JEE ADVANCED-2015

CHEMISTRY

Q.21 Sol. (1)

Given that the complex is a strong electrolyte, therefore, it dissociates completely.

According to vant – hoff's equation,

$$\Delta T_f = k_f \times m \times i$$

$$\Delta T_f = 0.0558°C = 0.0558 K$$

$$\therefore \quad 0.0558 K = 1.86 \text{ k kg mol}^{-1} \times .01 m \times i$$
$$i = 3$$

$\therefore$ the no. of ions after dissociation = 3

Let the no. of chloride ions outside the coordination sphere is x

$$[co(NH_3)cl_y]cl_x \rightarrow xcl^- + [co(NH_3)cl_y]$$

$$i = \frac{\text{no. of ions ofter dissociation}}{\text{no. of ions before dissociation}}$$

$$3 = \frac{x+1}{1}$$

$$x = 2$$

$\therefore$ no. of chloride ions outside the sphere = 2

$\therefore$ To balance the charge on the complex, 1 chloride ion has to go inside the sphere

$\therefore$ Ans = 1

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Q.22 Sol. (4)

For the reaction

$M^{+} \rightarrow M^{3} + 2e^{-}, E° = -0.25V$

$\Delta G°$ for the cell

$$\begin{aligned} \Delta G° &= -nf\,E°cell \\ &= +2 \times 96500\,cmol^{-1} \times 0.25V \\ &= 48250\,J\,mol^{-1} \end{aligned}$$

The $\Delta G°$ we are providing by the reaction $X \rightarrow Y$

$\Delta G°_{rxn} = -193000\,J\,mol^{-1}$

$\therefore$ no. of moles of M^{+} oxidised to M^{3+} is

$$\frac{-193000\,J\,mol^{-1}}{-48250\,J\,mol^{-1}}$$

$= 4$

Q.23 Sol. (4)

Fe^{3+} electronic conf. is $3d^{5}$

SCN^{-} is a weak field ligand $\rightarrow$ no pairing

$CN-$ is strong field ligand $\rightarrow$ causes pairing

for CN^{-}

↿⇂	↿⇂	↿		

_____ case I

for SCN^{-}

↿	↿	↿	↿	↿

_____ case II

magnetic moment for case I

$$\sqrt{n(n+2)}=\sqrt{1(1+2)}=\sqrt{3}$$

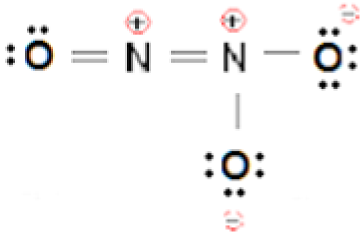
For case II

$$\sqrt{5(5+2)}=\sqrt{35}$$

$$\begin{aligned}\text{Diff. in magnetic moment} &= 4.184\\ &\approx 4\end{aligned}$$

Q.24 Sol.(8)

N_2O_3 is



No. of lone pairs is 8

Q.25 Sol. (3)

$$BeCl_2 \rightarrow \frac{1}{2}(2+2)=\frac{4}{2}=2 \rightarrow sp \rightarrow \text{linear}$$

$$N_3^- \rightarrow \text{azide} \rightarrow \text{Linear}$$

$$N_2O \rightarrow \text{Linear}$$

$NO_2^+ \rightarrow$ non-Linear

$O_3 \rightarrow$ non-Linear

$SCl_2 \rightarrow Bent - v$

$ICl_2^-, I_3^-, Xef_2 \rightarrow$ all have d orbits in central atom

Q.26 Sol. (3)

$$Degeneracy = \sum_{1=0}^{n+1} (2L+1)$$

For H atom

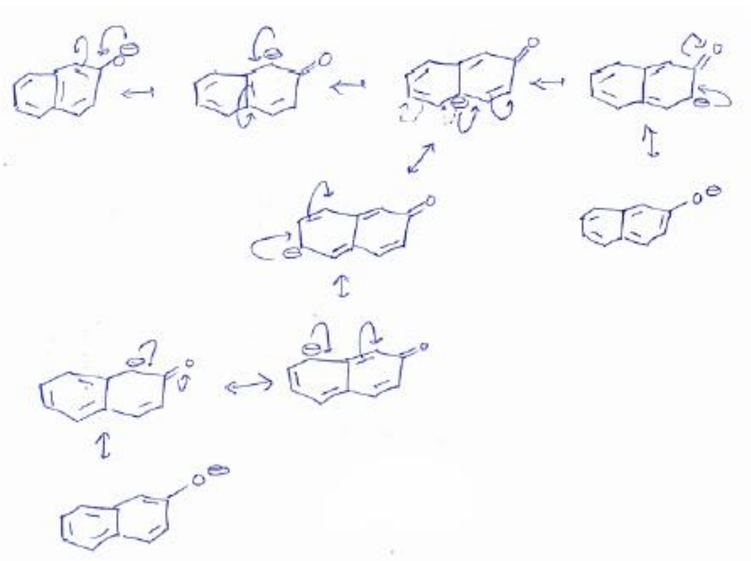
For H-ion , degeneracy =3 (for second excited state).

Q.27 Sol. (2)

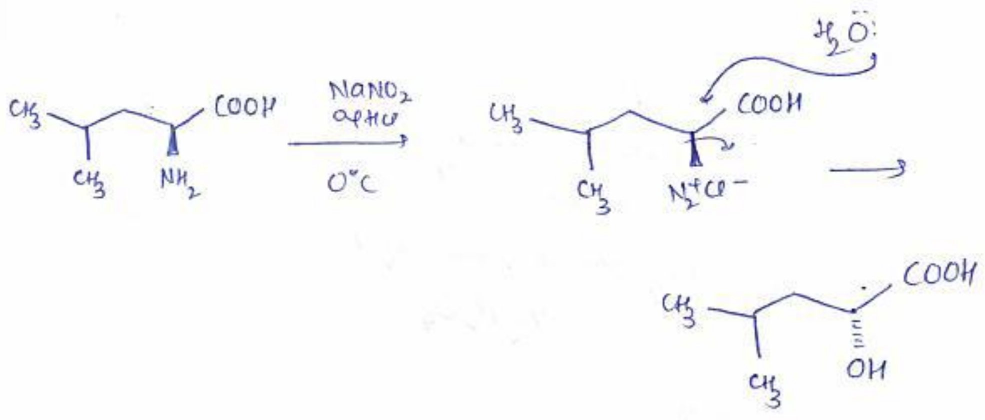
$no.of\ chiral\ centres = 1$

$\therefore Ans = 2^n = 2^1 = 2$

Q.28 Sol. (9)

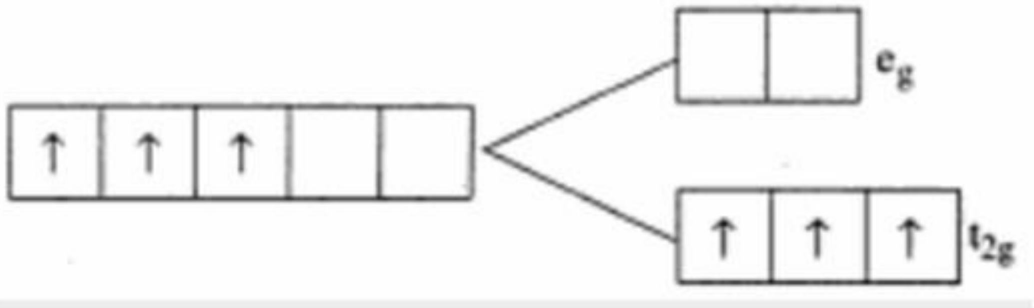


Q.29 Sol. (B)



Q.30 Sol. (A,B,C)

Cr^{2+} is strongly reducing is nature. It has a d^4 configuration. While acting as a reducing agent, it gets oxidized to Cr^{3+} (electronic configuration, d^3). This d^3 configuration can be written as t^3_{2g} configuration, which is a more stable configuration,



In the case of $Mn^{3+}(d^4)$ it acts as an oxidizing agent and gets reduced to $Mn^{2+}(d^5)$. This has an exactly half – filled d- orbital and has an extra – stability.

Q.31 Sol. (B,C,D)

(B,C,D)

Process of electrolytic refining.

Q.32 Sol. (A,B)

Fe^{3+} can be reduced by using either Na_2O_2 or H_2O_2. While using H_2O_2, the presence of basic medium is must.

Hence, Sol. $(A),(B)$

Q.33 Sol. (C)

Since the rxn is exothermic,

$\therefore$ it will be favored at low temp.

On increasing the temp, the rate of the rxn decreases.

$\therefore$ at every point of time,

The % yield at temp $T_2 < \%$ yield at T_1

The graph (c) explains the answer.

Q.34 Sol. (A)

$O^{2-} \rightarrow ccp(4)$

$Al^{3+} \rightarrow$ octahedral void(4)

$Mg^{2+} \rightarrow$ tetrahedral void(8)

Considering the mineral of Al,O and Mg as

$Mg\,Al_2\,O_4$

$O^{2-} \rightarrow 4$

$Al^{3+} \rightarrow m = \frac{2}{4} = \frac{1}{2}$

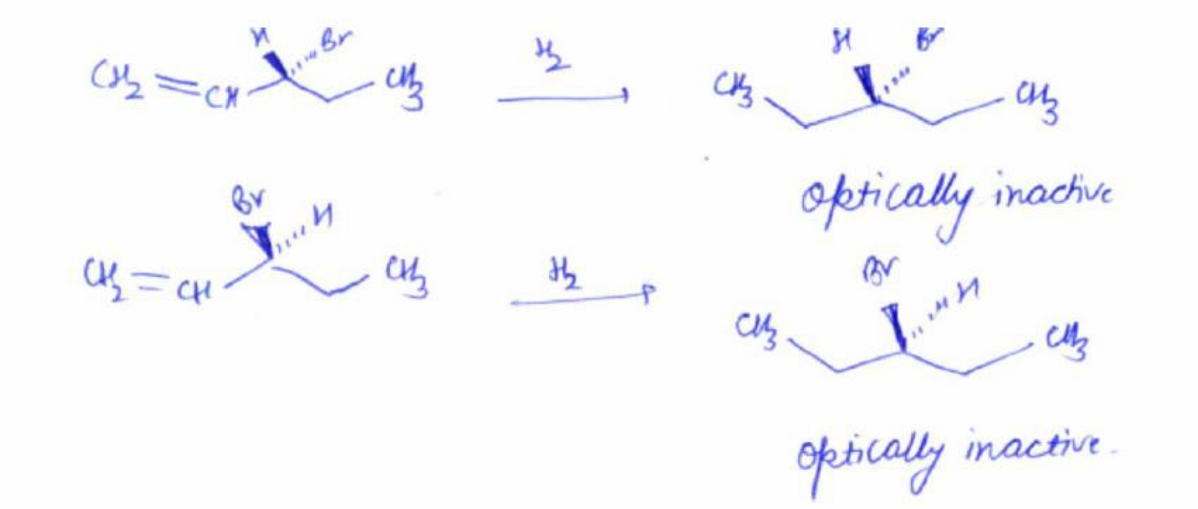
$Mg^{2+} \rightarrow n = \frac{1}{8}$

$\therefore$ the m and n values are

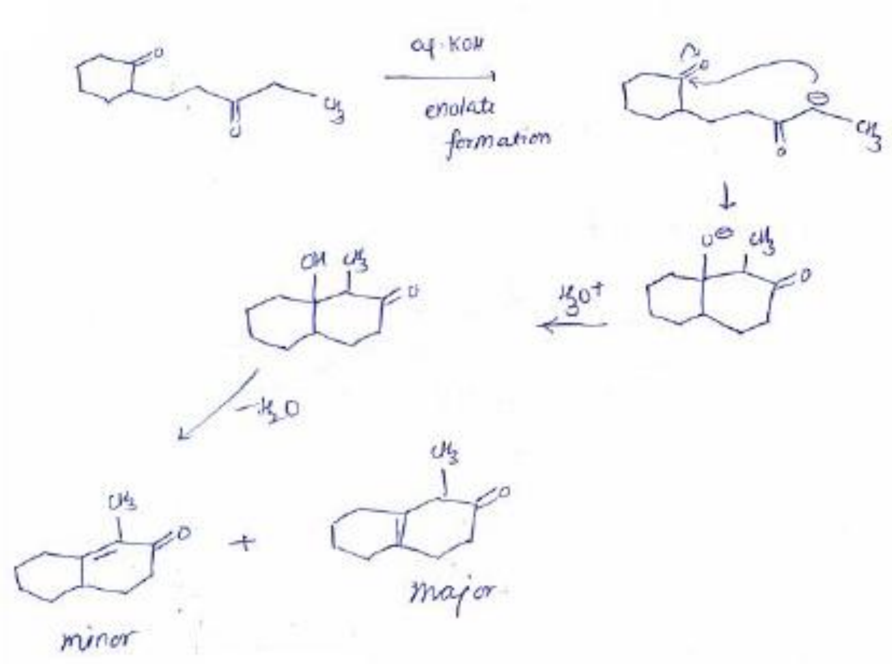
$\frac{1}{2}, \frac{1}{8}$

Q.35 Sol. (B, D)

The reactions give optically inactive products



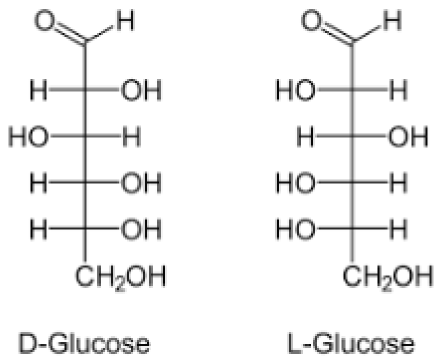
Q.36 Sol. (B)



Q.37 Sol. (B)

Tertiary carbocation will be more stable.

Q.38 Sol. (A)



Q.39 Sol. (A-P,Q), (B-T),(C-Q,R) and (D-R,S)

The composition of the ores is:

(P) Siderite $\xrightarrow{}$ carbonate. $(Feco_3)$

(Q) Malachite $\rightarrow$ carbonate, hydroxide

(R) Bauxite $\left(Al(OH)_3\right)$, $\underset{\text{hydroxide, oxide.}}{\gamma - Al\ O(OH)}$, $\alpha\, AlO(OH)$

(S) calamine$\left(ZnO + \text{ferric oxide}\right) \rightarrow$ oxide.

(T) Argentite $\rightarrow Ag_2S \rightarrow$ sulphide

$\therefore$ Ans is $A \rightarrow P, Q$

$B \rightarrow T$

$C \rightarrow Q, R$

$D \rightarrow R, S$

Q.40 Sol. (A) $\rightarrow R, T, Q$

R, T, Q

during the phase change,

work done $= w = 0$

change in internal energy is less than O

& since the rxn. occurs at equilibrium,

$\Delta G = O$

(B) $\rightarrow P, Q, S$

(C) $\rightarrow P, Q, S$

During the mixing of equal volumes of two ideal gases at constant T and P in an isolated container, heat change taking place is O,

Work done is zero

(C) $\rightarrow P, Q, S$

$\Delta U = 0$

(D) $\rightarrow P, Q, S, T$