MODEL QUESTION PAPER SET- 2 : 2021 - 22

MM : 70 | **CHEMISTRY THEORY SOLUTIONS** | **Time : 3 Hrs**

Entire Syllabus

SECTION A

Q.1 Select & Write the correct Answer **10M**

i. **a)** $1.1 \times 10^{-5}\ s^{-1}$ **1M**

ii. **b)** Second law of thermodynamics **1M**

iii. **b)** Ag^+ and Fe **1M**

iv. **c)** Non-Polar molecular solid **1M**

v. **d)** Ebullioscopy **1M**

vi. **c)** Arsenic (Z = 33) **1M**

vii. **d)** Dimethylamine **1M**

viii. **b)** polyester fibre **1M**

ix. **d)** it cannot be synthesised by human body **1M**

x. **a)** A- U base pairing **1M**

Q.2 Short Answers (1 Mark Each) **8M**

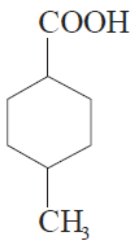
i. The degree of dissociation (a) of an electrolyte is defined as a fraction of total number of moles of the electrolyte that dissociates into its ions when the equilibrium is attained. **1M**

ii. Boiling Point: The boiling point is the temperature at which the vapour pressure of a liquid becomes equal to the atmospheric pressure. **1M**

iii. IUPAC name of benzylamine is phenymethanamine. **1M**

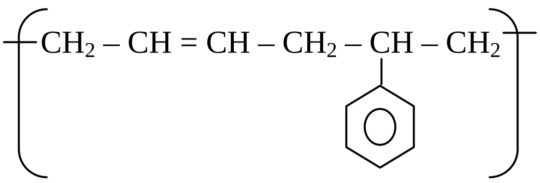
iv. The change in enthalpy when 1 mole of substance is completely converted from solid to gaseous state without passing through liq. State. **1M**

v. **IUPAC name of** **1M**



4-Methyleyclohexanecarboxylic acid

vi. **Draw structure of Buna-S.** **1M**



vii. a) Formalin (40% solution of formaldehyde) is used as preservative for biological specimens **1M**

b) Formaldehyde is used for silvering mirror.

c) Formaldehyde is used for the production of several plastic and resins, bakelite and binders in plywood.

viii. For a given cell, the ratio of separation (*l*) between the two electrodes divided by the area of cross section (a) of the electrode is called the cell constant. **1M**

$$\text{Cell constatant} = \frac{l}{a}$$

The unit of cell constant is m-1 (SI unit) or cm-1 (C.G.S. unit).

SECTION B

Attempt Any Eight Questions **16M**

Q.3 (i) Condensed electronic configurations of Sc^{3+}, Ti^{4+}, V^{5+} are : Sc^{3+} : [Ar] $3d^0$; Ti^{4+} : [Ar] $3d^0$; V^{5+} : [Ar] $3d^0$ **2M**

(ii) The ions Sc^{3+}, Ti^{4+} and V^{5+} have completely empty d-orbitals i.e., no unpaired electrons are present.

Thus, their salts are colourless, as d-d transitions are not possible.

Q.4 (i) Atom economy is a measure of the amount of atoms from the starting material that are present in the final product at the end of a chemical process. Good atom economy means most of the atoms of the reactants are incorporated in the desired products. Only small amount of waste is produced, hence lesser problem of waste disposal. **2M**

(ii) The atom economy of a process can be calculated using the following formula

$$\%\text{ atom economy } = \frac{\text{Formula weight of the desired product}}{\text{Sum of formula weight of all the reactants used in the reaction}} \times 100$$

Consider the conversion of Butan-1-Ol to 1-bromobutane

$$CH_3 - CH_2 - CH_2 - CH_2\ OH + NaBr + H_2SO_4 \longrightarrow$$
$$CH_3 - CH_2 - CH_2 - CH_2 - Br + NaHSO_4 + H_2O$$

$$\%\text{ atom economy } = \frac{\text{mass of 1-bromo butane}}{\text{Sum of mass of 1-butanol+sodium bromide}} \times 100$$

$$= \frac{\text{mass of (4C+9H+1Br)atoms}}{\text{mass of }(4C + 12H + 5O + 1Br + 1Na + 1S)\text{ atoms}} \times 100$$

$$= \frac{137\,u}{275u} \times 100 = 49.81\%$$

The atom economy of the above reaction is less than 50% and waste produced is higher.

Q.5 **a)** Adiabatic process **2M**

The mathematical expression for the first law of thermodynamics is,

$\Delta U = q + w$

When ΔU = change in energy

q = heat absorbed by the system

w = Amount of work done

Adiabatic Process : A process in which heat is not allowed to enter or leave the system at any stage the process is called adiabatic process.

$\therefore q = 0$

The mathematical expression for first law of thermodynamics is,

$\Delta U = q + w$

$\therefore \Delta U = + w$

b) Isochoric process

By substituting equation $W = -p_{ex}.\Delta V$ in the equation $\Delta U = q + W$, we get

$\Delta U = q - p_{ex}.\Delta V$.........(1)

If the reaction is carried out in a closed container so that the volume of the system is constant, then $\Delta V = 0$. In such a case, no work is involved.

The equation (1) becomes $\Delta U = q_v$.

Equation (1) suggests that the change in internal energy of the system is due to heat transfer. The subscript v indicates a constant volume process. As U is a state function, qv is also a state function. We see that an increase in the internal energy of a system is numerically equal to the heat absorbed by the system in a constant volume (isochoric) process.

Q.6 Given : Concentration of solution = C = 0.02M $AgNO_3$ **2M**

Temperature = T = 273 + 25 = 298 K

Conductivity = $K = 2.428 \times 10^{-3}\ \Omega^{-1}\ cm^{-1}$ (or $S\ cm^{-1}$)

Molar conductivity = $\wedge_m$ = ?

$$\wedge_m = \frac{K \times 1000}{C} = \frac{2.428 \times 10^{-3} \times 1000}{0.02}$$

$$= 121.4\,\Omega^{-1}cm^2mol^{-1} (\text{or } 121.4\,S\,cm^2mol^{-1})$$

Molar conductivity = $\wedge_m = 121.4\,\Omega^{-1}cm^2mol^{-1}$

Q.7 Reagents and conditions required to prepare phenol from: **2M**

i. Chlorobenzene

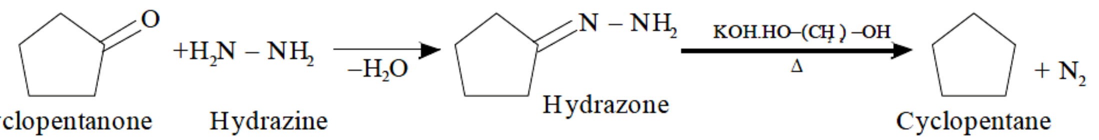
Reagents: NaOH, dil HCl

ii. Benzene sulphonic acid

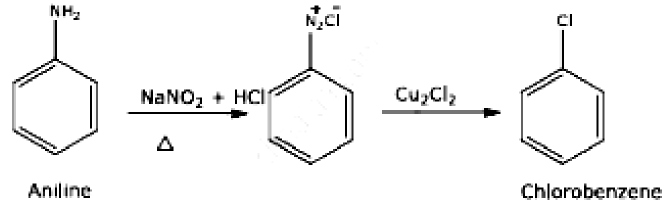
Reagents: NaOH, Solid NaOH, dil HCl

Conditions: Temperature 573 K

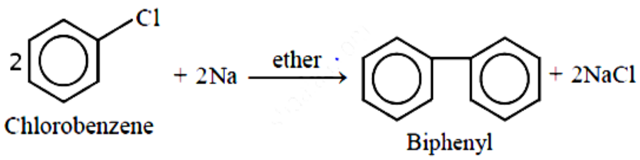
Q.8 **2M**



Q.9 Aniline reacts with nitrous acid to give benzene diazonium chloride which on treatment with cuprous chloride gives chlorobenzene **2M**



Chlorobenzene converted into diphenyl/biphenyl



Q.10 Nitriles are reduced to immune hydrochloride by stannous chloride in presence of hydrochloric acid which on acid hydrolysis give corresponding aldehydes. This reaction is called stephen reaction. **2M**

$$R-C\equiv N + 2[H] \xrightarrow{SnCl_2,\ HCl} R-HC=NH.HCl \xrightarrow{H_3O^+} R-CHO + NH_4Cl$$

Alkane nitrile   Imine hydrochloride   Aldehyde

e.g.

$$H_3C-C\equiv N + 2[H] \xrightarrow[\text{(reduction)}]{SnCl_2,\ HCl} CH_3-HC=NH.HCl \xrightarrow{H_3O^+} CH_3-CHO + NH_4Cl$$

Alkane nitrile   Ethanimine hydrochloride   Ethanal

Q.11 **2M**

(i) NO_2^- is an ambidentate ligand which can be linked through N or O.

(ii) $[Co(NH_3)_5(NO2)]^{2+}$ Pentaamminenitrocobalt (III) ion

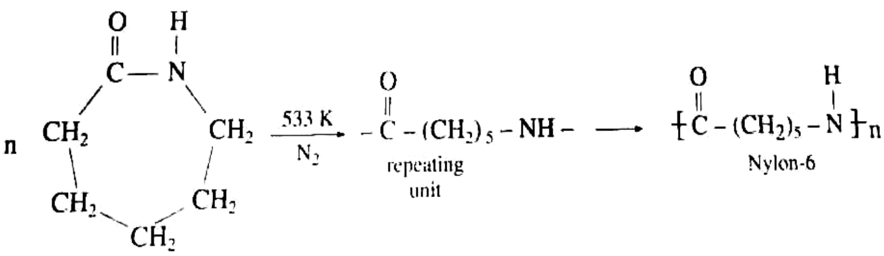
(iii) $[Co(NH_3)_5(ONO)]^{2+}$ Pentaamminenitritocobalt(III)ion

Q.12 Carbohydrates: Carbohydrates are optically active polyhydroxy aldehydes or polyhydroxy ketones, or the compounds which on hydrolysis produce polyhydroxy aldehydes or polyhydroxy ketones. **2M**

Examples: Glucose, sucrose, fructose.

Nylon-6 is a polyamide fibre formed by the polymerisation of ε-caprolactum.

ε-caprolactum is heated in an inert atmosphere to about 523–533 K. It undergoes polymerisation to form nylon-6.



Q.13 The difference in the acidic character of phenols and alcohol is due to the difference in reactivity of these compounds **2M**

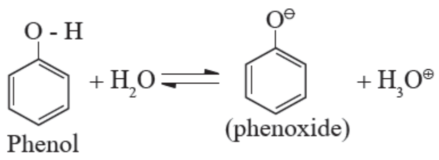
towards the ionization of the O - H bond. This can be explained as follows:

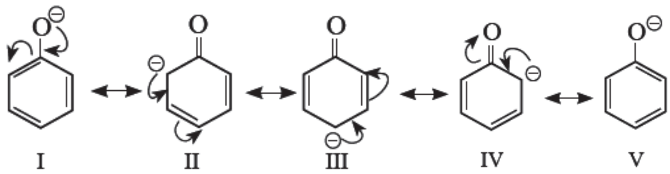
i. Ionization of alcohols is represented by the following equilibrium

$$\underset{\text{Alcohol}}{R-OH} + H_2O \rightleftharpoons \underset{\text{Alkoxide}}{R-O^-} + H_3O^+$$

The electron donating inductive effect (+I effect) of the alkyl group destabilizes the alkoxide ion (the conjugate base of alcohol). As a result, alcohol does not ionize much in the water, and behaves like a neutral compound in an aqueous medium.

ii. Ionization of phenol is represented by the following equilibrium





Phenoxide ion, the conjugate base of phenol, is resonance stabilized by delocalization of the negative charge.

Therefore, phenol ionizes in an aqueous medium to a moderate extent and thereby shows a weak acidic character.

Q.14 a) Osmosis : **2M**

Osmosis is a passive process and happens without any expenditure of energy. It involves the movement of molecules from a region of higher concentration to lower concentration until the concentrations become equal on either side of the membrane.

b) Freezing point :

Freezing point: The freezing point of a substance may be defined as the temperature at which the vapour pressure of solid is equal to the vapour pressure of liquid.

SECTION C

Attempt Any Eight Questions **24M**

Q.15 (i) The formulation of the cell: **3M**

$$Pt \mid Cu^+_{(aq)}, Cu^+_{(aq)} \parallel Cu^+_{(aq)} \mid Cu_{(s)}$$

LHE $Cu^+_{(aq)} \longrightarrow Cu^{2+}_{(aq)} + e^-$ (Oxidation at anode)

RHE $Cu^+_{(aq)} + e^- \longrightarrow Cu_{(s)}$ (Reduction at cathode)

$2Cu^+_{(aq)} \longrightarrow Cu^{2+}_{(aq)} + Cu_{(s)}$ (Overall cell reaction)

$\therefore$ n = 1

$$E^0_{cell} = \underset{\text{(cathode)}}{E^0_{Cu^+|Cu}} - \underset{\text{(anode)}}{E^0_{Cu^{+2},Cu^+}}$$

$= 0.52 - 0.16 = 0.36$ V

(ii) $\Delta G^0 = -nFE^0_{cell} = -1 \times 96500 \times 0.36 = -34740\,J$

$= -34.74\ kJ$

Ans. (i) $E^0_{cell} = 0.36V$ (ii) $\Delta G^0 = -34.74\,kJ$

Q.16 **3M**

Molar mass of benzene $C_6H_6 = (6 \times 12 + 6 \times 1) \times 10^{-3}$ kg mol^{-1}

$p_1^0 = 640$mm Hg, $p = 600$mm Hg

$W_1 = 39 \times 10^{-3}$ kg

$W_2 = 2.175 \times 10^{-3}$ kg mol^{-1}

$M_1 = 78 \times 10^{-3}$ kg mol^{-1}

$M_2 = ?$

$$\frac{p_1^0 - p}{p_1^0} = \frac{W_2}{M_2}\frac{M_1}{W_1}$$

$$\frac{640mm - 600mm}{640mm} = \frac{2.175 \times 10^{-3}\text{kg} \times 78.0 \times 10^{-3}\text{kg mol}^{-1}}{39.0 \times 10^{-3}\text{kg} \times M_2}$$

$$M_2 = \frac{2.175 \times 10^{-3}\text{kg} \times 78.0 \times 10^{-3}\text{kg mol}^{-1} \times 640\text{mm}}{39.0 \times 10^{-3}\text{kg} \times 40\text{mm}}$$

$$M_2 = 69.6 \times 10^{-3}\text{kg mol}^{-1}$$

Molecular mass $= 69.6$g mol^{-1}

Q.17 **3M**

i. $3CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 + PCl_3 \longrightarrow 3CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 + H_3PO_3$

Propan–2–ol → 2–Chloropropane

ii. $\underset{\text{Ethanol}}{C_2H_5OH} + HI \xrightarrow{NaI/H_3PO_4} \underset{\text{Ethyl iodide}}{C_2H_5I} + H_2O$

iii. $H_3C-\overset{\overset{CH_3}{|}}{HC}-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{ZnCl_2 + HCl} CH_3-\overset{\overset{CH_3}{|}}{CH}-\underset{\underset{Cl}{|}}{CH}-CH_3$

3-Methylbutan-2-ol → 2-Chloro-3-methylbutane

Q.18 **3M**

Given: Rate constant $k_1 = 0.58\ s^{-1}$

Rate constant $k_2 = 0.045\ s^{-1}$

$T_1 = 313$ K

$T_2 = 293$ K

$R = 8.314\ J\ K^{-1}mol^{-1}$

To find: Activation energy (E_a)

Formula : $\log_{10}\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{T_2 - T_1}{T_1T_2}\right]$

Calculation : From Formula,

$$\log 10\left(\frac{0.045\ s^{-1}}{0.58\ s^{-1}}\right) = \frac{E_a}{2.303 \times 8.314\ JK^{-1}mol^{-1}}\left[\frac{293K - 313K}{293K \times 313K}\right]$$

$$\therefore \log 0.0776 = \frac{E_a}{19.147\ J\ mol^{-1}}\left[\frac{-20}{293 \times 313}\right]$$

$$\therefore -1.110 = \frac{E_a}{19.147}\left[\frac{-20}{293 \times 313}\right]$$

$$\therefore E_a = \frac{-1.110 \times 19.147 \times 293 \times 313}{-20}$$

$= 97455.34\ J\ mol^{-1}$

Q.19 i. Nylon 6,6 is obtained by polymerization reaction between the monomers adipic acid and hexamethylenediamine. **3M**

ii. Mixing of the two monomers forms nylon salt, which upon condensation polymerization under conditions of high temperature and pressure give the polyamide fibre, nylon 6,6.

$$\underset{\text{(adipic acid)}}{n\,HOOC-(CH_2)_4-COOH} + \underset{\text{(hexamethylene diamine)}}{n\,H_2N-(CH_2)_6-NH_2} \longrightarrow \underset{\text{(nylon salt)}}{n[\overset{-}{O}-\overset{O}{\overset{\|}{C}}\!-\!(CH_2)_4\!-\!\overset{O}{\overset{\|}{C}}-\overset{-}{O}H_3\overset{+}{N}\!-\!(CH_2)_6\!-\!\overset{+}{N}H_4]}$$

$$\xrightarrow[-n\,H_2O]{553K\ \text{High pressure}} \underset{\text{(nylon 6, 6)}}{[\overset{O}{\overset{\|}{C}}-(CH_2)_4-\overset{O}{\overset{\|}{C}}-NH-(CH_2)_6-\overset{H}{\overset{|}{N}}]_n}$$

Q.20 Methyl n-propyl ether: **3M**

Structure:

$CH_3-O-CH_2-CH_2-CH_3$

IUPAC Name: 1-Methoxypropane

Action of hot HI on methyl n-propyl ether:

$$\underset{\text{Methyl n-propyl ether}}{CH_3-O-CH_2-CH_2-CH_3} + \underset{\text{(Conc.)}}{2HI} \xrightarrow{\text{Hot/373 K}} \underset{\text{Methyl iodide}}{CH_3I} + \underset{\text{Propyl iodide}}{CH_3-CH_2-CH_2-I} + H_2O$$

Q.21 (a) $H_3BO_3(aq) \longrightarrow HBO_2(aq) + H_2O(l);\ \Delta H_1^0 = -0.02kJ$ **3M**

(b) $H_2B_4O_7(s) \longrightarrow 2B_2O_3(s) + H_2O(l); \Delta H_2^0 = -17.3kJ$

(c) $H_2B_4O_7(s) + H_2O(l) \longrightarrow 4HBO_2(aq); \Delta H_3^0 = -11.58kJ$

Required equation is

$2H_2BO_3(aq) \longrightarrow B_2O_3(s) + +3H_2O(l)$ ……………(d)

To get equation (d) , add 2 times equation (a) and $\frac{1}{2}$ times equation (b)and subtract $\frac{1}{2}$ times equation (c).

$$\therefore\ eq(d) = 2eq(a) + \frac{1}{2}eq(b) - \frac{1}{2}eq(c)$$

$$\Delta H_4 = 2\Delta H_1 + \frac{1}{2}\Delta H_2 - \frac{1}{2}\Delta H_3$$

$$\Delta H^{\circ} = 2\times(0.02)+\frac{1}{2}\times17.3-\frac{1}{2}(-11.58)$$

$$=-0.04+8.69+5.79$$

$= 14.4$ kJ

Q.22 Williamson's synthesis: When an alkyl halide (R-X) is heated with sodium alkoxide (R – O –Na), and ether is obtained, this reaction is known as Williamson's synthesis. This method is used to prepare simple (or symmetrical) ethers and mixed (unsymmetrical) ethers. Sodium alkoxide is obtained by a reaction of sodium with an alcohol. **3M**

$$\underset{\text{alcohol}}{2R-OH}+2Na\rightarrow \underset{\text{Sodium alkoxide}}{2R-ONa}+H_2$$

E.g. $$\underset{\text{ethanol}}{2C_2H_5OH}+2Na\rightarrow \underset{\text{Sodium ethoxide}}{2C_2H_5ONa}+H_2$$

(i) Simple (symmetrical) ether : When an alkyl halide and sodium alkoxide having similar alkyl groups are heated, symmetrical ether is obtained.

$$R-\overset{+}{O}-\overset{-}{N}a+R-X\xrightarrow{\Delta}R-O-R+NaX$$

Sodium ethoxide on heating with ethyl bromide gives diethyl ether.

$$\underset{\text{Sodium ethoxide}}{C_2H_5-\overset{-}{O}-\overset{+}{N}a}+\underset{\text{ethyl bromide}}{C_2H_5-Br}\xrightarrow{\Delta}\underset{\text{diethyl ether}}{C_2H_5-O-C_2H_5}+NaBr$$

(ii) Mixed (Unsymmetrical) ether: When an alkyl halide and sodium alkoxide or sodium phenoxide having different alkyl groups are heated, unsymmetrical ether (dialkyl ethers or alkyl aryl ether) is obtained.

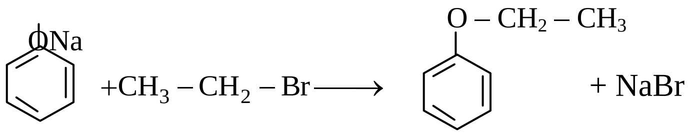
$$R-\overset{-}{O}-\overset{+}{N}a+R'-X\xrightarrow{\Delta}R-O-R'+NaX$$

$$Ar-\overset{-}{O}-\overset{+}{N}a+RX\rightarrow Ar-O-R+NaX$$

Sodium ethoxide on heating with methyl bromide gives ethyl methyl ether.

$$\underset{\text{Sodium ethoxide}}{C_2H_5-\overset{-}{O}-\overset{+}{N}a}+\underset{\text{methyl bromide}}{CH_3-Br}\xrightarrow{\Delta}\underset{\text{ethylmethyl ether}}{C_2H_5-O-CH_3}+NaBr$$

Sodium phenoxide on heating with ethyl bromide gives ethyl phenyl ether.



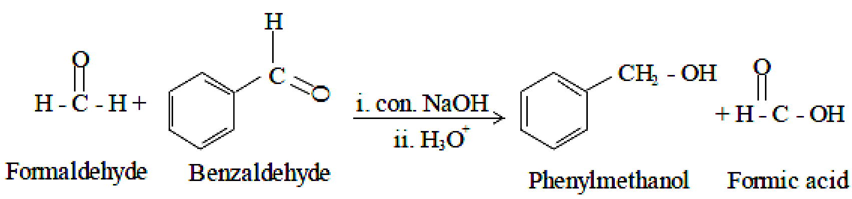
Sodium phenoxide   Ethyl phenyl ether

Q.23 **Cross Cannizaro reaction:** **3M**

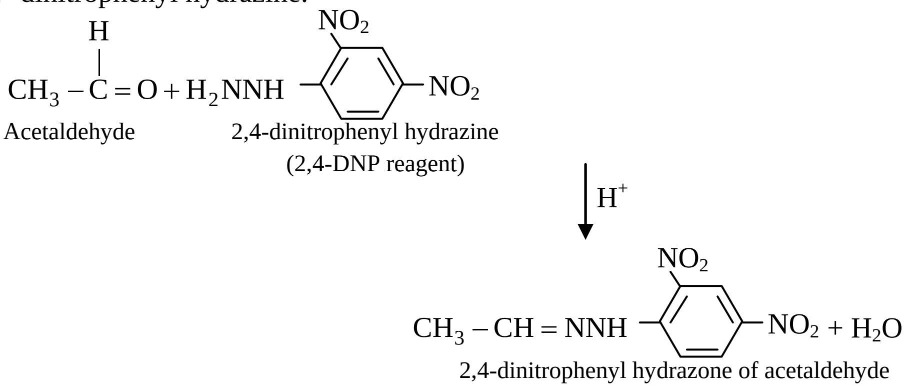
i. When a mixture of formaldehyde and non-enolisable aldehyde (aldehyde with non a-hydroge) is treated with a strong base, formaldehyde is oxidized to formic acid while the other non-enolisable aldehyde is reduced to alcohol.

ii. Formica acid forms sodium formate with NaOH. On acidification, sodium format is converted into formic acid.

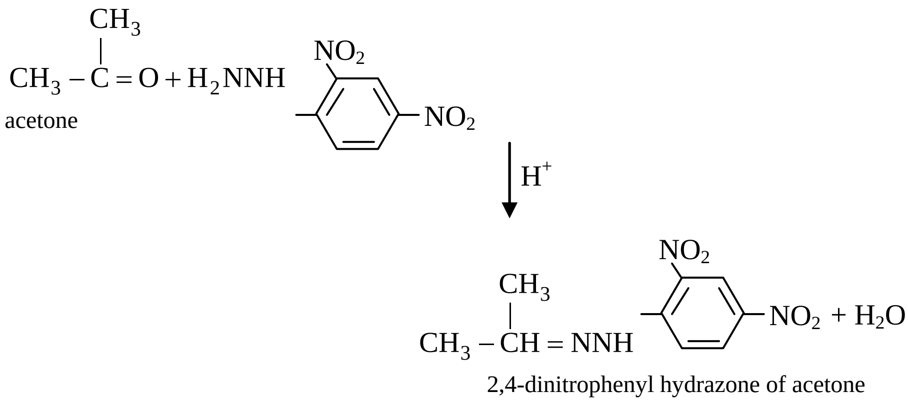
e.g.



Q.24 (i) Acetaldehyde on reaction with 2,4-dinitrophenyl hydrazine forms 2, 4- dinitrophenyl hydrazine. **3M**



(ii) Acetone on reaction with 2, 4-Dinitrophenyl hydrazine forms 2,4-dinitrophenyl hydrazine.



Q.25 i. The standard state of a substance is the form in which the substance is most stable at a press lire of 1 bar and at temperature 298 K. **3M**

ii. If the reaction involves species in solution its standard state refers to 1 M concentration.

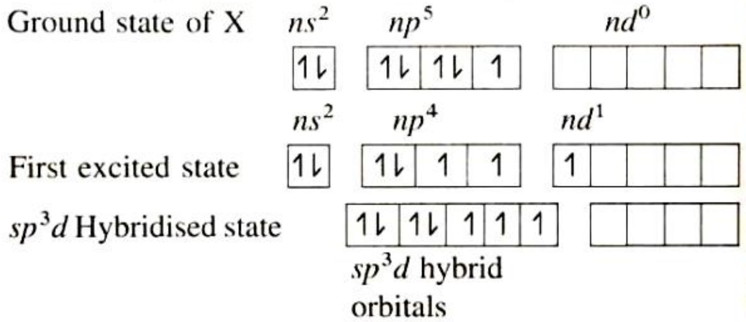
e.g. Standard states of certain elements and compounds arc (at 1 bar and 25°C); $H_{2(g)}$. $H_{(l)}$, $Na_{(s)}$, $C_{(grapillte)}$. $C_2H_5OH_{(f)}$, $CaCO_{3(s)}$, $CO_{2(g)}$, $C_2H_5OH_{(t)}$, $H_2O_{(f)}$, $CaCO_{3(s)}$, $CO_{2(s)}$.

Q.26 **3M**

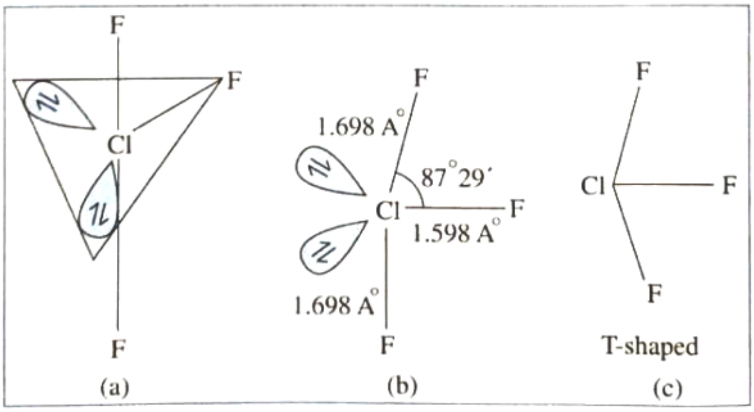
(i) Interhalogen compound of the type XX'_3 possesses trigonal bipyramidal or T-shaped structure.

(ii) The central halogen atom X (X = Cl, Br, I) undergoes sp^3d hybridisation forming five hybrid orbitals.

(iii) Two hybrid orbitals contain lone pairs of electrons.



Consider ClF_3 molecule :



The bond angle F-Cl-F is 87° 29' close to 90^0 due to repulsion between lone pairs-lone pairs and lone pairs

Molality is *independent of temperature*, since it involves mass of solute and mass of solvent which are independent of temperature.

SECTION D

Attempt Any Three Questions **12M**

Q.27 **a)** These are the oxides which show neither basic nor acidic properties, i.e. they are non-metal oxides which do not react with acids or bases. **2M**

Zinc oxide is an amphoteric oxide which shows both basic and acidic properties.

$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$ (basic nature)

Zinc chloride

$ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$ (acidic nature)

Sodium zincate

b) **2M**

Molar conductivity:

Molar conductivity is the conductance of a volume of solution containing 1 mole of dissolved electrolyte when placed between two parallel electrodes 1cm apart and large enough to contain between them all the solution.

Zero order reaction:

Zero order reaction is the reaction whose rate is independent of the reactant concentration and remains constant throughout the course of the reaction.

Q.28 **a)** $CH_3Cl_{(g)} + Cl_{2(g)} \longrightarrow CH_2Cl_2 + HCl;\ \Delta H^o = -104kJ$ **2M**

If C – H; Cl – Cl & H-Cl bond enthalpies are 414, 243 & 431 Kj/mol

Given :

Bond enthalpy	C – H	Cl – Cl	H – Cl
$\Delta H^0 / kJ\,mol^{-1}$	414	243	431

For the given reaction, $\Delta_r H^0 = -104kJ$

Bond enthalpy of $C-Cl = \Delta H^0{}_{C-Cl} = ?$

$$CH_3Cl_{(g)} + Cl_{2(g)} \longrightarrow CH_2Cl_{2(g)} + HCl_{(g)}$$

$$\begin{array}{c} H \\ | \\ H-C-Cl \\ | \\ H \end{array} + Cl-Cl \longrightarrow \begin{array}{c} H \\ | \\ H-C-Cl \\ | \\ Cl \end{array} + H-Cl$$

In this reaction, 1C – H, 1 Cl – Cl bonds of the reactants are broken while 1C – Cl and 1 H – Cl bonds of the products are formed.

$$\therefore \quad \Delta_f H^0 = \begin{bmatrix} \text{Sum of bond} \\ \text{enthalpies of} \\ \text{bonds broken} \\ \text{of the reactants} \end{bmatrix} - \begin{bmatrix} \text{Sum of bond} \\ \text{enthalpies of} \\ \text{bonds formed} \\ \text{of the products} \end{bmatrix}$$

$$= [\Delta H^0{}_{C-H} + \Delta H^0{}_{Cl-Cl}] - [\Delta H^0{}_{C-Cl} + \Delta H^0{}_{H-Cl}] \ -104 = [414 + 243] - [\Delta H^0{}_{C-Cl} + 431]$$

$$= 657 - 2\Delta H^0{}_{C-Cl} - 431$$

$$\therefore \ \Delta H^0{}_{C-Cl} = 657 - 431 + 104 = 330 kJ$$

Ans: Bond enthalpy of C-Cl $= \Delta H^0{}_{C-Cl}$ = **330 kJ mol^{-1}**

b) State and explain Henry's Law. **2M**

Henry's law : It states that the solubility of a gas in a liquid at constant temperature is proportional to the pressure of the gas above the solution.

(i) If S is the solubility of a gas in mol dm^3 at a pressure P and constant temperature then Henry's law,

$S \propto P$ or $S = K \times P$

where K is called Henry's law constant.

(ii) If P = 1 atm, then S = K.

(iii) If several gases are present, then the solubility of any gas in the mixture is proportional to its partial pressure at given temperature.

Q.29 **a)** Methyl bromide can be Converted into ethyl amine in two stage reaction sequence as shown below. **2M**

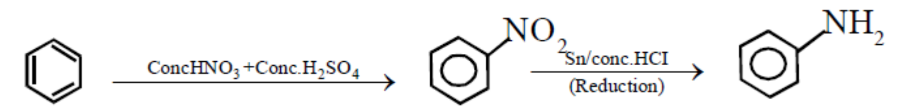
CH_3 - Br + KCN $\longrightarrow$ CH_3 - CN + KBr

CH_3 - CN $\xrightarrow[\text{(reducation)}]{Na/C_2H_5OH}$ CH_3 - CH_2 - NH_2

The starting compound methyl bromide contains one carbon atom while the product ethylamine contains

conversion of methyl bromide into ethyl amine is a step up conversion.

b) **2M**



Benzene (A) Nitrobenene (B) Aniline

Q.30 Given : $[A]_0 = 100$; $[A]_t = 40\%$ **4M**

$T = 45$ min; $k = ?$

$$k = \frac{2.303}{t}\log_{10}\frac{[A]_0}{[A]_t}$$

$$= \frac{2.303}{45}\log_{10}\frac{100}{40}$$

$$= 0.02036\ \text{min}^{-1}$$

Ans: $k = 0.02036$ mon^{-1}.

Q.31 i. Presence of an aldehyde group: The carbonyl group in glucose is in the form of aldehyde. This was inferred from the observation that glucose gets oxidised to a six carbon monocarboxylic acid called gluconic acid on reaction with bromine water which is a mild oxidizing agent. **4M**

$$\underset{\text{Glucose}}{\begin{array}{l}\text{CHO}\\ |\\ (\text{CHOH})_4\\ |\\ \text{CH}_2\text{OH}\end{array}} + [\text{O}] \xrightarrow{\text{Br}_2\text{ water}} \underset{\text{Gluconic acid}}{\begin{array}{l}\text{CHOH}\\ |\\ (\text{CHOH})_4\\ |\\ \text{CH}_2\text{OH}\end{array}}$$

ii. Presence of five hydroxyl groups: It is determined as glucose reacts with acetic anhydride to form glucose pentaacetate. As glucose is a stable compound. it was further inferred that the five hydroxyl groups are bonded to five different carbon atoms in glucose molecule.

$$\underset{\text{Glucose}}{\begin{array}{l}\text{CHO}\\ |\\ (\text{CHOH})_4\\ |\\ \text{CH}_2\text{OH}\end{array}} + \underset{\text{Acetic anhydride}}{5(\text{Cl}_3-\overset{\overset{\text{O}}{\|}}{\text{C}}-)_2\text{O}} \longrightarrow \underset{\text{Glucose pentaacetate}}{\begin{array}{l}\text{CHO}\\ |\\ (\text{CH}-\text{O}-\overset{\overset{\text{O}}{\|}}{\text{C}}-\text{CH}_3)_4\\ |\\ \text{CH}_2-\text{O}-\underset{\underset{\text{O}}{\|}}{\text{C}}-\text{CH}_3\end{array}} + \underset{\text{Acetic acid}}{5\text{CH}_3-\overset{\overset{\text{O}}{\|}}{\text{C}}-\text{OH}}$$

iii. Presence of one primary alcoholic group: Glucose and gluconic acid both on oxidation with dilute nitric acid give the same dicarboxylic acid called saccharic acid. Thus, glucose contains one primary alcoholic (-CH_2OH) group.

$$\underset{\text{Glucose}}{\begin{array}{l}\text{CHO}\\ |\\ (\text{CHOH})_4\\ |\\ \text{CH}_2\text{OH}\end{array}} \xrightarrow[\text{[O]}]{\text{Dil.NHO}_3} \underset{\text{Saccharic acid}}{\begin{array}{l}\text{COOH}\\ |\\ (\text{CHOH})_4\\ |\\ \text{COOH}\end{array}} \xleftarrow{\text{dil HNO}_3\text{.[O]}} \underset{\text{Gluconic acid}}{\begin{array}{l}\text{COOHa}\\ |\\ (\text{CHOH})_4\\ |\\ \text{CH}_2\text{OH}\end{array}}$$

Together we will make a difference