JEE Advanced 2020

Chemistry Paper - 2_Solutions

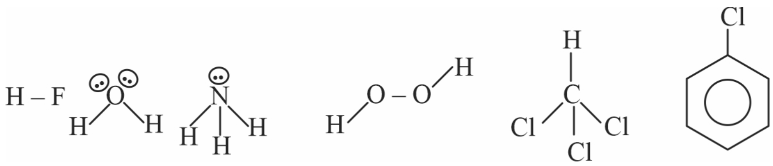
1.(9) From the given data, it is clear that $(n+2)$ atom is alkali metal and $(n+3)$ atom is alkaline earth metal.

So, $n+2=11$

$\Rightarrow \; n=9$

Ans. = 9

2.(6)



$\mu \neq 0$ (Polar)

Only polar compounds will be showing deflection when a charged comb is brough near them.

Ans. = 6.

3.(6) $MnO_4^- + 3I^- + 2H_2O \xrightarrow[\text{Basic solution}]{\text{Weakly}} MnO_2 + \frac{3}{2}I_2 + 4OH^-$

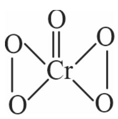
$1 \text{ mole } MnO_4^- \longrightarrow \frac{3}{2} \text{ mole } I_2$

$4 \text{ mole } MnO_4^- \longrightarrow \frac{3}{2} \times 4 \text{ mole } I_2 = 6 \text{ mole } I_2$

Ans. = 6

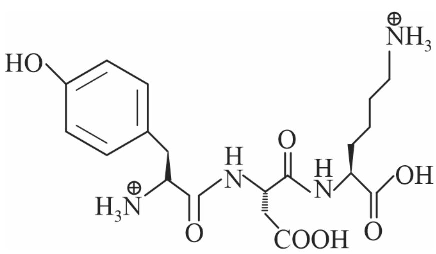
4.(4) $K_2Cr_2O_7 + H_2O_2 + H_2SO_4 \xrightarrow[\text{or ether}]{\text{amyl alcohol}} CrO_5$ (blue colouration)

Structure of CrO_5 is :



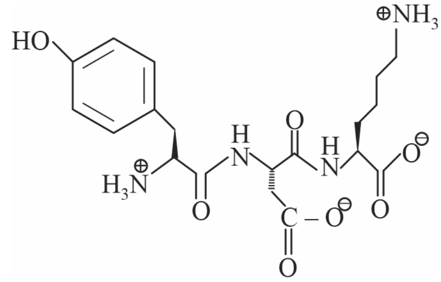
No. of oxygen atoms bonded with Cr by single bond = 4.

5.(5) At pH = 2 (strongly acidic medium) Structure of peptide will be :



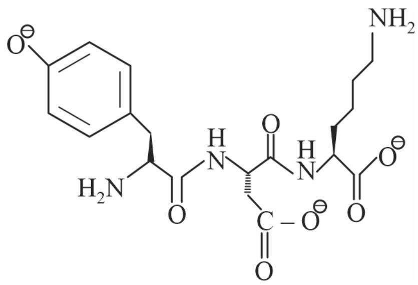
$\Rightarrow |z_1| = 2$ at pH $= 2$

At pH = 6 (Nearly neutral medium) structure of peptide will be:



$\Rightarrow \quad |z_2| = 0$ at pH = 6

At pH = 11 (Strongly basic medium). Structure of peptide will be :



$\Rightarrow \quad |z_3| = 3$ at pH = 11

$|z_1| + |z_2| + |z_3| = 2 + 0 + 3 = 5$

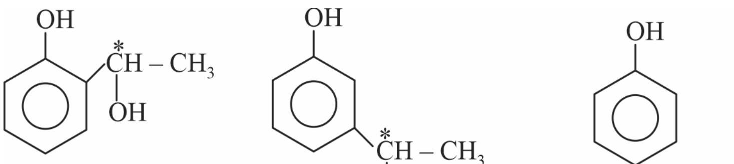
Ans. = 5

6.(6) $C_8H_{10}O_2 \Rightarrow$ D.U. = 4

It produces pink colour with neutral $FeCl_3$, so it will be phenolic compound.

It also rotates plane polarized light. So it should be optically active.

Therefore possible structures of $C_8H_{10}O_2$ will be :



(*d* and *l*) (*d* and *l*) (*d* and *l*)

Total No. of all possible isomers = 6

7.(ABC)

(A) H_2O is diamagnetic. Magnetic balance will deflect upward.

(B) $X = K_4[Fe(CN)_6]$

Here Fe is in +2 oxidation state

$Fe^{2+} : 3d^6$

CN^- is a strong ligand, so pairing of electrons take place. It is diamagnetic. Magnetic balance will deflect away from magnetic field.

(C) $X = O_2$

Here O_2 is paramagnetic. It will attract towards magnetic field. Magnetic balance will deflect downward.

(D) $C_6H_6(l)$ is diamagnetic so magnetic balance will deflect upward.

8.(A) Here SN1 reaction take place.

Rate is independent of the concentration of nucleophile.

It is first order reaction.

(A) Is correct as in first order reaction, $t_{1/2}$ is independent of concentration.

$$t_{1/2} = \frac{0.693}{k}$$

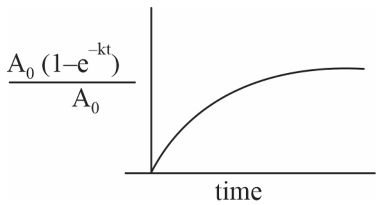
(B) Rate = k [A]

Rate = $k\ A_0 e^{-kt}$

As A_0 increases, rate increases

(C) $A_t = A_0 e^{-kt}$

Here concentration of product $= A_0(1-e^{-kt})$



(D) $A_t = A_0\ e^{-kt}$

$\frac{A_t}{A_0} = e^{-kt}$

$\ln\left(\frac{A_t}{A_0}\right) = -kt$

Incorrect as slope is negative.

9.(ABCD)

(A) $NaAlO_2 \xrightarrow{CO_2} Al(OH)_3 + Na_2CO_3$

(B) Correct. Na_3AlF_6 is added in electrolyte to decrease the melting point of alumina.

(C) Correct. Here anode is made of graphite

O^{2-} ion gets oxidized at anode to give O_2. It combines with graphite to give CO_2.

(D) Correct.

10.(AB)

(A) Sn^{2+} is a good reducing agent.

(B) $SnO_2 + KOH \longrightarrow K_2[Sn(OH)_6]$

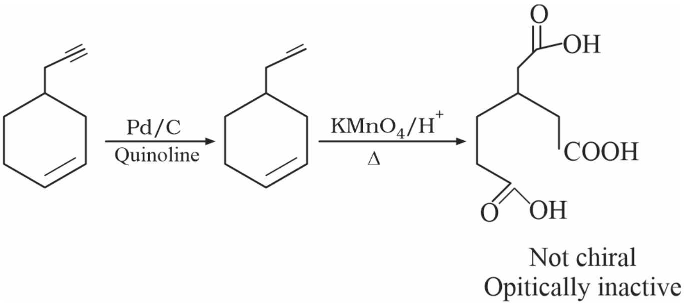
(C) $PbCl_2 + HCl \longrightarrow [PbCl_4]^{2-}$

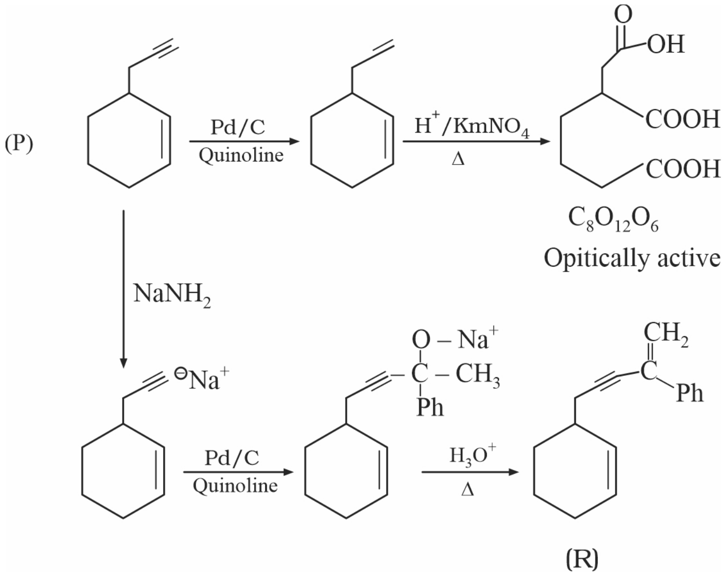
(D) $Pb_3O_4 + HNO_3 \longrightarrow Pb(NO_3)_2 + PbO_2$

It is not a redox reaction.

11.(CD) Correct order of basicity : II > I > IV > III. IV is much more basic than III due to stearic inhibition in Resonance (SIR effect)

12.(BC)





13.(3) $\text{pOH} = \frac{\text{pK}_b}{2} - \frac{1}{2}\log C$

$[\because\ \text{OH}^- = \sqrt{k_b C}\ ]$

$2 = \frac{\text{pK}_b}{2} - \frac{1}{2}\log 0.1$

$2 = \frac{\text{pK}_b}{2} + \frac{1}{2}$

$\text{pK}_b = 3$

14.(0.20) $P_T = P_A^0\ X_A + P_B^0\ X_B$

$0.3 = P_A^0 \times \frac{1}{4} + P_B^0 \times \frac{3}{4}$ **…(i)**

$0.4 = P_A^0 \times \frac{1}{4} + P_B^0 \times \frac{1}{2}$ **…(ii)**

$1.2 = P_A^0 + 3P_B^0$

$\underset{(-)\quad\ (-)\quad (-)}{0.8 = P_A^0 + P_B^0}$

$0.4 = 2P_B^0 \qquad \Rightarrow\ P_B^0 = 0.2\ \text{ bar}$

15.(–5252.06)

$\because$ PE b/w 2H atoms = 0 at $d = d_0$

$\therefore$ only PE of 2 H atoms are considered in ground state.

PE of 1 H atoms = $2.18 \times 10^{-18} \times 10^{-3} \times \text{NA}\ \times 2$ kJ/mole

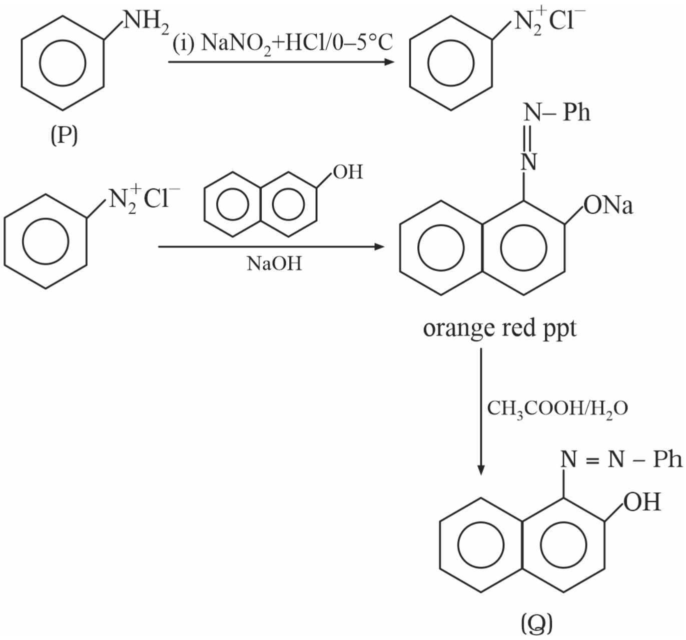
PE of 2 H atoms = $-2.18 \times 10^{-18} \times 10^{-3} \times \text{NA} \times 4$ kJ/mole

$= -1313.014 \times 0.14 \times 4$ kJ/mole

$= -5252.056$

$\simeq -5252.06$ kJ / mole

16.(18.60)



$P \rightarrow C_6H_5NH_2 \rightarrow M_w = 93\text{ g}$

$Q \rightarrow C_{10}H_7ON_2C_2H_5$

$\because$ 93 g of P forms 248 of Q

9.3 g of P forms $\frac{248}{93} \times 9.3 \times \frac{75}{100}$ g of Q

= 18.6 g

17.(935) $SnO_2(s) + C(s) \rightarrow Sn(s) + CO_2(g)$

$\Delta_r H^\circ = -394 - (581) = 187\text{ KJ mol}^{-1}$

$\Delta_r S^\circ = 210 + 52 - (56 + 6) = 200\text{ J mol}^{-1}\text{ k}^{-1}$

$\Delta_r G^\circ = \Delta_r H^\circ - T\Delta_r S^\circ$

Minimum temperature at which reduction is possible be T.

$0 = 187000 - 200 \times T$

$T = \frac{187000\text{ K}}{200}\text{K} = 935\text{ K}$

18.(0.20) $K_1 \times K_2 = \frac{[H^+]^2[S^{-2}]}{[H_2S]} \Rightarrow 10^{-21} = \frac{[H^+]^2[S^{-2}]}{0.1}$

$S^{-2} = \frac{10^{-22}}{[H^+]^2}$

K_{sp} of ZnS $= [Zn^{2+}][S^{-2}]$

$1.25 \times 10^{-22} = 0.05 \times \frac{10^{-22}}{[H^+]^2} \Rightarrow [H^+]^2 = \frac{0.05}{1.25} = \frac{1}{25}$

$H^+ = \frac{1}{5} = 0.2\text{ M}$