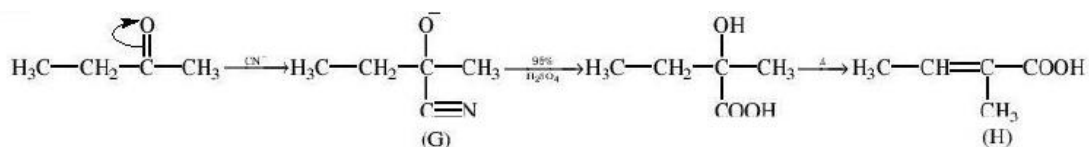


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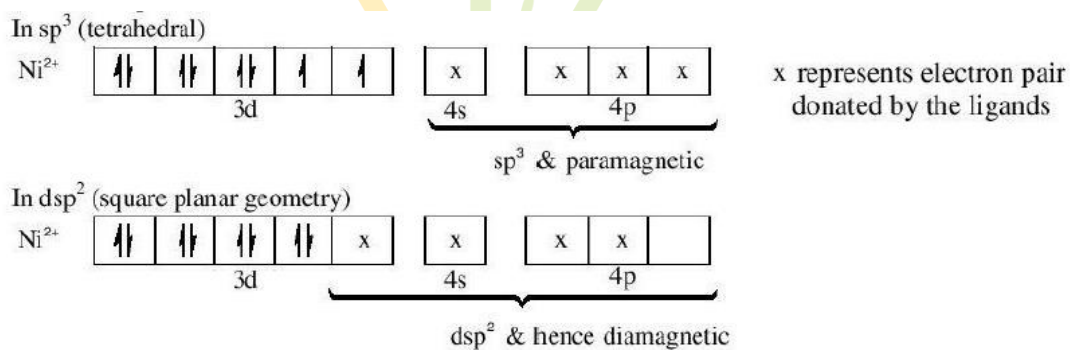
CHEMISTRY

21. Sol. (A)



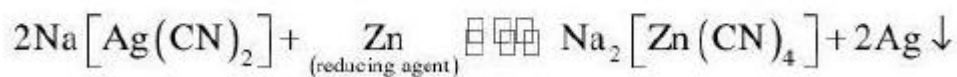
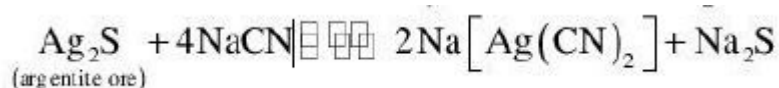
22. Sol. (C)

In both complexes Ni exists as Ni^{2+} .



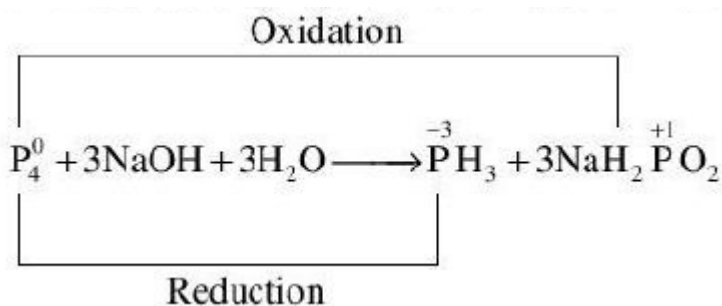
23. Sol. (B)

The reactions involved in cyanide extraction process are:

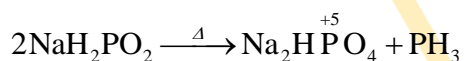


24. Sol. (C)

The balanced disproportionation reaction involving white phosphorus with aq. NaOH is

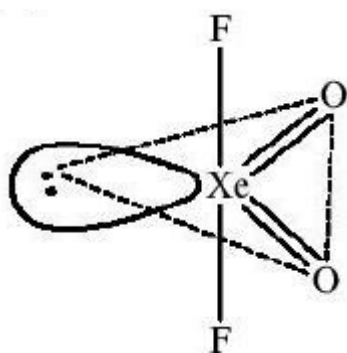


However, as the option involving +1 x oxidation state is completely missing, one might consider that NaH_2P_2O formed has undergone thermal decomposition as shown below:



Although heating is nowhere mentioned in the question, the "other product" as per available options seems to be Na_2HPO_4 (oxidation state = +5).

25. Sol. (D)



Hybridization = sp^3d

Shape = sec – saw

26. Sol. (A)

$B \rightarrow \text{Solute}; A \rightarrow \text{Solvent}$

$$W_B = 2.5 \text{ g}, W_A = 100 \text{ g}$$

$$\Delta T_b = 2^\circ$$

$$\frac{p^\circ - p_s}{p^\circ} = X_B = \frac{n_B}{n_B + n_A}$$

$$\frac{p^\circ - p_s}{p^\circ} = \frac{n_B}{n_A} \because n_B \ll n_A$$

$$\frac{p^\circ - p_s}{p^\circ} = \frac{n_B}{n_A}$$

$$\frac{760 - P_{\text{soln}}}{760} = \frac{2.5/M}{\frac{100}{18} \times \frac{1000}{1000}} = \frac{m \times 18}{1000} \dots \text{(i)}$$

and from boiling point elevation,

$$2 = 0.76 \times m$$

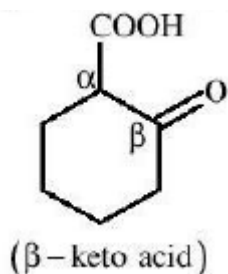
$$m = \frac{2}{0.76} \dots \text{(ii)}$$

on equating (i) and (ii)

$$P_{\text{soln}} = 724 \text{ mm}$$

27. Sol. (B)

β -keto acids undergoes decarboxylation easily.



28. Sol. (D)

- (i) $2\text{C}(\text{s}) + \text{H}_2(\text{g}) \rightarrow \text{H}-\text{C}\equiv\text{C}-\text{H}(\text{g}) \quad \Delta\text{H} = 225 \text{ kJ mol}^{-1}$
 (ii) $2\text{C}(\text{s}) \rightarrow 2\text{C}(\text{g}) \quad \Delta\text{H} = 1410 \text{ kJ mol}^{-1}$
 (iii) $\text{H}_2(\text{g}) \rightarrow 2\text{H}(\text{g}) \quad \Delta\text{H} = 330 \text{ kJ mol}^{-1}$

From equation (i):

$$225 = [2 \times \Delta\text{H}_{\text{C}(\text{s}) \rightarrow \text{C}(\text{g})} + 1 \times \text{BE}_{\text{H}-\text{H}}] - [2 - \text{BE}_{\text{C}-\text{H}} + 1 \times \text{BE}_{\text{C}=\text{C}}]$$

$$225 = [1410 + 1 \times 330] - [2 \times 350 + 1 \times \text{BE}_{\text{C}=\text{C}}]$$

$$225 = [1410 + 330] - [700 + \text{BE}_{\text{C}=\text{C}}]$$

$$225 = 1740 - 700 - \text{BE}_{\text{C}=\text{C}}$$

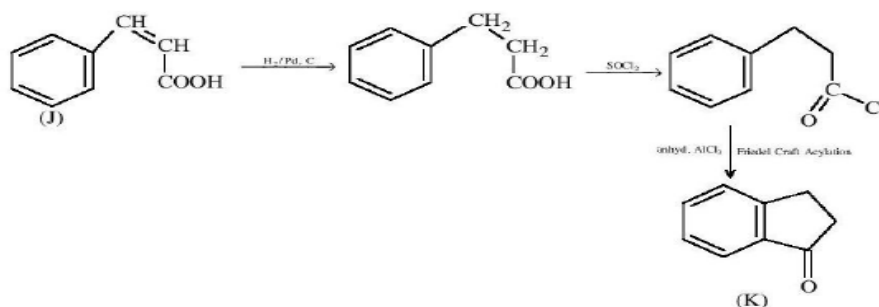
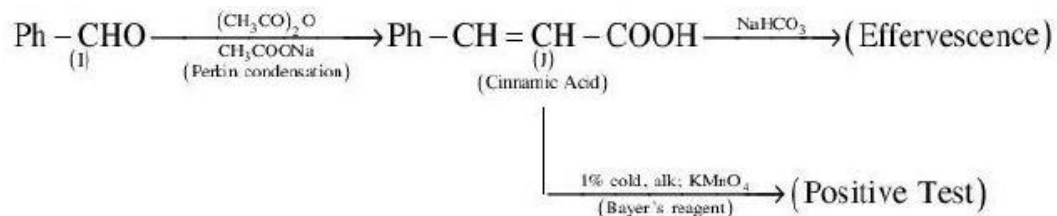
$$225 = 1040 - \text{BE}_{\text{C}=\text{C}}$$

$$\text{BE}_{\text{C}=\text{C}} = 1040 - 225 = 815 \text{ kJ mol}^{-1}$$

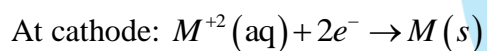
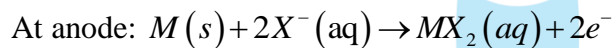
29. Ans. (A)

30. Ans. (C)

Sol. 29–30



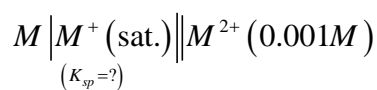
31. Sol. (D)



n -factor of the cell reaction is 2.

$$\Delta G = -nFE_{\text{cell}} = -2 \times 96500 \times 0.059 = -113873/\text{mole} = -11.387 \text{ KJ/mole} = -11.4 \text{ KJ/mole}$$

32. Sol. (B)

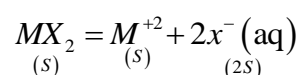


emf of concentration cell,

$$E_{cell} = \frac{-0.059}{n} \log \frac{[M^{+2}]_a}{[M^{+2}]_c}$$

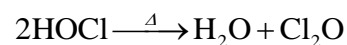
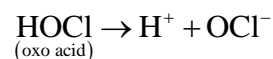
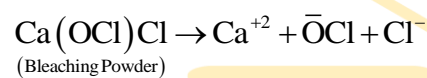
$$0.059 = \frac{0.059}{2} \log \frac{[0.001]}{[M^{+2}]_a}$$

$$[M^{+2}]_a = 10^{-5} = S \text{ (solubility of salt in saturated solution)}$$



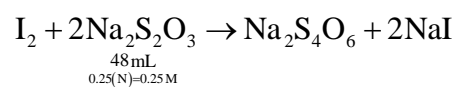
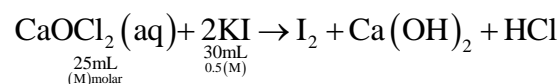
$$K_{sp} = 4S^3 = 4 \times (10^{-5})^3 = 4 \times 10^{-15}$$

33. **Sol. (A)**



Anhydride of oxoacid (HOCl) is Cl_2O .

34. **Sol. (C)**



$$\text{So, number of millimoles of } I_2 \text{ produced} = 48 \times \frac{0.25}{2} = 24 \times 0.25 = 6$$

In reaction;

Number of millimoles of bleaching powder

$$(n_{\text{CaOCl}_2}) = n_{\text{I}_2\text{-produced}} = \frac{1}{2} \times n_{\text{Na}_2\text{S}_2\text{O}_3 \text{ used}} = 6$$

$$S_o, (M) = \frac{n_{\text{CaOCl}_2} (\text{millimoles})}{V (\text{in mL})} = \frac{6 \text{ millimoles}}{25 \text{ mL}} = 0.24$$

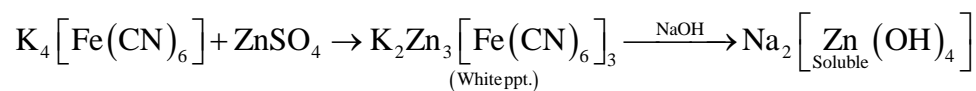
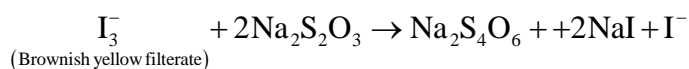
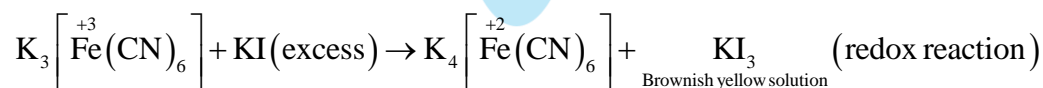
35. **Sol. (A, C, D)**

$T_1 = T_2$ because process is isothermal.

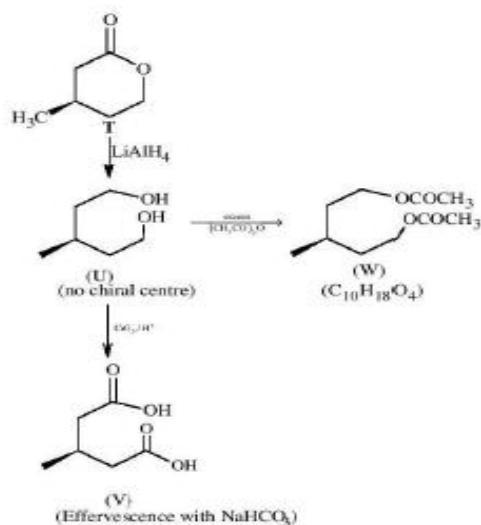
Work done in adiabatic process is less than in isothermal process because area covered by isothermal curve is more than the area covered by the adiabatic curve.

In adiabatic process expansion occurs by using internal energy hence it decreases while in isothermal process temperature remains constant that's why no change in internal energy.

36. **Sol. (A, C, D)**

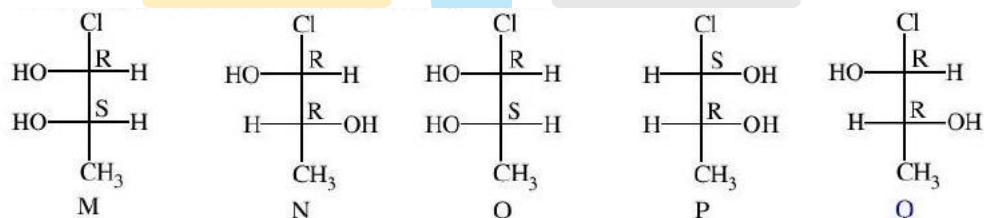


37. Sol. (A, C, D)



38. Sol. (A,B,C)

Converting all the structure in the Fischer projection



M and N are diastereoisomers

M and O are identical

M and P are enantiomers

M and Q are diastereoisomers

Hence, the correct options are A,B,C.

39. **Sol. (B, D)**

⇒ Diamond is harder than graphite.

⇒ Graphite is good conductor of electricity as each carbon is attached to three C-atoms leaving one valency free, which is responsible for electrical conduction, while in diamond, all the four valencies of carbon are satisfied, hence insulator.

⇒ Diamond is better thermal conductor than graphite. Whereas electrical conduction is due to availability of free electrons; thermal conduction is due to transfer of thermal vibrations from atom to atom. A compact and precisely aligned crystal like diamond thus facilitates fast movement of heat.

⇒ In graphite, $C-C$ bond acquires double bond character, hence higher bond order than in diamond.

40. **Sol. (A,C)**

Graph (I) and (III) represent physisorption because, in physisorption, the amount of adsorption decreases with the increase of temperature and increases with the increase of pressure.

Graph (II) represent chemisorption, because in chemisorption amount of adsorption increase with the increase of temperature. Graph (IV) is showing the formation of a chemical bond, hence chemisorption.