300}{1000}$ litre, $P_2 = \frac{684}{760}$ atm, $T_2 = 300$ K

At STP V_1 = ?, P_1 = 1 atm, T_1 = 273 K

Now use, $\frac{P_2V_2}{T_2} = \frac{P_1V_1}{T_1}$

V_1 = 0.2457 litre

∴ Volume (V) at STP = 245.7 mL.

7. (a) 1 : 3 (b) 12.3 litre

8. Let, vol of containers be V & temp be T

P_1 = 100 mm P_2 = 400mm

$\therefore n_1 = \frac{P_1V}{RT}$ & $n_2 = \frac{P_2V}{RT}$

$\therefore n_1 + n_2 = \frac{(P_1+P_2)\times V}{RT}$

After joining two containers final vol = (V+V) = 2V(for gases)

$\therefore P_{final} = \frac{(n_1+n_2)RT}{V_{final}} = \frac{(P_1+P_2)\times V}{RT} \times \frac{RT}{2V} = \frac{(P_1+P_2)}{2}$

$= \frac{(100+400)mm}{2}$ = 250 mm.

DPP No. # 27

9. Volume of I^{st} gas = 3 × 22.4 = 67.2 L

Volume of II^{nd} gas = 2 × 22.4 = 44.8 L

Volume of III^{rd} gas = 4 × 22.4 = 89.6 L

So, order of volume will be III > I > II

10. PV = nRT

3.06 × 1 = n × 0.0821 × 373

n = 0.1, mass of $H_2O_{(vap)}$ = 1.8 g

⇒ Volume of $H_2O_{(l)}$ =1.8 mL

11. (A) 1 bar ≈ 1 atm = 760 torr

(B) T (in K) = T (in °C) + 273

(C) 1 m^3 = 10^6 mL

12. PV = nRT

For equal pressure and volume,

$n_{H_2} \propto \frac{1}{T}$

If the temperature in flask A is greater than in flask B, then flask B contains greater number of moles of H_2 gas than flask A.

DPP No. # 28

6. Finally, the ratio of moles of gas in the 2 flasks is the ratio of the partial pressure of gas in the two flasks.

$\therefore \frac{n_1}{n_2} = \frac{T_2}{T_1} = \frac{400}{320} = \frac{5}{4}$

7. 88.67 cm of Hg

8. No of moles present initially = No of moles present finally

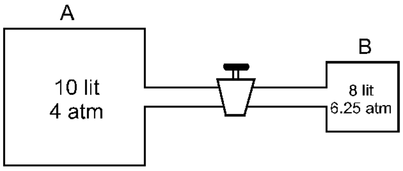
$\therefore \frac{7\times 5}{R\times 600} = \frac{P\times 5}{R\times 600} + \frac{P\times 2.5}{R\times 400}$

on solving , P = 4 atm **Ans.** 4 atm

9. After the opening of the stop cock the pressure of the each bulb will remain same.

At the beginning, the no. of moles of gas in A = $\frac{10 \times 4}{RT}$

At the beginning, the no. of moles of gas in B = $\frac{6.25 \times 8}{RT}$



∴ total no. of mole at the beginning = $\frac{90}{RT}$

Total no. of mole of gas before opening the stop cock

= total no. of moles of gas after opening stop cock = $\frac{90}{RT}$

∴ pressure after the opening of the stop cock

$$P = \frac{90}{RT} \times \frac{RT}{V_{total}} = \frac{90}{10+8} = 5 \text{ atm}$$

DPP No. # 29

1. Let the mass of SO_2 and oxygen be m g. Mole fraction of SO_2, X_{SO_2}

$$= \frac{\frac{m}{64}}{\frac{m}{64}+\frac{m}{32}} = \frac{m}{32} \times \frac{32}{3m} = \frac{1}{3}$$

Let the total pressure be P.

∴ Partial pressure of SO_2, $P_{SO_2} = P \times X_{SO_2}$ $\qquad P \times \frac{1}{3} = \frac{1}{3}$ P.

3. $n_T = n_1 + n_2 + n_3 + \ldots\ldots\ldots\ldots\ldots$

$$\frac{P_T.V_T}{RT} = \frac{P_1 V_1}{RT} + \frac{P_2 V_2}{RT} + \ldots\ldots\ldots\ldots\ldots = \Sigma P_i V_i$$

$$P_T V_T = \Sigma P_i V_i$$

$$= 2PV + \frac{P.V}{2} + \frac{P}{2}.\frac{P}{4} + \frac{P}{4}.\frac{V}{8} + \ldots\ldots\ldots\ldots\ldots$$

$$= 2PV\,[\,1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$P_T V_T = 2PV \frac{1}{1-\frac{1}{4}} = 2PV.\frac{4}{3}$$

$$V_T = V_1 + V_2 + V_3 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

$$= V + \frac{V}{2} + \frac{V}{4} + \frac{V}{8} \ldots\ldots\ldots\ldots\ldots$$

$$= V\left[1+\frac{1}{2}+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\right] = V\frac{1}{1-\frac{1}{2}} = 2V$$

∴ $P_T . 2V = 2PV.\frac{4}{3}$

$$P_T = \frac{4}{3}P$$

4. 0.28 atm

5. Mole of A = $\frac{0.60}{60} = 0.01$; Mole of B = $\frac{0.20}{40} = 0.005$; Total mole = 0.015

Total pressure = 750 mm ; Partial pressure of A = $\frac{\text{mole of A}}{\text{total moles}}$ x total pressure

$= \frac{0.01}{0.015} \times 750 = 500$ mm ; Partial pressure of B = $\frac{0.005}{0.015} \times 750 = 250$ mm

6. $M_{balloon} + M_{gas} + M_{payload} = M_{air\ displaced}$

$$100 + \frac{\frac{4}{3}\times\frac{22}{7}\times\left(\frac{21}{2}\right)^3\times 1000\times 5}{\frac{1}{12}\times 441}\times\frac{4}{1000} + M_{payload} = \frac{4}{3}\times\frac{22}{7}\times\left(\frac{21}{2}\right)^3\times\frac{14}{11}$$

on solving , $M_{payload}$ = 3434 kg

7. (D) Weight of H_2 = 20 g in 100 g mixture ; Weight of O_2 = 80 g

$\therefore$ Moles of $H_2 = \frac{20}{2} = 10$; $\therefore$ Moles of $O_2 = \frac{80}{32} = \frac{5}{2}$

$\therefore$ Total moles = $10 + \frac{5}{2} = \frac{25}{2}$

$\therefore$ $P'_{H_2} = P_T$ x mole fraction of H_2 = 1 x $\frac{10}{25/2}$ = 0.8 bar

8. $\frac{20 + w_{H_2}}{11} = 2$ $\Rightarrow$ $w_{H_2} = 2$ g.

$M_{avg} = \frac{20+2}{\frac{20}{20}+\frac{2}{2}} = 11.$

DPP No. # 30

1. $d = \frac{PM}{RT}$ $\therefore 2.5 = \frac{2\times M_{gas}}{0.082\times 546}$ $\therefore M_{gas} = 56$

$\therefore$ Both (A) & (C) options are correct.

5. Rate of diffusion of He = $\frac{5mL}{15}$ = 5ml/s = r_{He} (say)

$\therefore$ $r_{SO_2} = r_{He} \times \frac{1}{4}$ = 5ml/s × $\frac{1}{4}$

$\therefore$ Volume of SO_2 diffused in 2.0 seconds

= $\frac{5}{4}$ × 2 ml = **2.5 ml Ans.**

7. $$\frac{r_{A_2}}{r_{B_2}} = \frac{P_{A_2}}{P_{B_2}}\sqrt{\frac{VD_{B_2}}{VD_{A_2}}}$$

$$\frac{60/\Delta t}{40/\Delta t} = \frac{1}{P}\sqrt{\frac{10}{40}}$$

$$P = \frac{1}{3}\ \text{atm}$$

8. Rate of diffusion of He = r_1

rate of diffusion of $CH_4 = r_2$

$$\frac{r_1}{r_2} = \frac{n_1}{n_2}\sqrt{\frac{M_2}{M_1}} = \frac{2}{1}\sqrt{\frac{16}{4}} = \frac{4}{1}$$

Diffused mole of He = $\frac{4}{5}\times 100 = 80\%$

Diffused mole of CH_4 = $\frac{1}{5}\times 100 = 20\%$

9. 39/46

DPP No. # 31

1. $\frac{n_A/t}{n_B/t} = \frac{P_A}{P_B}\sqrt{\frac{M_B}{M_A}}$

$\frac{n_1M_1 + n_2M_2}{x_1 + x_2} = M_{mix}$

$X_1M_1 + (1 - X_1)M_2 = M_{mix}$

$\Rightarrow X_1 = \frac{2}{5}, X_2 = \frac{3}{5}$

$\Rightarrow \frac{x_A}{x_B} = \frac{2}{3}\sqrt{\frac{72}{128}} = \frac{1}{2}$

$\Rightarrow X_A = \frac{1}{3}, X_B = \frac{2}{3}$

2. Initially $r_A = \frac{1000 - 900}{5} = 20$ torr/s

In the mix.

$M_{mix} = X_AM_A + (1 - X_A)M_B$

$\Rightarrow \frac{472}{5} = X_A \times 128 + (1 - X_A)72$; $\frac{472}{5} = 56X_A + 72$

$472 = 280X_A + 360$; $X_A = \frac{112}{280} = \frac{2}{5}, X_B = \frac{3}{5}$

The mix.

$\frac{r_A}{r'_A} = \frac{P_A \cdot 'A_1'}{P'_A A_2}$; $\frac{r_A}{r_{A'}} = \frac{1}{2} \times \frac{x^2}{x \times \frac{3x}{2}} = \frac{1}{3}$

$r_A' = 3r_A = 3 \times 20 = 60$ torr/s ; $\frac{r'_{A^0}}{r'_{B^0}} = \frac{P'_A}{P'_B}\sqrt{\frac{M_B}{M_A}} = \frac{2}{3} \times \sqrt{\frac{72}{128}} = \frac{1}{2}$

$r_B' = 120$ torr/s

After 10 sec

$P_A'' = 2000 - 60 \times 10 = 1400$ torr ; $P_B'' = 3000 - 120 \times 10 = 1800$ torr

$\frac{n''_A}{n''_B} = \frac{7}{9}$

3. $2000 - 60t = 3000 - 120t$

$60t = 1000 \Rightarrow t = \frac{50}{3}$ sec.

6. $\frac{r_{mix}}{r_{D_2}} = \frac{r_{He} + r_{SO_2}}{r_{D_2}} = \frac{r_{He}}{r_{D_2}} + \frac{r_{SO_2}}{r_{D_2}} = \frac{P_{He}}{P_{D_2}}\sqrt{\frac{M_{D_2}}{M_{He}}} + \frac{P_{SO_2}}{P_{D_2}}\sqrt{\frac{M_{D_2}}{M_{SO_2}}}$

$\therefore \frac{r_{mix}}{r_{D_2}} = \frac{0.8}{1}\sqrt{\frac{4}{4}} + \frac{0.2}{1}\sqrt{\frac{4}{64}} = 0.8 + \frac{0.4}{8} = 0.85$

7. K.E. $= \frac{1}{2} M\overline{C}^2$

Now for the helium atom, K.E. $= \frac{1}{2} M_{He}\overline{C}^2 = \frac{1}{2} M_{He} \times \frac{3RT}{M_{He}} = \frac{3}{2}$ RT ;

Again for H_2 molecules; KE $= \frac{1}{2} M_{H_2}\overline{C^2} = \frac{1}{2} \times M_{H_2} \times \frac{3RT}{M_{H_2}} = \frac{3}{2}RT$

$\therefore$ K.E. of H_2 molecules is same as it is for H_2 molecules.

DPP No. # 32

6. $N_2 \quad + \quad 3H_2 \longrightarrow 2NH_3$

Initially a atm b atm

Finally $a - x$ $b - 3x$ $2x$

$\therefore$ a + b = 1 and a + b – 2x = 0.75

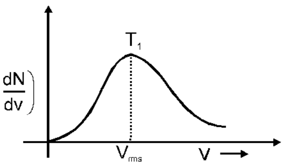
$\therefore P_{NH_3} = 2x = 0.25$ atm

7. $V_{RMS} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3P}{\rho}} = \sqrt{\frac{3 \times 1.2 \times 10^5}{4}} = 300$ m/s

8. $[(v_{rms})_X]_{546°C} = [(v_{mp})_Y]_{273°C}$

$\sqrt{\frac{3RT_X}{M_X}} = \sqrt{\frac{2RT_Y}{M_Y}} \qquad \frac{3 \times 819}{9} = \frac{2 \times 546}{M_Y}$

$\therefore M_Y = 4$ amu.

9. **(C)** Area under the curve $\left(\frac{1}{N}\frac{dN}{dv}\right)$ 

$= \int_0^x y dx = \int_0^N \left(\frac{1}{N}\frac{dN}{dV}\right) dV = \frac{1}{N}\int_0^N dN = 1.$

11. **(C,D)**

If two gases haves identical Max wellian plot then their all the speeds will also be identical.

Hence $\frac{T_A}{M_A} = \frac{T_B}{M_B}$. Since all the speeds are proportional to $\sqrt{\frac{T}{M}}$

for SO_2 – $M_1 = 64$, $T_1 = 600$ K ; O_2 – $M_2 = 32$, $T_2 = 300$ K $\Rightarrow \frac{T_1}{M_1} = \frac{T_2}{M_2}$.

DPP No. # 33

1. (a) V.P. depends on temperature.

3. Pressure of air = 750 – 100 = 650 mm of Hg

on compressing P_f = Hg 650 × 3 mm of Hg

= 1950 mm of Hg

so P_T = (1950 + 100) = 2050 mm of Hg

4. $P_{N_2} + P_{H_2O(v)} = 1$ atm, $\because P_{H_2O} = 0.3$ atm

$\therefore P_{N_2} = 0.7$ atm

Now new pressure of N_2 in another vessel of volume V/3 at same T is given by :

$P_{N_2} \times \frac{V_1}{3} = 0.7\ 0 \times V_1$

$\therefore P_{N_2} = 2.1$ atm

Since aqueous tension remains constant, and thus total pressure in new vessel.

$= P_{N_2} + P_{H_2O} = 2.1 + 0.3 = 2.4$ atm.

5. $3O_2 \rightleftharpoons 2O_3$

t = 0 60

t = t_1 48 8

so V_1 = 48 + 8 = 56 and V_2 = 48 (on passing through turpentine oil, O_3 will be absorbed.)

7. $CO_2 + C \longrightarrow 2CO$

At t = 0 x L (1 – x) L

At = t 0 2x L

1 – x + 2x = 1.6

1 + x = 1.6

x = 0.6 L

1 – x = 0.4 L

8. 896 mL.

DPP No. # 34

1. $T_4 < T_3 < T_2 < T_1$

2. A real gas behaves idealy under conditions of low pressure and high temperature .

3. Order of Vander waals constant $CO_2 > CH_4 > N_2 > H_2$

$\therefore$ ease of liqufication $CO_2 > CH_4 > N_2 > H_2$

5.* Z for an ideal gas is equal one.

6. Clearly, from the graph at 80 K = $\frac{PV}{RT}$ = 1 and at 60K, Z < 1

7. $Z = \frac{PV}{nRT} \Rightarrow n = \frac{PV}{ZRT}$

8. Translational energy = (3/2) kT

= (3/2) kT = hcR_H ((1/1) – (1/4))

$= (3/2)\ T = 6.626 \times 10^{-34} \times 2.996 \times 10^{10} \times 109679 \times (3/4)\ \frac{6.02 \times 10^{23}}{8.315}$

= 118331.1 K

T = 118331.1 × 2/3 = 80000 K.

DPP No. # 35

4. For very large value of molar volume (V_m)

$\frac{a}{V_m}$ and b can be neglected, so gas behaves as Ideal

$\therefore PV_m = RT$

5. At low pressure vander waal's equivalent for a real gas is given as

$Z = 1 - \frac{a}{RTV}$

intercept = 1

slop = –ve

7. (i) $Z = \frac{PM}{dRT} = \frac{2 \times 16}{0.8 \times \frac{1}{12} \times 400} = 1.2$

(ii) As Z > 1, so repulsive forces are dominating among gas molecules.

8. At Boyle's temperature, for low pressure regions, Z = 1. However, for high pressure regions, Z > 1.

DPP No. # 36

4. Under low pressure region and below the boyle temperature, Z < 1.

5. Refer class notes.

7.* at very high Pressure $Z = 1 + \frac{Pb}{RT}$

$Z > 1$

for particular realgas above boyle temp Z > 1.

8. [A – r] ; [B – r,s] ; [C – q] ; [D – r].

DPP No. # 37

5. $H_2 + I_2 \rightleftharpoons 2HI$

0.4   0.4   2.4

$K = \frac{2.4 \times 2.4}{0.4 \times 0.4} = 36$ (Since volume term is cancelled)

7. Mol. mass of HI = 1 + 127 = 128

64 g HI = 64 / 128 = 0.5 mole

$[HI] = \frac{0.5}{2}\ M = 0.25\ M$

DPP No. # 38

1. $K_p = K_c (RT)^{\Delta n}$

$2K_c = K_c (RT)^{\Delta n}$

$2 = (RT)^1$

$T = \frac{2}{0.0821} = 24.36\ K$

4. $N_2 + 3H_2 \rightleftharpoons 2NH_3$

1   3   0

0.5   1.5   1

$P_{H_2} = \frac{1.5}{3} P = P/2$

6. $2NO_2 \rightleftharpoons N_2O_4$

$K_c = \frac{[N_2O_4]}{[NO_2]^2} = \left(= \frac{mol\ L^{-1}}{(molL^{-1})^2}, K_c \text{ has unit of } L\ mol^{-1} \right)$

$K_p = \frac{p_{N_2O_4}}{p^2_{NO_2}} \left(= \frac{atm}{atm^2}, K_p \text{ has unit of } atm^{-1} \right)$

(Since mole fraction is itself unitless hence, K_x is also unitless)

7. (i) Molar concentrations :

$[PCl_5] = \frac{mol}{L} = \frac{1}{2} = 0.5\ mol\ L^{-1}$

$[PCl_3] = \frac{2}{2} = 1.0\ mol\ L^{-1}$

$[Cl_2] = \frac{2}{2} = 1.0\ mol\ L^{-1}$

(ii) Mole fractions :

Total moles at equilibrium = 1 + 2 + 2 = 5

$\therefore \quad X_{PCl_5} = \frac{n_{PCl_5}}{n_{total}} = \frac{1}{5} = 0.2$

$X_{PCl_3} = \frac{n_{PCl_3}}{n_{total}} = \frac{2}{5} = 0.4$

$X_{Cl_2} = \frac{n_{Cl_2}}{n_{total}} = \frac{2}{5} = 0.4$

(iii) Equilibrium constants :

$K_c = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{1\times 1}{0.5} = 2\ (mol\ L^{-1})^{-1} \quad = 2\ L\ mol^{-1}$

8. $K_C = 4.0.$

9. $PCl_3 + Cl_2 \rightleftharpoons PCl_5$

t = 0	n	n	0
t = teq.	n-y	n-y	y

$K_p = \frac{y}{(n-y)(n-y)}\left[\frac{P}{2n-y}\right]^{-1}$

$K_p = \frac{(2n-y)y}{(n-y)^2 P}$

DPP No. # 39

8. The equilibrium reaction is

$2XO\ (g) + O_2(g) \rightleftharpoons 2XO_2\ (g)$

since the unit of K_c given is lit/mole.

	$2XO(g)$	+ $O_2(g)$	$\rightleftharpoons$ $2XO_2(g)$
Initial conc.	1	2	0
Conc. at equilib.	$1-2x$	$2-x$	$2x$

$\therefore \quad K_c = \frac{[XO_2]^2}{[XO]^2[O_2]} = \frac{(2x)^2}{(1-2x)^2(2-x)} = \frac{4x^2}{(1-2x)^2(2-x)} = \frac{4x^2}{2}$

Since, the value of equilibrium constant is very small (1×10^{-4}), so 2x can be ignored with respect to 1 and x can be ignored with respect to 2.

$\therefore \quad 1 \times 10^{-4} = \frac{4x^2}{2}$

$x = 7.07 \times 10^{-3}$

we can see that the value of x is very small, so the assumtion made was correct as it is within 1.4% of the actual value. Thus, the assumption made is correct and acceptable.

$\therefore \quad [XO] = 1 - 0.01414 = 0.985$ M

$[O_2] = 2 - 0.00707 = 1.992$ M

$[XO_2] = 0.0141$ M

9.

1		0	0	Initial moles (say)
PCl_5 $\rightleftharpoons$		PCl_3 +	Cl_2	
(1 – 0.5)		0.5	0.5	Moles at equilibrium

Total moles at equilibrium = 0.5 + 0.5 + 0.5 = 1.5

$K_p = \frac{p_{PCl_3} \cdot p_{Cl_2}}{p_{PCl_2}} = \frac{\left(\frac{0.5}{1.5}p\right)\left(\frac{0.5}{1.5}p\right)}{\left(\frac{0.5}{1.5}p\right)}$ (p = total pressure)

or $\quad K_p = \frac{1}{3}.p \quad$ or $\quad p = 3K_p.$

DPP No. # 40

3. $2HI \rightleftharpoons H_2 + I_2$

Initial 2moles

At eqm. $2 - \frac{20}{100} \times 2$ 0.2 0.2

$= 2 - 0.4 = 1.6$

$K = \frac{[H_2]\,[I_2]}{[HI]} = \frac{0.2 \times 0.2}{(1.6)^2} = \frac{1}{64}$.

7. $H_2(g) + Br_2(g) \rightleftharpoons 2HBr(g)$

	$H_2(g)$	$Br_2(g)$	$2HBr(g)$
Intial pressures	0	0	10.0 bar
At equilibrium	p/2	p/2	(10.0-p)

$$K_p = \frac{p^2_{HBr}}{p_{H_2} \times p_{Br_2}}$$

$$1.6 \times 10^5 = \frac{(10-p)^2}{(p/2)(p/2)}$$

Taking square root of both sides

$$4 \times 10^2 = \frac{10-p}{p/2}$$

$$200\ p = 10 - p\ ;\ p = \frac{10}{201}\ \text{bar}$$

$p_{H_2} = p/2 = \frac{1}{2}\left(\frac{10}{201}\right)\text{bar} = 2.5 \times 10^{-2}\text{bar}$; $p_{Br_2} = p/2 = 2.5 \times 10^{-2}$ bar ; $p_{HBr} = 10 - p \approx 10$ bar .

8. We have,

10 mole	10 mole	10 mole	10 mole	Initial moles
$CO(g)$ +	$H_2O(g)$ $\rightleftharpoons$	$CO_2(g)$ +	$H_2(g)$	
$10 - x$	$10 - x$	$10 + x$	$10 + x$	Moles at eqb. or concentration at eqb.

where x is the number of moles of each reactant changed to the products at equilibrium.

$K = \frac{(10+x)^2}{(10-x)^2} = 9/4$ (given) or $\frac{10+x}{10-x} = 3/2$; $x = 2$

Mole percent of H_2 (g) at equilibrium $= \frac{10+x}{40} \times 100 = 30$

DPP No. # 41

3. 0.2.

4. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

0.02 0.01

0.02-x x 0.01+x

$$D = \frac{PM}{RT}$$

Calculate M_{avg}.

$$\frac{(0.02-x)208.5 + 137.5x + (0.01+x)71}{0.03+x} = M_{avg}.$$

5. $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$

P P

$2P = 1.12$

$P = 0.56$

$K_p = P^2 = (0.56)^2 = 0.3136\ atm^2$

6. $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
0.2-x x x

$K_P = P_{CO_2} = 1$

x = mole of $CO_2 = \frac{PV}{RT}$

Remaining mass of $CaCO_3$ = (0.2 – x) 100 g.

7. $[CaO] = \frac{\rho_{CaO(s)}}{M_{CaO(s)}} = \frac{1.12}{56} \times 1000$

9.* Addition of solids have no effect on equilibrium and temperature favours endothermic direction while increasing pressure will shift equilibrium in backward direction as Δn_g is +ve.

DPP No. # 42

2. $K_p = (p_{H_2O})^4 = 2.56 \times 10^{-10}\ atm^4$

$\therefore\ p_{H_2O} = 4 \times 10^{-3}\ atm = 4 \times 10^{-3} \times 760 = 3.04$ torr.

Partial pressure of water vapour in air = $\frac{40}{100} \times 12.5 = 5$

So, the amount of water vapour in air should decrease to decrease value of partial pressure of water vapour from 5 torr to the equilibrium value (3.04 torr).
so, mass of $CuSO_4.5H_2O$ will increase and mass of $CuSO_4.H_2O$ will decrease.

3. (A) As reaction is endothermic therefore it will go in the forward direction hence moles of PbO will increase.
(B) With the increase or decrease of volume partial pressure of the gases will remain same.
(C) Due to the addition of inert gas at constant pressure reaction will proceed in the direction in which more number of gaseous moles are formed.

4.* $N_2(g) + O_2(g) \rightleftharpoons 2NO\ (g)$
(A) For changing pressure volume has to be changed, though number of moles of NO(g) do not get changed but its concentration will get changed.
(B) Temperature change will change K_P and hence concentration.
(C) Volume change will change concentration, not the number of moles.
(D) Catalyst does not change equilibrium concentrations.

5.* Number of moles will remain unchanged but due to decreased volume pressure will get increased and also the concentrations.

6. Slope = $-\tan 30° = \frac{-1}{\sqrt{3}} = \frac{-\Delta H°}{R}$

$\therefore\ \Delta H° = \frac{R}{\sqrt{3}}$

7. As $T \to \infty$, K = A
$\therefore\ \ell nA = \ell nK = 46.06$
$\therefore\ 2.303 \log_{10} A = 46.06$
$\therefore\ A = 10^{20}$

8. $\Delta H° > O$ $\therefore$ Endothermic reaction
Y – intercept = +ve $\therefore\ \Delta S° > 0$
for endothermic reaction, as $T\uparrow$, $K\uparrow$.
The value of equilibrium constant K is unaffected by pressure changes.

DPP No. # 43

1. $A_2(g) + B_2(g) \rightleftharpoons 2AB(g) \quad K_C = 50$

1   2   0

$\frac{1-x}{3} \quad \frac{2-x}{3} \quad \frac{2x}{3}$

$$50 = \frac{\frac{2x}{3}\cdot\frac{2x}{3}}{\frac{1-x}{3}\cdot\frac{2-x}{3}} = \frac{4x^2}{(1-x)(2-x)} = \frac{4x^2}{2-3x+x^2} \quad \Rightarrow \quad 100 - 150x + 50x^2 = 4x^2$$

$\therefore$ no. of mol of AB = $\frac{2x}{3}$ = 1.868.

$\therefore$ AB की मोल संख्या = $\frac{2x}{3}$ = 1.868

2. (i) From the graph 0.3 × n = 0.6

n = 2

(ii) K = $(0.6)^2$ / 0.3 = 1.2 mol / L

3. $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$.

	PCl_5	PCl_3	Cl_2
Initial	3	0	1
	(3–x)	x	1+x
	2	1	2

Initial total moles = (3+1) = 4.

Now from Ideal gas equation

PV = nRT = P × 100 = 4 × 0.082 × 500

P = 0.082 × 20 = 1.64 atm.

At equilibrium Total mole = 3 – x + x + 1 + x = (4 + x)

PV = nRT.

2.05 × 100 = (4+x) × 0.082 × 500.

2.05 = (4+x) × 0.41.

5 = 4 + x.

x = 1.

$$\alpha = \frac{\text{No. of mole dissociated}}{\text{Initially total mole taken}} = \frac{1}{3} = 0.33.$$

$P_{PCl_5} = \frac{2}{5} \times 2.05$; $P_{PCl_3} = \frac{1}{5} \times 2.05$ $\quad P_{Cl_2} = \frac{2}{5} \times 2.05$

$$K_P = \frac{\left(\frac{1}{5}\times 2.05\right)\left(\frac{2}{5}\times 2.05\right)}{\left(\frac{2}{5}\times 2.05\right)} = \mathbf{[0.41]}$$

4. $Ag^+ + 2CN^- \rightleftharpoons [Ag(CN)_2]^-$

t = 0   0.1   0.5   0

t_{eq} 10^{-6} 0.3   0.1 $K_1 = \frac{10}{9} \times 10^6$

$Zn^{2+} + 4CN^- \rightleftharpoons [Zn(CN)_4]^{2-}$

t = 0   0.1   0.5   0

eq. 10^{-12} 0.1   0.1 $K_2 = \frac{0.1}{(0.1)^4 \times 10^{-12}} = 10^{15}$

Substracting two times I[st] reaction from II[nd] reaction, we will get the required reaction, so

$$K_{eq} = \frac{10^{15}}{\left(\frac{10}{9}\right)^2 \times 10^{12}} = \frac{10^3 \times 81}{100} = 810$$ **Ans. 810**

5.* When some amount of HCl is added to equilibrium, the first eq will shift in backward direction leading to decrease in amount of O_2. Then, the second eq. will shift in backward direction to increase the amount of O_2. Thus, amount of N_2 gas will increase.

DPP No. # 44

4. (i) Molecules move faster for which $\frac{T}{M}$ greater obviously H_2 molecule move faster.

5. State function : a, b, c, d, g, h, j ; Path function : e, f, i, k

6. Intensive : a, c, d, f, g, h, i, k ; Extensive : b, e, j, l

7. Open system : b, f, g, i, j ; Closed system : a, c, h ; Isolated system : d, e

8. Q = 7.5 KJ
$\Delta U = -12$ KJ
$\Delta U = Q + W$
W = –12 – 7.5 = **–19.5 KJ. Ans.**
Now W = 0,
$\therefore$ $\Delta U = Q$ $\therefore$ $Q = \Delta U =$ **– 12 KJ Ans.**

DPP No. # 45

5. $\Delta U_{ab} = Q_{abc} + W_{abc}$
or $\Delta U_{ab} = 100 - 40 = 60$ J
$\Delta U_{ab} = Q_{aeb} + W_{aeb}$
or $60 = Q_{aeb} - 20$
or $Q_{aeb} =$ **80 J** **Ans.**

$\Delta U_{ba} = -60$ J
$W_{bda} = 30$ J
$\Delta U_{ba} = Q_{bda} + W_{bda}$
or $Q_{bda} = \Delta U_{ba} - W_{bda}$

or $\boxed{Q_{bda} = -60 - 30 = \mathbf{-90\ J}}$ **Ans.**

Since Q_{bda} is (–)ve $\therefore$ Heat is liberated from the system.

6. 4275 J.

7. 6.66 min. (400 sec)

8. Since $\Delta E = q + w$
$= 80 - 30 = 50$
So for ADB
$\Delta E = q + w$
$50 = q - 10$
$q = 60$ J

9. For B to A,
$\Delta E = -50$ J
$w = +20$ J
$q = -50 - 20 = -70$
heat is liberate.

10. In ADB process, DB process is isochoric so $w_{DB} = 0$
So , $\Delta E_{AD} = q_{AD} + w_{AD}$
$-40 = q_{AD} + (-10)$
$q_{AD} = -30$ J
Now , $q_{AB} = q_{AD} + q_{DB}$
$60 = -30 + q_{DB}$
$q_{DB} = 90$ J

DPP No. # 46

1. $w = P_{ext}\,\Delta V$

$w = -1.2 \times 32 = -38.4$ lt atm.

$= -38.4 \times 100\ J = -3840\ J = -3.84\ kJ$

$\Delta E = q + w$

so, $q = \Delta E - w = -51 + 3.84 = -47.16$.

6. W = 240 L atm.

7. $\Delta U = \Delta H = 0 \quad Q = -W$

$W = -2.303\ nRT \log \frac{V_2}{V_1} \quad \Rightarrow \quad W = -2.3 \times \frac{20}{40} \times 8.3 \times 300 \log \frac{10}{5} = -859.05$ J.

8. (a) $W = -nRT \ln \frac{V_2}{V_1}$

$W = -P_1V_1 \ln \frac{V_2}{V_1} = -14 \times 0.03 \ln \frac{0.06}{0.03}$ bar m^3 $= -14 \times 0.7 \times 0.03$ $=$ **$-$ 0.294 bar m^3 Ans.**

(b) $P_1V_1 = P_2V_2$

$\therefore \quad P_2 = \frac{P_1V_1}{V_2} = \frac{14 \times 0.03}{0.06} = 7$ bar

$\therefore \quad W = -P_{ext}(V_2 - V_1) = -7(0.06 - 0.03) = -7 \times 0.03 = -0.21$ bar m^3.

Efficiency $= \frac{0.21}{0.294} = 71.43\%$ **Ans.**

9. (a) F (b) T (c) F (d) T (e) T

DPP No. # 47

1. The product PV is increasing so temperature will keep or increasing in the process, hence

$\Delta H = \Delta E + \Delta(PV)$ will increase constantly.

2. From graph we know that $V_B > V_A$, so expansion has taken place so w will be with –ve sign and ΔH will be +ve as both ΔE and $\Delta(PV)$ have increased.

3. At A and D the temperatures of the gas will be equal, so

$\Delta E = 0, \qquad \Delta H = 0$

Now $w = W_{AB} + W_{BC} + W_{CD} = -P_0V_0 - 2P_0V_0 \ln 2 + P_0V_0 = -2P_0V_0 \ln 2$

and $q = -W = 2P_0V_0 \ln 2$

5. Since liquid is expanding against external pressure P_0 hence work done

$w = -P_0(4V_0 - V_0) = -3P_0V_0$

$\Delta U = w = -3P_0V_0$

$\Rightarrow \quad \Delta H = \Delta U + P_2V_2 - P_1V_1 = -3P_0V_0 + 4P_0V_0 - 2P_0V_0$.

7. γ for $O_2 = 1.44$ γ for He = 1.66.

8. Since, ΔH is a state function, and the final state attained by the gas is same as its initial state, so value of $\Delta H = 0$.

9. $q = q_{AB} + q_{BC} + q_{CD} + q_{DA}$

$= -1R \times 300\ell n2 + 1 \times \frac{5R}{2} \times (400 - 300) + 1R \times 400\ell n2 + 1 \times \frac{5R}{2} \times (300 - 400)$

($\because q_{AB} = -W_{AB} = -1R \times 300\ell n2$ since process is reversible isothermal for which $\Delta U = 0$).

($\because q_{BC} = \Delta H_{BC} = 1 \times \frac{5R}{2} \times (400 - 300)$ since process is reversible isobaric).

($\because q_{CD} = -W_{CD} = 1R \times 300\ell n2$ since process is reversible isothermal for which $\Delta U = 0$).

($\because q_{DA} = \Delta H_{AB} = 1 \times \frac{5R}{2} \times (300 - 400)$ since process is reversible isobaric).

So, $q = 100\ R\ell n2$.

10. Since, for a cyclic process, $\Delta U = 0$.

So, $W = -q = -100\ R\ell n2$.

DPP No. # 48

1. $TV^{\gamma-1}$ = constant

$\gamma = \frac{5}{3}$ $\therefore$ $\gamma - 1 = \frac{2}{3}$

$\therefore$ $300 \times (8)^{2/3} = 250 \times (V_2)^{2/3}$ $\Rightarrow$ $(V_2)^{2/3} = 4.8$

$\Rightarrow$ $V_2 = (4.8)^{3/2} \cong 4.8 \times 2.2 = 10.5$ L

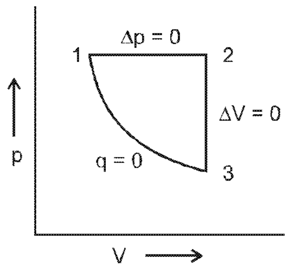
8. $\gamma_{mix} = \frac{n_A C_{P_A} + n_B C_{P_B}}{n_A C_{V_A} + n_B C_{V_B}} = \frac{2(4R) + 4(5R/2)}{2(3R) + 4(3R/2)} = \frac{18R}{12R} = \frac{3}{2}$

$T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$ $(\gamma = \gamma_{mix} = 1.5)$

$\therefore$ $T_2 = 320 \left(\frac{2}{8}\right)^{1.5-1} = 320 \times \frac{1}{2} = 160$ K

$\therefore$ $W = \frac{nR}{\gamma - 1}(T_2 - T_1) = \frac{6R}{1.5 - 1}(160 - 320) = -1920\,R = 1920 \times 2 = -3840$ calories.

9. The process can be described on a p-V diagram as



At 1 : p = 10 atm T = 400 K $V = V_1$
At 2 : p = 10 atm T = 800 K $V = V_2 = 2V_1$
At 3 : p = ? $T = T_3$ $V = V_3 = V_2 = 2V_1$
Therefore,

$W_{12} = -p\Delta V = -nRT = -400\,R$

$W_{23} = 0$ $[\because \Delta V = 0]$

Between 3 and 1 ; $TV^{\gamma-1}$ = constant

$T_3 (2V_1)^{\gamma-1} = 400(V_1)^{\gamma-1}$

$\Rightarrow$ $T_3 = 400 \left(\frac{1}{2}\right)^{2/3} = 252$ K

$\Rightarrow$ $W_{31} = \Delta E_{31} = nC_V(T_1 - T_3) = \frac{3}{2}R(400 - 252) = 222\,R$

$\Rightarrow$ $W_{12-31} = W_{12} + W_{23} + W_{31} = -178\,R$

10. $W = -\int PdV$

$= -\int \frac{K}{V^n}dV = -\frac{K}{1-n}\left[V^{-n+1}\right]_{V_1}^{V_2} = \frac{K}{n-1}[V_2^{1-n} - V_1^{1-n}]$

$= \frac{P_1V_1^n}{n-1}\left[V_2^{1-n} - V_1^{1-n}\right] = \frac{P_1V_1^{n+1-n}}{n-1}\left[\left(\frac{V_2}{V_1}\right)^{1-n} - 1\right]$

DPP No. # 49

1. Standard molar enthalpy of formation (ΔH^o_f) of element in their stable state of agregation is zero.

$\therefore \quad \Delta H^o_f (O_2, g) = 0$

4. Some of the heat is used to vaporise the H_2O (ℓ)

$\therefore \quad x_1 > x_2$

5. $CS_2(\ell) + 3O_2(g) \longrightarrow CO_2 (g) + 2SO_2(g)$; $\quad \Delta H^o_{rxn.} = 5 \times -215 = -1075$ kJ

$\Delta H^o_{rxn.} = \Delta H^o_f (CO_2) + 2 \times \Delta H^o_f (SO_2) - \Delta H^o_f (CS_2)$

$\Delta H^o_{rxn.} = (-393.5 - 2 \times 296.8) - (-1075)$

$\Delta H^o_{rxn.} = 87.9$

6. Refer Class notes.

8. Eq (i) + Eq (ii)

$C_{diamond} + O_2 (s) \longrightarrow CO_2(g)$

$\Delta H = \Delta H_1 + \Delta H_2$

DPP No. # 50

2. Since it is neutralisation of a weak acid with strong base.

3. enthalpy of dissociation = (13.7 – 3) KCal = 10.7 KCal

6. $n_{CH_4} = \dfrac{280}{22.4}$

$\therefore \quad \Delta H_{obntained} = \dfrac{240 \times 280}{22.4}$ KCal

$\therefore \quad m = \dfrac{240 \times 280}{22.4 \times 2 \times 1 \times 180}$ kg = 8.33 kg.

7. Heat generated = $C_T \Delta T = 1260 \times 0.667$ cal.

$\therefore \quad n_{CH_4} = \dfrac{1260 \times 0.667}{210 \times 10^3}$

$n_{total} = \dfrac{PV}{RT} = 4 \times 10^{-2} \qquad \therefore \quad mol\% = \dfrac{4 \times 10^{-3}}{4 \times 10^{-2}} \times 100\% = 10\%$ Ans.

8. $\Delta H_2 - 24 = -0.024 \times (523 - 473)$ Cal/g.

$\therefore \quad \Delta H_2 = 22.8$ Cal/g.

9. **Target eq** $1/2\ H_2 (g) + 1/2\ Cl_2 (g) \longrightarrow HCl (g)$

$NH_3 (aq) + HCl (aq) \longrightarrow NH_4Cl (aq)$ $\quad \Delta H = -12.1$ ....(1)

$1/2N_2(g) + 3/2H_2(g) \longrightarrow NH_3(g)$; $\quad \Delta H = -11$ ....(2)

$1/2N_2 + 2H_2 + 1/2Cl_2 (g) \longrightarrow NH_4Cl(s)$; $\quad \Delta H = -75.3$ ....(3)

$NH_3(g) + aq \longrightarrow NH_3 (aq)$ $\quad \Delta H = -8.8$ ....(4)

$NCl(g) + aq \longrightarrow HCl (aq)$ $\quad \Delta H = 17.5$ ....(5)

$NH_4Cl(s) + aq \longrightarrow NH_4Cl (aq)$ $\quad \Delta H = 3.8$ ....(6)

ΔH = eq (6) – eq (3) + eq (2) + eq (4) + eq (5)

= – 12.1 – 3.8 – (–75.3) – 11 – 8.8 – 17.5

= + 22.1

from this we get equation

$HCl (g) \longrightarrow 1/2\ H_2(g) + 1/2\ Cl_2 (g)$

$\therefore$ ΔH of target eq = – ΔH = – 22.1 Kcal Ans.

DPP No. # 51

1. - 372.0 kCal. **2.** - 136.8 kJ. **3.** - 121 kJ/mole.

4. $\Delta H = -67710$ Cal **5.** - 22 kCal/mol.

6. $C_2H_4(g) + H_2 \longrightarrow C_2H_6$
$\Delta H = (\Delta H)_{sup} - (\Delta H)_{req}$
$\Delta H = [145 + 104] - [80 + 2 \times 99]$
$\Delta H = -29$ kCal/mol

7. $C_2H_4\ (s) \longrightarrow 2C(o) + 4H\ (g)$
$\Delta H_{reaction} = 4 \times 52.1 + 2 \times 170.9 - 12.5 = 53.7 = \Delta H_{C=C} + 4 \times 99$
$\Delta H_{C=C} = 141.7$

8. $= \dfrac{3y - 4x}{3}$ kCal mol^{-1}. **9.** 49 kCal/mol.

11. $-49.86 = \Delta H_{ioni} - 55.84$
$\Delta H_{ion} = 55.84 - 49.86 = 5.98$ KJ/mol.

DPP No. # 52

1. - 41.104 kCal.

2. $C_6H_6\ (g) + \dfrac{15}{2} O_2\ (g) \longrightarrow 6CO_2\ (g) + 3H_2O(\ell) \quad \Delta_r u_1 = -800$ kcal/mole

$C_2H_2\ (g) + \dfrac{5}{2} O_2\ (g) \longrightarrow 2CO_2\ (g) + H_2O(\ell) \quad \Delta_r u_2 = -300$ kcal/mole

$\therefore \quad 3C_2H_2\ (g) \longrightarrow C_6H_6\ (g) \quad \Delta_r u = -100$ kcal/mole
$\Delta_r H = \Delta_r u + (-2) \times 2 \times 300 \times 10^{-3}$
$\Delta_r H = -100 - 1.2 = -101.2$ kcal/mol.

3. 80 kCal/mol.

4. 100 kJ/mol.

5. $P_4(s) \rightarrow 4P(g) \quad \Delta H = 53.2 \times 6$
$H_2(g) \rightarrow 2H(g) \quad \Delta H = 104.2$

$\dfrac{1}{4} P_4(s) + \dfrac{3}{2} H_2(g) \rightarrow PH_3(g) \ \Delta H = 5.5$

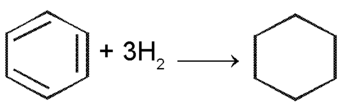
$\dfrac{1}{4} \times 6 \times 53.2 + \dfrac{3}{2} \times 104.2 - 3\epsilon_{P-H} = 5.5$

$\Rightarrow \quad \epsilon_{P-H} = 76.866$ i.e. 76.9 kcal mol^{-1}

6. C - H = 99 kCal ; C - C = 82 kCal

7. - 56.5 kJ.

8. –152 KJ mol^{-1}



$\Delta H_{calculated} = 3 \times (-119) = -357$ KJ mol^{-1}

$\Delta H_{experimental} = \sum (\Delta H^\circ_f)_{product} - \sum (\Delta H^\circ_f)_{reactant}$

or $\Delta H_{expt} = -156 - (49 + 0) = -205$ KJ mol^{-1}
Resonance energy $= -357 - (-205) = -152$ KJ mol^{-1}

9. – 18.7 kCal

10. - 167.2 kJ/mol.

DPP No. # 53

2. Latent heat of fusion of ice per mole = 80 × 18 = 1440 cal.
Latent heat of vpourisation of liquid water per mole = 596 × 18 = 10728 cal.
$\therefore$ Total q = (1440 + 10728) cal = 12168 cal.
$\therefore$ $q_p = \Delta H$ = 12168 cal Ans.
$\Delta E = \Delta H - P\Delta V = q_P - P\Delta V$
V_2 = volume of 1 mole of H_2O (g) and $V_t \approx 0$.
$\therefore$ $P\Delta V$ = 546 Cal
$\therefore$ ΔE = (12168 – 546) cal = 11622 Cal.

3. W = 0.1 KJ, q = 2KJ, DE = 2.1 KJ.

4. n_{O_2} (inhaled) = $\frac{640}{32} = 20$
12 mole O_2 consumes 1 mole = 342 g sucrose.
$\therefore$ Mass of sucrose consumed = $\frac{342}{12} \times 20$ g = 570 g.

and heat liberated = $\frac{5472}{342} \times 570$ kJ. = 9120 kJ.

5. $$\Delta H_{vap}(0^oC) = \int_{273}^{373} C_p\,(\text{liquid})\,dT + \Delta H_{vap}(100^oC) + \int_{373}^{273} C_p\,(\text{gas})\,dT$$
= 75 × 100 + 40,000 – 30 × 100
= 44,500 J mole^{-1} = 44.5 kJ mole^{-1}

6. $$\Delta H_{sub}(223K) = \int_{223}^{273} C_p\,(\text{solid})\,dT + \Delta H_{fus}(0^oC) + \int_{273}^{373} C_p\,(\text{liquid})\,dT + \Delta H_{vap}(100^oC) + \int_{373}^{223} C_p\,(\text{gas})\,dT$$
= 50 × 40 + 6000 + 100 × 75 + 40000 – 150 × 30
= 51 kJ/mole.

7. $\Delta H_2^o = \Delta H_1^o + \Delta C_p (T_2 - T_1)$ = 43.285 + (–45 × 100)
= 38785 J mole^{-1}.

8. ΔC_p = –ve
$C_{p\ (products)} < C_{p\ (Reactants)}$ so $q_2 < q_1$

9. ΔH_0^2 = [–30 kJ/mole] + [{2 × 2 × 17 – 28 – 3 × 2 × 10} (100) J/mole]
= (–30 kJ/mole) + (–2000 J/mole) = –32 kJ/mole.

DPP No. # 54

1. Polymerisation leads to more ordered structure.

2. Δn_g is + ve

3. Δn_g is most – ve

4. For same amount of gas at constant temperature, lesser is the volume, lower will be the entropy.

6. For a reversible adiabatic process,
$\Delta S_{sys} = \Delta S_{surr} = \Delta S_{univ} = 0$

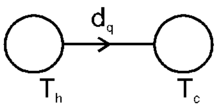
7. For initinal state P_i × 22.4 = 2 × R × 546 $\therefore$ P_i = 4 atm
Now, $P_i V_i = P_f V_f$ ($\because$ process is Isothermal)
4 × 22.4 = 2 × V_f $\therefore$ V_f = 44.8 L

$$\therefore \Delta S_{sys} = nR\ln\left(\frac{V_f}{V_i}\right) = 2R\ln\left(\frac{44.8}{22.4}\right) = 2R\ln 2 = R\ln 4$$

8. **(a)** $\Delta S_{vap.} = \frac{\Delta H_{vap.}}{T} = \frac{26 \times 10^3}{325} = 80\ JK^{-1}\ mol^{-1}$.

(b) $\Delta S_{cond.} = \frac{\Delta H_{cond}}{T} = -80\ JK^{-1}\ mol^{-1}$.

9.



For a small exchange in heat at time 't'

change entropy for hot piece = $\frac{dq}{T_h^1}$

where T_h^1 is temp of hot piece at time 't'

change of entropy by cold piece = $\frac{dq}{T_c^1}$.

As heat capacities of the pieces is same.

$T_c + T_h = T_c^1 + T_h^1 = 2T_f$

where T_f is final temperature of each piece.

ΔS for hot piece = $\int \frac{dq}{T_h^1} = mS \int_{T_h}^{T_f} \frac{dT}{T_h^1}$ $= mS \ln \frac{T_f}{T_h}$

ΔS for cold piece = $mS \ln \frac{T_f}{T_c}$.

$\therefore$ Total $\Delta S = mS \ln \frac{T_f^2}{T_h T_c}$ $= ms \ln \frac{(T_C + T_h)^2}{4T_h T_C}$

10. For isoentropic process $\Delta S_{system} = 0$

$\therefore nC_{p,m} \ln \frac{T_2}{T_1} + nR \ln \frac{P_1}{P_2} = 0$

$\Rightarrow \ln (P_2) = \frac{5}{2} \times \ln \left(\frac{600}{300}\right)$ $= 1.75$ atm

DPP No. # 55

1. $W = -P_{ext}(V_f - V_i) = -(1\ atm)(8-2)\ L = -6\ L\ atm$

as q = 0 so

$\Delta E = W = n\left(\frac{6}{2}R\right)\left(\frac{P_f V_f}{nR} - \frac{P_i V_i}{nR}\right)$ Here $\Delta E = nC_V\Delta T$

$3(8P_f - 12) = -6$

therefore, $8P_f = 12 - \frac{6}{3} = 10$ $\Rightarrow$ $P_f = \frac{5}{4}$ atm

so, $\frac{T_f}{T_i} = \frac{\frac{5}{4}\times 8}{6\times 2} = \frac{10}{12}$

so $\Delta S = 3\frac{12}{300} \ln\left(\frac{10}{12}\right) + \frac{12}{300} \ln 4 = 3.312$ J/K

2. P^2V = constant $\therefore \left(\frac{nRT}{V}\right)^2 V$ = constant $\therefore \frac{T^2}{V}$ = constant

$\therefore \quad \frac{T_1^2}{V_1} = \frac{T_2^2}{V_2} \therefore \frac{(300)^2}{1} = \frac{T_2^2}{4} \therefore T_2 = 600K$

$\Delta S_{sys} = nC_V \ell n \frac{T_2}{T_1} + nR\ell n \frac{V_2}{V_1} = 2 \times \frac{3R}{2} \ell n \left(\frac{600}{300}\right) + 2 \times R\ell n \left(\frac{4}{1}\right) = 7R\ell n\, 2$

$\therefore \quad X = 7$

4.* For isothermal free expansion of an ideal gas,
$\Delta T = 0$ Therefore, $\Delta H = \Delta E = 0$
Also, W = 0 (since $P_{ext.} = 0$)
Therefore, from first law, q = 0. Therefore, $\Delta S_{surr.} = 0$.
Since gas is expanding, $\Delta S_{sys.} > 0$.

5. **I.** Molar entropy of gas is much greater than that of solid and liquid.
II. Entropy change is positive if Δn_g is positive.
III. Molar entropy of a crystalline solid will be zero at absolute zero.
IV. In irreversible process both system and surroundings are not restored if path is reversed.
V. Refractive index and molarity are intensive properties.

7. If $\Delta H < 0$ and $\Delta S < 0$, then reaction is non-spontaneous at high temperatures and spontaneous at low temperatures.

8. $H_2O(\ell, 1bar, 373K) \longrightarrow H_2O(g, 1bar, 373\,K)$
$\Delta S > 0$
$\Delta H > 0$
$\Delta G = 0$

9. $(C_p)_m = aT^3 \therefore 0.375 = a\,(10)^3 \therefore a = \frac{3}{8} \times 10^{-3}$

$S_m = \int_0^{20} \frac{(C_P)_m dT}{T} = \int_0^{20} aT^2 dT = \left.\frac{aT^3}{3}\right|_0^{20} = \frac{8000a}{3} = \frac{8000}{3} \times \frac{3}{8} \times 10^{-3} = 1\,J/K\text{–}mol$

10. $\Delta G = nRT\,\ell n \left(\frac{P_f}{P_i}\right) = \left(\frac{144}{18}\right) \times \frac{2}{1000} \times 373\ell n \left(\frac{4}{1}\right) \approx 8Kcal.$

DPP No. # 56

1. Gram mol. wt. of $C_6H_{12}O_6$ = 180 g
i.e. wt. of 6.023×10^{23} molecules = 180

so wt. of 1 molecules = $\frac{180}{6.023 \times 10^{23}} = 2.988 \times 10^{-22}$ g.

2. No. of carbon atom in glucose $= \frac{1.71}{342} \times 12\,N_a$

$= 3.6 \times 10^{22}$

4. $x \times \frac{0.5}{100} = 78.4 \quad \Rightarrow \quad x = \frac{78.4 \times 10^2}{5 \times 10^{-1}} = \frac{78.4}{5} \times 10^3 = 1.568 \times 10^4$.

6. At NTP, weight of 1 litre gas = 0.178 gm
so weight of 22.4 litre gas = weight of 1 mole gas = molar mass of gas = 0.178×22.4 gm
vapour denstiy = molar mass of gas / 2

so V.D. = $\frac{0.178 \times 22.4}{2} = 2$

7. $C_8H_{18} + \frac{25}{2}O_2 \longrightarrow 8CO_2 + 9\,H_2O$

M = 1.425 × 1000 × 0.8 = 1140 g

mol $= \frac{1140}{114}$ = 10 mol

Now from mole–mole analysis

$$\frac{\text{mole of } C_8H_{18}}{1} = \frac{\text{mole of } O_2}{25/2}$$

$$\frac{10}{1} = \frac{\text{mole of } O_2}{25/2} \qquad \Rightarrow \text{mole of } O_2 = \frac{25}{2}\times 10 = 125 \text{ mol.}$$

8. $CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

$\frac{100}{64}$ (excess)

From mole-mole analysis

$$\frac{100}{64} = \frac{n_{C_2H_2}}{1} \quad \text{(here n = mole)}$$

vol. $= n_{C_2H_2}$ × 22.4 (at N.T.P) (N.T.P पर)

$$= \frac{100}{64} \times 22.4 = 35 \text{ lit.}$$

9. $3BaCl_2 + 2Na_3PO_4 \longrightarrow Ba_3(PO_4)_2 + 6\,NaCl$

mole 0.5 0.1

$\frac{0.5}{3}$ $\frac{0.1}{2}$ (L.R is Na_3PO_4)

Now from mole– mole analysis अब मोल–मोल विश्लेषण से

$$\frac{\text{mole of } Na_3PO_4}{2} = \frac{\text{mole of } Ba_3(PO_4)_2}{1}$$

$= \frac{0.1}{2}$ = mole of $Ba_3(PO_4)_2$ — $Ba_3(PO_4)_2$ के मोल

$\Rightarrow$ mole of $Ba_3(PO_4)_2$ = 0.05 mol. — $Ba_3(PO_4)_2$ के मोल = 0.05 mol.

10. Ag + HMO_3 $\xrightarrow{NaCl}$ AgCl

21.6 — 14.35

mole $\frac{21.6}{108}$ = 0.2

Ag Atom remain conseved

So No. of mole of Ag = No. of mole of Ag Cl

So. No. of mole of AgCl = 0.2

Weight of AgCl = 28.7

% Yield $= \frac{14.35}{28.7} \times 100 = 50\ \%.$

11. $[NO_3^-] = \frac{0.1V + 0}{2V} = \frac{0.1}{2} = 0.05$ M.

12. $[Cl^-] = \frac{300\times 3 + 200 \times 4 \times 2}{500}$

$$= \frac{2500}{500} = 5 \text{ M}$$

13. $2Al + KClO_3 \longrightarrow Al_2O_3 + KCl$

(excess) 1 mole ($KClO_3$ is L.R.) 1 mole ($KClO_3$ L.R. है)

From mole-mole analysis

$$\frac{n_{KClO_3}}{1} = \frac{n_{Al_2O_3}}{1}$$

$\Rightarrow$ $n_{Al_2O_3}$ = 1 mole.

15. Mole fraction of A i.e. $X_A = \frac{n_A}{\text{Total moles}}$

So $X_{H_2O} = \frac{n_{H_2O}}{\text{Total moles}}$

Now $\frac{X_A}{X_{H_2O}} = \frac{n_A}{n_{H_2O}}$

and molality = $\frac{n_A \times 1000}{n_{H_2O} \times 18} = \frac{X_A \times 1000}{X_{H_2O} \times 18} = \frac{0.2 \times 1000}{0.8 \times 18}$ = **13.9 Ans.**

16. Let wg water in added to 16 g CH_3OH

molality = $\frac{16 \times 1000}{W \times 32} = \frac{500}{W}$

$\frac{500}{W} = \frac{x_A \times 1000}{(1 - x_A)m_B} = \frac{0.25 \times 1000}{0.75 \times 18}$ W = 27 gm.

17. (A) Molarity of second solution is = $\frac{10 \times d \times x}{M}$ = 1 M (B) Volume = 100 + 100 = 200 ml

(D) Mass of H_2SO_4 = $\frac{200 \times 1}{1000} \times 98$ = 19.6 gm.

18. $NaN_3 \Rightarrow 1(+1) + 3(x) = 0 \therefore x = -1/3$

$N_2H_2 \Rightarrow 2(x) + 2(+1) = 0 \therefore x = -1$

$NO \Rightarrow 1(x) + 1(-2) = 0 \therefore x = +2$

$N_2O_5 \Rightarrow 2(x) + 5(-2) = 0 \therefore x = +5$

19. (D)

SO_3	SO_2	H_2S	S_8
6	4	–2	0

20. $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$

V.f. = 5 V.f. = 2

$\therefore$ Balanced equation : $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

Topic : Atomic Structure

3. For photoelectric effect to take place, $E_{light} \geq W \therefore \frac{hc}{\lambda} \geq \frac{hc}{\lambda_0}$ or $\lambda \leq \lambda_0$.

4. More energy means less wavelength.

5. Power = $\frac{nhC}{\lambda \times t}$ $\Rightarrow$ $40 \times \frac{80}{100} = \frac{n \times 6.62 \times 10^{-34} \times 3 \times 10^8}{620 \times 10^{-9} \times 20}$ $\Rightarrow$ $n = 2 \times 10^{21}$

9. $r \propto n^2$

11. This is the range of visible region.

12. infrared lines = total lines – visible lines – UV lines $= \frac{6(6-1)}{2} - 4 - 5$ = 15 – 9 = 6.

(visible lines = 4 $6\to2, 5\to2, 4\to2, 3\to2$) (UV lines = 5 $6\to1, 5\to1, 4\to1, 3\to1, 2\to1$)

13. For third line of Bracket series ($4 \to 7$)

$$\frac{1}{\lambda} = R\left(\frac{1}{16} - \frac{1}{49}\right) \Rightarrow \lambda = \frac{784}{33R}$$

14. $\lambda = \frac{h}{mv} = 0.4 \times 10^{-33}$ cm

15. $\lambda = \frac{h}{\sqrt{2mK}} = 3.328 \times 10^{-10}$ m.

18. Number of radial nodes = $n - \ell - 1 = 1$, $n = 3$. $\therefore$ $\ell = 1$.

Orbital angular momentum = $\sqrt{\ell(\ell+1)}\,\frac{h}{2\pi} = \sqrt{2}\,\frac{h}{2\pi}$.

19. After np orbital, (n + 1) s orbital is filled.

20. Rb_{37} : [Kr] $5s^2$. $\therefore$ $n = 5, \ell = 0, m = 0, s = \pm\frac{1}{2}$.

DPP No. # 57

1. $PV = \left(P + \frac{1}{100}P\right)V_2$

$V_2 = \frac{PV}{\frac{101}{100}P}$ $\Rightarrow$ $V_2 = \frac{100}{101}V$

% decrease (% कमी) $= \frac{\frac{100}{101}V}{V} = \frac{100}{101}\%$

2. V_1 = 100 ml V_2 = 80 ml
T_1 = 300 K T_2 = ?
P_1 = 740 mm P_2 = 740 mm
Applying charles law $V \propto T$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{100}{300} = \frac{80}{T_2}$$

$T_2 = \frac{300 \times 80}{100}$ = 240 K = 24 – 273 = 240 – 273ºC = – 33ºC.

3. $V \propto T$ (at constant n and P).

4. Apply Dalton's law of partial pressure

Initially $n_1 = \frac{P_1V}{RT} = \frac{100 \times V}{RT}$; $n_2 = \frac{P_2V}{RT} = \frac{400 \times V}{RT}$

5. $P.P_{H_2} = \dfrac{\frac{w}{2}}{\frac{w}{2}+\frac{w}{16}} \times P \quad \Rightarrow \quad P.P_{H_2} = \dfrac{8}{9}P$

6. $\dfrac{1}{6} = \sqrt{\dfrac{2}{x}}$ (Where X is molecular weight of gas)

$\dfrac{1}{36} = \dfrac{2}{x}$

$x = 72$

7. $\dfrac{r_{H_2}}{r_{O_2}} = \sqrt{\dfrac{d_{O_2}}{d_{H_2}}}$

$\dfrac{1}{r_{O_2}} = \sqrt{\dfrac{1.44}{0.09}}$

$r_{O_2} = \sqrt{\dfrac{1}{16}}$

$r_{O_2} = \dfrac{1}{4}$

8. $\dfrac{\frac{50}{20}}{\frac{40}{t}} = \sqrt{\dfrac{32}{2}}$

$\dfrac{50t}{20\times40} = 4$

$t = 64$ min.

9. K.E. $\propto$ T
(T will same)

10. $V_{mps} : V_{av} : V_{rms}$

$\Rightarrow \sqrt{\dfrac{2RT}{M}} : \sqrt{\dfrac{8RT}{\pi M}} : \sqrt{\dfrac{3RT}{M}} \quad \Rightarrow \quad \sqrt{2} : \sqrt{8/\pi} : \sqrt{3}$

11. Average K.E. for one mole = $\dfrac{3}{2}RT$

Average K.E. for 14 g of N_2 $\left(\dfrac{1}{2}\text{mole}\right) = \dfrac{3}{2} \times \dfrac{8.314}{2} \times 400 = 2494$ J.

12. $\dfrac{V_{rms,SO_2}}{V_{rms,He}} = \sqrt{\dfrac{T_{SO_2}}{T_{He}} \times \dfrac{M_{He}}{M_{SO_2}}}$

$\dfrac{1}{2} = \sqrt{\dfrac{T_{SO_2}}{300} \times \dfrac{4}{64}}$

$4 = \dfrac{T_{SO_2}}{300}$

$T_{SO_2} = 1200$ K

13._ A real gas approaches the behaviour of ideal gas when the pressure is low and the temperature is high.

15._ For ideal gas, compressibility actor (Z) = 1.

16._ $T_c = \frac{8a}{27Rb}$. Thus $T_c \propto \frac{a}{b}$

17. $PV = nRT = \frac{w}{M}RT$

or $P = \frac{w}{V}\frac{RT}{M} = \frac{dRT}{M}$

Thus $P \propto d$, $P \propto T$. Hence,

$$\frac{P_1}{P_2} = \frac{d_1}{d_2} \times \frac{T_1}{T_2} = \frac{1}{2} \times \frac{2}{1} = 1 : 1.$$

18. $U_{rms} = \sqrt{\frac{3RT}{M}}$ using ideal gas equation,

$PV = nRT = \frac{w}{M}RT;$ $\frac{RT}{M} = \frac{RV}{w} = \frac{P}{d}$ where d is the density of the gas

$\therefore$ $U_{rms} = \sqrt{\frac{3P}{d}}$ at constant pressure, $U_{rms} \propto \frac{1}{\sqrt{d}}$

19. Pressure of helium = 8 bar

Pressure of CH_4 = 2 bar

$$\frac{r_{He}}{r_{CH_4}} = \frac{P_1}{P_2}\sqrt{\frac{M_{CH_4}}{M_{He}}} = \frac{8}{2}\sqrt{\frac{16}{4}} = \frac{8}{1} = 8 : 1$$

20. At constant temperature,

$P_1 V_1 + P_2 V_2 = P_3 (V_1 + V_2)$

(4.0 bar) (4.0 dm^3) + (6.0 bar) (6.0 dm^3) = P_3 (4.0 + 6.0 dm^3)

or $P_3 = \frac{16+36}{10} = \frac{52}{10}$ = 5.2 bar.

21. $HCOOH \longrightarrow H_2O + CO$

a mole 0 0

a a

$H_2C_2O_4 \longrightarrow H_2O + CO + CO_2$

b mole 0 0 0

b b b

H_2O absorb by H_2SO_4 and CO_2 absorbed by KOH

volume of CO_2 / total volume = b/a + 2b = 1/6

a/b = 4/1

the molar ratio of HCOOH and $H_2C_2O_4$ is 4 : 1.

DPP No. # 58

1. $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$ $K_p = 4\times10^{-3}$

$SO_3 \rightleftharpoons SO_2(g) + \frac{1}{2}O_2(g)$ $K^1_p = \frac{1}{Kp}$

$K^1_p = \left(\frac{1}{4\times10^{-3}}\right)$

$2SO_3 \rightleftharpoons 2SO_2 + O_2(g)$

$K^{II}_p = (K^I_p)^2 = \left[\frac{1}{4\times10^{-3}}\right]^2 = \left[\frac{1000}{4}\right]^2 = 6250 = 625\times10^2$ **6.25×10^4 atm.**

2. $\log \frac{K_P}{K_C} + \log RT = 0$

$\log\left(\frac{K_P}{K_C}.RT\right) = 0$

$K_P = K_C\,(RT)^{-1}$

$\because\ K_P = K_C\,(RT)^{\Delta n}$; $\Delta n = -1$

This is possible one for option (B).

3. Equilibrium const. is temp. dependent only.

4. $C_2H_5OH\,(\ell) + CH_3COOH\,(\ell) \rightleftharpoons CH_3COOC_2H_5\,(\ell) + H_2O\,(\ell)$.

a	a	0	0
a 0.33a	a – 0.33a	0.33a	0.33a

$$K_C = \frac{(0.33a)\times(0.33a)}{(0.67a)\times(0.67a)} = K_C = 1/4.$$

5. Since, K_p is temperature dependent only.

8. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

$\alpha = .2$, initially, $K_p = \frac{\alpha^2}{1-\alpha^2}P = \frac{(0.2)^2}{1-(.2)^2}\times 1 = \frac{.04}{.96} = .042$

If $\alpha = .5$, thus, $\frac{(.5)^2}{1-(.5)^2} \times P = .042$, $P = .126$

9. Since inert gas addition has no effect at const. volume.

12. $P_{NH_3} = P_{H_2S} = \frac{P}{2}$ Hence $K_p = P_{NH_3} \times P_{H_2S} = \frac{P}{2} \times \frac{P}{2} = \frac{P^2}{4}$

13. At room temperature, K = 4.32

and at 425°C, equilibrium constant become 1.24×10^{-4} i.e. it is decreases with increase in temperature. So, it is exothermic reaction.

14. $K = [B(g)]^2\,[C(g)]^3 = x^2y^3$. If [C(g)] is doubled

i.e. = 2y. Suppose [B(g)] is z. Then

$K = z^2\,(2y)^3 = x^2y^3$ or $z^2 = \frac{1}{8}x^2$ or $z = \frac{1}{\sqrt{8}}x = \frac{1}{2\sqrt{2}}x$.

17. On mixing some quantity of 0.01 MHCl in aqueous solution of CH_3COOH, equilibrium concentration of CH_3COO^- will be increase.

18. $N_2O_4(g) \rightleftharpoons 2\,NO_2(s)$

t = 0	0.1 mole	0
t = eq	0.05	0.1

$k = \frac{(0.1)^2}{0.05} = 0.2$

19. $PCl_5\,(g) \rightleftharpoons PCl_3(g) + Cl_2(s)$

at eq, mole of PCl_3 = mole of Cl_2

So $K = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{\left[\frac{0.2}{10}\right]\left[\frac{0.2}{10}\right]}{\frac{0.1}{[10]}} = 0.04$

DPP No. # 59

2. First law of thermodynamics is the law of conservation of energy.

4. Work done by the gas in the cyclic process = Area bounded (ABCA) = $5P_1V_1$

6. From I law of thermodynamics $\Delta E = Q + W$
where Q = 0 for adiabatic process.

7. $\Delta U = W$

$nCv\,(T_2 - T) = -P \times (V_2 - V_1)$

$\frac{3}{2} R\,(T_2 - T) = -1 \quad \Rightarrow \quad \therefore \quad T_2 = T - \frac{2}{3 \times 0.0821}$

8. $q = 0 \quad \therefore \quad \Delta U = w$

$\Rightarrow nC_{v,m}\,(T`_2 - T_1) = -P_{ext}\left[\frac{nRT_2}{P_2} - \frac{nRT_1}{P_1}\right]$

$\therefore\; C_{v,m}\,[T_2 - T_1] = P_{ext}\,.\,R\left[\frac{T_1}{P_1} - \frac{T_2}{P_2}\right] \quad \Rightarrow \frac{3}{2} R\,[T_2 - 300] = 2 \times R\left[\frac{300}{5} - \frac{T_2}{2}\right] \quad \Rightarrow \quad T_2 = 228\text{ K}$

9. When one mole of NH_3 is formed from its constituent elements the enthalpy change = – 46.0 kJ
Therefore when one mole of NH_3 decompose to give its constituent elements enthalpy change = 46.0 kJ
$\Rightarrow$ When 2 mole NH_3 decompose, enthalpy change = 2 × 46 = 92.0 kJ

10. Combustion reaction of solid boron

$B(s) + \frac{3}{4} O_2(g) \longrightarrow \frac{1}{2} B_2O_3$

$\Delta H^\circ_r = \Delta H^\circ_c = \frac{1}{2}\Delta H^\circ_f\,(B_2O_3, s) - \Delta H^\circ_f\,(B, s) - \frac{3}{4}\Delta H^\circ_f\,(O_2, g)$

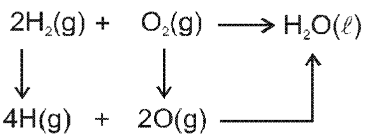
ΔH_f° of element in stable state of aggregation is assumed to be zero.

$\mathbf{\Delta H^\circ_C = \frac{1}{2}\Delta H^\circ_f\,(B_2O_3)}$

11. (1) $H_2O(\ell) \longrightarrow H_2O(g)$ $\Delta H = 40.6$ KJ/mole

(2) $2H(g) \longrightarrow H(g)$ $\Delta H = -435.0$ KJ/mole

(3) $O_2(g) \longrightarrow 2\,O_2(g)$ $\Delta H = -49836$ KJ/mole

(4) 

$\Delta H = -571.6$ KJ/mole

(1) **Calculation of $\Delta H^\circ_f\,(H_2O,\ell)$**

$2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)\;\; \Delta H = -571.6$ KJ/mole

$\Delta H^\circ_r = 2\Delta H^\circ_F(H_2O, \ell) - 2\Delta H^\circ_F\{H_2,(g)\} - \Delta H^\circ_F(O_2, g)$

$\downarrow$ Zero $\quad \downarrow$ Zero

$-571.6 = 2\Delta H^\circ_F(H_2O, \ell)$ so $\quad \Delta H^\circ_F(H_2O, \ell) = -285.5$

(2) **Calculation of $\Delta H^\circ_F(H_2O, g)$**

$H_2O(\ell) \longrightarrow H_2O(g) \qquad \Delta H = 40.6$

$\Delta H_r = \Delta H^\circ_F\,(H_2O, g) - \Delta H^\circ\,(H_2O, \ell)$

$\Delta H^\circ_F\,(H_2O, g) = \Delta H^\circ_F\,(H_2O, \ell) + \Delta H_r$

$= -285.8 + 40 = -245.8$

(3) $H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(g)$ $\Delta H = -245.8$

$$\begin{array}{ccccc} H_2(g) & + & \frac{1}{2}O_2(g) & \longrightarrow & H_2O(g) \\ \downarrow & & \downarrow & & \uparrow \\ 2H(g) & + & O(g) & \longrightarrow & \end{array}$$

$\Delta Hr = \epsilon_{H-H} + \frac{1}{2}\epsilon_{O-O} - 2\,\epsilon_{O-H}$ $\Rightarrow$ $-245.8 = +435 + \frac{1}{2}(489.6) - 2 \times \epsilon_{O-H}$

$2\epsilon_{O-H} = 435 + 244.8 + 245.8$ $\Rightarrow$ $2\epsilon_{O-H} = 925.6$

ϵ_{O-H} = **462.5**

13. $nCH_2 = CH_2 \longrightarrow (-CH_2 - CH_2 -)_n$ $\Delta H = -100$ KJ/mole

n [C = C] + n[C – H]4 – n [C – H] 4 – n[C – C] × 2 = – 100

n[C = C] – 2n[C – C] = – 100 $\Rightarrow$ [C = C] – 2[C – C] = – 100

$\Rightarrow$ + 600 – 2[C – C] = – 100 $\Rightarrow$ – 2 [C – C] = – 700 KJ/mole $\Rightarrow$ (C – C) = – 350

14. Process is Reversible and adiabatic (Q = 0)

So, $\Delta S = 0$

15.* Process is endothermic i.e., ΔH = + ve and process is also spontaneous i.e., ΔG = – ve

Hence, from Gibbs-Helmholtz equation

$\Delta G = \Delta H - T.\Delta S$

ΔS must be positive so that ΔG may be negative.

16.* It is because of the fact that for spontaneity, the value of $\Delta G = (\Delta H - T\Delta S)$ should be < 0. If ΔH is – ve, the value of $T\Delta S$ shall have to be less than ΔH or the value of ΔS has to be less than $\frac{\Delta H}{T}$ i.e., $\frac{x}{298}$.

18. The assertion that the increase in internal energy for vaporisation of one mole of water at 1 atm and 373 K is zero is true because for all isothermal process change in internal energy is zero.

19. $H_2\,(g) + \frac{1}{2}O_2 \longrightarrow H_2O\,(g)$; $\Delta H_f = -\varepsilon_1$, ...(i)

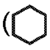
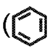
$H_2O\,(g) \longrightarrow H_2O\,(l)$; $\Delta H_f = -\varepsilon_2$, ...(ii)

and (i) and (ii).

$H_2\,(g) + \frac{1}{2}O_2\,(g) \longrightarrow H_2O\,(l).$; $\Delta H = -(\varepsilon_1 + \varepsilon_2)$.

20. Heat of neutralisation for strong acid and strong base combination is constant is equal to – 13.7 Kcal or – 57.1 KJ.

22. Enthalpy of formation of 3 carbon-carbon double bonds

= ΔH_F () – ΔH_f ()

= –156 – (+ 49) kJ = –205 kJ.

Given that,  + $H_2 \longrightarrow$  ΔH = 119 kJ

Theoretical enthalpy of formation of 3 double bonds in benzene ring

= 3 × (–119) kJ = – 357 kJ.

$\therefore$ resonance energy of benzene = – 357 – (–205) kJ = –152 kJ mole^{-1} ®

DPP No. # 1

1. On descending a group, the atoms and ions increase in size. On moving from left to right the size decreases. Thus on moving diagonally the size remains nearly the same. They also have nearly same polarising powers on account of nearly same charge to size ratio.

2. Z = 15 = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$; so element belongs to p-block. Thus its group number will be 10 + 2 + 3 = 15.
Z = 33 = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^3$; so element belongs to p-block. Thus its group number will be 10 + 2 + 3 = 15.
Z = 51 = $[Kr]^{36}\ 4d^{10}\ 5s^2\ 5p^3$; so element belongs to p-block. Thus its group number will be 10 + 2 + 3 = 15.
Hence, all these elements belongs to 15^{th} group i.e. nitrogen family.

3. Z = 118 $[Rn]^{86}\ 5f^{14}\ 6d^{10}\ 7s^2\ 7p^6$; as last electron enters in p-subshell, it belongs to p-block. Thus its group number will be 10 + 2 + 6 = 18. Hence the element is a noble gas.

4. When n = 4, the configuration will be $[Ar]^{18}\ 3d^1\ 4s^2$ and thus period is fourth and group no is third.

5.* (A) ns^2np^3, (B) and (C) are correct statements (D) All are non-metals like $\underbrace{F_2, Cl_2}_{\text{gases}}$, $\underbrace{Br_2}_{\text{liquid}}$, $\underbrace{I_2}_{\text{solid}}$

6.* All statements are correct.

7. Na, Mg, Ar

DPP No. # 2

1. Al^{3+}
K^+ has more number of shells than Mg^{2+} and Al^{3+} . Al^{3+} and Mg^{2+} are isoelectronic but Al^{3+} has higher nuclear charge so $Al^{3+} < Mg^{2+}$. Mg^{2+} and Li^+ has diagonal relationship. But due to +2 charge in Mg^{2+}, the Mg^{2+} is smaller than Li^+. Hence Al^{3+} is the smallest one.
K^+ = 1.38 Å, Li^+ = 0.76 Å, Mg^{2+} = 0.72 Å and Al^{3+} = 0.535 Å.

2. On moving along the period ionic radii decreases.

3. Penetration of p-subshell electron is less than s-subshell electrons. In case of Mg, the first electron is to be removed from completely filled $3s^2$ valence shell configuration as compared to partially filled $3p^1$ of Al. These two factors collectively accounts for the higher ionisation energy of Mg than that of Al. Therefor, (C) option is correct.

4. O (oxygen) have half filled outer orbitals.

5.* The number of electrons present are not same in (D) options N^{3-} = 10 electrons, S^{2-} = 18 electrons, Cl^- = 18 electrons. So this group does not represent the isoelectronic species.

6.* IE_1 values in $KJmol^{-1}$ (IE_1 मान $KJmol^{-1}$ में)
(A) N = 1402 ; O = 1314 ; (B) Be = 899 ; B = 801
(C) Al = 577 ; Ga = 579 ; (D) Cl = 1255 ; F = 1681

7. **(a).** Since $I.E_3 >> I.E_2 > I.E_1$ for X.
(b). Since, for Y, $IE_2 >> IE_1$ and also for Z, $IE_2 >> I.E_1$ ∴ These belongs to 1st group.
(c). Energy required = 118 + 1220 = 1338.

8. (a) $Li^+ < Na^+ < K^+$ (b) $Mg^{2+} < Mg^+ < Mg$
(c) $F^- < O^{2-} < N^{3-}$ (d) $O < O^- < O^{2-}$
(e) $Mg^{2+} < Ca^{2+}$ (f) $N^{3-} < P^{3-}$
(g) $Ca^{2+} < K^+$ (h) $I^+ < I^-$

DPP No. # 3

1. $A \underset{E.A=I.E}{\overset{I.E}{\rightleftharpoons}} A^{\oplus}$ **2.** $EN = \frac{I.P. + E.A.}{2}$

3. $\because$ Here $I.E._4 >> IE_3$ $\therefore$ After removed of $3e^{\ominus}$ element obtain noble gas configuration.

4. Li, B, P, H

6.* Electron affinity is the measure of the ease with which an atom receives the additional electron in its valence shell in gaseous phase.
Generally down the group, the electron affinity decreases due to increase in atomic size.

7. **(a).** Z_{eff} for $S^{2\ominus}$ is least. **(b).** $F \rightarrow 1s^2\ 2s^2\ 2p^5$

8. (a) ${}_9F$ (b) ${}_{36}Kr$ (c) ${}_{12}Mg$

DPP No. # 4

4. % ionic character $= 16(X_A - X_B) + 3.5\,(X_A - X_B)^2$
$= 17.235 \quad = 17\%$

5. Down the group non-metalic character decreases & by increase of oxidation number acidic charaeter of oxide increases.

6. As non-metallic character of element attached to oxygen atom increases, the difference between the electronegativity values of element and oxygen decreases and the acid character of oxides increases and vice-versa.

8. As bond polarity $\uparrow$, % ionic character $\uparrow$, % ionic character $= 16(X_A - X_B) + 3.5\,(X_A - X_B)^2$
As bond polarity $\uparrow$, Bond Length $\downarrow$, $d = r_A + r_B - 0.09\,(X_A - X_B)$
$d_{N-O} \simeq 1.445$ Å
$d_{C-O} \simeq 1.42$ Å
As polarity $\uparrow$ B. Str. $\uparrow$ B. Length $\downarrow$
$\therefore$ $d_{C-O} < d_{N-O}$

DPP No. # 5

1. (i) Sodium meta aluminate (ii) Sodium metaborate
(iii) Potassium pyrophosphate (iv) Sodium zincate
(v) Mercurous metaborate (vi) Potassium dichromate
(vii) Sodium dihydrogen phosphate (ortho) (viii) Sodium monohydrogen phosphate (ortho)
(ix) Sodium phosphate (ortho) (x) Calcium dihydrogen phosphate (ortho)
(xi) Calcium monohydrogen phosphate (ortho) (xii) Calcium phosphate (ortho)
(xiii) Magneisum chlorate (xiv) Sodium hypobromite
(xv) Calcium chlorite (xvi) Cupric plumbite
(xvii) Potassium chlorate (xviii) Ammonium molybdate
(xix) Barium chromate (xx) Sodium stannate
(xxi) Ferrous tungstate (xxii) Potassium manganate
(xxiii) Potassium hypophosphite

2. (i) $Mg_3(PO_4)_2$ (ii) $Ca(NO_2)_2$ (iii) $Ca(BO_2)_2$ (iv) $FePO_4$
(v) $Ca(ClO)_2$ (vi) PO_3^- (vii) $(NH_4)_4Sb_2O_7$ (viii) As_2O_3
(ix) $Na_2S_2O_7$ (x) $KClO_4$ (xi) Ag_2SO_3 (xii) Ag_3AsO_3
(xiii) $PbCr_2O_7$ (xiv) $Zn(NO_3)_2$ (xv) Ag_2PbO_3 (xvi) $NaNH_4HPO_4$

3. Carbonate : CO_3^{2-} ; Sulphite : SO_3^{2-} ; Sulphide : S^{2-}
Nitrite : NO_2^- ; Acetate : CH_3COO^- ; Chloride : Cl^-
Brominde : Br^- ; Iodide : I^- ; Nitrate : NO_3^-
Oxalate : $C_2O_4^{2-}$; Orthoborate : BO_3^{3-} ; (ortho) Phosphate : PO_4^{3-}
Sulphate : SO_4^{2-}

4. $MgHPO_4 \longrightarrow Mg_2P_2O_7 + H_2O$

5. CuBr and Br_2, Cupric bromide , Cuprous bromide.

6. $MgCO_3$, Magnesium carbonate

7. (A) : As/Sb ; (B) : Na_3As/Na_3Sb ; (C) : $AsCl_3/SbCl_3$; (D) : $AsCl_5/SbCl_5$

8. (a) $SOCl_2$ (b) XeO_2F_2, $XeOF_4$ (c) SO_2F_2, SOF_4 (d) VO_2Cl, $VOCl_3$ (e) NOCl

DPP No. # 6

1. (a) Calcium phosphide (b) Barium cyanide (c) Sodium sulphide
(d) Chlorine trifluoride (e) Sulphur tetrafluoride (f) Cobalt (II) metaborate
(g) Scandium pyrosilicate (h) Sodium pyrosulphate (i) Barium nitrate
(j) Sodium metasilicate (k) Sodium pyrophosphite (l) Aluminium sulphate

2. (a) SF_6 (b) Li_3N (c) $SrCl_2$ (d) O_2F_2 (e) $Ba(N_3)_2$ (f) $Ba(ClO_4)_2$
(g) NaOCl (h) $Ca_3(PO_4)_2$ (i) $Mg_2P_2O_7$ (j) $Cu(BO_2)_2$ (k) $Na_2S_2O_5$ (l) $Fe(NO_3)_3$

3. (a) Ortho boric acid (b) Ortho silicic acid (c) Chromic acid
(d) Perxenic acid (e) Phosphorus acid (f) Metaphosphoric acid
(g) Sulphurous acid (h) Dithionous acid (i) Thiosulphuric acid
(j) Peroxymonosulphuric acid (k) Chloric acid (l) Hyponitrous acid
(m) Hydrobromic acid (n) Hydrazoic acid

4. (a) H_2CO_3 (b) $H_6Si_2O_7$ (c) HBO_2 (d) H_2MnO_4 (e) H_2XeO_4 (f) H_3PO_2
(g) H_3PO_4 (h) $H_2S_2O_5$ (i) $H_2S_2O_6$ (j) $HClO_2$ (k) HNO_2 (l) HNO_4
(m) HI (n) HCN

DPP No. # 7

1. $E_{required} = IE_1 + IE_2 = 24.6 + 13.6\,(2)^2 = 79$ eV
After removal of one electron , He atom follows Bohr model.So, $IE_2 = 13.6\,Z^2$ eV

2. Order of acidic strength : $H_2SiO_3 < H_3PO_4 < H_2SO_4 < HClO_4$
On moving L $\rightarrow$ R in a period, EN $\uparrow$. So, acidic strength increases.

3. $2HNO_3 \longrightarrow N_2O_5 + H_2O$
So, N_2O_5 is the anhydride of HNO_3.

4. (B) $\overset{+7}{Cl_2}O_7$ having higher oxidation state is more acidic than $\overset{+5}{N_2}O_5$ having lower oxidation state.

5. (D) HI > HBr > HCl > HF

6.* (A) $S^-(g) \longrightarrow S^{2-}(g)$; $\Delta H_{e.g.}$ = (+) ve because of electrostatic repulsion.
(B) Ne (g) + e^- (g) $\longrightarrow$ Ne^- (g); $\Delta H_{e.g.}$ = (+) ve because of stable completely filled electron configuration.
(C) N(g) $\longrightarrow$ N^- (g) ; $\Delta H_{e.g.}$ = (+) ve because of stable half filled electron configuration.
(D) $Al^{2+}(g) \longrightarrow Al^{3+}(g)$; $\Delta H_{I.E.}$ = (+) ve because of the removal of electron from cation.

7.* (C) C < N < O< F (Non-metallic character)
(D) Correct order is Li < Na < K < Rb < Cs. The chemical reactivity increases down the group with decreasing ionisation energy. Although Li has highest negative reduction potential but it's reactivity with water is lowest on account of its higher ionisation energy

8. Electronegativity of A = $\frac{400+80}{62.5\times 2} = 3.84$

Electronegativity of B = $\frac{300+85}{62.5\times 2} = 3.08$

Ans. Electronegativity of A = 3.84 ; electronegativity of B = 3.08. Therefore A has higher electronegativity.

DPP No. # 8

5. $C^* \rightarrow 1s^2\,2s^1\,2p^3$ 4 unpaired electron $\therefore$ 4 bonds
$B^* \rightarrow 1s^2\,2s^1\,2p^2$ 3 unpaired electron $\therefore$ 3 bonds
$I^* \rightarrow 5s^1\,5p^3\,5d^3$ 7 unpaired electron $\therefore$ 7 bonds
$P \rightarrow 3s^2\,3p^3$ 3 unpaired electron $\therefore$ 3 bonds
* represent excited state

8. (i) four (ii) three covalent and one coordinate.

DPP No. # 9

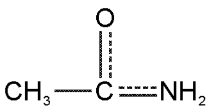
1. N–atom can't form hypervalent compound.

7. (a) All zero
(b) All have zero except single bonded oxygen (–1)
(c) All have zero except nitrogen (+1)
(d) Both single bonded O-atoms have (–1), N-atom has (+1) and double bonded O-atom has zero.

8. $[\ddot{C} = C = \ddot{C}]^{4-}$

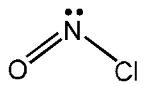
DPP No. # 10

3. P : $CH_3 - C \equiv N$
Q : H -- N = C = O

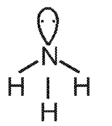
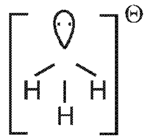
R : 

4. CO_3^{2-} : bond length between C–O and C=O (due to resonance) bond length Maximum
CO_2 : bond length shorter than C=O.
CO : bond order = 3 ⇒ Triple bond ⇒ bond length Minimum.

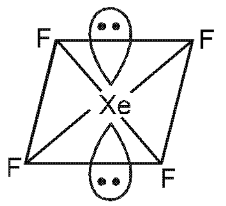
DPP No. # 11

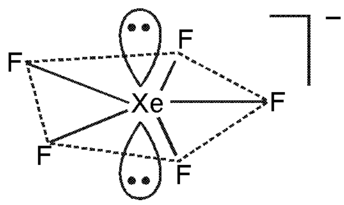
2.  'N' atom is sp^2.

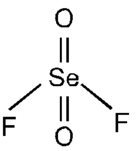
4. O = C = C = C = O

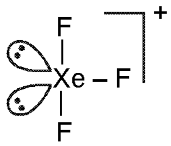
5. NH_3 ≡ 
Pyramidal
&
$CH_3^{\ominus}$ ≡ 
Pyramidal

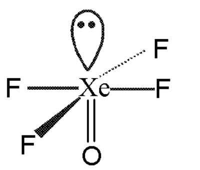
6.* Hybridisation of C in CH_3^- is sp^3.

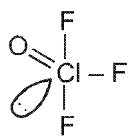
7. XeF_4 

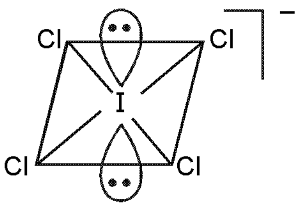
XeF_5^- 

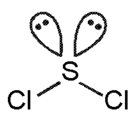
F_2SeO_2 

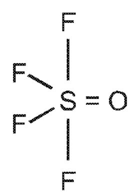
XeF_3^+ 

$XeOF_4$ 

$ClOF_3$ 

ICl_4^- 

SCl_2 

OSF_4 

8. (A – t) ; (B – s) ; (C – p) ; (D – r).

DPP No. # 12

1. $N \equiv C - C \equiv C - C \equiv N$

3. Both $PO_4^{3\ominus}$ & $SO_3^{2\ominus}$ have hybridisation sp^3

4. $N_3^{\ominus} \equiv [\overset{\ominus}{N} = \overset{\oplus}{N} = N^-]$; $NOCl \equiv$ $O = N - Cl$ & $N_2O \equiv$ $\overset{-}{N} = \overset{+}{N} = O$

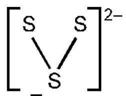
5.

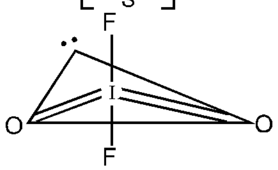
Species	Hybridisation
$CO_3^{2\ominus}$	sp^2
XeF_4	sp^3d^2
$I_3^{\ominus}$	sp^3d
NCl_3	sp^3
$BeCl_2$	sp

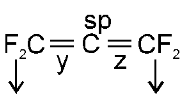
8.

1.	BeH_2	sp	2.	BeF_2	sp
3.	CO_2	sp	4.	$HC \equiv CH$	sp, sp
5.	O_3	sp^2	6.	BF_3	sp^2
7.	$CH_2=CH_2$	sp^2	8.	CH_3^+	sp^2
9.	HNO_3	sp^2	10.	HNO_2	sp^2
11.	SO_2	sp^2	12.	SO_3	sp^2
13.	HCO_3^-	sp^2	14.	$HCOO^-$	sp^2
15.	$SnCl_2$	sp^2	16.	$AlCl_3$	sp^2
17.	AlH_4^-	sp^3	18.	NF_3	sp^3
19.	PF_3	sp^3	20.	$AsCl_3$	sp^3
21.	CH_3^-	sp^3	22.	OF_2	sp^3
23.	SCl_2	sp^3	24.	SF_4	sp^3d
25.	$[SiF_6]^{2-}$	sp^3d^2	26.	PCl_6^-	sp^3d^2
27.	ICl_2^-	sp^3d	28.	ICl_5	sp^3d^2
29.	ICl_4^-	sp^3d^2	30.	XeF_6	sp^3d^3

DPP No. # 13

1. S_3^{2-} = 

3. 

5. 

These flourine atoms will be in xz plane — These flourine atoms will be in xy plane

8. (a-ii) (b-iii) (c- iv) (d-v) (e-vi) (f-i).

DPP No. # 14

1. All are ionic solids
XeF_6 (S) consists XeF_5^+ & F^-
PBr_5 (s)................ PBr_4^+ & Br^-
CaC_2(s) .... Ca^{++} & C_2^{--}

2. (1) Number of sigma bonds is 7.
(2) Odd number of consecutive double bonds. So, all the hydrogen atoms lie in same plane.

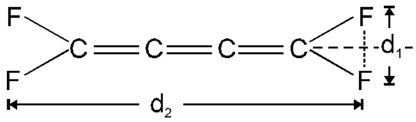
5.*

6.* The compound containing same type of ions having same hybridization & sape is isomorphous to each other.

Species	**Hybridisation**	**Shape**
CO_3^{2-}	sp^2	Trigonal planar
NO_3	sp^2	Trigonal planar
SO_3^{2-}	sp^2	Pyramidal
SO_4^{2-}	sp^3	Tetrahedral
MnO_4^-	sp^3	Tetrahedral
ClO_4^-	sp^3	Tetrahedral

7. (A – p, B – q, C – p, D – s)

8.

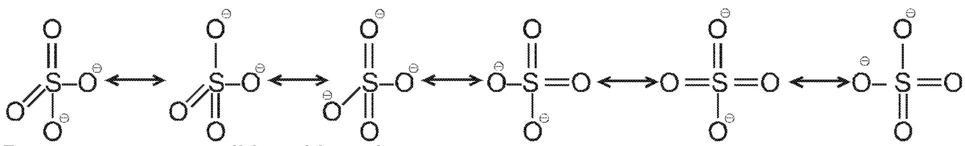


$d_1 = 2 \times 134 \times \sin 60°$ pm = 227.8 pm = 228 pm

$d_2 = 134 \times 3 + 2 \times 134 \cos 60°$ pm = 536 pm

DPP No. # 15

3.



Due to resonance all bond length are same.

4. (A) NH_3 (106.6º) > PH_3 (93.8º) > AsH_3 (91.83º) > SbH_3 (91.3º) – bond angle
(B) Cl_2O (110.9º) > H_2O (104.5°) > F_2O (103.3º)
(C) SbI_3 (99°) > $SbBr_3$ (98.2°) > $SbCl_3$ (97.1°)
(D) All are trigonal planar (bond angle 120º).

5. Bond angle x size of central atom (if all other factors are same.

6.* All given order are correct

OF_2 <	H_2O <	Cl_2O <	ClO_2
sp^3	sp^3	sp^3	sp^3
low bp-bp repulsion		larger size of Cl	

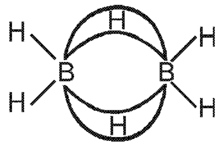
$COF_2 < COCl_2 < COBr_2 < COI_2$ ($X\hat{C}X$ bond angle)

$PH_3 < PF_3$
92º 97.7º

KrF_4 > SF_2 < N_2H_2
sp^3d^2 Sp^3 sp^2 (< 120º)
(90ºC) (< 109º28') sp^2(< 120º)

8. (a) $F_2O < H_2O$ (b) $NH_3 > PH_3$ (c) $SO_2 < SO_3$ (d) $NO_2^+ > NO_2^-$

DPP No. # 16

1. 

Diborane

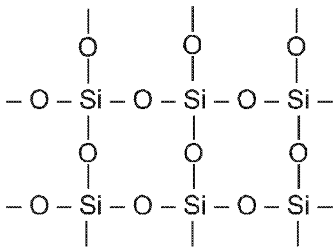
3. $H_3Si \Leftarrow \ddot{N} = C = O$

6. In $(CH_3)_3\dot{N}$, N is sp^3 hybridized, having pyramidal structure because of absence of vacant orbital on carbon atom therefore no back bonding is possible.
In $(SiH_3)_3N$, N is sp^2 hybridized, on the basis of $p\pi$-$d\pi$ back bonding $(SiH_3)_3N$ resulting into triangular planar structure.

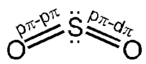
DPP No. # 17

4. diamond (1.54 Å)
graphite (1.42 Å) . ($\perp^r$ to the sheets there is no covalent bonding)
C_{60} (1.45 Å and 1.38 Å)
benzene (1.36 Å).

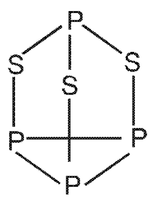
DPP No. # 18

1. Structure of SiO_2 : 

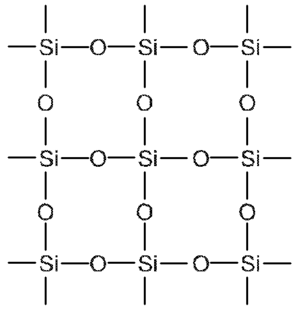
2. **(Moderate)**



4. ClO_2 does not dimerise because odd electron is present in 'd' orbital and is declocalised not localised as in NO_2.

6. The structure of P_4S_3 is 

7. (i) Nitrogen → $p\pi - p\pi$ multiple bond (very high bond enthalpy).
(ii) In phosphorus their atomic orbitals are so large and diffuse that they cannot have effective over lapping.

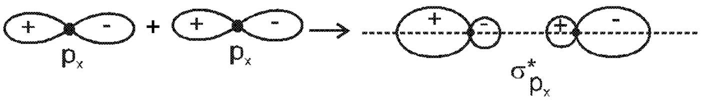
8. 

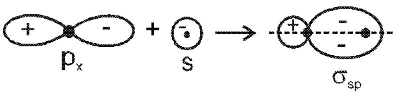
DPP No. # 19

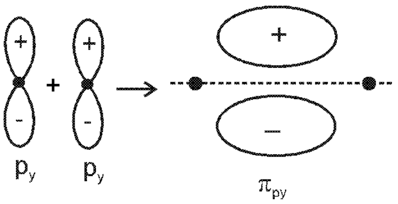
1. C_2 :KK $(\sigma\ 2s)^2\ (\sigma^*\ 2s)^2\ \underbrace{(\pi 2p_x^2 = \pi 2p_y^2)}_{2\pi-\text{bonds}}$.

2. (A) Be_2 : BO = 0 (zero) $\therefore$ unstable molecule.
(B) He_2 : BO = 0 (not stable) , He_2^+ : BO = 0.5 (expected to exist).
(C) N_2 : BO = 3 , maximum bond order means maximum bond strength.
(D) For F_2 molecule, $E(\sigma 2p_z) < E(\pi 2p_x) = E(\pi 2p_y)$.

3. From the graph
B.E. of H_2 > B.E. of H_2^+ > B.E of He_2^+ > BE of He_2 where BE = bond energy or bond dissociation energy
and B.L. of H_2 < B.L. of H_2^+ < B.L. of He_2^+ < B.L. of He_2
where B.L. = bond length
so stability order = $H_2 > H_2^+ > He_2^+ > He_2$

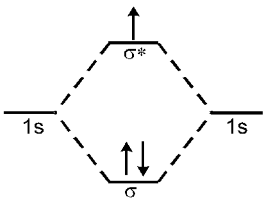
6. (A) 

(B) 

(D) 

7. Bonding M.O. has maximum electron density between two nuclei

8. It should be stable because it has one more bonding electron than antibonding



He_2^+

DPP No. # 20

1. O_2 = 2 unpaired e^-
O_2^+ = 1 unpaired e^-
O_2^- = 1 unpaired e^-
O_2^{2-} = 0 unpaired e^-
O_2 and O_2^{2-} have largest difference in no. of unpaired electrons.So, they have largest difference in magnetic moment.

2. O_2^- :KK $(\sigma\ 2s)^2\ (\sigma^*\ 2s)^2\ (\sigma\ 2p_z)^2\ (\pi\ 2p_x^2 = \pi\ 2p_y^2)\ \underbrace{(\pi^* 2p_x^1 = \pi^* 2p_y^1)}_{\text{HOMO}}$

3. Bond order of N_2 = 3
Bond order of N_2^+ = 2.5
Bond order of N_2^- = 2.5
But N_2^+ consist of lesser electrons in anti bonding molecular orbital. So it is more stable than N_2^-.

as $N_2^+ = \sigma_{1s}^2 < \sigma_{1s}^{*\,2} < \sigma_{2s}^2 < \sigma_{2s}^{*\,2} < \pi_x 2p^2 = \pi_y 2p^2 < \sigma_{2p_z}^1$

$N_2^- = \sigma_{1s}^2 < \sigma_{1s}^{*\,2} < \sigma_{2s}^2 < \sigma_{2s}^{*\,2} < \pi_x 2p^2 = \pi_y 2p^2 < \sigma_{2p_z}^2 < \pi_x 2p^{*1} = \pi_y 2p^{*0}$

4. Greater bond order $\Rightarrow$ Lesser bond length.

5. O_2^+ = BO = 2.5 > BO_{O_2}
15 electron $\therefore$ paramagnetic.

6.* In CaC_2 there is $C \equiv C$, while in CH_2CCH_2, there is only C = C.
$KO_2 = K^+ + O_2^-$
Bond order = 1.5
$Na_2O_2 = 2Na^+ + O_2^{2-}$
Bond order = 1.0
$O_2\ (Pt\ F_6] = O_2^+ + [Pt\ F_6]^-$
Bond order = 2.5
NO Bond order = 2.5
while in NOCl, bond order = 2.

7.

Species	No. of electrons	Bond order	Magnetic nature
NO	15	1/2 (10 – 5) = 2.5	Paramagnetic
NO^+	14	1/2 (10 – 4) = 3.0	Diamagnetic
NO^{2+}	13	1/2 (9 – 4) = 2.5	Paramagnetic
NO^-	16	1/2 (10 – 6) = 2.0	Diamagnetic

Highest bond order $\Rightarrow$ shortest bondlength (NO^+).

8. NO has lost an antibonding electron to form NO^+. So NO^+ is more stable.
CO has lost a bonding electron to form CO^+. So CO^+ is less stable.

DPP No. # 21

5. $BeCl_2$, $MgCl_2$, $CaCl_2$, $BaCl_2$
$\longrightarrow$ cationic size $\uparrow$ $\therefore$ covalent character $\downarrow$ $\therefore$ mp $\uparrow$

6. Greater the charge on cation and smaller the size of cation, more will be the covalent character in ionic compound.

7. (B) For this comparison, larger the size difference between cation and anion, greater will be the water solubility.

8. (a) Electronegativity difference Li and iodine is less than Li and F. Thus, LiI is more covalent.
(b) Although Li^+ is same in both the compounds yet difference in the size of F^- and I^- is not same. Since F^- is smaller than I^- hence lattice energy of LiF is more than that of LiI. Similarly heat of hydration of F^- is more than that of I^-. But the decrease of L.E. from LiF to LiI is much more than the decrease in heat of hydration from LiF to LiI. Hence solubility increases from LiF to LiI.

DPP No. # 22

1. All are symmetrical molecules. $\therefore$ $\mu = 0$ (Non polar compounds).

2. The dipole moment of BF_3 , NF_3 and NH_3 respectively is zero, 0.24D and 1.46D.

3. $AB_2L_2 \rightarrow$ Bent ($\mu \neq 0$), $AB_2L_3 \rightarrow$ Linear ($\mu = 0$), $AB_4L_2 \rightarrow$ Square planar ($\mu = 0$), $AB_4 \rightarrow$ Tetrahedral ($\mu = 0$).

4.* Correct orders of dipole moment are
HF > HCl > HBr > HI (decreasing bond polarity)
$CD_3F >$ CH_3F (D is more electro +ve than hydrogen)
$SO_2 > SO_3$ (SO_3 is symmetircal so dipole moment - 0)

5. (a) 1.07×10^{-8} esu –cm = $\delta \times 1.2738 \times 10^{-8}$
$\Rightarrow$ 8.4×10^{-11} esu

Fraction = $\frac{\delta}{e} = \frac{8.4 \times 10^{-11}}{4.8 \times 10^{-10}} = \frac{7}{40}$ or 0.175.

(b) All N – N bond length are same in azide ion but not in hydrazoic acid.

6. $BF_3 < H_2S < H_2O$. BF_3 has a zero dipole moment because of its symmetry. H_2S has a lower dipole moment than H_2O because of the much lower bond polarity of H–S bond compared to H–O bond.

7. Dipole moment of compound if it would have been completely ionic
= $(4.8 \times 10^{-10}$ esu$)(2.67 \times 10^{-8}$ cm$)$ = 12.8 D

so % ionic character = $\frac{9.6}{12.8} \times 100\% = 75\%$

8. (A) NH_3 : $\mu \neq 0$ (polar molecule). 3 unpaired electron and 3 bonds.
$\therefore$ Bonding takes place in ground state.
(B) PF_2Cl_3 : $\mu = 0$ (Non-polar molecule) 3 unpaired electron and 5 bonds.
$\therefore$ Bonding takes place in excited state.
(C) XeF_2 : $\mu = 0$ (Non-polar molecule) 0 unpaired electron and 2 bonds.
$\therefore$ Bonding takes place in excited state.
(D) H_2S : $\mu \neq 0$ (Polar molecule) 2 unpaired electron and 2 bonds.
$\therefore$ Bonding takes place in ground state.

DPP No. # 23

1. Bond polarity is a more dominating factor for strength of H–bond than lone pair availability.

2. **[D]**
Benzene has hydrogens connected to carbons and the bonds are almost non polar. Hence no question of hydrogen bonding. It is a liquid owing to vander waal forces.

3. Two ice cubes unite due to H–bond developed between water molecules of two cubes.

4.* (A) H–bonding exists in $CH_3 - CH_2 -$ OH due to polar O – H bond.
(B) I_2 has maximum moecular mass, thus stronger vander waal forces and higher b.p.
(C) H–bonding exists in HF, so it has highest b.p.
(D) H–bonding exists in NH_3, so it has highest b.p.

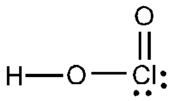
5. No polar bond of H–atom (N – H or O – H) is present in $CH_3 - CH_2 - CH_3$, but in all other compound, it is present.

6. I – density of water increases up to 4°C
II – in case of ice each water molecule is attached with four other molecules tetrahedrally forming a cage like structure.

7. Conditions for H–bonding :
(A) Positive charge density on H–atom should be high.
(B) Availability of lone pair of EN atom should be high.
(C) Size of EN atom should be small.

8. (i) dipole-dipole attraction. (ii) H – bonding (iii) H – bonding
(iv) dipole-dipole attraction. (v) H–bonding (vi) dipole-dipole attraction.
(vii) metallic bonding (viii) H–bonding. (ix) dipole-dipole attraction.
(x) ion-dipole attraction. (xi) dispersion forces (xii) covalent bond.
(xiii) disperison forces (xiv) ionic bond (xv) dipole - induced dipole attraction.
(xvi) disperison forces.

DPP No. # 24

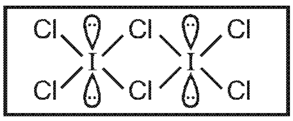
1.  ; Cl is sp^3 and molecule is polar Cl , sp^3 संकरित है और अणु ध्रुवीय है

6.* Electronic configuration of C_2 molecule will be

$$\sigma_{1s^2}\ ,\ \sigma^*_{1s^2}\ ,\ \sigma_{2s^2}\ ,\ \sigma^*_{2s^2}\ ,\ \pi_{2P_x^2}\ ,\ \pi_{2P_y^2}\ ,\ \sigma_{2P_z}\ ,$$

so, B.O. = 2 (both bonds are π bonds)
LUMO = σ_{2P}
HOMO = π_{2P}

7. **08**
I_2Cl_6 is a planar molecule.



8.

Species		**Number of π^* electrons**
O_2		2
O_2^-		3
O_2^{2-}		4
Total	=	**9 electrons**

DPP No. # 25

1. When sodium and potassium react with water, the heat evolved causes them to melt, giving a larger area of contact with water, lithium on the other hand, does not melt under these condition and thus reacts more slowly.

	Li	Na	K
Melting point (ºC)	180	98	64.

2. $M + (x + y)NH_3 \longrightarrow [M(NH_3)_x]^+ + [e(NH_3)_y]^-$
It is paramagnetic due to the presence of the unpaired electrons

3. As the size of cation decreases, the extent of polarisation increases so covalent character $\uparrow$ and stability $\downarrow$

5. (4) Reducing nature increases down the group as their stability decreases down the group
CsH > RbH > KH > NaH > LiH

6. Both statements are correct but S_2 is not correct explanation of S_1 .
Statement - 1 : The reason for this is that their lattice energies change is more than the hydration energies on descending the group.

Statement - 2 : Hydration energy $\propto \dfrac{1}{\text{size of cation}}$.

7. **(C)**
The atom becomes larger on descending the group, so the bonds are weaker (metallic bond), the cohesive force/energy decreases and accordingly melting point also decreases.

8. **(A,B,C,D)**
(A) Due to the formation of metal ion clusters
(B) $M + (x + y)\ NH_3 \longrightarrow M^+(NH_3)_x + e^-(NH_3)_y$
(C) due to the formation of metal clusters.
(D) $M\ (NH_3)_6 \longrightarrow$ true statement

9. **(C)**
(i) E^θ $Li^+/Li = -3.04$; $Na^+/Na = -2.71$ which is least among the alkali metals.
(ii) Hydration enthalpy / KJ mol^{-1}
Li = – 506 ; Na = – 406 ; Cs has the least $\Delta H_{hyd} = -276$

10. (A) Bigger anion is stabilised by bigger cation through lattice energy effect.
(B) Because of their high reactivity towards air and water.
(C) True Statement
(D) In concentrated solution, unpaired electrons with opposite spins paired up – forming the solution diamagnetic.

11. **(B)**
Solubility of alkaline earth metal hydroxide increases as the solubility product increases.

	$Be(OH)_2$ < – – – – – – –	< $Ba(OH)_2$
K_{SP}	1.6×10^{-26}	5.4×10^{-3}

12. The anhydrous magnesium chloride is fused with NaCl to provide conductivity to the electrolyte and to lower the fusion temperature of anhydrous $MgCl_2$.

13. LiF has more ionic character while LiI has more covalent character. The latter is due to the greater polarizability of larger iodide ion than the lithium ion.

14. As metallic character i.e. electropositive character of cations increases thermal stability of their sulphates increases and thus the correct order is $SrSO_4 > CaSO_4 > MgSO_4 > BeSO_4$.

15. **(i)** higher effective nuclear charge
(ii) Decreases; as mobility of free electron decreases on cooling.

16. **(a)** **True :** The metallic bonding decreases with increase in atomic size and thus close packing of atoms in crystal lattice decreases from Li to Cs resulting in an increase in softness.

(b) **False :** Sodium when burnt in excess of oxygen gives monoxide and sodium peroxide (Na_2O_2) and not sodium oxide.

$$4Na + O_2 \rightarrow 2Na_2O;\ 2Na + O_2 \rightarrow Na_2O_2$$

17. Ca is obtained by electrolysis of molten mixture of $CaCl_2$ mixed with CaF_2.

18. Both S & E are true and E is the correct explanation of S. So (a)

DPP No. # 26

1. (A) $4\ LiNO_3 \longrightarrow 2Li_2O + 4NO_2 + O_2$

$2NaNO_3 \longrightarrow 2NaNO_2 + O_2$ (similar decomposition with the nitrates of K, Rb and Cs)

(B) Only LiCl is deliquescent and crystallises as a hydrate $LiCl.2H_2O$

(C) $2M + 2H_2O \longrightarrow 2M^+ + 2OH^- + H_2$ (M = an alkali metal)

(D) Halides of Li are covalent in nature.

3. (i) $Na_2S + 4Na_2O_2 \longrightarrow Na_2SO_4 + 4Na_2O$.

(ii) $2Na + O_2$(excess) (आधिक्य) $\xrightarrow{350°C} Na_2O_2$.

(iii) $Na_2O_2 + CO \longrightarrow Na_2CO_3$; $2Na_2O_2 + 2CO_2 \longrightarrow 2Na_2CO_3 + O_2$.

(iv) $2Cr(OH)_3 + 3Na_2O_2 \longrightarrow 2Na_2CrO_4 + 2NaOH + 2H_2O$.

(v) $MnSO_4 + 2Na_2O_2 \longrightarrow Na_2MnO_4 + Na_2SO_4$.

(vi) $Na_2O + NH_3 \longrightarrow NaNH_2 + NaOH$

(vii) $Na_2O_2 + 2H_2O \xrightarrow{Cold} 2NaOH + H_2O_2$

5. $MgCO_3 \xrightarrow{\Delta} \underset{(Basic)}{MgO} + \underset{(Acidic)}{CO_2}$

6. (2) $KO_2 + 2H_2O \longrightarrow KOH + H_2O_2 + 1/2O_2$

(3) $4KO_2 + 2CO_2 \longrightarrow 2K_2CO_3 + 3O_2$

7. **(i)** $2NaOH + 2NO_2 \longrightarrow NaNO_2 + NaNO_3 + H_2O$; $2NaOH + SO_3 \longrightarrow Na_2SO_4 + H_2O$.

(ii) $6NaOH + 3Br_2 \longrightarrow 5NaBr + NaBrO_3 + 3H_2O$.

$4NaOH + 2F_2 \longrightarrow 4NaF + O_2 + 2H_2O$.

(iii) $6NaOH + 4S \longrightarrow 2Na_2S + Na_2S_2O_3 + 3H_2O$.

(iv) $2B + 6NaOH \longrightarrow 2Na_3BO_3 + 3H_2$

(v) $2NaOH + Si + H_2O \longrightarrow Na_2SiO_3 + 2H_2$.

(vi) $PbO + 2NaOH \longrightarrow Na_2PbO_2 + H_2O$; $PbO_2 + NaOH \longrightarrow Na_2PbO_3 + H_2O$.

(vii) $4NaOH + 2H_2O + 2Al \longrightarrow 2NaAlO_2 + 3H_2$.

(viii) Form insoluble hydroxides.

$CrCl_3 + 3NaOH \longrightarrow Cr(OH)_3 \downarrow$ (Green) $+ 3NaCl$.

$CuCl_2 + 2NaOH \longrightarrow Cu(OH)_2 \downarrow$ (bule) $+ 2NaCl$.

(ix) $HgCl_2 + 2NaOH \longrightarrow Hg(OH)_2 \downarrow + 2NaCl$; $Hg(OH)_2 \longrightarrow HgO \downarrow$ (yellow or brown) $+ H_2O$.

$2AgNO_3 + 2NaOH \longrightarrow 2AgOH \downarrow + 2NaNO_3$; $2AgOH \longrightarrow Ag_2O \downarrow$ (black) $+ H_2O$.

(x) $NaOH + CO \xrightarrow[5\text{–}10\,atm]{150\text{–}200°C} HCOONa$.

8. $CaO + H_2O \xrightarrow{\text{Hissing sound}} Ca(OH)_2 + \text{Heat}$

$CaO + CO_2 \longrightarrow CaCO_3$

9. $BaO_2.8H_2O + 2HCl \longrightarrow BaCl_2 + H_2O_2 + 8H_2O$.

10. Since $NaHCO_3$ is an acid salt of H_2CO_3. it reacts with NaOH to form Na_2CO_3 and H_2O.

$Na_2CO_3 + NaOH \rightarrow Na_2CO_3 + H_2O$.

11. **S_1 :** $(2\,CaSO_4.2H_2O) \xrightarrow{393K} 2\,(CaSO_4).\,H_2O + 3H_2O$; above 393 K dead burnt plaster is obtained.

S_2 : $Ca^{2+} + Na_2CO_3 \longrightarrow CaCO_3 \downarrow + 2Na^+$

S_3 : $Li^+ < Na^+ < K^+ < Kb^+ < Cs^+$

Bigger hydrated ion moves slower in aqueous solution.

13. **(A → P, Q, R) ; (B → P,Q,R) ; (C → P,Q) ; (D → P,Q,S)**

(A) $NaSO_4 + C + CaCO_3 \longrightarrow Na_2CO_3(sp^2) + CaSO_4(sp^3)\downarrow$ (White)

(B) $NaCl + NH_4.\,HCO_3 \longrightarrow NaHCO_3(sp^2)\downarrow$ (White) $+ NH_4Cl(sp^3)$

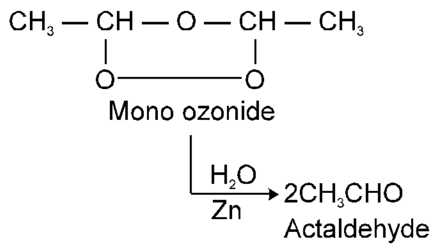
(C) $Na_2CO_3 + Ca\,(OH)_2 \longrightarrow Ca\,CO_3(sp^2)\downarrow$ (White) $+ NaOH$

(D) $2KOH + 4NO \longrightarrow 2KNO_2(sp^2) + N_2O + H_2O(sp^3)$

If $4\,KOH + 6NO \longrightarrow 4KNO_2 + N_2 + 2H_2O$

14. The gas (A) on treatment with but 2–ene followed by treatment with Zn /H_2O yields acetaldehyde and thus (A) is ozone

(i) $O_3 + CH_3 - CH = CH - CH_3 \longrightarrow$



(ii) $5O_3 + 2KOH \longrightarrow 2KO_3$(Deep red) + $H_2O_{(g)} + 5O_2$
(A) Potassium ozonide (B) (C)

15. $CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$ (calcium bicarbonate).

16. MgO is used for the lining of steel making furnace because it acts as basic flux and facilitates the removal of acidic impurities of Si, P and S from steel through slag formation.

17. $3\,Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 .\,Ca(OH)_2 .CaCl_2 .2H_2O$
Bleaching powder
(a mixture of $Ca(OCl)_2$ and basic chloride)

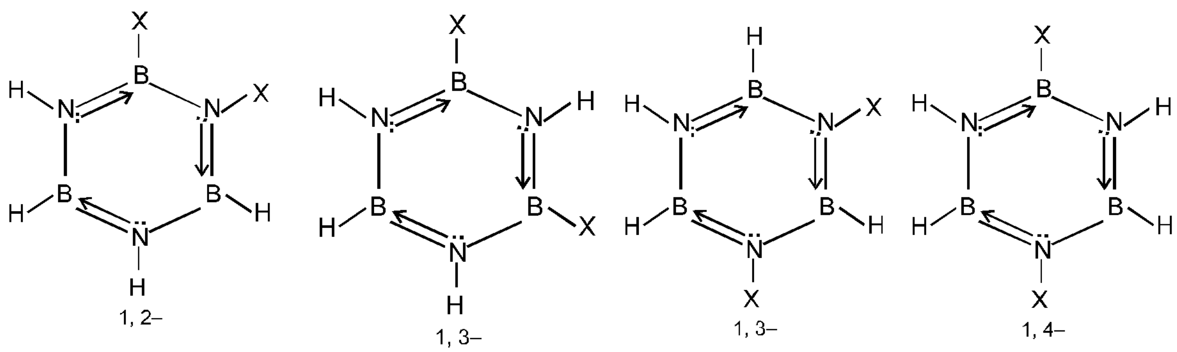
18. $Ca_5(PO_4)_3F + 5H_2SO_4 + 10H_2O \xrightarrow{\Delta} 3H_3PO_4 + 5CaSO_4.2H_2O + HF$

19. $Na_2\,Al_2\,Si_2\,O_8\,.\,xH_2O + Ca^{2+} \rightarrow CaAl_2\,Si_2\,O_8\,.\,xH_2O + 2Na^+$
$Na_2\,Al_2\,Si_2\,O_8\,.\,xH_2O + Mg^{2+} \rightarrow MgAl_2\,Si_2\,O_8\,.\,xH_2O + 2Na^+$

DPP No. # 27

1. $T\ell^{3+}$ acts as an oxidising agent because it has tendency to reduce to $T\ell^+$ as +1 oxidation state of $T\ell$ is more stable on account inert pair effect.

3.



4.* Boron does not increase its covalence beyond four as it does not have d-orbital.

5. $B(OH)_3 + 2HOH \rightleftharpoons [B(OH)_4]^- + H_3O^+$.
In aqueous solution the boron completes its octet by accepting OH^- from water molecules. It therefore function as a weak monobasic lewis acid.

6. As boron completes it octet by accepting OH^- from water molecule. Hence it acts as a Lewis acid.

7. $Na_2B_4O_7 + H_2SO_4 + 5H_2O \longrightarrow Na_2SO_4 + 4H_3BO_3$

8. $[B_4O_5(OH)_4]^{2-} + 5H_2O \rightleftharpoons 2B(OH)_3$ (weak acid) + $2[B(OH_4)]^-$ (salt)

9. Borax is not used as fuel in rockets.

10. $B_2H_6 + 2NH_3 \longrightarrow [H_2B(NH_3)_2]^+ + [BH_4]^-$

$B_2H_6 + 2N(CH_3)_3 \longrightarrow 2H_3B \longleftarrow N(CH_3)_3$

11. (C) CH_3 group being larger can not form a bridge between two small sized boron atoms.

12. $B_2H_6 + NH_3 \xrightarrow[\text{low temperature}]{\text{Excess } NH_3} B_2H_6 . 2NH_3$ or $[H_2B(NH_3)_2]^+ [BH_4]^-$ (ionic compound).

13. (A) $B_2O_3 + 3H_2O \longrightarrow 2H_3BO_3$

(B) $B_2H_6 + 6H_2O \longrightarrow 2H_3BO_3 + 6H_2$

(C) $B_3N_3H_6 + 9H_2O \longrightarrow 3B(OH)_3 + 3NH_3 + 2H_2$

(D) $BCl_3 + 3H_2O \longrightarrow B(OH)_3 + 3HCl$.

14. As it becomes passive by the action of conc. HNO_3 forming a protective oxide layer on the surface.

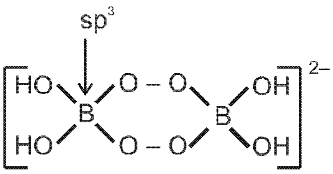
15. $Na_2CO_3 + H_2O \longrightarrow 2NaOH + CO_2$; $4OH^- + Al \longrightarrow [Al(OH)_4]^-$ (soluble complex)

16. A (both assertion & reason are correct and explanation also correct)

17. It is acidic because of the hydrolysis of $Al_2(SO_4)_3$ according to the following reaction.

$Al_2(SO_4)_3 + 6H_2O \longrightarrow 2Al(OH)_3 + 3H_2SO_4$.

18. **(i)** This is the test of borate.

(ii) 

Peroxoborate ion.

(iii) $H_3BO_3 + 4HF \longrightarrow H^+ + [BF_4]^- + 3H_2O$

(iv) False

(v) Elemental Boron can be obtained from Van Arkel method.

$2BI_3 \xrightarrow[\text{or Tantalum}]{\text{red hot W}} 2B\uparrow + 3I_2\uparrow$ (Van Arkel method).

DPP No. # 28

2. As differ in their crystal structures and physical properties.

4. CO_2 can not act as reducing agent because carbon is in its highest oxidation state, i.e., +4.

6. CO burns with blue flame and also acts as reducing agent ; used in the extraction of various metal from their oxide ores.

7. (X) is CO_2 because $CO_2 + NH_3$ under pressure gives urea, in reaction (B) does not produce CO_2

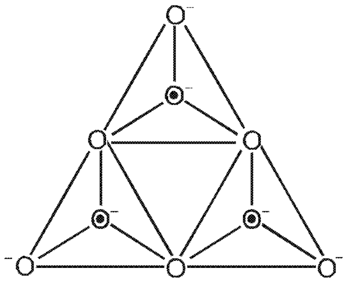
$CaO + C \xrightarrow{\Delta} CaC_2 + CO$.

10. Hydrated chloride of tin(IV) is white in colour and is known by the name 'butter of tin' ore oxymercurate of tin".

11. $2PbO_2 + 4HNO_3 \longrightarrow 2Pb(NO_3)_2 + 2H_2O + O_2$

12. Red lead pigment contains Pb_3O_4.

14.



$Si_3O_9^{6-}$

15. $Pb_3O_4 + 4HNO_3 \longrightarrow 2Pb(NO_3)_2 + 2H_2O + PbO_2$

16. (A) Two oxygen atoms per tetrahedron are shared forming rings. $(SiO_3)_n^{2n-}$. Hybridisation of each Si is sp^3.

(B) Two oxygen atoms per tetrahedran are shared forming a chain of tetrahedron , $(SiO_3)_n^{2n-}$. Hybridisation of each Si atom is sp^3.

(C) One oxygen atom per tetrahedron is shared. $Si_2O_7^{2-}$. Hybridisation of each Si atom is sp^3.

(D) Three oxygen atoms per tetrahedron are shared. $(Si_2O_5)_n^{2-}$, sp^3 hybridisation.

Note : EN difference between Si – O is 1.7. ∴ 50% ionic and 50% covalent.

17. **(i)** Fullerene

(ii) Glass

(iii) Inert pair effect.

(iv) NaOH

(v) Litharge = PbO and red lead = Pb_3O_4 are used as pigments in paints.

(vi) CO is readily absorbed by an ammonical solution of copper (I) chloride to give $CuCl.CO.2H_2O$.

$2NaOH + CO_2 \longrightarrow Na_2CO_3$

(vii) It is fact.

(viii) $SiO_2 + 6HF \longrightarrow H_2SiF_6 + 2H_2O$

(ix) CO_2 (s) is know as dry ice.

CO_2 (s) को शुष्क बर्फ कहा जाता है।

(x) $CO + Cl_2 \xrightarrow{\text{sun light}} COCl_2$

(xi). $H_2C_2O_4 \xrightarrow[-H_2O]{\text{conc. } H_2SO_4, \Delta} CO + CO_2$

18. **(i)** False

(ii) True

(iii) True

(iv) $AlCl_3 + 3H_2O \longrightarrow Al(OH)_3 + 3HCl$

(v) $HCOOH \xrightarrow[\Delta]{P_4O_{10}} CO + H_2O$

(vi) True.

(vii) $I_2O_5 + 5CO \longrightarrow 5CO_2 + I_2$

(viii) Graphite has layered structure. Layers are held by van der Waal's forces and distance between two layers is 340 pm and therefore, graphite is less denser than diamond.

(ix) In silicones the silicon atoms are surrounded by non-polar alkyl or aryl groups.

(x). Having repeated R_2SiO units held by Si—O—Si linkage.

7. (X) is CO_2 because $CO_2 + NH_3$ under pressure gives urea, in reaction (B) does not produce CO_2

$CaO + C \xrightarrow{\Delta} CaC_2 + CO.$

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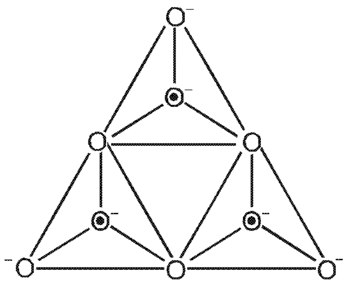
14.



$Si_3O_9^{6-}$ • Silicon O Oxygen

15. $Pb_3O_4 + 4HNO_3 \longrightarrow 2Pb(NO_3)_2 + 2H_2O + PbO_2$

16.
(A) Two oxygen atoms per tetrahedron are shared forming rings. $(SiO_3)_n^{2n-}$. Hybridisation of each Si is sp^3.
(B) Two oxygen atoms per tetrahedran are shared forming a chain of tetrahedron , $(SiO_3)_n^{2n-}$. Hybridisation of each Si atom is sp^3.
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(D) Three oxygen atoms per tetrahedron are shared. $(Si_2O_5)_n^{2-}$, sp^3 hybridisation.
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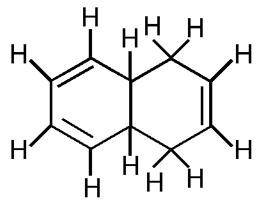
$2NaOH + CO_2 \longrightarrow Na_2CO_3$
(vii) It is fact.
(viii) $SiO_2 + 6HF \longrightarrow H_2SiF_6 + 2H_2O$
(ix) CO_2 (s) is know as dry ice.
(x) $CO + Cl_2 \xrightarrow{\text{sun light}} COCl_2$
(xi). $H_2C_2O_4 \xrightarrow[-H_2O]{\text{conc. } H_2SO_4, \Delta} CO + CO_2$

18. **(iv)** $AlCl_3 + 3H_2O \longrightarrow Al(OH)_3 + 3HCl$
(v) $HCOOH \xrightarrow[\Delta]{P_4O_{10}} CO + H_2O$

(vii) $I_2O_5 + 5CO \longrightarrow 5CO_2 + I_2$
(viii) Graphite has layered structure. Layers are held by van der Waal's forces and distance between two layers is 340 pm and therefore, graphite is less denser than diamond.
(ix) In silicones the silicon atoms are surrounded by non-polar alkyl or aryl groups.
(x). Having repeated R_2SiO units held by Si—O—Si linkage.

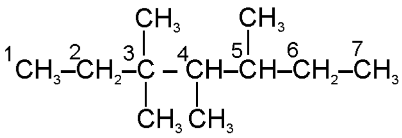
DPP No. # 1

1. 

DPP No. # 2

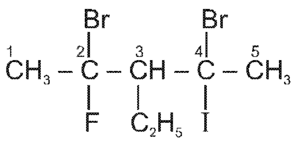
8. (A) $CH_3–CH_2–CH_2–CH_3$
M.F = C_4H_{10} = 48 + 10 = 58
(B) $HC \equiv CH$
M.F. $\rightarrow C_2H_2$ = 24 +2 = 26
(C) $CH_3–CH = CH_2$
M.F. $\rightarrow C_3H_6$ = 36 +6 = 42
(D) $CH_3 –C \equiv CH$
M.F. $\rightarrow C_3H_4$ = 36 +4 = 40

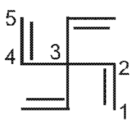
DPP No. # 3

3. (A) 

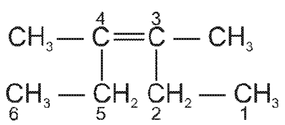
Lowest set of Locant (3, 3, 4, 5)

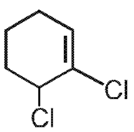
DPP No. # 4

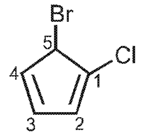
1. 

4. 

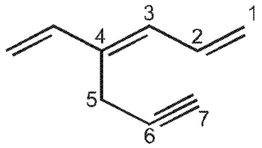
Diethenyl pentadiene

5.*  3,4–Dimethylhex–3–ene

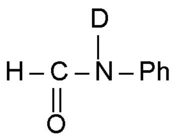
6.*  is 1,6-Dichlorocyclohex-1-ene not 2,3–dichloro cyclohex-1-ene.

7. 

5-Bromo-1-chlorocyclopenta-1,3-diene

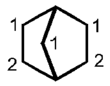
8. **(a)** 

DPP No. # 5

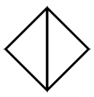
1. 

N-Deutero-N-phenylmethanamide.

6.

(a) 

Bicyclo [2. 2. 1] heptane

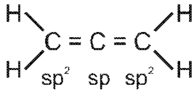
(b)  is bicyclo [1. 1. 0] butane.

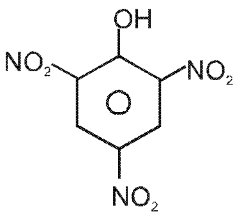
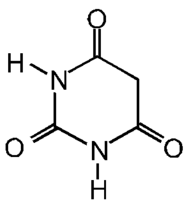
7. (i) 3-Bromo-4-methylpentane-2-sulphonic acid
(ii) 5–Bromo–6–chlorocyclohex–2–ene–1–carboxylic acid
(iii) 4-Methylbenzene-1-sulphonic acid
(iv) Methylenecyclohexane

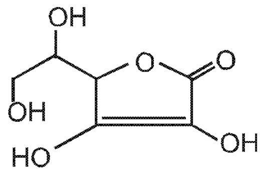
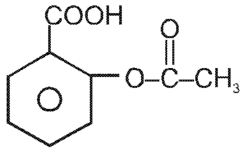
DPP No. # 6

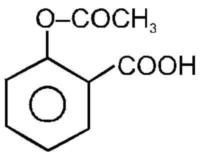
7. (i) Functional isomer (ii) Functional isomer (iii) Functional isomer
(iv) Metamer (v) Position isomer (vi) Functional isomer

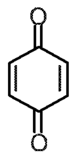
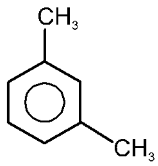
DPP No. # 7

1. C_3H_4 

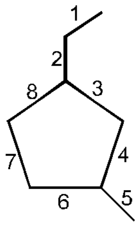
2.  picric acid ;  barbituric acid

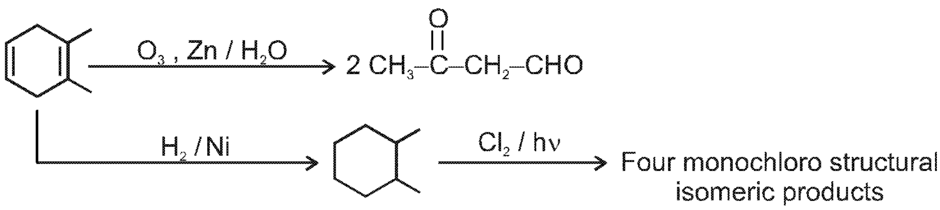

ascorbic acid ;

aspirin

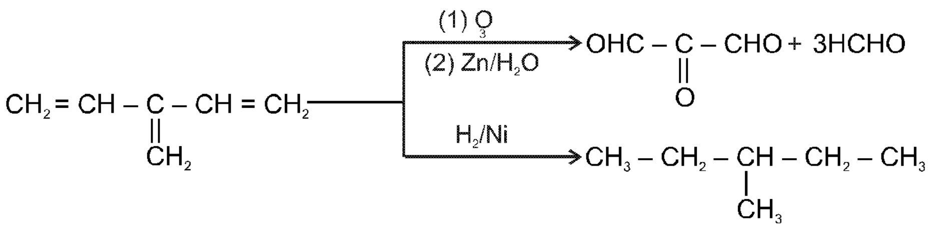
3.  Aspirin (Acetyl salicylic acid)

8. (a)  (b)  (c) CH_2-COOH | CH_2-COOH (d) $CH_3-CH(OH)-COOH$

DPP No. # 8

2. 

5. 

6. 

7. $H_3C-CH=C(CH_2CH_3)-CH_2-CH_2-CH=C(CH_3)-CH_2-CH_2-CH_3$

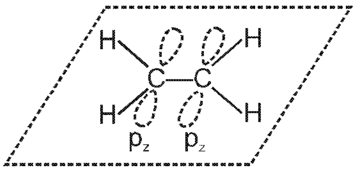
DPP No. # 9

1.

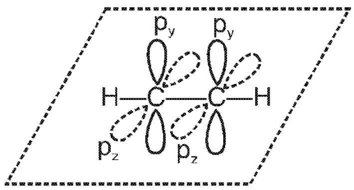
	No. of sp^2–sp^2 σ-bonds	No. of sp^2–sp σ-bonds
Hyb. : sp^3 sp^3 sp^3 **1.** CH_3— CH_2— CH_3 B. A 109° 109° 109°	0	0
Hyb. sp^3 sp^2 sp^2 **2.** CH_3—CH = CH_2 B. A 109° 120° 120°	1	0
Hyb.: sp^3 sp sp **3.** CH_3– C ≡ CH B. A 109° 180° 180°	0	0
Hyb. : sp^2 sp^2 sp^2 sp^2 **4.** CH_2 = CH —CH = CH_2 B. A 120° 120° 120° 120°	3	0
Hyb. : sp^2 sp^2 sp sp **5.** CH_2 = CH — C ≡ CH B. A 120° 120° 180° 180°	1	1
Hyb. : sp^2 sp sp^2 **6.** CH_2 = C = CH_2 B. A 120° 180° 120°	0	2
Hyb. : sp^2 sp^2 sp^3 sp^2 sp sp^2 **7.** CH_2 = CH — CH_2 — HC = C = CH_2 B. A 120° 120° 109° 120° 180° 120°	1	2

2.

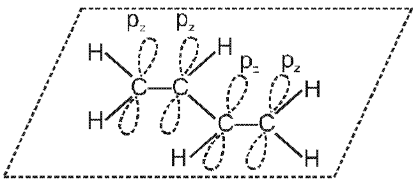
1.



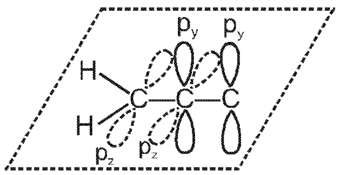
2.



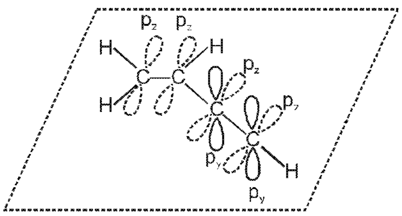
3.



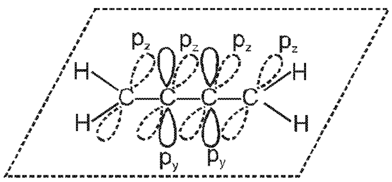
4.



5.



6.



DPP No. # 11

2. ex. $\overset{\delta+}{CH_3} \rightarrow \overset{\delta+}{CH_2} \rightarrow \overset{\delta-}{Cl}$

3. Case A has incorrect direction of I-effect.
4. Maximum – I effect – Cl.
5. Self explanatory.
6. Self explanatory.
7. Magnitude of inductive effect diminisnes as the number of intervening bonds increases. Hence, the effect is least in the bond between cabon 3 and carbon 2.

DPP No. # 12

1. (A,B,C,D)
Due to delocalization of paired & unpaired p-orbital electrons

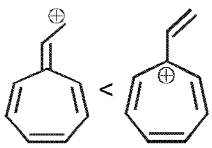
2. (A,B,C,) $CH_2 = C = C = CH_2 \longleftrightarrow \overset{\oplus}{C}H_2 - C \equiv C - \overset{\ominus}{C}H_2$

$\longleftrightarrow \overset{\ominus}{C}H_2 - C \equiv C - \overset{\oplus}{C}H_2$

3. **Lone pair of electrons of $H_2C = \ddot{N} - CH_3$ is in sp² hybrid orbital.**
$H_2C = \ddot{N} - CH_3$ का एकाकी इलेक्ट्रॉन युग्म **sp²** संकरित कक्षक में है।

6.* (C) $CH_3 - \overset{\oplus}{C} = O \longleftrightarrow CH_3 - C \equiv \overset{\oplus}{O}$
(I) (II)
Stability II > I due to No. of π bonds.

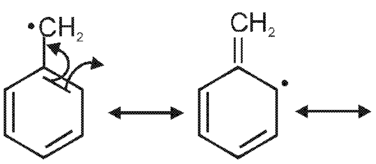
7. (A – q) ; (B – p) ; (C – r)

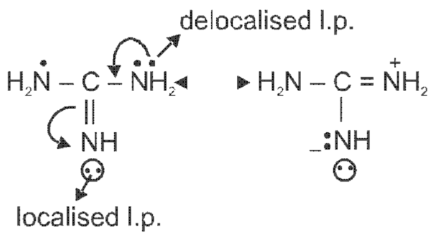
8. (a) $\overset{\oplus}{C}H_2 - NH_2 < CH_2 = \overset{\oplus}{N}H_2$; (b) 

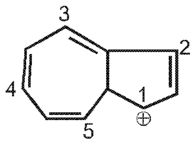
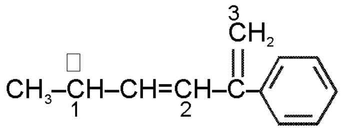
DPP No. # 13

1. Self explanatory
2. **(Moderate)** There are unpaired electrons, others have no unpaired electrons.
3. $-O^{\ominus} > -NH_2 > -OH > -NH-CO-CH_3$
6. Due to delocalization of π electron in benzene.

7. (A) $\overset{\oplus}{C}H_2 - CH = CH_2 \longleftrightarrow CH_2 - CH = \overset{+}{C}H_2$ (B) $\ddot{N}H_2 - CH = CH_2 \longleftrightarrow \overset{\oplus}{N}H_2 = CH - \overset{\ominus}{C}H_2$
delocalised l.p.

(C) 

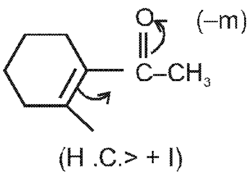
(D) 

8. (a) 
(b) 

DPP No. # 14

3. (A,D) $—CH_3$ (H.C.& + I)
$— O\ CH_3$ (+M> – I)

4. $CH_3 — CH = CH — CH = CH — CH_3$
(A) reso + H.C.
$>C = C<$ bond order ↓ as, bond lenght ↑ $\alpha\sigma$

5. (C) 

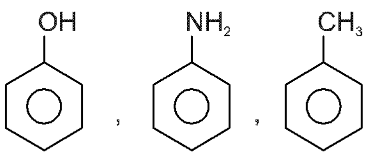
DPP No. # 15

1. (D) Due to +m order

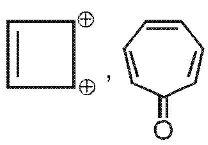
$$-\overset{\ominus}{O} > -\ddot{O}CH_3 > -O-\overset{O}{\overset{\|}{C}}-CH_3 > -\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3$$

2. Rate of electrophilic substitution reaction $\propto$ Stability of arenium ion.

4. Aromatic → planar, cyclic , (4n+2) $\pi e^{\ominus}$, complete conjugation
Antiaromatic → planar, cyclic , (4n) $\pi e^{\ominus}$, complete conjugation
Non aromatic– cyclic structure with non-planar geometry with any hybridization

5.  are more reactive than benzene towards electrophilic substitution.

6. Aromatic species are

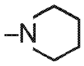


7. Inductive effect is permanent displacement of shared pair of electron along the chain of carbon atom due to presence of polar covalent bond.
Electromeric effect is a temporary effect. It is defined as the complete transfer of a shared pair of π-electrons to one of the atoms joined by a multiple bond on the demand of an attacking reagent.

8. (a) $H_3C – Br$ (b) $H_3C – OH$ (c) $H_3C – OH$

DPP No. # 16

S.No.	Species	+ I	– I	+ m	– m	+ H.C.	– H.C.
1	$-NO_2$		✓		✓		
2	$-CN$		✓		✓		
3	$-CHO$		✓		✓		
4	$-C(=O)-R$		✓		✓		
5	$-C(=O)-OR$		✓		✓		
6	$-C(=O)-O^-$	✓			✓		
7	$-C(=O)-F$		✓		✓		
8	$-C(=O)-NH_2$		✓		✓		
9	$-NH-C(=O)-CH_3$		✓	✓			
10	$-O-C(=O)-CH_3$		✓	✓			
11	$-ONO$		✓	✓			
12	$-O-NO_2$		✓	✓			
13	$-SO_3H$		✓		✓		
14	$-O-S(=O)_2-O-R$		✓	✓			
15	$-S(=O)_2-O-R$		✓		✓		
16	$-NO$		✓	✓	✓		
17	$-F$		✓	✓			
18	$-Cl$		✓	✓	✓		
19	$-Br$		✓	✓	✓		
20	$-I$		✓	✓	✓		
21	$-\overset{\oplus}{N}\equiv N:$		✓		✓		
22	$-C\equiv\overset{\oplus}{O}:$		✓		✓		

23	–S–R		✓	✓	✓		
24	$-\overset{O}{\underset{O}{\overset{\Vert}{\underset{\Vert}{S}}}}-R$		✓		✓		
25	$-\overset{\oplus}{P}R_3$		✓		✓		
26	$-\overset{\oplus}{N}R_3$		✓				
27	$-CH_3$	✓				✓	
28	$-\overset{\oplus}{S}R_2$		✓		✓		
29	$-CMe_3$	✓					
30	$-CF_3$		✓				✓
31	$-CCl_3$		✓				✓
32	–Ph		✓	✓	✓		
33	$-CH=CH_2$		✓	✓	✓		
34	–COOH		✓		✓		
35	$-O-CH_3$		✓	✓			
36	$-\ddot{O}H$		✓	✓			
37	$-\ddot{N}H_2$		✓	✓			
38			✓	✓			
39	$-\overset{\ominus}{\ddot{C}}R_2$	✓		✓			
40	$-\overset{\oplus}{C}R_2$		✓		✓		