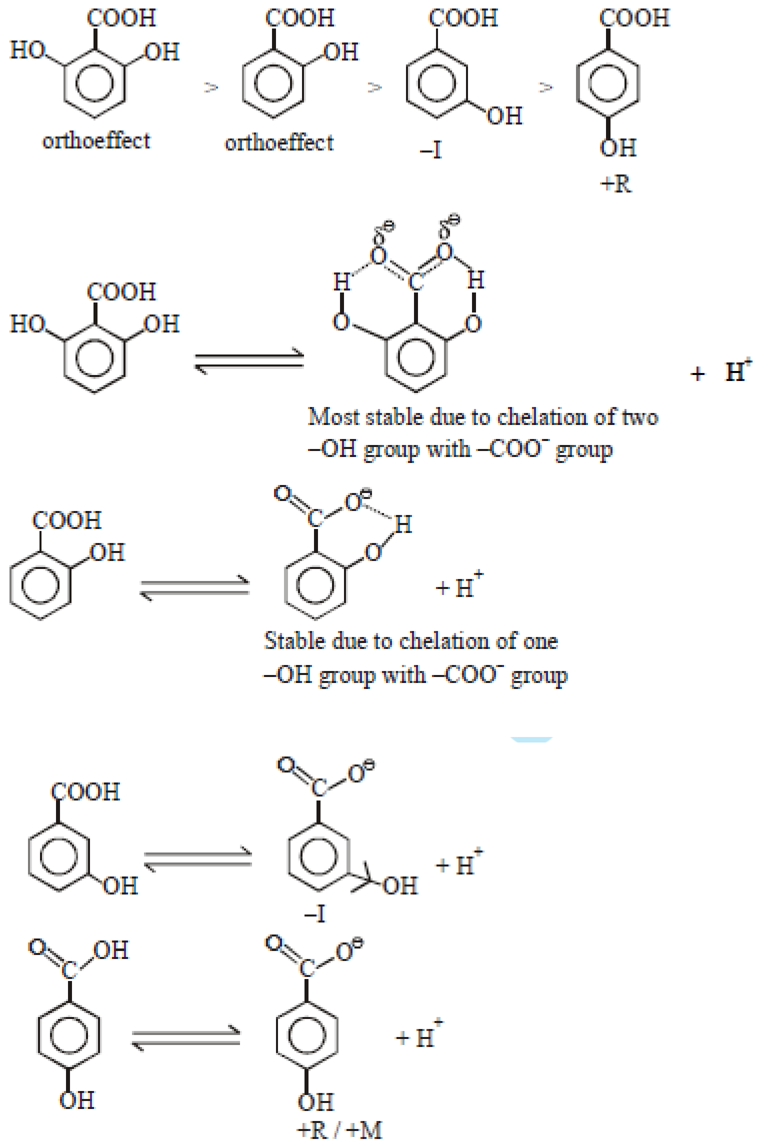
JEE ADVANCED-2016 (PAPER-2)

CHEMISTRY

19. Sol. (A)



20. Sol. (A)

Metal ion	Complex with NH_3	Geometry
Ni^{2+}	$[Ni(NH_3)_6]^{2+}$	Octahedral
Pt^{2+}	$[Pt(NH_3)_4]^{2+}$	Square planar
Zn^{2+}	$[Zn(NH_3)_4]^{2+}$	Tetrahedral

So, option (A) is correct.

21. Sol. (D)

At anode $H_2(g) \rightleftharpoons 2H^+(aq) + 2e^-$

At cathode $M^{4+}(aq) + 2e^- \rightleftharpoons M^{2+}(aq)$

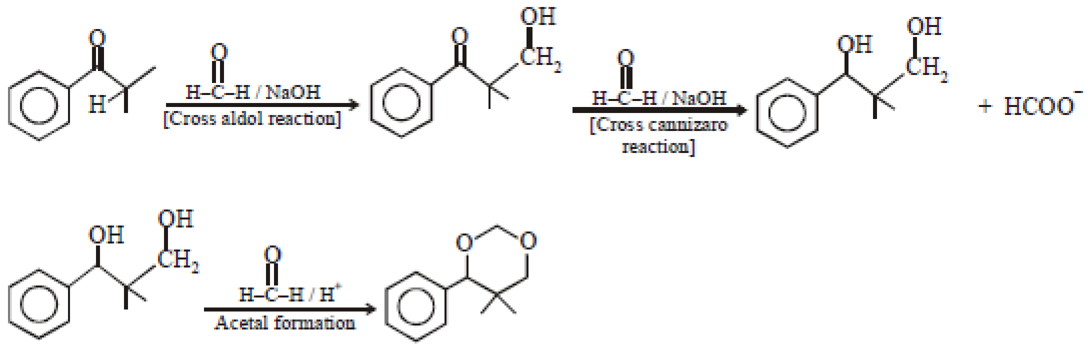
Net cell reaction $H_2(g) + M^{4+}(aq) \rightleftharpoons 2H^+(aq) + M^{2+}(aq)$

Now, $E_{cell} = \left(E^o_{M^{4+}/M^{2+}} - E^o_{H^+/H_2}\right) - \frac{0.059}{n}.\log\frac{[H^+]^2[M^{2+}]}{P_{H_2}.[M^{4+}]}$

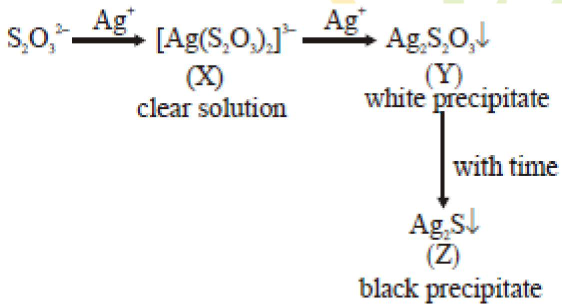
or, $0.092 = (0.151 - 0) - \frac{0.059}{2}.\log\frac{1^2 \times [M^{2+}]}{1 \times [M^{4+}]}$

$\therefore \quad \frac{[M^{2+}]}{[M^{4+}]} = 10^2 \Rightarrow x = 2$

22. Sol. (A)



23. Sol. (A)



So, X, Y and Z are $\left[Ag(S_2O_3)_2\right]^{3-}$, $Ag_2S_2O_3$ and Ag_2S respectively

24. Sol. (D)

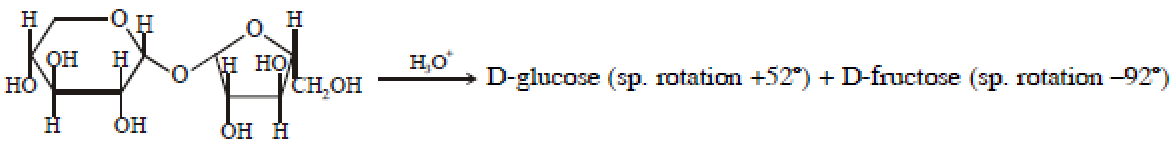
Water has large surface tension due to very strong interaction. Generally adding organic derivatives to water decreases its surface tension due to hydrophobic interaction.

In case III, hydrophobic interaction is stronger than case I causing surface tension to decrease more rapidly.

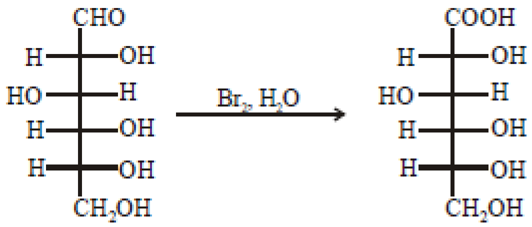
Due to $K^+ + Cl^-$ (inorganic electrolyte) intermolecular forces increases, surface tension increases.

25. **Sol. (B, C)**

Invert sugar is equailmolar mixture of D-glucose and D-fructose which is obtained by hydrolysis of sucrose Specific rotation of mixture is half of sum of sp. rotation of both components $\frac{+50° + (-92°)}{2} = -20°$



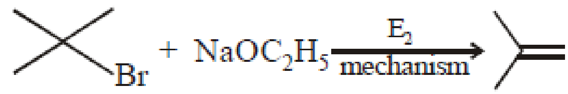
Sucrose sp. rotation + 66°



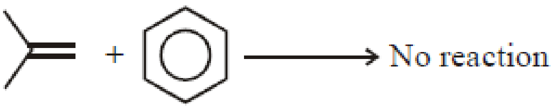
D-glucose D-gluconic acid (not saccharic acid)

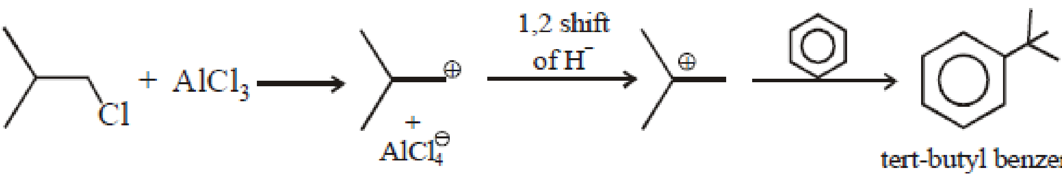
D-fructose $\xrightarrow{Br_2, H_2O}$ No reaction

26. **Sol. (B, C, D)**

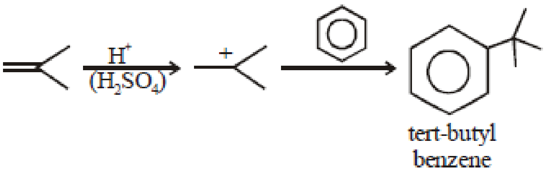


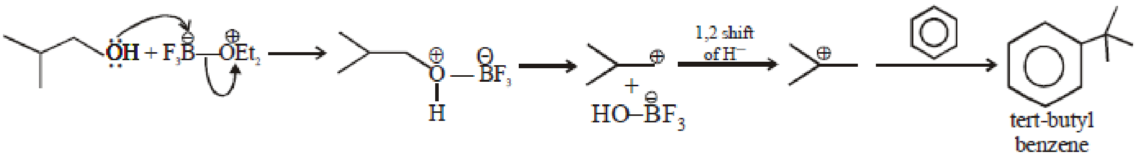
3° alkyl bromide





tert-butyl benzene



(D) 

27. **Sol. (A,B,C)**

Copper pyrite $[CuFeS_2]$

↓ Crushing into fine powder

Concentrated by froth floatation process

↓

Roasting take place in reverberatory furnace

$$\left\{\begin{array}{l} 2CuFeS_2 + \underset{(air)}{O_2} \xrightarrow{\Delta} Cu_2S + 2FeS + SO_2 \\ FeS + O_2 \xrightarrow{\Delta} FeO + SO_2 \end{array}\right.$$

↓ Smelting [Iron is removed as slag of $FeSiO_3$; $FeO + SiO_2(flux) \xrightarrow{\Delta} FeSiO_3(\ell)(slag)$]

Copper matte $(Cu_2S + FeS)$

↓ Self reduction [Self reduction occurs in Bessemer converter; $2Cu_2S + 3O_2 \longrightarrow 2Cu_2S + 2SO_2(\uparrow)$; $Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2(\uparrow)$]

(Blister copper)

↓

Refining of blister copper is done by poling followed by electrorefining but not by carbon reduction method.

28. **Sol. (B,C,D)**

CCP is ABC ABC $\cdots$ type packing

(A) In topmost layer, each atom is in contact with 6 atoms in same layer and 3 atoms below this layer.

(B) Packing fraction $= \dfrac{4 \times \frac{4}{3}\pi r^3}{\left(\frac{4r}{\sqrt{2}}\right)^3} = (0.74)$

(C)

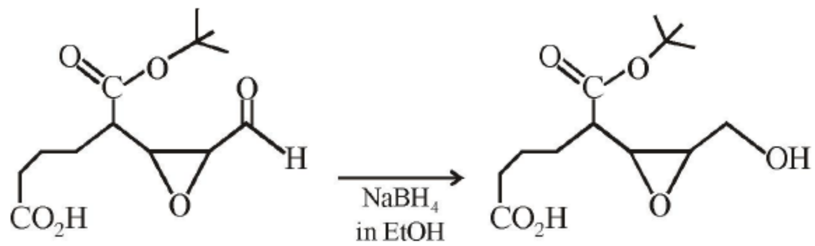
Each FCC unit has effective no of atoms = 4

Octahedral void = 4

Tetrahedral void = 8

(D) $4r = a\sqrt{2}$

29. **Sol. (C)**



$LiAlH_4$ in $(C_2H_5)_2O; BH_3$ in(THF); Raney Ni (H_2) either can reduce all functional group or can reduce some of the functional group of the compound given above in reactant side.

But $NaBH_4$ is example of selective reducing agent. It can not reduce $-\underset{\underset{O}{\|}}{C}-O-$ (ester group), $-\underset{\underset{O}{\|}}{C}-OH-$ (carboxylic acid group) ,  (epoxide group) , but reduces $-CH=O\,(\text{aldehyde group})$ into $-CH_2OH\,(1°\text{alcohol})$

30. Sol. (A, B)

(A) $H\text{-bonding}$ of methanol breaks when CCl_4 is added so bonds become weaker, resulting positive deviation.

(B) Mixing of polar and non-polar liquids will produce a solution of weaker interaction, resulting positive deviation

(C) Ideal solution

(D) $-ve$ deviation because stronger $H\text{-bond}$ is formed.

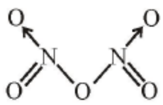
31. Sol. (B, D)

$$P_4O_{10} + 4HNO_3 \xrightarrow{\text{dehydration of } HNO_3} 4\underset{\text{(required product)}}{(HPO_3) + 2N_2O_5}$$

(A) $P_4 + 20HNO_3 \rightarrow 4H_3PO_4 + 20NO_2\uparrow + 4H_2O$

(B) N_2O_5 is diamagnetic in nature

(C)

$N_2O_5 \rightarrow$ 

N_2O_5 contains one N–O–N bond not N–N bond.

(D) $Na + N_2O_5 \rightarrow NaNO_3 + \underset{\text{(Brown gas)}}{NO_2}\uparrow$ □

32. Sol. (A, C)

(A) The molecular orbital energy configuration of C_2^{2-}

$$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi_{2p_x}^2 = \pi_{2p_y}^2, \sigma_{2p_z}^2$$

In the MO of C_2^{2-} there is no unpaired electron hence it is diamagnetic

(B) Bond order of O_2^{2+} is 3 and O_2 is 2 therefore bond length of O_2 is greater than O_2^{2+}

(C) The molecular orbital energy configuration of N_2^+ is

$$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi_{2p_x}^2 = \pi_{2p_y}^2, \sigma_{2p_z}^1$$

Bond order of N_2^+ $= \frac{1}{2}(9-4)$

$= 2.5$

The molecular orbital energy configuration of N_2^- is

$$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi_{2p_x}^2 = \pi_{2p_y}^2, \sigma_{2p_z}^2, \pi_{2p_x}^{*1} = \pi_{2p_y}^{*}$$

Bond order of $N_2^- = \frac{1}{2}(10-5)$

$= 2.5$

(D) He_2^+ has less energy as compare to two isolated He atoms

33. **Sol. (B)**

$$X_2(g) \rightleftharpoons 2X(g)$$

$$1-\frac{\beta_{eq.}}{2} \qquad \beta_{eq.}$$

$$K_P = \frac{P_X^2}{P_{X_2}} = \frac{\left(\frac{\beta_{eq.}}{1+\frac{\beta_{eq}}{2}}P_T\right)^2}{\left(\frac{1-\frac{\beta_{eq.}}{2}}{1+\frac{\beta_{eq}}{2}}P_T\right)}$$

$$K_P = \frac{\beta_{eq.}^2}{1-\frac{\beta_{eq.}^2}{4}}P_T = \frac{2\beta_{eq}^2}{1-\frac{\beta_{eq.}}{4}}$$

$$= \frac{8\beta_{eq.}^2}{4-\beta_{eq.}^2}$$

34. **Sol. (C)**

(A) On decreasing $P_T \left[Q = \frac{n_{x^2}P_T}{n_{x_2}n_T}\right] Q$ will be less than K_P reaction will move in forward direction

(B) At the start of the reaction $\Delta G = \Delta G^0 + RT\ln Q$

$t = 0, Q = 0 \Rightarrow \Delta_{rxn}G = -ve(\text{spontaneous})$

(C) if $\beta_{eq} = 0.7$

$$K_p = \frac{8 \times 0.49}{4 - 0.49} = \frac{3.92}{3.51}$$

$$K_p > 1$$

Since it is given that

$$\Delta G^0 > 0 \Rightarrow K_p < 1$$

$\therefore$ This is incorrect

(D)

$$K_p = K_C \times (RT)^{\Delta n_g}$$

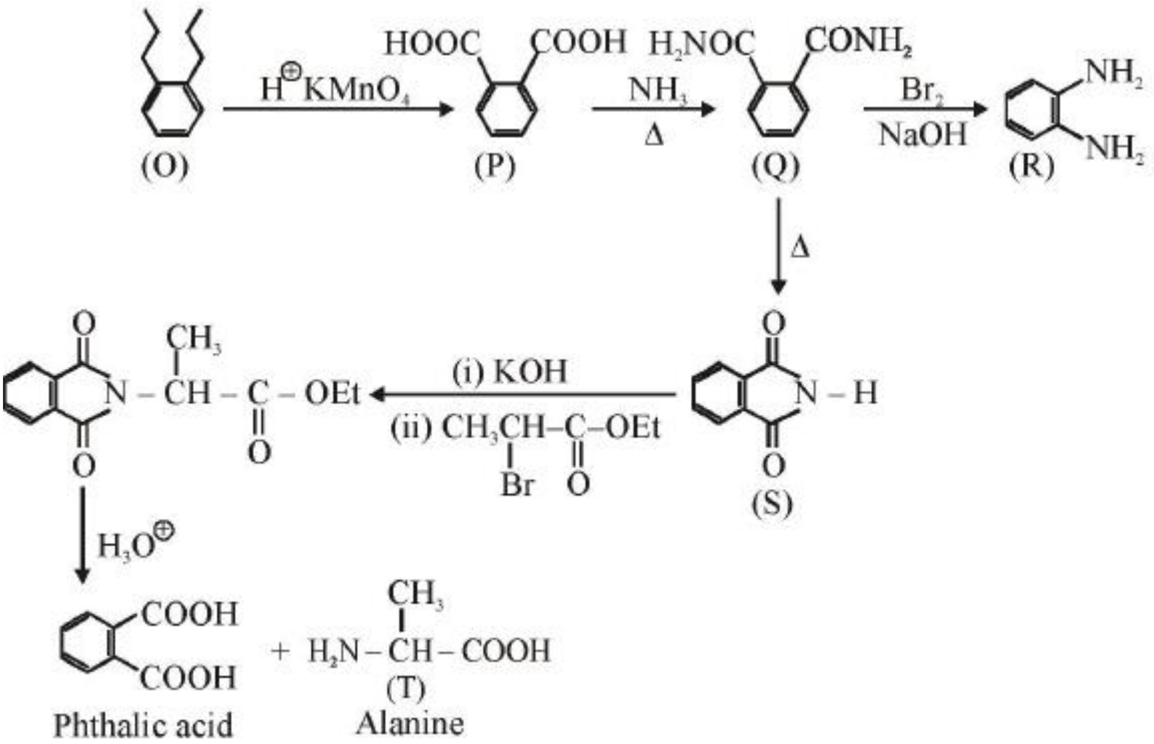
$$K_C = \frac{K_P}{(R \times 298)^1}$$

$$K_C < 1$$

35. Sol. (A)

36. **Sol. (B)**

So. Solution Q.35 & 36.



Q to R is Hoffmann’s bromamide degradation reaction

S to T is Gabriel's phthalimide sysnthesis