PRACTICE PAPER – 5

ANSWERS

SECTION – A

1. How is molar mass related to the elevation in boiling point of a solution ?

Ans. The expression for elevation of boiling point is

$$\Delta T_b = \frac{K_b \times 1000 \times w}{m \times w} = K_b = \text{molal elevation constant}$$

w = Weight of solute
W = Weight of solvent
m = molar mass of solute

$$\text{Molar mass of solute } m = \frac{K_b \times 1000 \times w}{\Delta T_b \times w}$$

$\therefore$ Molar mass of solute (m) and elevation of boiling point (ΔT_b) are inversely related.

2. What is rate determining step in a complex reaction ?

Ans. The overall rate of a reaction is controlled by the slowest step in a reaction is called the rate determining step in a complex reaction.

3. Between C and CO, which is a better reducing agent for ZnO ?

Ans. **Case – I :** [Coke as reducing agent]

$ZnO + C \longrightarrow Zn + CO$,

ΔG° becomes lesser as the T is more then 1120K.

Case – II : [CO as reducing agent]

$ZnO + CO_2 \longrightarrow Zn + CO$, ΔG° becomes lesser when the T is more then 1323K.

$\rightarrow$ The value of ΔG° is negative for a reaction to occur.

$\rightarrow$ In the equation (1)

ΔG° becomes negative at low temperature- so equation (1) is feasible i.r. C is a better reducing agent for ZnO.

4. Write 'spin only' formula to calculate the magnetic moment of transition metal ions.

Ans. Spin only formula to calculate the magnetic moment of transition metal ions is

$\mu = \sqrt{n(n+2)}\,BM$ BM = Bohr Magneton.

5. What is Poly Dispersity Index ?

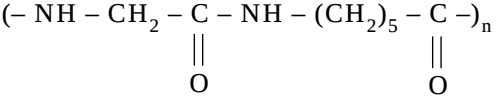
Ans. Poly Dispersity Index (PDI) : The ratio between weight average molecular mass ($\overline{M}_w$) and the number average molecular mass ($\overline{M}_n$) of a polymer is called Poly Dispersity Index (PDI).

6. Give the structure of nylon 2 – nylon 6 ?

Ans. Nylon 2 – Nylon 6 :

It is an alternating polyamide copolymer of glycine (CH_2 – COOH) and amino caproic acid ($H_2N - (CH_2)_5 - COOH$). It is a biodegradable polymer.

Structure of Nylon 2 – Nylon – 6



7. Define Carbohydrates.

Ans. The compounds which are primarily produced by plants and form a very large group of naturally occuring organic compounds are called Carbohydrates. **Eg :** Glucose, Fructose, Starch.

→ Carbohydrates are the polyhydroxy aldehydes (or) ketones.

8. What are fibrous and globular proteins ?

Ans. Fibrous proteins : When the poly peptide chains run parallel and are held together by hydrogen and disulphide bonds then fibre - like structure is formed. These are called fibrous proteins. These are insoluble in water. **Eg :** keratin, myosin.

Globular proteins : When the chains of polypeptides coil around to give a spherical shape then globular proteins are formed. These are usually soluble in water. **Eg :** insulin and albumins.

9. What are barbiturates ?

Ans. Barbiturates : Derivatives of barbituric acid which functions as important class of tranquilizers are called barbiturates.

E.g. : Veronal, Amytatt etc.,

10. What is tincture of iodine ? What is its use ?

Ans. Tincture of iodine (antiseptic) is a mixture of 2 – 3% Iodine solution in alcohol-water.

SECTION – B

11. What is relative lowering of vapour pressure ? How is it useful to determine the molar mass of a solute ?

Ans. Relating lowering of vapour pressure : The ratio of lowering of vapour pressure of a solution containing non-volatile solute to the vapour pressure of pure solvent is called relative lowering of vapour pressure.

$$\text{R.L.V.P.} = \frac{P_0 - P_S}{P_0}$$

$P_o - P_S$ = lowering of vapour pressure

P_o = Vapour pressure of pure solvent

Raoult's law for volatile solute : For a solution of volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction present in solution.

Raoult's law for non-volatile solute : The relative lowering of vapour pressure of dilute solution containing non-volatile solute is equal to the mole fraction of solute.

Relative lowering of vapour pressure

$$\frac{P_0 - P_s}{P_0} = X_s \text{ (mole fraction of solute)}$$

$$\frac{P_0 - P_s}{P_0} = \frac{n_s}{n_0 + n_s}$$

For very much dilute solutions $n_s < < < ..... n_0$

$$\therefore \frac{P_0 - P_s}{P_0} = \frac{n_s}{n_0} = \frac{w}{m} \times \frac{M}{W}$$

W = Weight of solute m = Molar mass of solute

w = Weight of solvent M = Molar mass of solvent

Molar mass of solute $m = \frac{w \times M}{w} \times \frac{P_0}{P_0 - P_s}$

12. Classify each of the following as either a p – type or a n – type semiconductor.

(1) Ge doped with In (2) Si doped with B.

Ans. Both (1) and (2) come under "p – type semiconductors".

Reason : In both the cases dopants (i.e.,) Indium in case – (1) and Boron in case – (2) belong to III (or) 13^{th} group. Si (or) Ge doped with III group element is known as p-type semi conductor.

Explanation : Doping the silicon or germanium element with III or 13^{th} group element like "B", A*l*, Ga or "In" results in the substitution of some silicon atoms in its structure by the dopant. The dopant has only three valency electrons. The fourth valency electron is required. It is left as a vacant place on the atom. It is known as an 'electron vacancy' (or) a 'hole'. The electron vacancy on an atom in the structure migrates from one atom to another. Hence it facilitates the electrical conductivity. Si (or) Ge, doped with elements that create a hole in the structure, is known as p-type semi-conductor.

13. What is the difference between a colloidal sol, gel, emulsion and a foam ?

Ans.

Colloid	Disperse phase	Disperse medium
i) Colloidal sol		
a) Sol	Solid	Liquid
b) Solid sol	Solid (or) gas	Solid
ii) Gel	Liquid	Solid
iii) Emulsion	Liquid	Liquid
iv) Foam	Gas	Liquid

14. Predict the conditions under which A*l* might be expected to reduce MgO.

Ans. The Equations for the formation of two oxides are

$$\frac{4}{3}Al_{(S)} + O_{2(g)} \longrightarrow \frac{2}{3}Al_2O_{3(S)};$$

$$2Mg_{(S)} + O_{2(g)} \longrightarrow 2MgO_{(S)}$$

From the Ellingham diagram the two curves of these oxides formation intersect each otherat a certain point. The corresponding value of ΔG° becomes zero for the reduction of MgO by aluminium metal,

$$2MgO_{(S)} + \frac{4}{3}Al_{(S)} \rightleftharpoons 2Mg_{(S)} + \frac{2}{3}Al_2O_{3(S)}$$

→ From the above information the reduction of MgO by A*l* metal cannot occur below this temperature (1665 K) instead, Mg can reduce Al_2O_3 to Al below 1665 K.

→ A*l*–Metal can reduce MgO to Mg above 1665K because ΔG° for Al_2O_3 is less compared to that of MgO.

$$3MgO_{(S)} + 2Al_{(s)} \xrightarrow{T > 1665K} Al_2O_{3(s)} + 2Mg_{(s)}$$

15. Explain the reaction of the following with water.

a) XeF_2 b) XeF_4 c) XeF_6

Ans. a) XeF_2 is hydrolysed to form Xe, HF and O_2

$2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$

b) XeF_4 is hydrolysed to give XeO_3

$6XeF_4 + 12H_2O \longrightarrow 4Xe + 2XeO_3 + 24\ HF + 3O_2$

c) XeF_6 undergo hydrolysis to form XeO_3

$XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$

XeF_6 undergo partial hydrolysis to form $XeOF_4 + XeO_2F_2$

$XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$

$XeF_6 + 2H_2O \longrightarrow XeO_2F_2 + 4HF$

16. Describe the preparation of potassium permanganate.

Ans. Preparation of $KMnO_4$ Potassium permanganate is prepared by the fusion of MnO_2 with an alkali metal hydroxide and an oxidising agent like KNO_3. It forms dark green, K_2MnO_4 which disproportionates in a neutral or acidic solution to give perman - ganate.

i) $2MnO_2 + 4KOH + O_2 \xrightarrow{KNO_3} 2K_2MnO_4 + 2H_2O$

ii) $3MnO_4^{2-} + 4H^+ \longrightarrow 2MnO_4^- + MnO_2 + 2H_2O$ or

$3K_2MnO_4 + 2H_2SO_4 \longrightarrow 2KMnO_4 + 2K_2SO_4 + MnO_2 + 2H_2O$

Potassium permanganate

17. Write the perparation and applications of Grignard reagents.

Ans. → Alkyl magnesium halides are generally called as Grignard reagenty.

Preparation : These are prepared by the treatment of alkyl halides with magnesium metal in presence of dry ether.

E.g. : $CH_3Br + Mg \xrightarrow{\text{dry Ether}} CH_3MgBr$

Methyl Magnesium Bromide

$CH_3CH_2C\ell + Mg \xrightarrow{\text{dry Ether}} CH_3CH_2MgC\ell$

Ethyl magnesium chloride

Applications :

→ Grignard reagents have wide applications in the synthesis of large no. of organic compounds.

1) Preparation of alkanes :

Grignard reagents reacts with alcohols and forces alkanes.

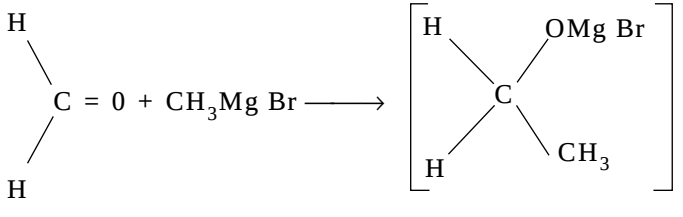
$CH_3MgBr + C_2H_5OH \longrightarrow CH_4 + C_2H_5OMgBr$

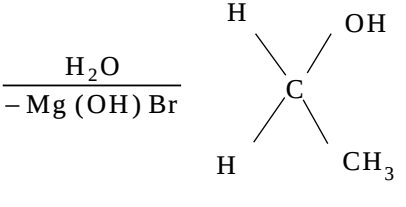
Methane

$CH_3CH_2MgC\ell + C_2H_5OH \longrightarrow C_2H_6 + C_2H_5OMgBr$

Ethane

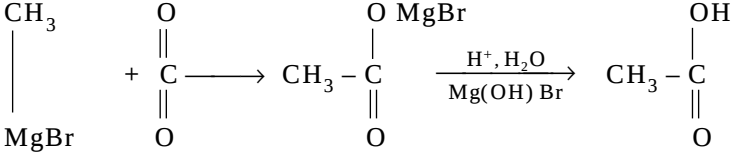
2) Preparation of alcohols : Ethylalcohol is obtained by the action of Methyl magnesium bromide on formal dehyde followed by the hydrolysis.





3) Preparation of carboxylicacids :

Grignard reagent on carboxylation followed by the hydrolysis to form carboxylic acids.



Acetic acid

18. Write the equations involved in the conversion of acetamide and propanaldehydeoxime to methyl cyanide and ethyl cyanide respectively.

Ans. $CH_3CONH_2 + C_6H_5SO_2Cl \xrightarrow{\text{pyricline, 70°C}}$

$CH_3 - CN + C_6H_5SO_3H + HCl$

Acetamide Benzene methyl cyanide

sulphonyl chloride

$CH_3 - CH_2 - CH = N.OH + (CH_3CO)_2O \longrightarrow$

$CH_3 - CH_2 - CN + 2CH_3COOH$

propanal Acetic anhydride Ethyl cyanide

dehydeoxime

SECTION – C

19. a) Define and explain the order of a reaction. How is it obtained experimentally ?

Ans. Order of a reaction : The sum of the powers of the concen - tration terms of the reactants present in the rate equation is called order of a reaction.

→ Order of a reaction can be 0, 1, 2, 3, and even a fraction

Eg : 1) $N_2O_5 \rightarrow N_2O_4 + \frac{1}{2}O_2$	2) $2N_2O \rightarrow 2N_2 + O_2$
rate $\propto [N_2O_5]$	rate $\propto [N_2O]^2$
∴ It is a first order reaction.	∴ It is 2^{nd} order reaction

→ Order of a reaction can be determined experimentally

Half–Time ($t_{1/2}$) method : The time required for the initial concentration (a) of the reactant to become half its value (a/2) during the progress of the reaction is called half–time ($t_{1/2}$) of the reaction.

A general expression for the half life, ($t_{1/2}$) is given by

$$t_{1/2} \propto \frac{1}{a^{n-1}}$$

Therefore, for a given reaction two half time values ($t'_{1/2}$ and $t''_{1/2}$) with initial concentrations a' and a" respectively are determined experimentally and the order is established from the equation.

$$\left(\frac{t'_{1/2}}{t''_{1/2}}\right) = \left(\frac{a''}{a'}\right)^{n-1}$$

Where 'n' is the order of the reaction.

b) What are primary and secondary batteries ? Give one example for each.

Ans. The batteries which after their use over a period of time, becomes dead and the cell reaction is completed and this cannot be reused again are called primary batteries.

Eg : Leclanche cell, dry cell.

Secondary battery : A secondary battery is the battery in which after it's use can be recharged and can be used again.

A good secondary battery undergoes large no. of discharging and charging cycles.

Lead storage battery is an example of secondary battery.

The cell reactions when the battery is in use are

$$Pb_{(s)} + SO_4^{-2}{}_{(aq)} \longrightarrow PbSO_{4(s)} + 2e^- \quad \text{(Anode)}$$

$$PbO_{2(s)} + SO_4^{-2}{}_{(aq)} \longrightarrow 4H^+_{(aq)} + 2e^- \longrightarrow PbSO_{4(s)} + 2\,H_2O_{(l)} \quad \text{(Cathode)}$$

Overall cell reaction is

$$Pb_{(s)} + PbO_{2(s)} + 2H_2SO_{4(aq)} \longrightarrow 2PbSO_{4(s)} + 2H_2O_{(l)}$$

20.a) Explain about oxoacids of chlorine.

Ans. Four oxyacids of chlorine are known. They are

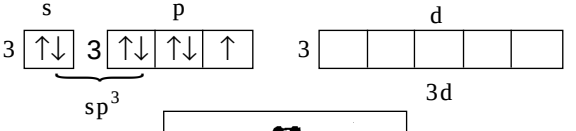
Hypochlorous acid – HO*Cl*

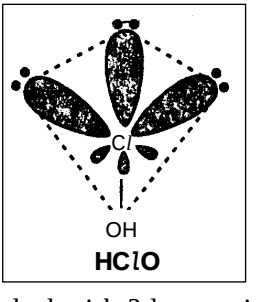
Chlorous acid – H*ClO*$_2$

Chloric acid – H*ClO*$_3$

Perchloric acid – H*ClO*$_4$

Structure of HClO : In this chlorine atom is sp^3 hybridised. Outer electronic configuration of C*l* in C*lO*$^-$ after sp^3 hybridisation.



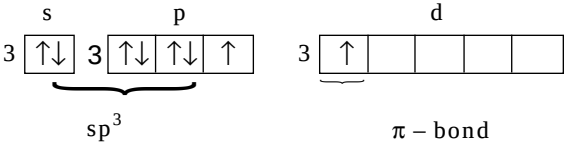


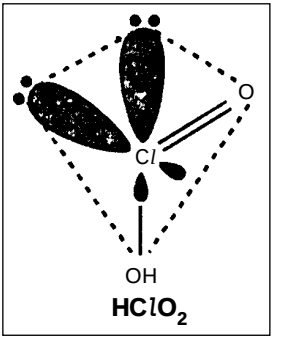
Shape is tetra hedral with 3 lone pairs (or) linear.

No π – bonds.

Chlorous acid : ($HClO_2$) : Chlorine is in sp^3 hybrid state, in first excited state. Shape is tetrahedral with 2 lone pairs (or) angular one π_{d-p} bond is present.

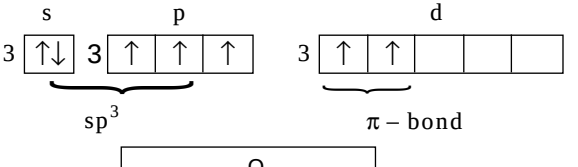
First excited state

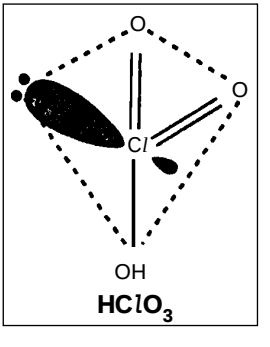




Chloric acid ($HClO_3$) : The central chlorine atom undergoes sp^3 hybridisation in second excited state.

Second excited state

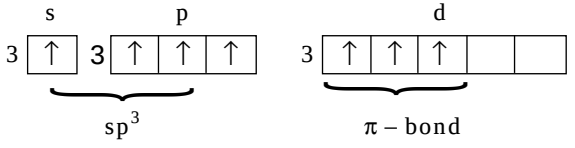


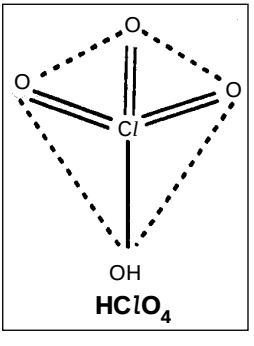


Shape is tetrahedral with one lone pair (or) pyramidal.

Two π_{d-p} bonds present.

Perchloric acid ($HClO_4$) : The central chlorine atom undergoes sp^3 hybridisation in third excited state.





Shape is perfect tetrahedral. No lone pairs.

Three π_{d-p} bonds present.

b) How is the presence of SO_2 detected ?

Ans. SO_2 has a pungent odour SO_2 presence can be detected by the following tests.

1. SO_2 changes the colour of acidified potassium dichromate solution from orange to green.

$$3SO_2 + Cr_2O_7^{-2} + 2H^+ \longrightarrow 3SO_4^{-2} + 2Cr^{+3} + H_2O$$

orange green

2. SO_2 decolourises acidified $KMnO_4$ solution.

$$5SO_2 + 2MnO_4^- + 2H_2O \longrightarrow 5SO_4^{-2} + 4H^+ + 2Mn^{+2}$$

Violet colour

21.a) Write the oxidation products of Acetaldehyc, Acetone and Acetophenone.

Ans. a) Acetaldehyde under goes oxidation to form acetic acid.

$$CH_3CHO \xrightarrow{(O)} CH_3COOH$$

b) Acetone undergoes oxidation to form acetic acid

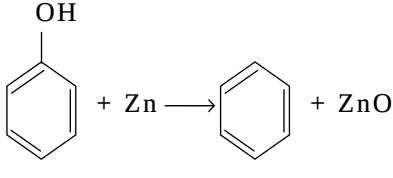
$$CH_3COCH_3 \xrightarrow[K_2Cr_2O_7/H^+]{(O)} CH_3COOH$$

c) Acetophenone undergoes oxidation to form benzoicacid and chloroform

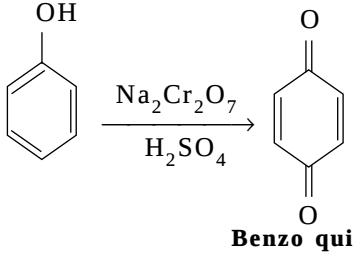
$$C_6H_5 - CO - CH_3 \xrightarrow[NaOCl,\ H_3O^+]{(O)} C_6H_5\ COOH + CHCl_3$$

b) Write the products formed by the reduction and oxidation of phenol.

Ans. i) Reduction of phenol : Phenol undergo reduction in presence of zinc dust to form benzene.



ii) Oxidation of phenol : Phenol undergo oxidation with chromic acid and forms a conjugated diketone known as benzo-quinone.



Benzo quinone

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