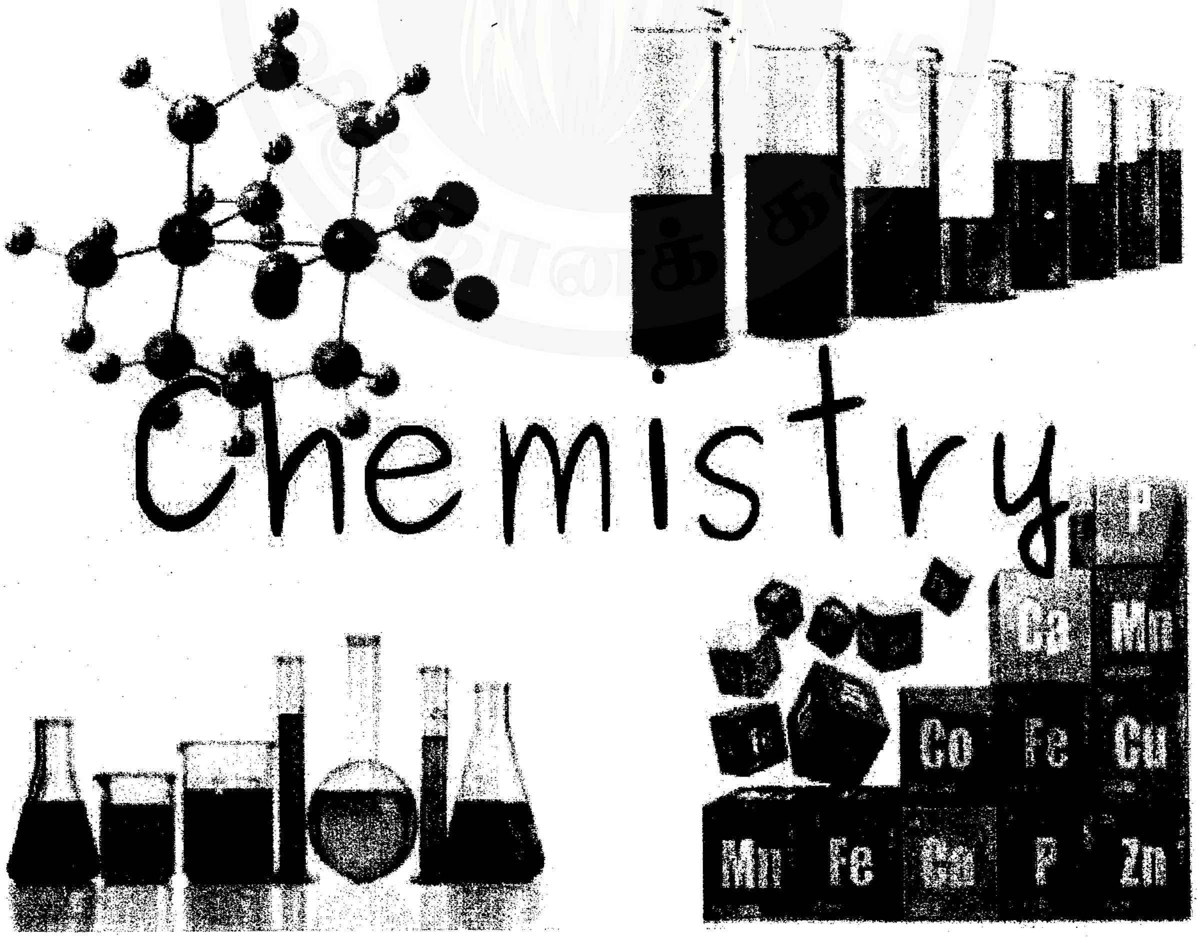
FWC

தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
4ம் தவணைப் பரீட்சை
Field Work Centre, Thondaimanaru
4th Term Examination

Grade - 13 (2021) Chemistry Marking Scheme

1) 5	11) 5	21) 1	31) 1	41) 1
2) 4	12) 5	22) 2	32) 2	42) 1
3) 3	13) 5	23) 3	33) 3	43) 5
4) 2	14) 1	24) 4	34) 2	44) 1
5) 1	15) 1	25) 5	35) 5	45) 1
6) 1	16) 2	26) 5	36) 1	46) 5
7) 2	17) 2	27) 5	37) 2	47) 4
8) 3	18) 4	28) 1	38) 4	48) 4
9) 4	19) 4	29) 1	39) 1	49) 1
10) 5	20) 4	30) 1	40) 2	50) 1

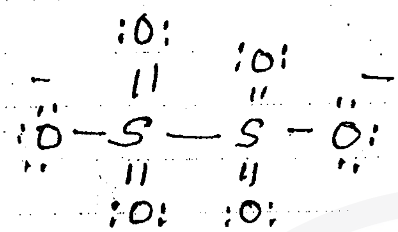


தரம் 13 இரசாயனவியல் [illegible]

1 (a) (i) S (ii) S^{2-} (iii) N (iv) F (v) S (vi) Cr

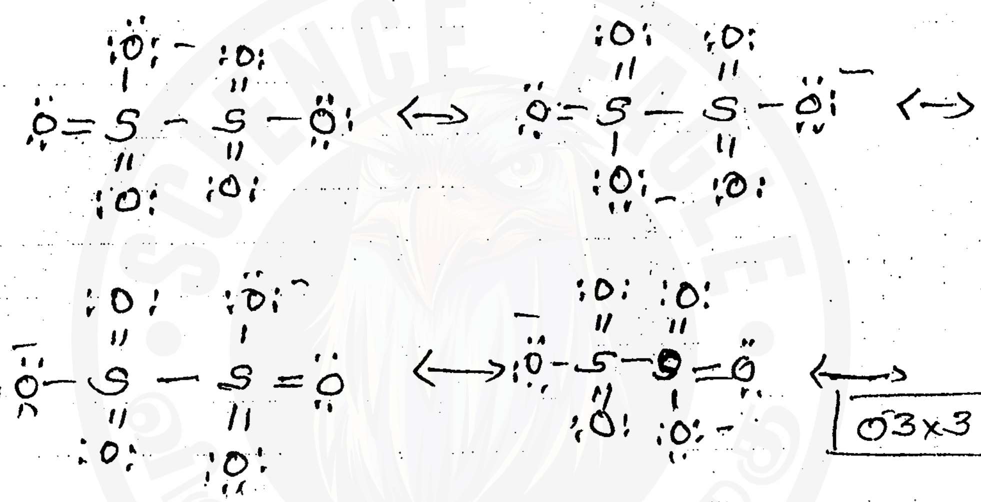
$\boxed{6 \times 0.5 = 30}$

(b) (i)



$\boxed{07}$

(ii)



$\boxed{03 \times 3 = 9}$

Any other possible resonance structure are also acceptable.

(iii)

	C^1	C^3	C^4	C^6
(I) Hybridization	sp^2	sp^2	sp^3	sp
(II) Electron pair geometry	trigonal planar	Trigonal planar	tetrahedral	linear
(III) Oxidation number	-2	$+2$	0	-1

$\boxed{12 \times 01 = 12}$

(iv) $C^4 < C^1 < C^3 < C^6$ $\boxed{04}$

(C) (i) NH_3 and H_2S $\boxed{03 \times 2 = 6}$

(ii) dipole moment (μ) = bond length $\boxed{\times}$ Charge of the pole $\boxed{02 \times 3 = 6}$

(D) (i) greater / ~~less~~ $\boxed{04}$

Higher electronegativity of 'F' makes the 'C' atom is attached to 4 Fluorine atoms highly positive compared to the C atom attached to 4 chlorine atoms. This makes the C attached to 'F', to have higher Electronegativity. $\boxed{05}$

(ii) $BeCO_3 < MgCO_3 < CaCO_3 < SrCO_3$ $\boxed{05}$

- Anion is not changed.
- Cation charged is not changed
- Cation radius increases along this order $Be^{2+} < Mg^{2+} < Ca^{2+} < Sr^{2+}$

$\therefore$ Polarizing powe dercreases as follows.

$Be^{2+} > Mg^{2+} > Ca^{2+} > Sr^{2+}$

So Polarization decreases in the above order there for Ionic character increases in the following order $BeCO_3 < MgCO_3 < CaCO_3 < SrCO_3$

$\therefore$ Thermal stability increase in the following order. $\boxed{06}$

(iii)
- Ion-dipole interaction
- Dipole - Dipole Interaction / Hydrogen-bond.
- Ion-induced dipole interaction
- Dipole induced dipole interaction
- Dispersion interaction

any three answers. $\boxed{06}$

/100

2 (a) (i) C or carbon

(ii) $1s^2 2s^2 2p^2$

(iii) CO, CO_2, C_2O_3

(iv) $CO_2 + H_2O \rightleftharpoons H_2CO_3$

$H_2CO_3 + H_2O \rightleftharpoons H_3O^+ + HCO_3^-$

$HCO_3^- + H_2O \rightleftharpoons H_3O^+ + CO_3^{2-}$

(v) $CO_2 + NaOH \longrightarrow NaHCO_3$

$CO_2 + 2NaOH \longrightarrow Na_2CO_3 + H_2O$

$\boxed{05 \times 8 = 40}$

(b) (i) Oxidation reaction:

$Al + 4\bar{O}H \longrightarrow AlO_2^- + 2H_2O + 3e$ 06

(ii) Reduction

$NO_3^- + 6H_2O + 8e \longrightarrow NH_3 + 9\bar{O}H$ 06

(iii) $3NO_3^- + 8Al + 5\bar{O}H + 2H_2O \longrightarrow 8AlO_2^- + 3NH_3$ 06

(iv) Test with the filter paper which was dipped in Nessler's reagent. the above filter paper turns to brown colour. $04 \times 2 = 8$

(v) (i) Brown ring test. 5

(ii) $[Fe(NO)]^{2+}$ Brown colour 5

$\boxed{36}$

i H_2S dihydrogen monosulfide

ii $HClO_3$ chloric acid | Hydrogen Chlorate.

iii KH_2PO_4 Potassium dihydrogen Phosphate

iv P_4O_6 tetraphosphorous hexoxide.

$\boxed{06 \times 4 = 24}$

(3) (a) (i) $Na_2S_2O_{3(aq)} + 2HNO_{3(aq)} \longrightarrow 2NaNO_{3(aq)} + S_{(s)} + SO_{2(g)} + H_2O_{(l)}$ ---- 04

100 15

(ii) • Formation of pale yellow turbidity

• Evolution of gas with pungent smell.

------ 2x03 = 06

(iii) • Draw a cross mark on a white sheet of paper.

• Put a cleaned beaker on the cross mark.

• Add the reagents ($Na_2S_2O_{3(aq)}$ and HNO_3) having different concentrations keeping the total volume a constant

• Measure the time taken for the cross mark to disappear from vision.

---- 5x04 = 20

(iv) • Keeping the eye level at constant height above the beaker.

• Using identical beakers.

• Keeping the total volume same in all expts

----- 3x02 = 06

(v) By measuring the time taken for the formation of a constant (known) amount of sulphur for which the rate is inversely proportional ------- 05

(vi) Table 1

	$\frac{1}{t}/s^{-1}$
Expt. 1	0.10
2	0.08
3	0.06
4	0.04
5	0.02

05

Table 2

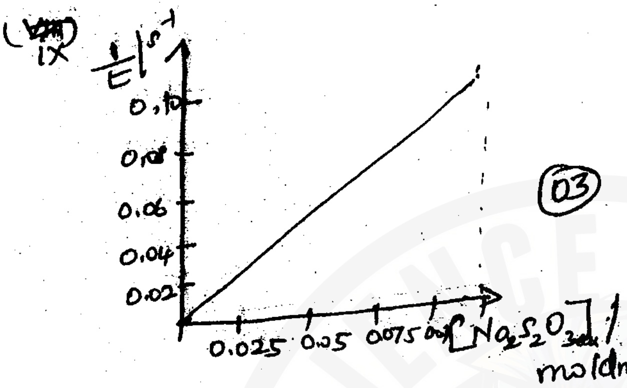
	$\frac{1}{t}/s^{-1}$
Expt. 1	0.049
2	0.050
3	0.050
4	0.050
5	0.049

05

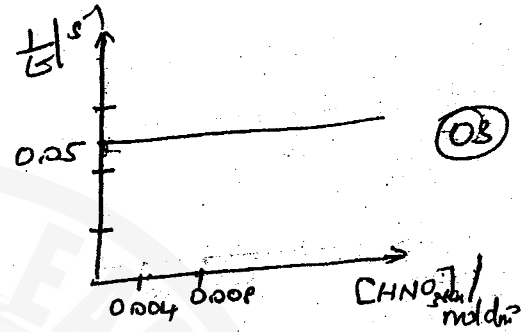
(VIII) • To maintain the concentration of a reactant (with higher concentration) a constant throughout all expts.

• To minimize the error in measuring the time taken for the cross mark to disappear. - - - - 06

(IX)



03



03

(X) Since $\frac{1}{t}$ is proportional to $[S_2O_{3(aq)}^{2-}]$; order with respect to $[S_2O_3^{2-}]$ is 1 . - - - 02

As $\frac{1}{t}$ does not depend on $[HNO_{3(aq)}]$, order with respect to $[HNO_3]$ is 0 . 02

$\therefore R \propto [S_2O_3^{2-}]$ - - - 02

VII) In order to neglect the change in concentration of the reactant which has a relatively higher concentration and determining the order w.r.t the other reactant by considering its change in concentration. - - ——— - - 06

(b) 25

(i) slow step / $Y + B \longrightarrow Z$. - - - - 05

(ii) rate $\propto [Y][B]$ - - - - - - 10

(iii) $k_1 = \frac{[X]}{[A][C]}$, $k_2 = \frac{[Y]}{[X][C]}$

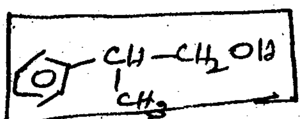
$\therefore k_1 \times k_2 = \frac{[Y]}{[A][C]^2} \Rightarrow [Y] = k_1 k_2 [A][C]^2$

Substituting this in the rate expression for slowest step,

$$rate \propto [A][B][C]^2.$$

--- (10)

(4) (a) (i) (50)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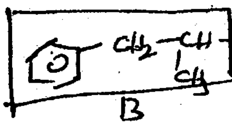
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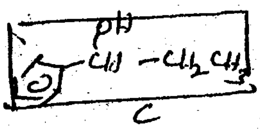
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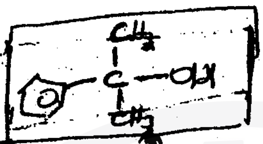
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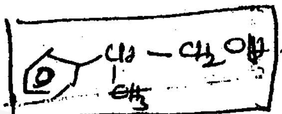
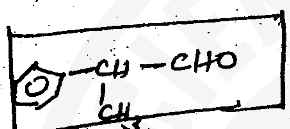

E

--- $5 \times 04 = 20$

(ii)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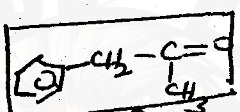
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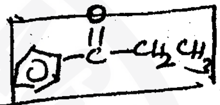
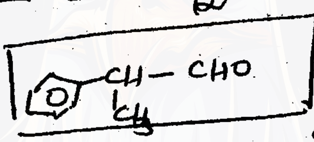
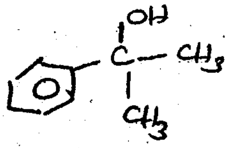

R


S

--- $4 \times 05 = 20$

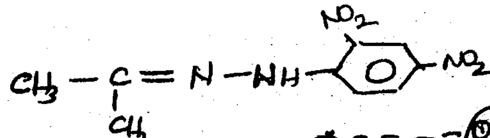
(iii) Add Tollen's reagent to both P and Q
P gives silver mirror whereas R doesn't. --- (10)

(b) (I) (i) $H_2 | Pd | BaSO_4 |$ Quinolene or S. (ii) CH_3CN
or $H_2 |$ Lindlar catalyst

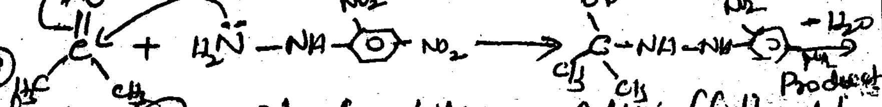
(iii) $CH_3-CH(CH_3)-ONa$ (iv)  (v) $C_6H_5OCOCH_3$

(vi) CH_3CH_2CHO (vii) $CH_3CH_2CH_2MgBr$ (viii) $CH_3-CH(OH)-CH_2COOH$.

$8 \times 04 = 32$

(II) Product : 

--- (06)

Mechanism: (08) 

Type of mechanism: (04) Nucleophilic addition (followed by elimination)

Part II B - Essay

(3)

(5) (a) (i) $A_{(g)} \rightleftharpoons B_{(g)} + C_{(g)}$

	A	B	C	
Initial:	1 mol	1 mol	1 mol	
Equilibrium:	0.5 mol	2 mol	1.5 mol	
Amt. reacted/formed	0.5	1	0.5 ---- mol	05

Smallest ratio 1 : 2 : 1 ------ 05

$\therefore$ Balanced equation $A_{(g)} \rightleftharpoons 2B_{(g)} + C_{(g)}$ --- 05

(ii) At equilibrium : $x_A = \frac{0.5}{4} = \frac{1}{8}$

$x_B = \frac{2}{4} = \frac{1}{2}$

$x_C = \frac{1.5}{4} = \frac{3}{8}$ $\Big\}$ $3 \times 03 = 09$

Since volume of the vessel is const.

$P \propto nT$ ------ 02

$\frac{6 \times 10^5 \text{ Pa}}{P} = \frac{3 \text{ mol} \times 400 \text{K}}{4 \text{ mol} \times 500 \text{K}}$ --- 02

$\therefore P = 1 \times 10^6 \text{ Pa}$ ----- 02

$P_A = \frac{1}{8} \times 1 \times 10^6 \text{ Pa} = 1.25 \times 10^5 \text{ Pa}$

$P_B = \frac{1}{2} \times 1 \times 10^6 \text{ Pa} = 5 \times 10^5 \text{ Pa}$

$P_C = \frac{3}{8} \times 1 \times 10^6 \text{ Pa} = 3.75 \times 10^5 \text{ Pa}$ $\Big\}$ $3 \times 02 = 06$

(iii) $K_p = \frac{P^2_{B_{(g)}} \times P_{C_{(g)}}}{P_{A_{(g)}}}$ 02 $= \frac{(5 \times 10^5 \text{ Pa})^2 \times (3.75 \times 10^5 \text{ Pa})}{1.25 \times 10^5 \text{ Pa}}$ ---- 02

$= 7.5 \times 10^{11} \text{ Pa}^2$ --- 02

(iv) $K_p = K_c (RT)^{\Delta n}$ ---- 02

$\Delta n = 3 - 1 = 2$

$\therefore K_c = \frac{K_p}{(RT)^2} = \frac{7.5 \times 10^{11} \text{ Pa}^2}{(4000 \text{ J mol}^{-1})^2}$ ---- 04 --- 02

$= 4.68 \times 10^4 \text{ mol}^{-2} \text{ m}^{-6}$

7

(V) When the temp. is decreased to 27°C,

$$A_{(g)} \rightleftharpoons 2B_{(g)} + C_{(s)} \text{ : solid}$$

Initial: 0.5   2   1.5 --- mol

New eq$^{\underline{m}}$: $(0.5-x)$ $2+2x$ $(1.5+x)$ solid

Since P_{total} at new equilibrium is 3×10^5 Pa

using $P \propto nT$,

$$\frac{1\times10^6\ Pa}{3\times10^5\ Pa} = \frac{4\ mol \times 500\ K}{(2.5+x)\times 300\ K} \text{ --- } 05$$

$$\Rightarrow x = -0.5\ mol \text{ --- } 02$$

negative sign of x indicates that the re$^{\underline{n}}$ proceeds in the reverse direction to attain equilibrium. --- 03

$$A_{(g)} \rightleftharpoons 2B_{(g)}$$

At eq$^{\underline{m}}$: 1 mol   1 mol

$$K_{p(at\ 27°C)} = \frac{P_B^2}{P_A} \text{ --- } 02 \quad = \frac{(0.5\ P_{Tot})^2}{(0.5\ P_{Tot})} \text{ --- } 02$$

$$= 0.5\ P_{Tot} = 0.5\times3\times10^5\ Pa$$

$$= 1.5\times10^5\ Pa \text{ --- } 03$$

(VI) Equilibrium shifts to the right/in the forward direc- --- 03

(b) (i) 40

$$2H_{2(g)} + O_{2(g)} \xrightarrow{\Delta H^\ominus_{re^n}} 2H_2O_{(g)}$$

$2\times\Delta H^\ominus_{D(H-H)}$ $\Delta H^\ominus_{D(O=O)}$ $4\times\Delta H^\ominus_{D(O-H)}$

$$4H_{(g)} + 2O_{(g)}$$

cycle → 12

According to Hess's law, --- 02

$$\Delta H^\ominus_{re^n} = 2\Delta H^\ominus_{D(H-H)} + \Delta H^\ominus_{D(O=O)} - 4\Delta H^\ominus_{D(O-H)}$$

$$= [2\times432 + 494 - 4\times460]\ kJ\,mol^{-1} \text{ --- } 02$$

$$= -482\ kJ\,mol^{-1} \text{ --- } 02$$

(ii) $\Delta S^{\ominus}_{rxn} = \sum S^{\ominus}_{Products} - \sum S^{\ominus}_{Reactants}$ ---- (02) (4)

$= [2 \times 188.8 - 2 \times 130.7 - 205.1]\ kJ\,mol^{-1}K^{-1}$ ---- (02)

$= -89.3\ J\,mol^{-1}K^{-1} = -89.3 \times 10^{-3}\ kJ\,mol^{-1}K^{-1}$ ---- (02)

(iii) $\Delta G^{\ominus}_{rxn} = \Delta H^{\ominus}_{rxn} - T\Delta S^{\ominus}_{rxn}$ ---- (04)

$= -482\ kJ\,mol^{-1} - 298\,K \times (-89.3 \times 10^{-3}\ kJ\,mol^{-1}K^{-1})$ ---- (04)

$= -455.389\ kJ\,mol^{-1}$ ---- (04)

Since $\Delta G^{\ominus}_{rxn} < 0$, the reaction is spontaneous ---- (04)

(C) (i) AP

	ΔG	
P :	negative	spontaneous
Q :	zero	equilibrium
R :	positive	non-spontaneous

$6 \times 02 = (12)$

(ii) P : $Q_c < K_c$

Q : $Q_c = K_c$

R : $Q_c > K_c$ ---- $3 \times 02 = (06)$

(iii) $A_{(g)} \rightleftharpoons 2B_{(g)}$

At eq^m: 0.4 mol 1.2 mol ---- (04)

Equilibrium pressure $P = \frac{nRT}{V}$

$= \frac{1.6\ mol \times 8.314\ N\,m\,mol^{-1}K^{-1} \times 300\,K}{4.157 \times 10^{-3}\ m^3}$ ---- (04)

$= 9.6 \times 10^5\ Pa$ ---- (04)

$K_p = \frac{P^2_{B(g)}}{P_{A(g)}}$ ---- (04)

$= \frac{\left(\frac{1.2}{1.6} \times 9.6 \times 10^5\ Pa\right)^2}{\frac{0.4}{1.6} \times 9.6 \times 10^5\ Pa}$ ---- (04)

$=$ ---- (02)

(6) (a) (i) 100

$$CH_3COOH_{(aq)} + H_2O_{(l)} \rightleftharpoons CH_3COO^-_{(aq)} + H_3O^+_{(aq)}$$ --- (02)

Initial: 0.1 — — $mol\,dm^{-3}$

At eq^m: $(0.1-x)$ x x --- $mol\,dm^{-3}$ --- (02)

$$K_a = \frac{[CH_3COO^-_{(aq)}][H_3O^+_{(aq)}]}{[CH_3COOH_{(aq)}]}$$ --- (02)

$$= \frac{x^2}{0.1-x}$$ --- (02)

Since ionization of CH_3COOH is very small,

$$0.1 - x \simeq 0.1$$ ---- (01)

$$\therefore K_a = \frac{x^2}{0.1}$$ ---- (01)

$$x = \sqrt{0.1\,K_a}$$

$$\therefore [H_3O^+_{(aq)}] = \sqrt{0.1 \times 1.8 \times 10^{-5}}\ mol\,dm^{-3}$$

$$= \sqrt{1.8 \times 10^{-6}}\ mol\,dm^{-3}$$

$$= 1.34 \times 10^{-3}\ mol\,dm^{-3}$$ --- (05)

$$\therefore pH = -\log_{10}[H_3O^+_{(aq)}]/mol\,dm^{-3}$$

$$= -\log_{10}(1.34 \times 10^{-3})$$

$$= 3 - \log_{10}1.34 =$$ --- (05)

(ii) When 10 cm^3 of $NaOH_{(aq)}$ is added,

$$CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$$

Initial: $0.1\,mol\,dm^{-3} \times 0.025\,dm^3$ $0.2\,mol\,dm^{-3} \times 0.01\,dm^3$

$= 2.5 \times 10^{-3}\,mol$ $= 2 \times 10^{-3}\,mol$

Reacted: $2 \times 10^{-3}\,mol$ 2×10^{-3}

Remaining: $0.5 \times 10^{-3}\,mol$ — $2 \times 10^{-3}\,mol$ ---- (05)

ii) $K_a = \dfrac{[CH_3COO^-_{(aq)}][H_3O^+_{(aq)}]}{[CH_3COOH_{(aq)}]}$ ----- 03

$[H_3O^+_{(aq)}] = \dfrac{K_a[CH_3COOH]}{[CH_3COO^-_{(aq)}]} = \dfrac{1.8\times10^{-5}\,mol\,dm^{-3} \times 0.5\times10^{-3}}{2\times10^{-3}\,mol\,dm^{-3}}$

$= 4.5\times10^{-6}\,mol\,dm^{-3}$ ----- 02

$\therefore pH = 6 - \log 4.5$ ----- 05

(iii) Let V be the volume of NaOH required for the equivalence point.

$\therefore 0.1\,mol\,dm^{-3}\times 25\,cm^3 = 0.2\,mol\,dm^{-3}\times V$

$\Rightarrow V = 12.5\,cm^3$ ----- 05

(iv) $CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

At the equivalence point

$[CH_3COONa_{(aq)}] = \dfrac{0.1\,mol\,dm^{-3}\times 25\,cm^3}{37.5\,cm^3}$ ----- 05

$= \dfrac{1}{15}\,mol\,dm^{-3}$

pH at the equivalence pt. is determined by the hydrolysis of the salt formed.

$CH_3COO^-_{(aq)} + H_2O_{(l)} \rightleftharpoons CH_3COOH_{(aq)} + OH^-_{(aq)}$ ----- 05

$K_{b(CH_3COO^-)} = \dfrac{[CH_3COOH_{(aq)}][OH^-_{(aq)}]}{[CH_3COO^-_{(aq)}]}$ ----- 05

$= \dfrac{[OH^-_{(aq)}]^2}{[CH_3COO^-_{(aq)}]}$ ----- 05

$[OH^-_{(aq)}] = \sqrt{\dfrac{K_w[CH_3COO^-_{(aq)}]}{K_a}}$ ----- 05

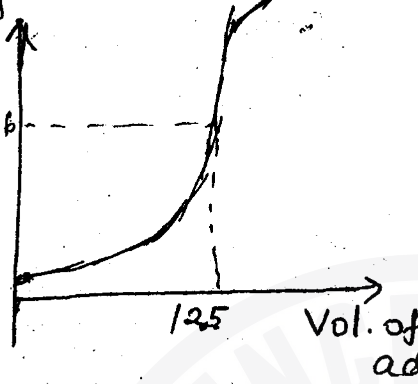
$= \sqrt{\dfrac{1\times10^{-14}}{1.8\times10^{-5}} \times \dfrac{1}{15}}\ mol\,dm^{-3}$

$[OH^-_{(aq)}] = (3.703 \times 10^{-11})^{1/2} \, mol\,dm^{-3} = \sqrt{37.03 \times 10^{-6}} \, mol\,dm^{-3}$

$pOH = 3 - \frac{1}{2}\log_{10} 37.03$ ---- (05)

$\therefore pH = 8 + \frac{1}{2}\log 37.03 = 8.$ ---- (05)

(V)



Graph → (15)

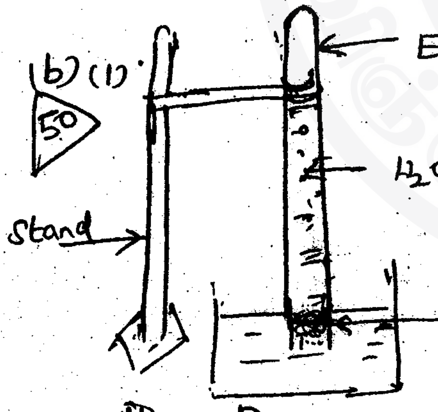
(b) (i) (V) Excess $[OH^-] = \frac{(0.2\,mol\,dm^{-3} \times 20\,cm^3 - 0.1\,mol\,dm^{-3} \times 25\,cm^3)}{45\,cm^3}\,mol\,dm^{-3}$ --- (05)

$= 0.033\,mol\,dm^{-3}$

$pOH = -\log_{10}(3.3 \times 10^{-2}) = 2 - \log 3.3$

$pH = 14 - pOH = 12 + \log 3.3 = 12.$ --- (05)

(b) (I) (50)



Labelled diagram → (10)

II) $P_{H_2} = P_{Total} - P^{\circ}_{H_2O} = (1.013 - 0.036) \times 10^5\,Pa$

$= 0.977 \times 10^5\,Pa$ --- (05)

Using combined gas eqn, convert the vol. of H_2 at 27°c to 0°c.

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{0.977 \times 10^5\,Pa \times 50\,cm^3}{300\,K} = \frac{1 \times 10^5\,Pa \times V}{273\,K}$$ (03)

$$V = \frac{0.977 \times 273 \times 50}{300} \text{ cm}^3 = 44.453 \text{ cm}^3 \text{ --- (02)}$$

$$n_{H_2} = \frac{V_{(STP)}}{V_{m(STP)}} = \frac{44.453 \text{ cm}^3}{22{,}400 \text{ cm}^3\text{mol}^{-1}} \text{ --- (05)}$$

$$= 1.985 \times 10^{-3} \text{ mol --- (05)}$$

According to the stoichiometry

$$n_{Mg} = n_{H_2} = 1.985 \times 10^{-3} \text{ mol --- (05)}$$

$$n_{Mg} = \frac{\text{mass of Mg}}{\text{Molar mass}} \text{ ---- (05)}$$

$$\Rightarrow \text{Molar mass of Mg} = \frac{0.05 \text{ g}}{1.985 \times 10^{-3} \text{ mol}} \text{ --- (05)}$$

$$= 25.19 \text{ g mol}^{-1} \text{ --- (05)}$$

---

(4) (60) (a) (i) $B_{(aq)} + H_2O_{(l)} \rightleftharpoons BH^+_{(aq)} + OH^-_{(aq)}$ --- (03)

Initial : c — — mol dm^{-3}

At eq^m : $c - x$ x x --- mol dm^{-3} } (02)

$$K_b = \frac{[BH^+_{(aq)}][OH^-_{(aq)}]}{[B_{(aq)}]} \text{ ----- (03)}$$

$$= \frac{x^2}{c - x} \text{ ----- (02)}$$

Since ionization of weak base B is negligible --- (03)

$c - x \simeq c$

$$\therefore K_b = \frac{x^2}{c} \Rightarrow x = \sqrt{cK_b} \text{ ---- (02)}$$

$$[OH^-_{(aq)}] = \sqrt{0.05 \times 5 \times 10^{-6}} \text{ mol dm}^{-3}$$

$$= 5 \times 10^{-4} \text{ mol dm}^{-3} \text{ --- (02)}$$

$$\therefore pOH = 4 - \log_{10} 5 \pm$$

$$pH = 10.7 \text{ --- (03)}$$

(ii) (I) $B_{(aq)} + HCl_{(aq)} \longrightarrow BH^+_{(aq)}Cl^-_{(aq)}$ ----- (05)

pH at the equivalence pt. is due to hydrolysis of salt BH^+Cl^-.

$BH^+_{(aq)} + H_2O_{(l)} \rightleftharpoons B_{(aq)} + H_3O^+_{(aq)}$ ---- (02)

$[H_3O^+_{(aq)}] = \sqrt{K_h c}$ -- (03) where K_h is the hydrolysis const of BH^+

(02)

Since $K_h = \frac{K_w}{K_a}$, $[H_3O^+_{(aq)}] = \sqrt{c\frac{K_w}{K_a}}$ --- (02)

$pH = -\log_{10}[H_3O^+_{(aq)}] = -\log_{10}\left(c\frac{K_w}{K_a}\right)^{1/2}$ -- (03)

$= -\frac{1}{2}\log_{10}K_w - \frac{1}{2}\log_{10}\left(\frac{c}{K_a}\right)$

$pH = \frac{1}{2}pK_w - \frac{1}{2}\log\frac{c}{K_a}$ -- (05)

(iii). $c = \frac{0.05\ mol\ dm^{-3} \times 25\ cm^3}{37.5\ cm^3} = 0.03\ mol\ dm^{-3}$

---- (10)

From part (ii), $pH = \frac{1}{2}\times 14 - \frac{1}{2}\log_{10}\left(\frac{0.03}{5\times10^{-6}}\right)$

$= 7 - 1.91 = 5.09$

--- (10)

(b) (I)

90

(i) A = Co / cobalt ---- (05)

(ii) +2 / Co^{2+} ------ (05)

(iii) m = 2 , n = 6 --- 2x05 = (10)

(iv) $P \Rightarrow [CoCl_4]^{2-}$, $Q \Rightarrow [Co(NH_3)_6]^{2+}$, $R \Rightarrow [Co(NH_3)_6]^{3+}$

$S \Rightarrow Co(OH)_2$, $T \Rightarrow [Co(OH)_4]^{2-}$

5x 03 = (15)

(v) P ⇒ blue , Q ⇒ yellow brown , T = pink

3x 05 = (15)

(II) (i) P $\Rightarrow$ $[Co(NH_3)_4Cl_2]Cl$

Q $\Rightarrow$ $[CoCl_2(NH_3)_4]I$

R $\Rightarrow$ $[CoCl(NH_3)_4(NO_2)]Br$

3 x 05 = 15

(ii) $2I^-_{(aq)} + Cl_{2(aq)} \longrightarrow I_{2(aq)} + 2Cl^-_{(aq)}$, violet

$2Br^-_{(aq)} + Cl_{2(aq)} \longrightarrow Br_{2(aq)} + 2Cl^-_{(aq)}$, orange

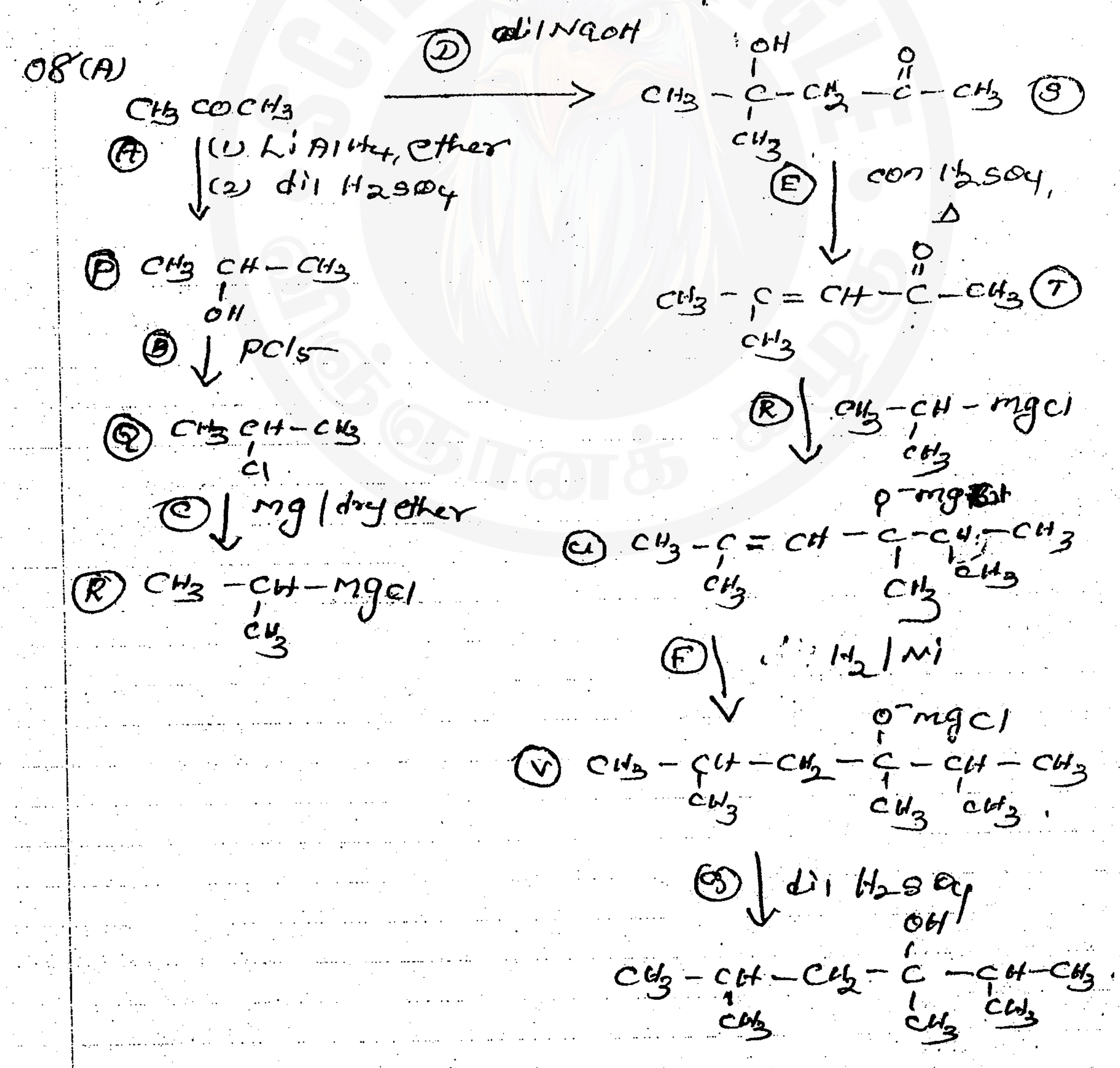
2 x 05 = 10

(iii) S $\Rightarrow$ $[CoBr(NH_3)_4Cl]NO_2$ or $[Co(Br)(NH_3)_4(NO_2)]Cl$ --- 10

(iv) Evolution of brown coloured gas with dilute HCl

or Formation of white precipitate with $AgNO_{3(aq)}$ --- 05

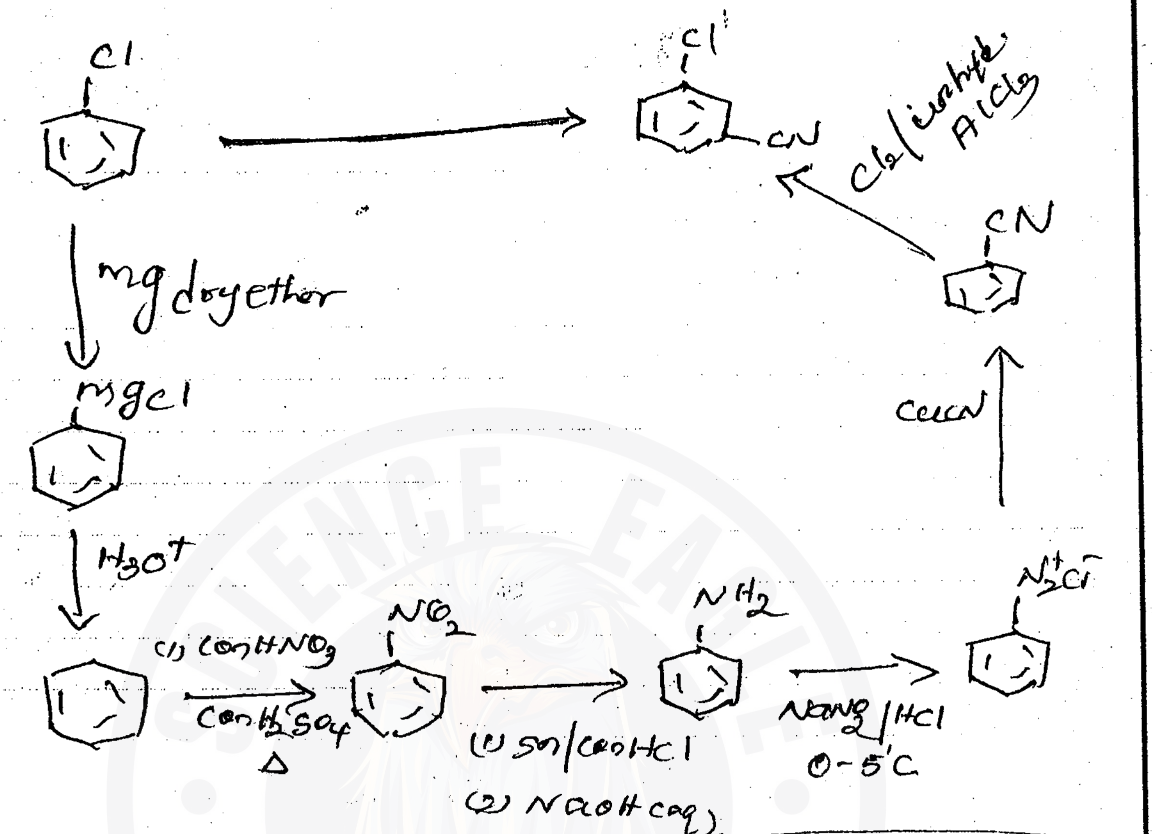
08(A)



15 x 04 = 60

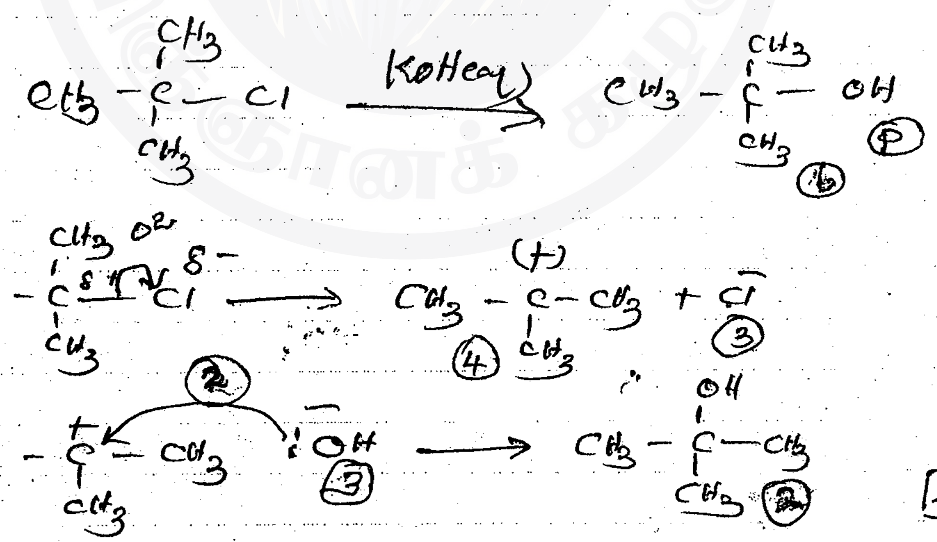
(2)

b



$\boxed{13 \times 04 = 52}$

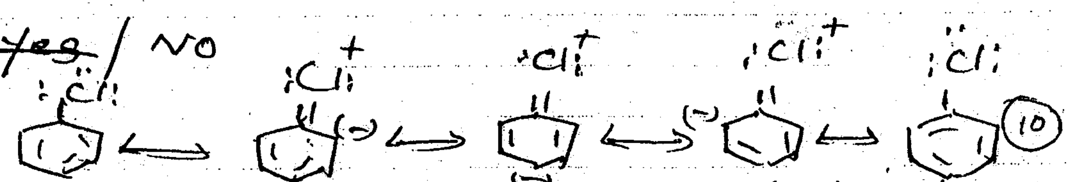
(C)



$\boxed{22}$

D (i) ~~Yes~~ / NO

(ii)



150

due to the above resonance C–Cl bond is strengthen. Therefore nucleophilic substitution reaction does not take place $\boxed{16}$ (06)

13

9 (A)

A - $(NH_4)_2CO_3$
B - NH_3
C - CO_2
D - $H_2O(g)$
E - CuO
F - Cu
G - N_2
H $CuSO_4$
I SO_2
J PbS
K HCl
L $PbCl_2(s)$
M $PbCl_2(aq)$
N $PbCl_2(s)$
O $Pb(NO_3)_2$
P H_2S
Q S

$\boxed{17 \times 05 = 85}$

(B)

$I_2 + SO_3^{2-} + H_2O \longrightarrow 2I^- + SO_4^{2-} + 2H^+$ (5)

$I_2 + 2S_2O_3^{2-} \longrightarrow 2I^- + S_4O_6^{2-}$ (5)

n_{I_2} (initial) $= 0.5\,mol\,dm^{-3} \times 25 \times 10^{-3}\,dm^3$
$= 12.5 \times 10^{-3}\,mol$ // (5)

$n_{S_2O_3^{2-}} = 0.20\,mol\,dm^{-3} \times 30 \times 10^{-3}\,dm^3$
$= 6 \times 10^{-3}\,mol$ (5)

n_{I_2} (remaining) $= 3 \times 10^{-3}\,mol$ (5)

n_{I_2} (reacted) $= 12.5 \times 10^{-3}\,mol - 6 \times 10^{-3}\,mol$
$= 9.5 \times 10^{-3}\,mol$ (5)

$n_{SO_3^{2-}} = 9.5 \times 10^{-3}\,mol$ // (5)

$[SO_3^{2-}] = \dfrac{9.5 \times 10^{-3}\,mol}{25 \times 10^{-3}\,dm^3} = 0.38\,mol\,dm^{-3}$ // (5)

$SO_4^{2-} + BaCl_2 \longrightarrow BaSO_4 \downarrow + 2Cl^-$ (5)

$n_{BaSO_4} = n_{SO_4^{2-}\,(total)} = \frac{3.728\ g}{233\ g\ mol^{-1}}$ (5)

$= 0.016\ mol$

$= 16 \times 10^{-3}\ mol$ (5)

$n_{SO_4^{2-}} = (16 \times 10^{-3} - 9.5 \times 10^{-3})\ mol$

$= 6.5 \times 10^{-3}\ mol$ (5)

$[SO_4^{2-}] = \frac{6.5 \times 10^{-3}}{25 \times 10^{-3}} = 0.26\ mol\ dm^{-3}$ (5)

$\boxed{65}$

150

10 (A) (i) Mn (10) (ii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7$ (5)

(iii) $MnCl_4$ greenish yellow $05 \times 2 = 10$

(iv)

MnO	Basic	+2
Mn_2O_3	weakly basic	+3
MnO_2	Amphoteric	+4
MnO_3	weakly acidic	+6
Mn_2O_7	Acidic	+7

$15 \times 01 = 15$

(v) MnO_4^- , MnO_4^{2-}

Permanganate , manganate

$03 \times 4 = 12$

(vi) $2MnO_4^- + 16H^+ + 10Cl^- \longrightarrow 2Mn^{2+} + 5Cl_2 + 8H_2O$

OR $2MnO_4^- + 16HCl \longrightarrow 2MnCl_2 + 5Cl_2 + 2Cl^- + 8H_2O$ (10)

(vii) used as Production of alloys,
its oxide (MnO_2) used in dry cell batteries
MnO_2 used as black - brown pigment in paint. (10)

(viii) $Mn(OH)_2$, white or cream
② ① 75

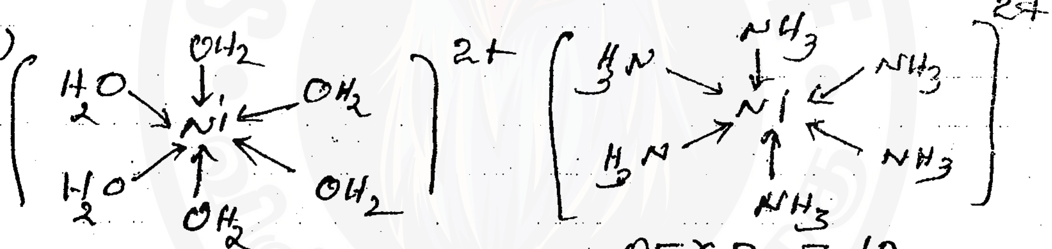
(B) (i) $X = H_2O$, $Y = NH_3$ $Z = Cl^-$ 05×3 = 15

(ii) $P = [Ni(H_2O)_6]^{2+}$ $Q = [Ni(NH_3)_6]^{2+}$ $R = NiCl_4^{2-}$
05×3 = 15

(iii) $[Ni(H_2O)_6]^{2+}$ hexaaquanickel(II) ion
$[Ni(NH_3)_6]^{2+}$ hexaamminenickel(II) ion
$[NiCl_4]^{2-}$ tetrachloridonickelate(II) ion
05×3 = 15

(iv) $[Ni(H_2O)_6]^{2+}$, $[Ni(NH_3)_6]^{2+}$ 05×2 = 10

(v)



05×2 = 10

vi $Ni(OH)_2$ வெளிர்பச்சை | green 05

vii $[Ni(H_2O)_6]^{2+}$ + Conc $6NH_3 \longrightarrow [Ni(NH_3)_6]^{2+} + 6H_2O$

05

75

150

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