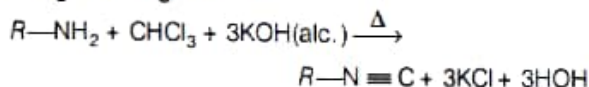


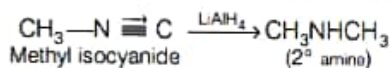
MARKING SCHEME

PRACTICE PAPER - 08

1. (i) (c) Carbylamine test is used to distinguish 1° amines (both aliphatic and aromatic) from 2° and 3° amines by using following reaction.



- (ii) (d) Aniline does not show Friedel-Crafts reaction due to salt formation with anhydrous $AlCl_3$ which is used as a catalyst. Here nitrogen of aniline will acquire positive charge and hence acts as a strong deactivating group.
- (iii) (c) Methyl isocyanide on reduction with lithium aluminium hydride will yield secondary amine.



Or

(d) Ethyl methyl amine being secondary amine cannot be prepared by Gabriel phthalimide synthesis, while others are primary amines which can be prepared by this process.

- (iv) (c) Solubility in water decreases as the extent of H-bonding decreased. So, solubility in water follows the order I > II > III.

2. (i) (b) Assertion and Reason both are correct but Reason is not correct explanation of Assertion. Corrected Reason is : In the mercury cell
 $Zn + HgO \longrightarrow ZnO + Hg$ does not involve any ion whose concentration may change.

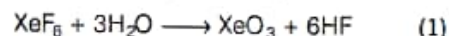
- (ii) (a) Assertion and Reason both are correct and Reason is the correct explanation of Assertion. Sulphuric acid is consumed in the reaction due to the formation of lead sulphate and hence density decreases.
- (iii) (c) Assertion is incorrect but Reason is correct. H_2-O_2 fuel cell is preferred over ordinary cell as fuel cells do not cause any pollution and also these have high efficiencies.

Or

(c) Assertion is correct, but Reason is incorrect. Acidic NH_4Cl corrodes the Zn container even when cell is not in use.

- (iv) (a) Assertion and Reason both are correct and Reason is the correct explanation of Assertion. As by applying external voltage following reaction (which is reverse of normal reaction) takes place.
 $2PbSO_4 + 2H_2O \longrightarrow Pb(s) + PbO_2(s) + 4H^+ + 2SO_4^{2-}$

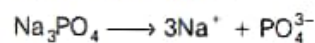
3. (d) On complete hydrolysis XeF_6 gives XeO_3 .



4. (c) The mixture of carbon tetrachloride and chloroform show positive deviations from Raoult's law as CCl_4-CHCl_3 interactions are lower than CCl_4-CCl_4 interactions or $CHCl_3-CHCl_3$ interactions. (1)

Or

(a) Sodium phosphate Na_3PO_4 will yield maximum ions on dissociation :



Total 4 ions and that's why lowering of vapour pressure will be maximum here. (1)

5. (a) Electronic configuration of metal in their respective complex are given below :

1. $Fe^{3+} : 3d^5$
2. $Pt^{2+} : 5d^8$
3. $Cu^{2+} : 3d^9$

Therefore, in complex $[Fe(CN_6)]^{3-}$, the metal contains the maximum number of electrons. (1)

6. (b) Carbohydrates made up of 2-10 monosaccharides are called oligosaccharides. Thus, upon hydrolysis, oligosaccharides form 2-10 monosaccharides. (1)

7. (d) Mercury does not liberate hydrogen when reacted with hot water as its ionisation energy is very high due to its completely filled configuration of $6s^2, 5d^{10}$. (1)

Or

(a) The solubility of silver bromide in hypo solution due to the formation of $[Ag(S_2O_3)_2]^{3-}$. (1)

8. (a) Due to lanthanoid contraction order will be
 $Yb^{3+} < Pm^{3+} < Ce^{3+} < La^{3+}$ (1)

9. (b) Ice has the lowest melting point and as such it has weakest intermolecular forces. (1)

Or

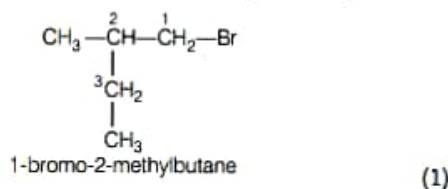
(a) Since, quartz glass is an amorphous solid having short range order of constituents. Hence, value of refractive index is same in all directions, can be measured and not be equal to zero always. (1)

10. (c) When excess of hot water is added to FeCl_3 , a positively charged sol of ferric hydroxide is formed due to adsorption of Fe^{3+} ions. $\text{Fe}(\text{OH})_3 / \text{Fe}^{3+}$ a positively charged sol. (1)

Or

(d) Physisorption is a process in which adsorbate get adsorbed on the adsorbent surface by weak van der Waals' force of attraction. On increasing temperature the interaction between adsorbate and adsorbent becomes weak and adsorbate particles get desorbed. (1)

11. (c) The correct IUPAC name of the given compound is



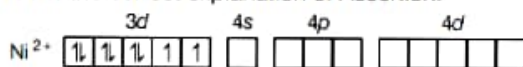
12. (a) According to Hardy-Schulze law, greater the charge/ valency on flocculating ion added greater will be its power to cause precipitation. Coagulating power \propto Valency of flocculating ion. Hence, both Assertion and Reason are correct and Reason is correct explanation of Assertion. (1)

13. (a) Molar conductivity of weak electrolytic solution increases on dilution, because as we add excess water to increases the dilution degree of dissociation increases which led to increase in number of ions in the solution. Thus, Δ_m show a very sharp increase. Hence, both Assertion and Reason are correct and Reason is the correct explanation of the Assertion. (1)

14. (d) Aromatic aldehydes and ketones undergo electrophilic substitution at the ring in which the carbonyl group acts as a deactivating and *meta*-directing group. Thus, Assertion is incorrect but Reason is correct. (1)

15. (b) Due to high electronegativity of oxygen it is more ionic than sulphur and so the di-negative anion of O^{2-} is quite common but the di-negative anion of sulphur, (S^{2-}) is less common. The covalency of oxygen is two as it cannot expand its valency beyond the octet. Thus, both Assertion and Reason are correct and Reason is not the correct explanation of Assertion. (1)

16. (b) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.



During rearrangement only one 3d-orbital may be made available by pairing of electrons. Thus, inner d^2sp^3 -hybridisation is not possible. So, only sp^3d^2 hybridisation can occur. (1)

Or

(b) Both Assertion and Reason are correct but greater stability is due to greater number of chelate rings formed by EDTA than by oxalate in the second case. (1)

17. Given, as we know that,

$$\text{At } t = 30 \text{ sec, } [R] = 0.31 \text{ M, } [R]_0 = 0.55 \text{ M}$$

For pseudo first order kinetics,

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$\therefore k = \frac{2.303}{30} \log \frac{0.55}{0.31} = \frac{2.303}{30} \log 1.774 = \frac{2.303}{30} \times 0.2490 = 1.91 \times 10^{-2} \text{ s}^{-1}$$

$$\text{At } t = 60 \text{ s, } [R] = 0.17 \text{ M } [R]_0 = 0.55 \text{ M}$$

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$\therefore k = \frac{2.303}{60} \log \frac{0.55}{0.17} = \frac{2.303}{60} \times 0.5099 = 1.96 \times 10^{-2} \text{ s}^{-1}$$

$$k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$$

$$\text{At } t = 90 \text{ s, } [R] = 0.085 \text{ M, } [R]_0 = 0.55 \text{ M}$$

$$k = \frac{2.303}{90} \log \frac{0.55}{0.085} = \frac{2.303}{90} \times 0.8109 = 2.07 \times 10^{-2} \text{ s}^{-1}$$

Average rate constant,

$$k = \frac{1.91 \times 10^{-2} + 1.96 \times 10^{-2} + 2.07 \times 10^{-2}}{3} = 1.98 \times 10^{-2} \text{ s}^{-1} \quad (2)$$

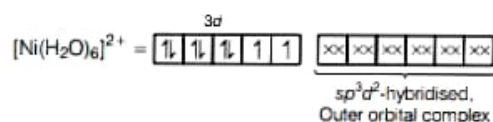
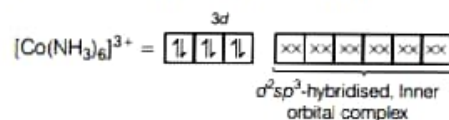
Or

(i) Reactions with higher molecularity (greater than three) are rare as probability of more than three molecules colliding simultaneously to form product(s) is very low. (1)

(ii) No, activation energy of a reaction cannot be zero because in that case, every collision among reactant molecules will be an effective collision. However, this is not possible. (1)

18. (i) For tetrahedral complexes, the crystal field stabilisation energy is lower than pairing energy, so they are not formed in low spin state. (1)

(ii) In $[\text{Co}(\text{NH}_3)_6]^{3+}$, pairing of 3d electrons takes place due to the presence of strong ligand (NH_3), whereas in $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ pairing of 3d electrons does not occur due to the presence of weak field ligand (H_2O). Thus, $[\text{Co}(\text{NH}_3)_6]^{3+}$ forms inner orbital complex, whereas $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ forms outer orbital complex.



19. Given, with 0.1 mol L^{-1} KCl, resistance is 100Ω , with 0.02 mol L^{-1} KCl resistance is 520Ω , conductivity of 0.1 mol L^{-1} KCl solution is 1.29 S / m or Sm^{-1} .

$$\text{Cell constant} = \text{Resistance (R)} \times \text{conductivity (\kappa)}$$

$$= 100 \times 0.0129 = 1.29 \text{ cm}^{-1} \quad (1)$$

Calculating conductivity of 0.02 M KCl solution

$$\kappa = \text{Cell constant} / \text{Resistance}$$

$$= 129 / 520 = 2.48 \times 10^{-3} \text{ S cm}^{-1}$$

Therefore, molar conductivity

$$\Lambda_m = \frac{1000 \times \kappa}{M}$$

$$= \frac{1000 \times 2.48 \times 10^{-3}}{0.02} = 124 \text{ S cm}^2 \text{ mol}^{-1} \quad (1)$$

Or

Aqueous solution of CuSO_4 on electrolysis gives Cu at cathode, O_2 at anode and H^+ ions in the solution.

$$\text{Eq. of current} = \frac{96.5 \text{ A} \times 10 \text{ s}}{96500 \text{ C}} = 0.01 \text{ eq} = 10^{-2} \text{ eq}$$

$$\therefore 10^{-2} \text{ eq of Cu} = 10^{-2} \text{ eq of O}_2 = 10^{-2} \text{ eq of H}^+$$

$$[\text{H}^+] = \frac{10^{-2} \text{ eq}}{\text{volume of solution (in L)}} = \frac{10^{-2} \text{ eq}}{1 \text{ L}}$$

$$\therefore = 10^{-2} \text{ N or M}$$

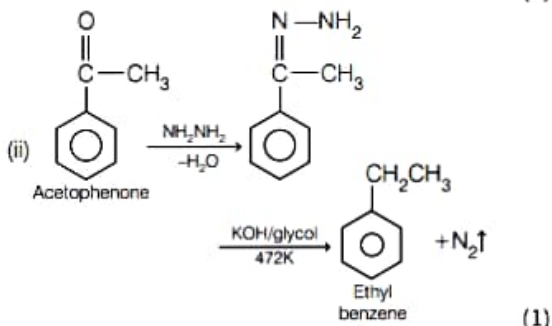
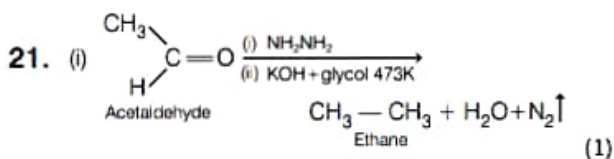
$$\therefore \text{pH} = -\log(10^{-2}) = 2 \quad (2)$$

20. (i) When ozone is passed through acidified SnCl_2 solution then SnCl_4 is formed. Reaction is as follows :



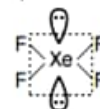
(ii) (a) $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$

(b) $\text{HI} > \text{HBr} > \text{HCl} > \text{HF} \quad (1)$



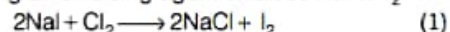
22. (i) XeF_4 shows sp^3d^2 -hybridisation. The orbital get mixed up to form six sp^3d^2 hybrid orbitals with two

orbitals having lone pair of electrons. Thus, the structure of XeF_4 is square planar.

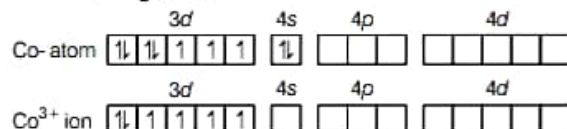


(1)

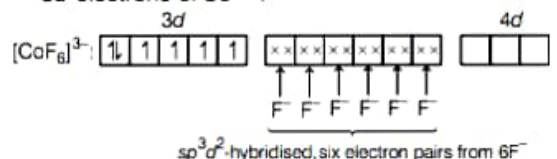
(ii) Cl_2 being an oxidising agent oxidises NaI to I_2 .



23. $[\text{CoF}_6]^{3-}$ oxidation state of Co is +3 due to presence of 6 F^- ligands.



Since, F^- is a weak field ligand, it cannot pair 3d-electrons of Co^{3+} .

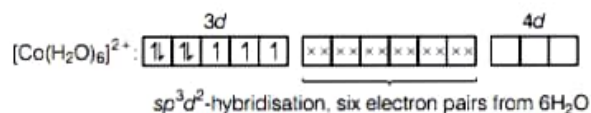


Hybridisation = sp^3d^2 -hybridised

$$\text{Magnetic moment} = \sqrt{n(n+2)}$$

$$= \sqrt{4(4+2)} = \sqrt{24} \text{ BM} = 2\sqrt{6} \text{ BM}$$

Similarly, in $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ the hybridisation of Co^{2+} is sp^3d^2 (due to the presence of unpaired electron).



$$\text{Magnetic moment} = \sqrt{n(n+2)}$$

$$= \sqrt{3(3+2)} = \sqrt{15} \text{ BM} \quad (2)$$

Hybridisation = sp^3d^2 -hybridised

24. Aryl halides are less reactive towards nucleophilic substitution reaction. Presence of electron withdrawing group at *o*- and *p*-position increases the stability of intermediates and, hence increases the reactivity of aryl halides towards nucleophilic substitution reaction.
- Now, more the number of EWG at *o*- and *p*-position, higher will be the reactivity of aryl halide. Compound (III) has three EWG, So it is most reactive and compound (I) has only one EWG, so it is least reactive.
- So, the order of reactivity is (I) < (II) < (III) (2)

25. For hydrogen electrode,
- $$\text{H}^+ + \text{e}^- \longrightarrow 1/2 \text{H}_2$$

Applying Nernst equation,

$$E_{\left(\text{H}^+ / \frac{1}{2}\text{H}_2\right)} = E_{\left(\text{H}^+ / \frac{1}{2}\text{H}_2\right)}^\circ - \frac{0.0591}{n} \log \left(\frac{1}{\text{H}^+} \right)$$

$$= 0 - \frac{0.0591}{1} \log \left(\frac{1}{10^{-10}} \right)$$

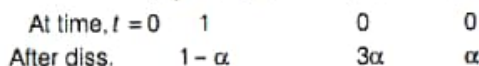
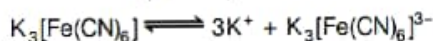
$$= 0 - \frac{0.0591}{1} \times (10 \log 10)$$

$$E_{\left(\text{H}^+ / \frac{1}{2} \text{H}_2 \right)} = -0.591 \text{ V} \quad \text{Or} \quad (2)$$

$$\Delta T_{f(\text{observed})} = 0.062^\circ \text{C}$$

$$\Delta T_{f(\text{calculated})} = K_f \times m = 1.86 \times 0.01 = 0.0186^\circ \text{C}$$

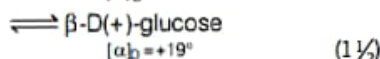
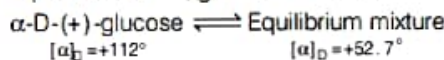
$$i = \frac{\Delta T_{f(\text{observed})}}{\Delta T_{f(\text{calculated})}} = \frac{0.062}{0.0186} = 3.33$$



$$\text{Total} = 1 + 3\alpha$$

$$\therefore i = \frac{1 + 3\alpha}{1} \Rightarrow \alpha = \frac{i - 1}{3} = \frac{3.33 - 1}{3} = 0.777 = 77.7 \quad (2)$$

26. (i) The change in specific rotation of an optically active compound in solution is called mutarotation, e.g. in aqueous solution, glucose exists as,

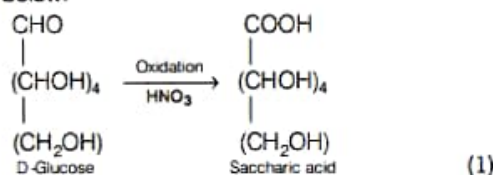


- (ii) DNA is a double stranded molecule. The two strands are complementary to each other. H-bonds are formed in between specific pairs of bases, i.e. adenine (A) is attached with thymine (T) by two H-bonds and guanine (G) is attached to cytosine (C) by three H-bonds. The other combination of bases are energetically less favoured and hence, do not occur in normal DNA.

Thus, the two strands of DNA are not identical but are complementary. (1½)

Or

- (i) It is saccharic acid which is formed as per the reaction given below:



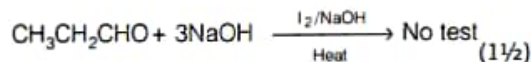
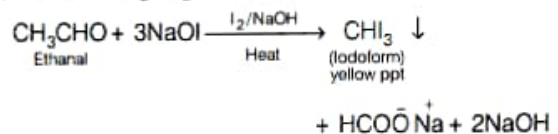
- (ii) Difference between α -helix and β -pleated structures

α -helix structure	β -pleated structure
If the size of R-group is large, intramolecular H-bonds are formed between C=O of molecule and NH of amino acid in polypeptide chain that gives right handed α -helix structure.	If size of R-group is small intermolecular H-bonds forms between C=O of polypeptide chain with N—H of other giving β -pleated sheet structure.
i.e. It is formed by the folding of a single polypeptide chain due to hydrogen bonding.	i.e. It is formed by the folding in more than one polypeptide chain due to hydrogen bonding.

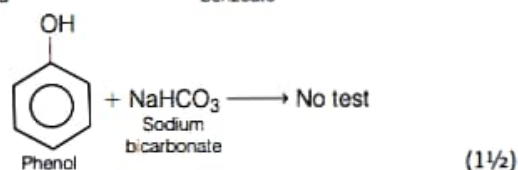
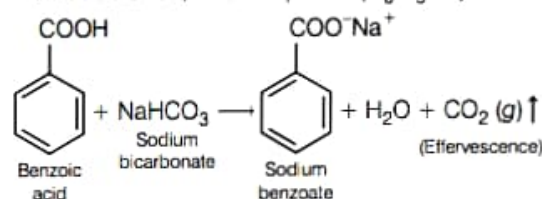
(2)

27. (i) **Ethanal and propanal** As ethanal has $\text{CH}_3\text{-C}(=\text{O})\text{-}$ group, therefore ethanal (CH_3CHO)

responds positively towards iodoform test, whereas propanal ($\text{CH}_3\text{CH}_2\text{CHO}$) does not.



- (ii) **Phenol and benzoic acid** Benzoic acid reacts with sodium bicarbonate to produce effervescence of carbon dioxide, whereas phenol ($\text{C}_6\text{H}_5\text{OH}$) does not.



28. (i) Molar mass of chloroform, (CHCl_3) = 119.5 g/mol
Molar mass of dichloromethane, (CH_2Cl_2) = 85 g/mol

$$\text{Moles of } \text{CHCl}_3 = \frac{25.5}{119.5} = 0.213 \text{ mol}$$

$$\text{Moles of } \text{CH}_2\text{Cl}_2 = \frac{40}{85} = 0.47 \text{ mol}$$

$$\text{Total number of moles} = 0.213 + 0.47 = 0.683 \text{ mol}$$

$$\text{Mole fraction of } \text{CH}_2\text{Cl}_2 = \frac{0.47}{0.683} = 0.688$$

$$\text{Mole fraction of } \text{CHCl}_3 = 1 - 0.688 = 0.312$$

Vapour pressure of the solution can be found out using the following equation,

$$P_{\text{total}} = P_1^0 + (P_2^0 - P_1^0)X_2$$

$$P_{\text{total}} = 200 + (415 - 200) \times 0.688$$

$$= 347.9 \text{ mm Hg} \quad (2)$$

- (ii) Using the relation, $y_1 = \frac{P_1}{P_{\text{total}}}$, mole fraction of the components in vapour phase (y_1) is

$$P_{\text{CH}_2\text{Cl}_2} = 0.688 \times 415 \text{ mmHg}$$

$$= 285.5 \text{ mm Hg}$$

$$P_{\text{CHCl}_3} = 0.312 \times 200 \text{ mm Hg}$$

$$= 62.4 \text{ mm Hg}$$

$$y_{\text{CH}_2\text{Cl}_2} = \frac{285.5 \text{ mm Hg}}{347.9 \text{ mm Hg}} = 0.82$$

$$y_{\text{CHCl}_3} = \frac{62.4 \text{ mm Hg}}{347.9 \text{ mm Hg}} = 0.18$$

(1)

Or

Given, No. of moles of liquid A, (n_A) = 1 mole

No. of moles of liquid B, (n_B) = 3 mole

We know that, $p = p_A^* \chi_A + p_B^* \chi_B$... (i)

$$\text{where, } \chi_A = \frac{n_A}{n_A + n_B} = \frac{1}{1+3}$$

$$\chi_B = \frac{n_B}{n_A + n_B} = \frac{3}{1+3}$$

The value of χ_A and χ_B put in Eq. (i)

$$\left(\frac{1}{1+3}\right) p_A^* + \left(\frac{3}{1+3}\right) p_B^* = 500 \text{ mm of Hg}$$

$$\frac{1}{4} p_A^* + \frac{3}{4} p_B^* = 500 \text{ mm of Hg}$$

$$1 p_A^* + 3 p_B^* = 2000 \text{ mm of Hg} \quad \dots \text{(ii)}$$

When 1 mole of B was added, the equation we get will be,

$$\left(\frac{1}{1+4}\right) p_A^* + \left(\frac{4}{1+4}\right) p_B^* = 510 \text{ mm of Hg}$$

$$\frac{1}{5} p_A^* + \frac{4}{5} p_B^* = 510 \text{ mm of Hg}$$

$$p_A^* + 4 p_B^* = 2550 \text{ mm of Hg} \quad \dots \text{(iii)}$$

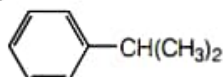
On subtracting Eq. (ii) from (iii), we get

$$p_B^* = 550 \text{ mm of Hg}$$

On putting the value of p_B^* in Eq. (ii), we get

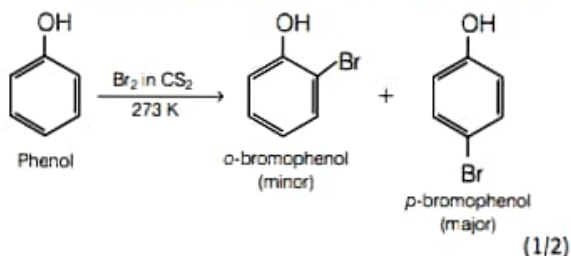
$$p_A^* = 350 \text{ mm of Hg} \quad (3)$$

29. (i) The initial material used in the industrial preparation of phenol is **cumene** (isopropyl benzene).

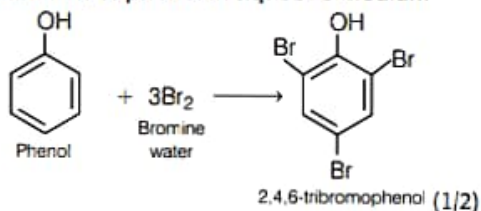


Structure of cumene (1)

- (ii) **Bromination of phenol in non-aqueous medium**



- Bromination of phenol in aqueous medium**



- (iii) In bromination of phenol, the polarisation of Br_2 molecule takes place even in the absence of Lewis acid. It is due to the highly activating effect of $-\text{OH}$ group attached to the benzene ring. Thus, Lewis acid is not required in bromination of phenol. (1)

30. Number of atoms in 0.5 mole

$$= 0.5 \times 6.023 \times 10^{23} = 3.01 \times 10^{23}$$

Number of octahedral voids = Number of atoms in close packing

$$N = 3.01 \times 10^{23}$$

Number of tetrahedral voids = 2 × number of atoms in close packing

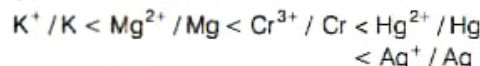
$$2N = 2 \times 3.01 \times 10^{23} = 6.02 \times 10^{23}$$

Total number of voids = $N + 2N$

$$= 3.01 \times 10^{23} + 6.02 \times 10^{23}$$

$$= 9.03 \times 10^{23} \quad (3)$$

31. (i) The lower the reduction potential, the higher is the reducing power. The given standard electrode potential are in the order.



Hence, order is

$$Ag < Hg < Cr < Mg < K \quad (2)$$

- (ii) $\text{Ag}(s) | \text{Ag}^+(10^{-3}\text{M}) || \text{Cu}^{2+}(10^{-1}\text{M}) | \text{Cu}(s)$

$$E_{\text{cell}}^{\circ} = +0.46 \text{ V and } \log 10^n = n, T = 25^{\circ} \text{C}$$

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.059}{n} \log \frac{[\text{Cu}^{2+}]}{[\text{Ag}^+]^2}$$

$$= 0.46 - \frac{0.059}{n} \log \frac{(10^{-1})}{(10^{-3})^2}$$

$$= 0.46 - 0.1475 = 0.3125 \text{ V} \quad (3)$$

Or

$$(i) E^{\circ} = \frac{0.0591}{n} \log K$$

If $K < 1$

$$\text{then, } E^{\circ} = \frac{0.0591}{n} \log 0.01 = \frac{-2 \times 0.0591}{n}$$

E° is thus negative.

If $E^{\circ} = 0 \text{ V}$, then $K = 1$.

(3)

$$(ii) E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.059}{n} \log \frac{[\text{Mg}^{2+}]}{[\text{Cu}^{2+}]}$$

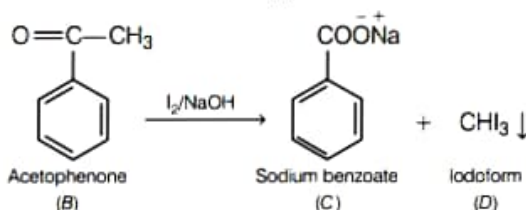
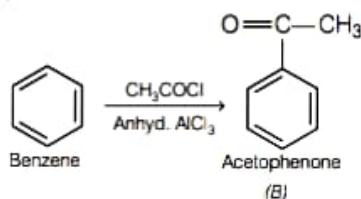
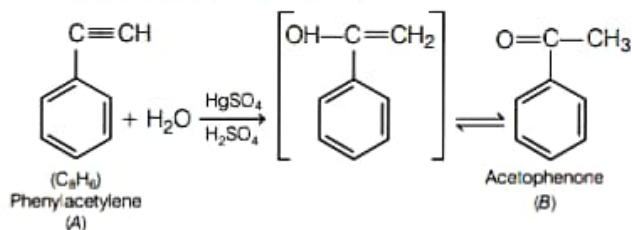
$$= 2.71 \text{ V} - \frac{0.059}{2} \log \frac{0.1}{0.001}$$

$$= 2.71 \text{ V} - \frac{0.059}{2} \log 10^2 = 2.651 \text{ V} \quad (2)$$

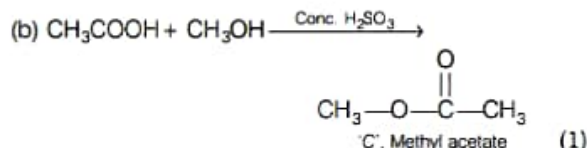
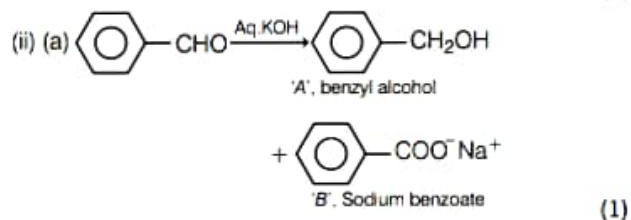
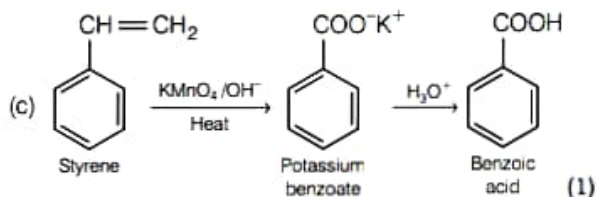
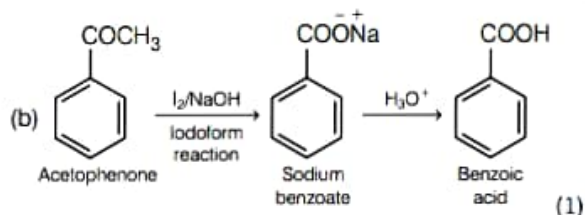
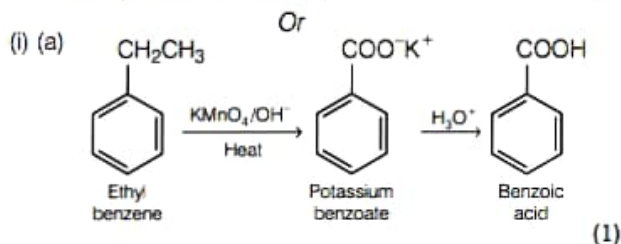
32. Compound B is formed by the reaction of benzene and acid chloride in the presence of anhyd. AlCl_3 . So, B is an aromatic ketone. When compound B reacts with iodine and aqueous NaOH , it produces iodoform; thus B is acetophenone. Compound A should be a derivative of acetylene. Also, it has

degree of unsaturation = 6 (i.e. has one ring, 5π -bonds) and undergoes hydration under acidic conditions to form *B* which is a ketone, i.e. acetophenone. (2)

The reactions involved are :



∴ Compound A = Phenylacetylene
Compound B = Acetophenone
Compound C = Sodium benzoate
Compound D = Iodoform (3)



33. (i) (a) $\text{Cr}^{3+}/\text{Cr}^{2+}$ has a negative reduction potential. Hence, Cr^{3+} cannot be reduced to Cr^{2+} , i.e. Cr^{3+} is most stable. $\text{Mn}^{3+}/\text{Mn}^{2+}$ has large positive E° value. Hence, Mn^{3+} can be easily reduced to Mn^{2+} , i.e. Mn^{3+} is least stable. E° value for $\text{Fe}^{3+}/\text{Fe}^{2+}$ is positive but small. Hence, Fe^{3+} is more stable than Mn^{3+} but less stable than Cr^{3+} .

(b) Oxidation potentials for the given pairs will be + 0.9V, + 12 V, + 0.4V. Thus, the order is $\text{Mn} > \text{Cr} > \text{Fe}$. (2)

(ii) (a) **Electronic configuration** The general electronic configurations of actinoids is $5f^{1-14}6d^{0-1}7s^2$. The irregularities in the electronic configuration of actinoids is due to the stabilities of f^0 , f^7 and f^{14} occupancies of $5f$ -orbitals. (1)

(b) **Ionic size** The radii of trivalent and quadrivalent ions of actinoids contract slightly with increasing atomic number due to **actinoid contraction**. This contraction results from poor shielding experienced by $5f$ -electrons. (1)

(c) **Oxidation states** Actinoids show a variety of oxidation states due to comparable energies of $5f$, $6d$ and $7s$ energy levels. The dominant oxidation state of actinoids is + 3 which show increasing stability for the heavier elements. (1)

Or

(i) In Cu, all the d -electrons are paired ($3d^{10}4s^1$). In Cr, all the d -electrons are unpaired ($3d^54s^1$). Hence, $d-d$ electron repulsions in Cu are much greater than those in Cr. Hence, Cu atom is larger in size than Cr. In Cu^{2+} ($3d^9$), $d-d$ electron repulsions decrease due to presence of one unpaired d -electron. Moreover, the electrons are attracted by 29 protons of the nucleus whereas in Cr^{2+} , three unpaired electrons are still present but they are attracted by only 24 protons of the nucleus. Thus, Cu^{2+} is smaller in size than Cr^{2+} . (2)

(ii) (a) Electronic configuration of $\text{Mn}^{2+} = [\text{Ar}]^{18}3d^5$

Electronic configuration of $\text{Fe}^{2+} = [\text{Ar}]^{18}3d^6$

Mn^{2+} having half-filled d -orbitals will be more stable than Fe^{2+} , as it has partially filled d -orbitals. (1)

(b) Zinc has completely filled d -orbitals, which limits its tendency to form metallic bonds. Thus, it requires least enthalpy to get atomised. (1)

(c) Ti^{3+} has one electron in the d -orbital ($3d^1$) which can absorb energy corresponding to yellow wavelength and jump from t_{2g} to e_g set of d -orbitals. But, Sc^{3+} has no electron in the d -orbital. (1)