LIBERTY PAPER SET

STD. 12 : Chemistry

Full Solution

Time : 3 Hours **ASSIGNTMENT PAPER 9**

Part A

1. (B) **2.** (B) **3.** (A) **4.** (B) **5.** (A) **6.** (C) **7.** (C) **8.** (D) **9.** (B) **10.** (C) **11.** (D) **12.** (C) **13.** (C) **14.** (B)
15. (B) **16.** (D) **17.** (D) **18.** (C) **19.** (A) **20.** (C) **21.** (C) **22.** (D) **23.** (A) **24.** (B) **25.** (D) **26.** (B) **27.** (B)
28. (D) **29.** (D) **30.** (A) **31.** (A) **32.** (D) **33.** (A) **34.** (B) **35.** (B) **36.** (A) **37.** (D) **38.** (B) **39.** (A) **40.** (C)
41. (C) **42.** (D) **43.** (B) **44.** (D) **45.** (A) **46.** (D) **47.** (C) **48.** (D) **49.** (A) **50.** (C)

Part B

Section A

➢ **Write the answer of the following questions : (Each carries 2 Mark)**

1.

- I = 5A

  t = 8 min 45 sec

  $= (8 \times 60) + 45$

  $= 480 + 45$

  t = 525 sec

  Q = It

  $= 5 \times 525$

  = 2625 C

  $\therefore F = \frac{2625}{96500}$

  Cathode :- $Cu^{+2} + 2e^- \rightarrow Cu$

  2F gives 1 mol Cu

  $\therefore \frac{2625}{96500}$ gives (?)

  $mol = \frac{2625 \times 1}{96500 \times 2}$

  $\frac{mass}{63.5} = 0.0136$

  mass = 0.8636 gm

2.

- Anode : $Zn(s) \rightarrow Zn^{+2} + 2e^-$

  Cathode : $MnO_2 + NH_4^+ + e^- \rightarrow MnO(OH) + NH_3$

- Anode : $Pb_{(s)} + SO_{4(aq)}^{-2} \rightarrow PbSO_{4(s)} + 2e^-$

  Cathode : $PbO_{2(s)} + SO_{4(aq)}^{-2} + 4H^+_{(aq)} + 2e^- \rightarrow 2PbSO4_{(s)} + 2H_2O$

3.

- The order of a reaction is sometimes altered by conditions.
- There are many reactions which obey first order rate law although they are higher order reactions.
- Consider the hydrolysis of ethyl acetate which is a chemical reaction between ethyl acetate and water. In reality, it is second order reaction and concentration of both ethyl acetate and water affect the rate of the reaction.
- But water is taken in large excess for hydrolysis, therefore, concentration of water is not altered much during the reaction.
- Thus, the rate of reaction is affected by concentration of ethyl acetate.
- For e.g. 0.01 mol ethyl acetate react with 10 mol of water amounts of the reactants and products at the beginning (t = 0) and completion (t) of the reaction are give as under.

$$CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} CH_3COOH + C_2H_5OH$$

	$CH_3COOC_2H_5$	H_2O	CH_3COOH	C_2H_5OH
t = 0	0.01 mol	10 mol	0 mol	0 mol
t = t	0 mol	9.99 mol	0.01 mol	0.01 mol

The concentration of water does not get altered much during the course of the reaction. So, the reaction behaves as first order reaction. Such reactions are called pseudo first order reactions.

Inversion of cane sugar is another pseudo first order reaction.

$$\underset{\text{cane sugar}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

$$\text{Rate} = k\,[C_{12}H_{22}O_{11}]$$

4.

- Suppose initial concentration $[R]_0 = 100$
- $\therefore$ Concentration at time t $[R]_t = 70$, (30% decomposition).
- $t = 40$ min.
- Comparing $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]_t}$ and

$$k = \frac{0.693}{t_{\frac{1}{2}}} \quad \text{we get,}$$

$$\frac{0.693}{t_{\frac{1}{2}}} = \frac{2.303}{t} \log \frac{[R]_0}{[R]_t}$$

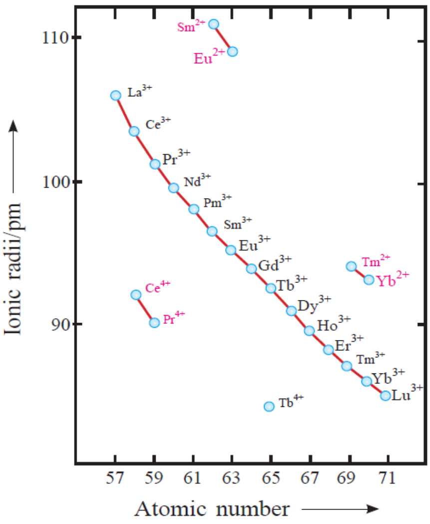
$$\therefore \frac{0.693}{t_{\frac{1}{2}}} = \frac{2.303}{40} \log \frac{100}{70} = \frac{2.303}{40} \times 0.1549$$

$$\therefore \frac{0.693}{t_{\frac{1}{2}}} = 0.0089185$$

$$\therefore t_{\frac{1}{2}} = 0.693 / 0.0089185 = 77.7 \text{ min}$$

5.

- As we move along the lanthanoid series, the atomic number increases gradually by one. This means that the number of electrons and protons present in an atom also increases by one.
- As electrons are being added to the same shell, the effective nuclear charge increases.
- This happens because the increase in nuclear attraction due to the addition of proton is more pronounced than the increase in the interelectronic repulsions due to the addition of electron.
- Also, with the increase in atomic number, the number of electrons in the 4f orbital also increases. The 4f electrons have poor shielding effect.
- Therefore, the effective nuclear charge experienced by the outer electrons increases. Consequently, the attraction of the nucleus for the outermost electrons increases.
- This results in a steady decrease in the size of lanthanoids with the increase in the atomic number. This is termed as lanthanoid contraction.



- Consequences of lanthanoid contraction
  - There is similarity in the properties of second and third transition series.
  - Separation of lanthanoids is possible due to lanthanoid contraction.
  - It is due to lanthanoid contraction that there is variation in the basic strength of lanthanoid hydroxides. (Basic strength decreases from $La(OH)_3$ to $Lu(OH)_3$.)

6.

- Manganese ($_{25}Mn$) shows largest number of oxidation states because it has maximum number of unpaired electrons.

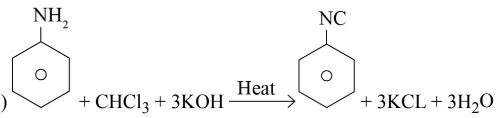
7.

- Aliphatic and aromatic primary amines on heating with chloroform and Ethanolic potassium hydroxide form isocyanides or carbylamines which are foul smelling substances.
- Secondary and tertiary amines do not show this reaction.
- This reaction is known as carbylamine reaction or isocyanide test and is used as a test for primary amines.

$$R - NH_2 + CHCl_3 + 3KOH \xrightarrow{Heat} R - NC + 3KCl + 3H_2O$$

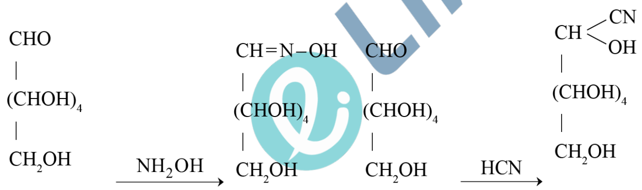
$$\text{e.g. (1) } CH_3 - NH_2 + CHCl_3 + 3KOH \xrightarrow{Heat} CH_3NC + 3KCl + 3H_2O$$

(2)

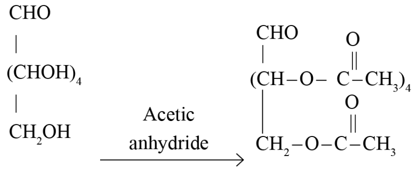


8.

- Glucose reacts with hydroxylamine to form an oxime and adds a molecule of hydrogen cyanide to give cyanohydrin. These reactions confirm the presence of carbonyl group $(>C=O)$ in glucose.



- Acetylation of glucose with acetic anhydride gives glucose pentaacetate which confirms the presence of five –OH groups. Since, it exists as a stable compound, five –OH groups should be attached to different carbon atoms.



9.

- Werner's theory could not explain

  (1) Directional properties of bonds in a coordination compound.

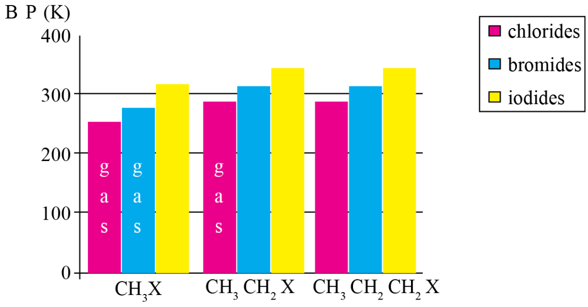
  (2) Ability of certain elements to form co-ordination compound.

  (3) The magnetic and optical properties of coordination compound.

10.

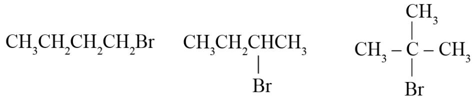
- Molecules of organic halogen compounds are generally polar.
- Due to greater polarity as well as higher molecular mass as compared to the parent hydrocarbon, the intermolecular forces of attraction (dipole-dipole and van der Waals) are stronger in the halogen derivatives.

- That is why the boiling points of chlorides, bromides and iodides are considerably higher than those of the hydrocarbons of comparable molecular mass.
- The pattern of variation of boiling points of different halides is depicted in Fig.



Comparison of boiling points of some alkyl halides

- For the same alkyl group, the boiling points of alkyl halides decrease in the order: RI> RBr> RCl> RF.
- This is because with the increase in size and mass of halogen atom, the magnitude of van der Waal forces increases.
- The boiling points of isomeric haloalkanes decrease with increase in branching ($1^0 > 2^0 > 3^0$).
- For example, 2-bromo-2- methylpropane has the lowest boiling point among the three isomers.



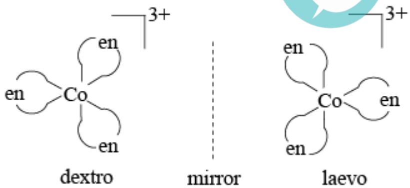
$CH_3CH_2CH_2CH_2Br$ $\quad$ $CH_3CH_2\underset{\displaystyle Br}{\underset{|}{C}}HCH_3$ $\quad$ $CH_3-\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle Br}{\underset{|}{C}}}}-CH_3$

b.p/k 375 364 346

1-bromobutane 2-bromobutane 2-Bromo-2-methyl propane

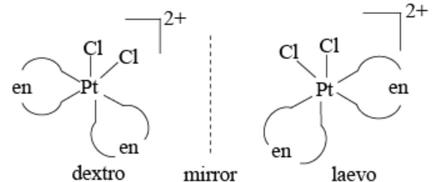
11.

- Optical isomers are mirror images that cannot be superimposed on one another.
- These are called as enantiomers.
- The molecules or ions that cannot be superimposed are called chiral.
- The two forms are called dextro (d) and laevo (l) depending upon the direction they rotate the plane of polarised light in a polarimeter
- Dextro (d) rotates plane polarised light to the right, and leaevo (l) rotates plane polarised light to the left.



Optical isomers (d and l) of $[Co(en)_3]^{3+}$

- Optical isomerism is common in octahedral complexes involving didentate ligands
- In a coordination entity of the type $[PtCl_2(en)_2]^{2+}$, only the cis isomer shows optical activity.



Optical isomers (d and l) of cis- $[PtCl_2(en)_2]^{2+}$

12.

➥ Propan-1-ol, 4-methylphenol, phenol, 3-nitrophenol, 3, 5-dinitrophenol, 2, 4, 6-trinitrophenol.

Section B

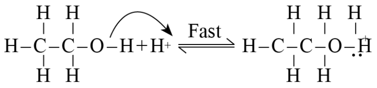
➢ **Write the answer of the following questions : (Each carries 3 Mark)**

13.

➥ The mechanism of dehydration of ethanol involves the following steps :

➥ Mechanism :

➥ Step 1 : Formation of protonated alcohol

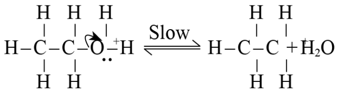


$$H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-O-H+H^+ \xrightleftharpoons{\text{Fast}} H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\overset{H}{\overset{+}{\underset{..}{O}}}-H$$

Ethanol

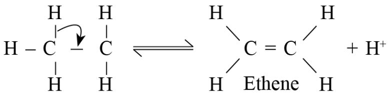
Protonated alcohol
(Ethyl oxonium ion)

➥ Step 2 : Formation of carbocation : It is the slowest step and hence, the rate determining step of the reaction.



$$H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\overset{H}{\overset{+}{\underset{..}{O}}}-H \xrightleftharpoons{\text{Slow}} H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{\overset{+}{C}}} + H_2O$$

➥ Step 3 : Formation of ethene by elimination of a proton.



Ethene

➥ The acid used in step 1 is released in step 3. To drive the equilibrium to the right, ethene is removed as it is formed.

14.

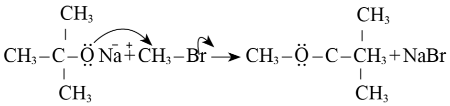
➥ Williamson synthesis is an important laboratory method for the preparation of symmetrical and unsymmetrical ethers.

➥ However, selection of appropriate reactants is required for the preparation of unsymmetrical ethers.

➥ Williamson synthesis occurs via S_N2 mechanism and primary alkyl halides are more reactive towards S_N2 reaction.

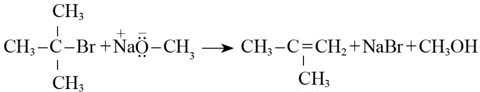
➥ Thus, better results are obtained if the alkyl halide is primary and alkoxide ion is primary,secondary or tertiary.

➥ For example, tert-butyl ether can be prepared by treating methyl bromide with tert-butyloxide ion.



$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-\ddot{\underset{..}{O}}\overset{-}{}\overset{+}{Na}+CH_3-Br \longrightarrow CH_3-\ddot{\underset{..}{O}}-\underset{CH_3}{\overset{CH_3}{C}}-CH_3+NaBr$$

➥ The above ether can not be prepared by the reaction between sodium mehoxide and tert-butyl bromide. Because in this case elimination competes over substitution and alkene compound iso-butylene obtain as a product.



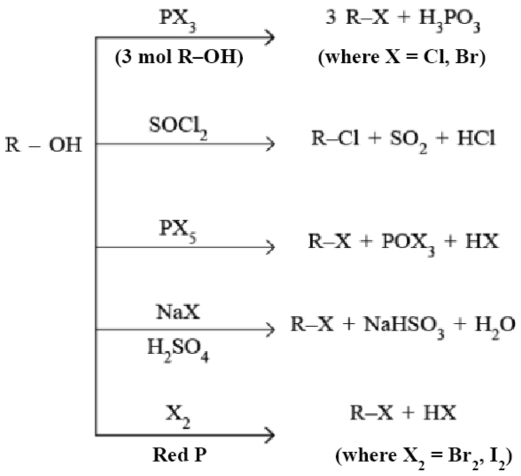
$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-Br+\overset{+}{Na}\ddot{\underset{..}{O}}\overset{-}{}-CH_3 \longrightarrow CH_3-\underset{CH_3}{C}=CH_2+NaBr+CH_3OH$$

2-Methylpropene

➥ It is because alkoxides are not only nucleophiles but strong bases as well. They react with alkyl halides leading to elimination reactions.

➥ Aryl and vinyl halides can not be used as reactant in Williamson synthesis as they are very less reactive towards nucleophilic reaction.

15.



16.

➥ Suppose,

Order of reaction with respect to A = x

Order of reaction with respect to B = y

$\therefore$ Rate $= k[A]^x[B]^y$

$\therefore r_1 = k[0.1]^x[0.1]^y = 6.0 \times 10^{-3}$ ... ... (1)

$r_2 = k[0.3]^x[0.2]^y = 7.2 \times 10^{-2}$ ... ... (2)

$r_3 = k[0.3]^x[0.4]^y = 2.88 \times 10^{-1}$ ... ... (3)

$r_4 = k[0.4]^x[0.1]^y = 2.40 \times 10^{-2}$ ... ... (4)

Dividing (4) and (1) we get,

➥ $$\frac{r_4}{r_1} = \frac{k[0.4]^x[0.1]^y}{k[0.1]^x[0.1]^y} = \frac{2.40 \times 10^{-2}}{6.0 \times 10^{-3}} = 4$$

$$\therefore \frac{r_4}{r_1} = [4]^x = [4]^1$$

$\therefore x = 1$

➥ Order of reaction with respect to A = 1

Dividing (3) and (2) we get,

$$\frac{r_3}{r_2} = \frac{k[0.3]^x[0.4]^y}{k[0.3]^x[0.2]^y} = \frac{2.88 \times 10^{-1}}{7.2 \times 10^{-2}} = 4$$

$$\therefore \frac{r_3}{r_2} = [2]^y = 4 = [2]^2$$

$\therefore y = 2$

$\therefore$ order of reaction with respect to A = 1

➥ order of reaction with respect to B = 2

➥ overall order of reaction = 3

$\therefore$ rate equation,

Rate $= k[A]^1[B]^2$

➥ Calculation of rate constant k

From equation (1)

➥ $r_1 = k[0.1]^1[0.1]^2 = 6.0 \times 10^{-3}$

$$k = \frac{6.0 \times 10^{-3}}{[0.1]^1\,[0.1]^2} = \frac{6.0 \times 10^{-3}}{[10]^{-1}\,[10]^{-2}}$$

$= 6.0\ \text{mol}^{-2}\ \text{L}^{-2}\ \text{min}^{-1}$

17.

➥ $W_2 = 45$ g $W_1 = 600$ g

M2 = 62 g.Mol–1 Kf = 1.86 K.kg.Mol–1

$\Delta T_f = (?)\ T_f = (?)$

$$\Delta T_f = K_f \,.\, \frac{W_2 \times 1000}{M_2 \times W_1}$$

$$= 1.86 \times \frac{45 \times 1000}{62 \times 600}$$

$\Delta T_f = 2.25$ K

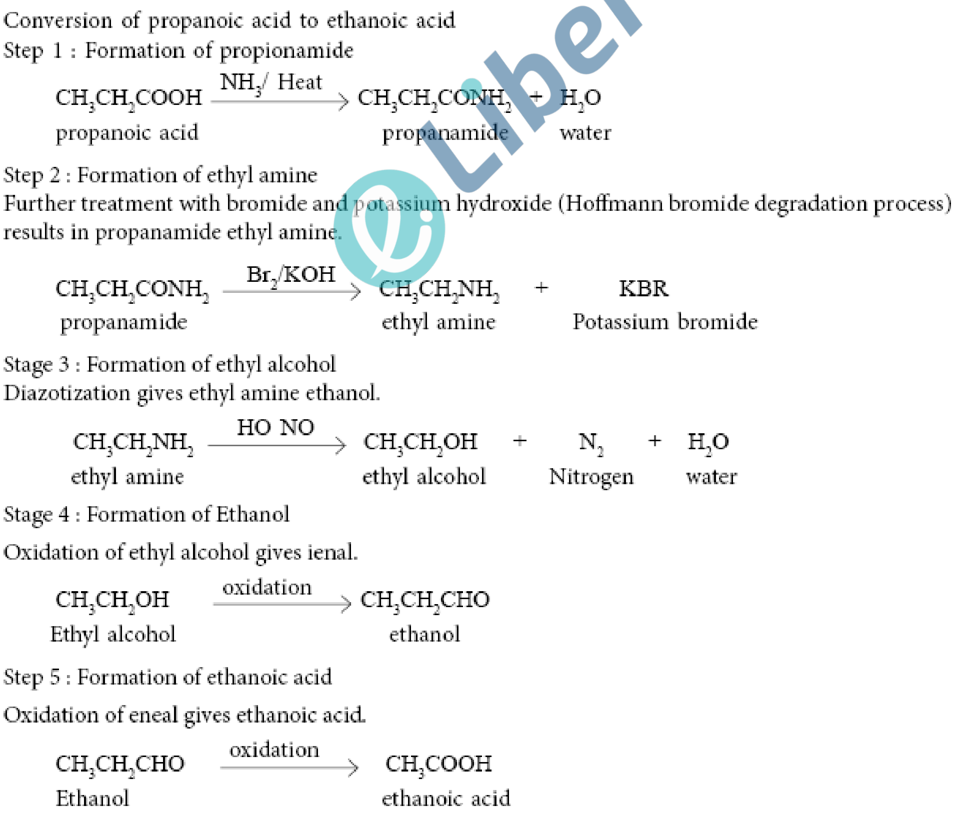
$\Delta T_f = T_f^0 - T_f$

$\therefore\ 2.25 = 273.15 - T_f$

$\therefore\ T_f = 273.15 - 2.25$

$T_f = 270.9$ K

18.



Conversion of propanoic acid to ethanoic acid

Step 1 : Formation of propionamide

$$\underset{\text{propanoic acid}}{CH_3CH_2COOH} \xrightarrow{NH_3/\ Heat} \underset{\text{propanamide}}{CH_3CH_2CONH_2} + \underset{\text{water}}{H_2O}$$

Step 2 : Formation of ethyl amine

Further treatment with bromide and potassium hydroxide (Hoffmann bromide degradation process) results in propanamide ethyl amine.

$$\underset{\text{propanamide}}{CH_3CH_2CONH_2} \xrightarrow{Br_2/KOH} \underset{\text{ethyl amine}}{CH_3CH_2NH_2} + \underset{\text{Potassium bromide}}{KBR}$$

Stage 3 : Formation of ethyl alcohol

Diazotization gives ethyl amine ethanol.

$$\underset{\text{ethyl amine}}{CH_3CH_2NH_2} \xrightarrow{HO\ NO} \underset{\text{ethyl alcohol}}{CH_3CH_2OH} + \underset{\text{Nitrogen}}{N_2} + \underset{\text{water}}{H_2O}$$

Stage 4 : Formation of Ethanol

Oxidation of ethyl alcohol gives ienal.

$$\underset{\text{Ethyl alcohol}}{CH_3CH_2OH} \xrightarrow{oxidation} \underset{\text{ethanol}}{CH_3CH_2CHO}$$

Step 5 : Formation of ethanoic acid

Oxidation of eneal gives ethanoic acid.

$$\underset{\text{Ethanol}}{CH_3CH_2CHO} \xrightarrow{oxidation} \underset{\text{ethanoic acid}}{CH_3COOH}$$

19.

- *"Ligands are atom or ions which donates electron pairs to the central metal ion."*

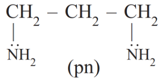
  (OR)
- *"The ions or molecules bound to the central atom/ion in the coordination entity are called ligands."*
- These may be simple ions such as Cl^-, small molecules such as H_2O or NH_3, larger molecules such as $H_2NCH_2CH_2NH_2$ or $N(CH_2CH_2NH_2)_3$ or even macromolecules, such as proteins.
- Classification of Ligands :
- (1) Unidentate ligands :
  - *"When a ligand is bound to a metal ion through a single donor atom, the ligand is said to be unidentate."*

    Example :

    (a) Neutral : $H_2\ddot{O}:$, $:NH_3$, $:CO$, $:NO$, $CH_3\ddot{N}H_2$, $C_5H_5\ddot{N}$ (py)

    (b) Negative ion : ^-OH, F^-, Cl^-, Br^-, I^-, ^-CN, $^-NH_2$, NO_3^- , NO_2^- , $NCH_3COO^-(AcO^-)$, O^{2-}, S^{2-}, N^{3-}
- (2) Didentate ligands :
  - *"When a ligand is bound to a metal ion through a two donor atom, the ligand is said to be didentate."*

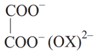
    (a) Neutral : $H_2\ddot{N}$, $-CH_2-CH_2-$ $\ddot{N}H_2$ (en),



$$\underset{\ddot{N}H_2}{CH_2} - CH_2 - \underset{\ddot{N}H_2}{CH_2}$$

(pn)

Negative ion : CO_3^{2-}, SO_4^{2-}, COO^-



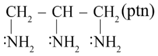
$$\begin{matrix} COO^- \\ | \\ COO^- \end{matrix}\ (OX)^{2-}$$

(b) Negative ion :

- (3) Tridentate ligands :
  - *"When a ligand is bound to a metal ion through a three donor atom, the ligand is said to be Tridentate."*

    Example :

    (a) Neutral :



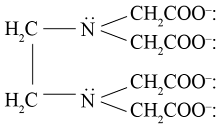
$$\underset{:NH_2}{CH_2} - \underset{:NH_2}{CH} - \underset{:NH_2}{CH_2}\ (ptn)$$

(b) Negative ion : PO_4^{3-} , AsO_4^{3-}

(4) Hexadentate ligands :

- When a ligand is bound to a metal ion through a six donor atom, the ligand is said to be hexadendate

  Example : Ethylenediaminetetraacetate ion ($EDTA^{4-}$)



20.

(a) A notable reaction is the oxidation of iodide to iodate:

$$2MnO_4^- + H_2O + I^- \rightarrow 2MnO_2 + 2OH^- + IO_3^-$$

(b) Thiosulphate is oxidised almost quantitatively to sulphate :

$$8MnO_4^- + 3S_2O_3^{2-} + H_2O \rightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$$

(c) Manganous salt is oxidised to MnO_2; the presence of zinc sulphate or zinc oxide catalyses the oxidation :

$$2MnO_4^- + 3Mn^{2+} + 2H_2O \rightarrow 5MnO_2 + 4H^+$$

21.

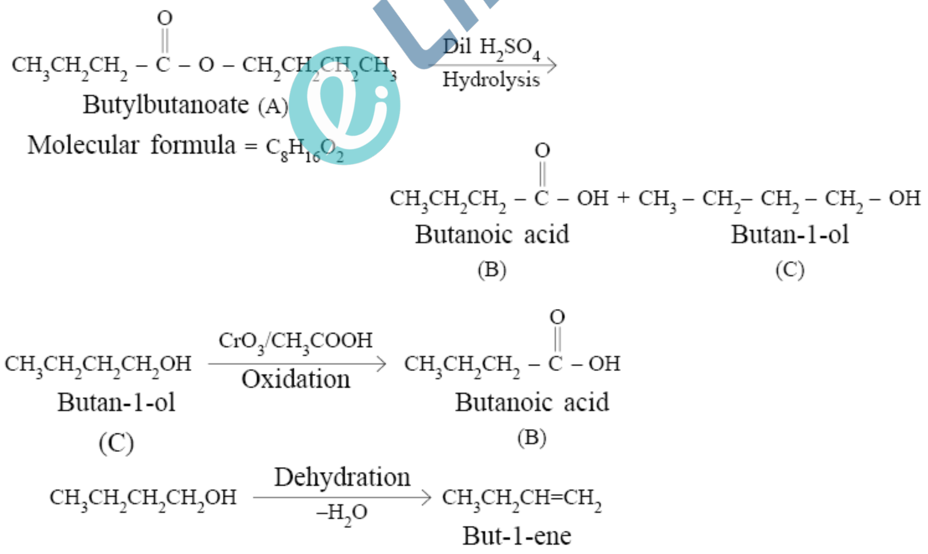
- *"The conductance of electricity by ions present in the solutions is called electrolytic or ionic conductance"*
- When electrolytes are dissolved in water, they furnish their own ions in the solution hence its conductivity also increases.
- The conductivity of electrolytic (ionic) solution depends on :
  - (i) The nature of the electrolyte added
  - (ii) The size of the ions produced and their solvation
  - (iii) The nature of the solvent and its viscosity
  - (iv) Concentration of the electrolyte
  - (v) Temperature (it increases with the increase of temperature)

Section C

Write the answer of the following questions : (Each carries 4 Mark)

22.

- A is an organic compound with a molecular formula $C_8H_{16}O_2$. This gives a carboxylic acid (B) and alcohol (C) on hydrolysis with dilute sulphuric acid. Thus, compound A must be an ester.
- Further, oxidation of alcohol (C) with chromic acid gives acid B. Thus, B and C must contain an equal number of carbon atoms.
- A total of 8 carbon atoms are present in compound A, each of B and C contain 4 carbon atoms.
- Again, alcohol C gives but-1-ene on dehydration. Therefore, C is of straight-chain and hence, it is butan-1-ol.
- On oxidation, Butan-1-ol gives butanoic acid. Hence, acid B is butanoic acid.
- Hence, the ester with molecular formula $C_8H_{16}O_2$ is butylbutanoate.
- All the given reactions can be explained by the following equations.



$$CH_3CH_2CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-O-CH_2CH_2CH_2CH_3 \xrightarrow[\text{Hydrolysis}]{\text{Dil } H_2SO_4} CH_3CH_2CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-OH + CH_3-CH_2-CH_2-CH_2-OH$$

Butylbutanoate (A)

Molecular formula = $C_8H_{16}O_2$

Butanoic acid (B)   Butan-1-ol (C)

$$CH_3CH_2CH_2CH_2OH \xrightarrow[\text{Oxidation}]{CrO_3/CH_3COOH} CH_3CH_2CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-OH$$

Butan-1-ol (C)   Butanoic acid (B)

$$CH_3CH_2CH_2CH_2OH \xrightarrow[-H_2O]{\text{Dehydration}} CH_3CH_2CH=CH_2$$

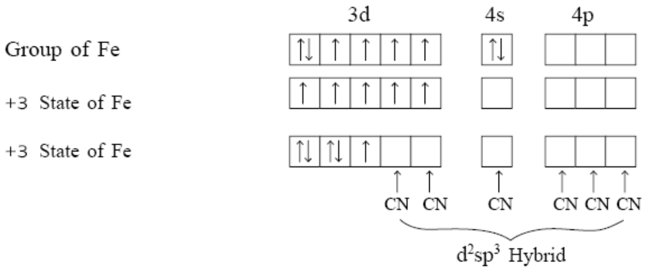
But-1-ene

23.

The $[Fe(CN)_6]^{-3}$ complex iron has +3 Oxidation state

Electrone configuration of Fe^{+3} : [Ar] $3d^6 4s^2$

Since CN^- is the dominant ligand there is a rearrangement of six electrons in the 3d orbital, and d^2sp^3 hybridization occura in the orbital of the metal ion.

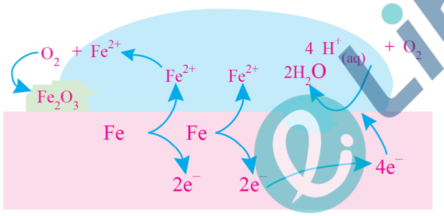


$[Fe(CN)_6]^{3-}$ has 0 unpaired electrons and is dianagnetic and has complex octaedral structure.

24.

- In corrosion, a metal is oxidised by loss of electrons to oxygen and informal of oxides.
- Corrosion of iron (commonly known as rusting) occurs in presence of water and air.
- At a particular spot of an object made of iron, oxidation takes place and that spot behaves as anode and we can write the reaction.

Anode : $2Fe(s) \rightarrow 2Fe^{2+} + 4e^-$



Oxidation : $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

Reduction : $O_2(g) + 4H^-(aq) + 4e^- \rightarrow 2H_2O(l)$

Atmospheric oxidation :

$$2Fe^{2+}(aq) + 2H_2O(l) + \frac{1}{2} O_2(g) \rightarrow Fe_2O_3(s) + 4H^+(aq)$$

- Electrons released at anodic spot move through the metal and go to another spot on the metal, where they reduce oxygen in presence of H^+ (which is believed to be available from H_2CO_3 formed due to dissolution of carbon dioxide from air into water.

Cathode : $O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$

$E^6_{H+ | O2 | H2O} = 1.23$ V

The overall reaction being :

$2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l)$

$E^6_{(cell)} = 1.67V$

- The ferrous ions are further oxidised by atmosphere oxygen to ferric ions which come out as rust in the form of hydrated ferric oxide (Fe_2O_3. x H_2O) and with further production of hydrogen ions.

(i) ***"The inverse of resistivity, called conductivity (specific conductors) is represented by the symbol, k (greek, kappa)"***

➥ The SI unit of conductivity are S m^{-1} but quite often, k is expressed in S cm^{-1}

➥ Conductivity of a material in S m^{-1} is its conductance when it is 1 m long and its area of crosss sections 1 m^2.

1 S cm^{-1} = 100 S m^{-1}.

(ii) ***"The resistivity for a substance is its resistance when it is one metre long and its area of cross section is one m^2."***

$\therefore\ \rho = R\left(\frac{A}{l}\right)$

➥ Its SI units are ohm metre (ΩM) and quite often its submultiple. ohm centimetre (Ω cm) is also used.

1 Ω m = 100 Ω cm or 1 Ω cm = 0.01 Ω m

25.

➥ $W_2 = 10$ g, $W_1 = 250$ g

$M_2 = 4(C) + 7(H) + Cl + 2(O)$ Ka = 1.4×10^{-3}

$= 4(12) + 7(1) + 35.5 + 2(16)$

$= 122.5$ g.Mol^{-1} $K_f = 1.86$ K.kg.Mol^{-1}

$\Delta T_f = (?)$

(Molality)

$C = \frac{W_2 \times 1000}{M_2 \times W_1}$

$= \frac{10 \times 1000}{122.5 \times 250}$

$= 0.3265$ Mol/L

$Ka = \frac{\propto^2 \cdot C}{1 - \propto}$

$1.4 \times 10^{-3} = \propto^2 . (0.3265)$

$4.287 \times 10^{-3} = \propto^2$

$0.4287 \times 10^{-2} = \propto^2$

$\propto = 0.6547 \times 10^{-1}$

$\propto = 0.06547$

$\propto = \frac{i-1}{n-1}$

$0.06547 = \frac{i-1}{2-1}$

$i = 1.06547$

➥ So, depression in the freezing point is

$\Delta T_f = i . K_f . m$

$= (1.06547)(1.86)(0.3265)$

$= 0.647$ K

26.

➥ A → product

here, $T_1 = 10\ °C = 283$ K

$k_1 = 4.5 \times 10^3\ s^{-1}$

$E_a = 60$ kJ mol^{-1} = 60000 J mol^{-1}

$k_2 = 1.5 \times 10^4\ s^{-1}$

$T_2 = ?$

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

➥ $$\log\frac{k_2}{k_1} = \frac{E_a}{2.303R}\left[\frac{1}{T_1}-\frac{1}{T_2}\right]$$

$$\log\frac{1.5\times10^4}{4.5\times10^3} = \frac{60000}{2.303\times8.314}\left[\frac{1}{283}-\frac{1}{T_2}\right]$$

$$0.5228 = \frac{60000}{2.303\times8.314}\left[\frac{1}{283}-\frac{1}{T_2}\right]$$

$$\left[\frac{1}{283}-\frac{1}{T_2}\right] = \frac{2.303\times8.314\times0.5228}{60000}$$

$$\frac{1}{283}-\frac{1}{T_2} = 0.0001668$$

$$\frac{1}{T_2} = \frac{1}{283} - 0.0001668$$

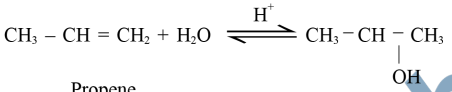
$$\frac{1}{T_2} = 0.003534 - 0.0001668 = 0.003367$$

$$T_2 = \frac{1}{0.003367} = 297.00\ K$$

$$T_2 = 297 - 273 = 24\ °C$$

27.

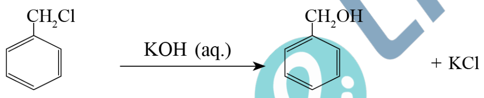
➥ (i) Propene → Propan-2-ol



$$CH_3-CH=CH_2 + H_2O \overset{H^+}{\rightleftharpoons} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$$

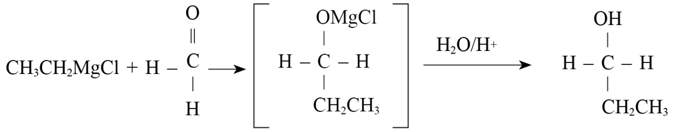
Propene Propan-2-ol

➥ (ii) Benzyl chloride → Benzyl alcohol



Benzyl chloride Benzyl alcohol

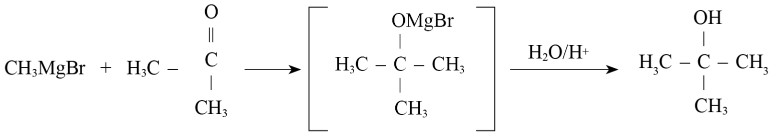
➥ (iii) Ethyl magnesium chloride → Propan-1-ol.



$$CH_3CH_2MgCl + H-\overset{\overset{O}{\|}}{\underset{\underset{H}{|}}{C}} \longrightarrow \left[H-\overset{\overset{OMgCl}{|}}{\underset{\underset{CH_2CH_3}{|}}{C}}-H\right] \xrightarrow{H_2O/H^+} H-\overset{\overset{OH}{|}}{\underset{\underset{CH_2CH_3}{|}}{C}}-H$$

Ethyal magnesium chloride methanal Intermediate propan-1-ol

➥ (iv) Methyl magnesium bromide → 2-Methylpropan-2-ol



$$CH_3MgBr + H_3C-\overset{\overset{O}{\|}}{\underset{\underset{CH_3}{|}}{C}} \longrightarrow \left[H_3C-\overset{\overset{OMgBr}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3\right] \xrightarrow{H_2O/H^+} H_3C-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$$

Methyl magnesium bromide propanone Intermediate 2-methylpropan-2-ol