G.C.E A/L Examination November - 2018

Filed Work Centre

FWC

Grade - 13 (2019) **CHEMISTRY** **Marking Scheme**

Part I

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

Part II A – Structured Essay

Q①: (a) (i) N (ii) Si (iii) S (iv) Cr (v) Sn

$\boxed{100}$

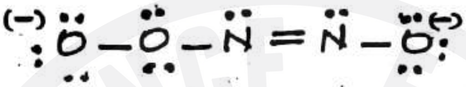
(vi) S, N

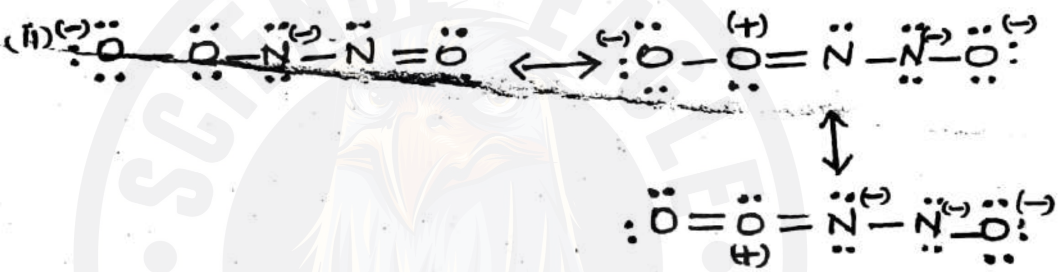
(a) ⇒ 7 × 04 = 28

(b) (i) True (ii) True (iii) False (iv) False

(v) True (vi) True

(b) ⇒ 6 × 04 = 24

(c) (I) (i)  03

(ii) 

3 × 03 = 09

(II)

	$O_{(1)}$	$N_{(2)}$	$N_{(3)}$	$P_{(4)}$
VSEPR pairs	4	3	3	4
electron pair geometry	tetrahedral	trigonal planar	trigonal planar	tetrahedral
shape	angular/V shaped	angular/V shaped	angular/V shaped	tetrahedral

12 × 03 = 36

(c) ⇒ 48

Q ② (a) (i) A = N / Nitrogen , B = O / Oxygen. 2 × 05 = 10

50

(ii) (I) $3Mg + N_2 \longrightarrow Mg_3N_2$

$2Mg + O_2 \longrightarrow 2MgO$ } 2 × 05 = 10

(II) $Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3$

05

III) Z = NH_3 / Ammonia (02)

Test : Adding Nessler's reagent (02)

observation : Brown colour (02)

IV) chloric(I) acid / hypochlorous acid (03)

use : as a bleaching agent (03)

(V) rhombic sulphur, monoclinic sulphur

$2 \times 03 =$ (06)

(VI) $3Mg + 2NH_3 \longrightarrow Mg_3N_2 + 3H_2$ (04)

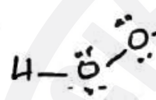
(VII) SO_2, NO_2 and H_2O $3 \times 01 =$ (03)

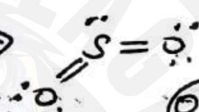
(a) ⇒ 50

(b) (i) $P = H_2O_2$, $Q = SO_2$ $2 \times 05 =$ (10)

50

(ii)

P ⇒  (05)

Q ⇒  (05)

(iii) $Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$ (05)

(iv) $2Cr^{3+}_{(aq)} + 10OH^-_{(aq)} + 3H_2O_{2(aq)} \longrightarrow 2CrO^{2-}_{4(aq)} + 8H_2O_{(l)}$ (05)

observation : Formation of yellow coloured solution (05)

(v) $2Mg + SO_2 \longrightarrow 2MgO + S$

or: $3Mg + SO_2 \longrightarrow 2MgO + MgS$

or: $SO_2 + 2H_2S \longrightarrow 3S + 2H_2O$

any one (03)

(vi) $R = H_2S$ (03)

(vii) Pass the gases Q and R through $(CH_3COO)_2Pb$ solution.

If black precipitate is formed, R is H_2S. (03)

(viii) P : $2MnO_4^- + 6H^+ + 5H_2O_2 \longrightarrow 2Mn^{2+} + 5O_2 + 8H_2O$

$2 \times 02 =$ (04) Q : $2MnO_4^- + 5SO_2 + 2H_2O \longrightarrow 2Mn^{2+} + 5SO_4^{2-} + 4H^+$

Q 3 : (a) (i) Rate $= k[A]^2$ 05

(ii) Expt 1: $4\times10^{-4}\,mol\,dm^{-3}s^{-1} = k(3.6\times10^{-3}\,mol\,dm^{-3})^2$ —— ①

$2\times05 = 10$

Expt 2: $x = k(1.8\times10^{-3}\,mol\,dm^{-3})^2$ —— ②

$\frac{②}{①} \Rightarrow \quad x = 1\times10^{-4}\,mol\,dm^{-3}s^{-1}$ 05

(iii) Using $R = k[A]^2$

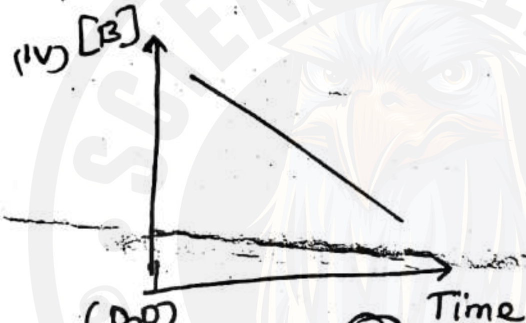
Expt. 1: $4\times10^{-4}\,mol\,dm^{-3}s^{-1} = k(3.6\times10^{-3})^2$

$2\times05 = 10$

Expt 3: 1.6×10^{-3} " $= k(c)^2$

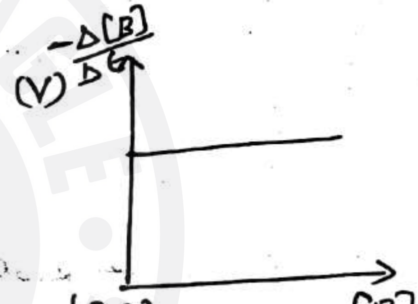
$\Rightarrow \quad c = 7.2\times10^{-3}\,mol\,dm^{-3}$ 04

(iv)



05

(v)



05

(vi) $R = k[A]^2$

$4\times10^{-4}\,mol\,dm^{-3}s^{-1} = k(3.6\times10^{-3}\,mol\,dm^{-3})^2$ 02

$\therefore k = \frac{4\times10^{-4}\,mol\,dm^{-3}s^{-1}}{3.6\times3.6\times10^{-6}\,mol^2dm^{-6}}$ 02

$= 3.086\times10^{-7}\,mol^{-1}dm^{3}s^{-1}$. 02 → 01+01

(vii) . Increasing the temperature

. Introducing a catalyst (decrease the E_a)

$2\times02 = 04$

44 (b)(i) From the given graph, after 2 minutes

decrease in concentration of P $= (0.6 - 0.5)\ mol\ dm^{-3}$

$= 0.1\ mol\ dm^{-3}$

(10)

Increase in concentration of Q $= 0.2\ mol\ dm^{-3}$

Therefore, rate of formation of Q is twice as the rate of consumption of P

Hence, n must be 2 ---- (05)

(ii) $P_{(g)} \rightleftharpoons 2Q_{(g)}$

$$K_c = \frac{[Q]^2_{eqm}}{[P]_{eqm}} = \frac{(0.6\ mol\ dm^{-3})^2}{0.3\ mol\ dm^{-3}} \checkmark \ (03)+(02)$$

(05)

$$= 1.6\ mol\ dm^{-3} \ (10)$$

(iii) Amt. (in moles) of P dissociated in 4 minutes $= (0.6 - 0.4)\ mol\ dm^{-3} \times 200 \times 10^{-3}\ dm^3$ (04)

$= 0.04\ mol$ (05)

---

(4) (a)(i) 25

$\boxed{CH_3-CH_2-\underset{CH_3}{\overset{OH}{C}}-CH_3}$ A

$\boxed{CH_3CH_2-\underset{CH_3}{CH}-CH_2OH}$ B

$\boxed{CH_3CH_2CH_2CH_2CH_2OH}$ C

$\boxed{CH_3-\underset{CH_3}{\overset{CH_3}{C}}-OH}$ D

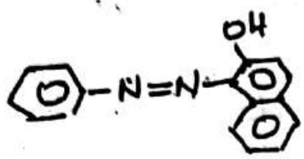
(ii) $\boxed{CH_3-CH_2-CH_2-\underset{OH}{CH}-CH_3}$ E

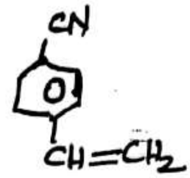
boxes $5 \times 05 = 25$

(b)(i) (i) 50

$C_2H_5-\underset{CH_3}{\overset{OH}{C}}-CH_3$

(II) $CH_3-\underset{OD}{CH}-CH_2CH_2-CH_2OD$

(iii) 

(iv) 

(v) $CH_3-\underset{|}{\overset{OH}{CH}}-CH_2Br$

(vi) $CH_3\underset{OH}{\underset{|}{CH}}\overset{CH_3}{CH}-COOH$

(vii) $CH_3CH_2CH_2NH_2$

(viii) 

(ix) $C_6H_5-\overset{OH}{\underset{CH_3}{C}}-CH_3$

(x) $CH_3-\underset{CH_3}{CH}-O-C_2H_5$ / or $CH_3-CH=CH_2$

Product $10 \times 05 = 50$

(e) 25

(i) $CH_3-\underset{CH_3}{CH}-Br$ 05

(ii) mechanism :

05 05

$CH_3-\underset{CH_3}{CH}-\ddot{O}-H \quad H-Br$

$\downarrow$

05

02

$(CH_3)_2-CH-\overset{+}{O}\begin{smallmatrix}H\\H\end{smallmatrix} + \bar{B}r$ 03

$\downarrow$

$(CH_3)_2-CH-Br + H_2O$

Part II B -

Q⑤ : (a) 55

(i) 4×03 = ⑫

$S_{(s/rhombic)} + O_{2(g)} \longrightarrow SO_{2(g)}$; $\Delta H_1 = -298\ kJmol^{-1}$ ①

$SO_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow SO_{3(g)}$; $\Delta H_2 = -98\ kJmol^{-1}$ ②

$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$; $\Delta H_3 = -287\ kJmol^{-1}$ ③

$SO_{3(g)} + H_2O_{(l)} \longrightarrow H_2SO_{4(l)}$; $\Delta H_4 = -130\ kJmol^{-1}$ ④

① + ② + ③ + ④ $\Rightarrow$ $S_{(s/rhombic)} + 2O_{2(g)} + H_{2(g)} \longrightarrow H_2SO_{4(l)}$ 04

$\Delta H = \Delta H_1 + \Delta H_2 + \Delta H_3 + \Delta H_4$

$= (-298 - 98 - 287 - 130)\ kJmol^{-1}$ 04

$= -813\ kJmol^{-1}$

05

(ii) (I) $\Delta S^{\ominus} = \Sigma S^{\ominus}_{Products} - \Sigma S^{\ominus}_{Reactants}$ (02)

$= 157\ kJmol^{-1} - (257+70)\ kJmol^{-1}$ (03)

$= -170\ kJmol^{-1}$ (05)

(II) $\Delta G^{\ominus} = \Delta H^{\ominus} - T\Delta S^{\ominus}$ (02)

$= -130\ kJmol^{-1} - 298K \times 0.170\ kJmol^{-1}K^{-1}$ (03)

$= -79.34\ kJmol^{-1}$ (05)

(III) Since $\Delta G^{\ominus} < 0$, the reaction is spontaneous at 298 K. (10)

Part(a) ⇒ 55

(b) (i) $2XY_{(g)} \rightleftharpoons X_{2(g)} + Y_{2(g)}$

55

Initially: – 1 mol 1 mol

At eq^{m}: $2x$ $(1-x)$ $(1-x)$ mol.

(i) $K_p = \dfrac{P_{X_2} \times P_{Y_2}}{P^2_{XY}}$ ----- (05)

(ii) $K_p = K_c(RT)^{\Delta n}$ where $\Delta n = 0$ ← (02) for identifying $\Delta n = 0$

$\therefore K_p = K_c$ ----- (03)

(iii) $K_p = 9\times10^{-2}$

$$9\times10^{-2} = \frac{\frac{(1-x)}{2}P \times \frac{(1-x)}{2}P}{\left(\frac{2x}{2}\times P\right)}$$ ---- (05)

$$9\times10^{-2} = \left(\frac{1-x}{2x}\right)^2$$ ----

$\frac{1-x}{2x} = 3\times10^{-1} \Rightarrow x = \frac{10}{16} = 0.625$ mol ---- (05)

At equilibrium $n_{X_2} = n_{Y_2} = \frac{6}{16}$ mol, $n_{XY} = \frac{20}{16}$ mol

$= 0.375$ mol ---(05) $= 1.25$ mol ---(05)

When $Y_{2(g)}$ is introduced to the system;

Let y be the no. of moles of $Y_{2(g)}$ introduced

$$2XY_{(g)} \rightleftharpoons X_{2(g)} + Y_{2(g)}$$

At Initial eq^{m} :	1.25	0.375	0.375	mol
New initial			(0.375+y)	mol (05)
New equilibrium	(1.25+2a)	(0.375−a)	(0.375+y−a)	mol (05)

$$n_{total} = 2 + y$$

Using $PV = nRT$, $n_{total} = \frac{PV}{RT}$

$$= \frac{4.988 \times 10^{7}\ Nm^{-2} \times 1 \times 10^{-3}\ m^{3}}{8.314\ J\ mol^{-1} K^{-1} \times 10^{3}\ K} \quad (05)$$

$$= 6 \text{ --- } (05)$$

$\therefore 2 + y = 6 \Rightarrow y = 4$

No of moles of Y_2 introduced to the system $= 4$ mol --- (05)

Part (b) ⇒ 55

(c) $CH_{4(g)} + H_2O_{(g)} \rightleftharpoons CO_{(g)} + 3H_{2(g)}$ 40

$$K_c = 2.4 \times 10^{-4}\ mol^{2} dm^{-6}$$

Initial concentrations

$$[CH_4]_{initial} = \frac{1.2 \times 10^{-2}\ mol}{2\ dm^3} = 6 \times 10^{-3}\ mol\ dm^{-3}$$

lll^{ly} $[H_2O]_{initial} = 4 \times 10^{-3}\ mol\ dm^{-3}$

$[CO]_{initial} = 8 \times 10^{-3}\ mol\ dm^{-3}$

$[H_2]_{initial} = 3 \times 10^{-3}\ mol\ dm^{-3}$

$4 \times 05 = 20$

Reaction quotient, $Q_c = \frac{[CO][H_2]^3}{[CH_4][H_2O]}$ ---- (05)

$$(05) = \frac{(8 \times 10^{-3}\ mol\ dm^{-3})(3 \times 10^{-3}\ mol\ dm^{-3})^3}{(6 \times 10^{-3}\ mol\ dm^{-3})(4 \times 10^{-3}\ mol\ dm^{-3})}$$

$$= 9 \times 10^{-6}\ mol^{2}\ dm^{-6} \text{ --- } (05)$$

Therefore, $Q_c < K_c$ ---- 03

Hence, the reaction will proceed to the right. ------ 03

Q. 6 (a) (i) Amount of A reacted in first 4 mins.

90

$$= (2 - 1.6)\ mol\,dm^{-3} \times 100 \times 10^{-3}\ dm^3 \quad 05$$

$$= 0.04\ mol \text{---} \quad 05$$

(ii) Initial rate of forward re^n.

$$R_f = K_f [A][B] \text{----} \quad 05$$

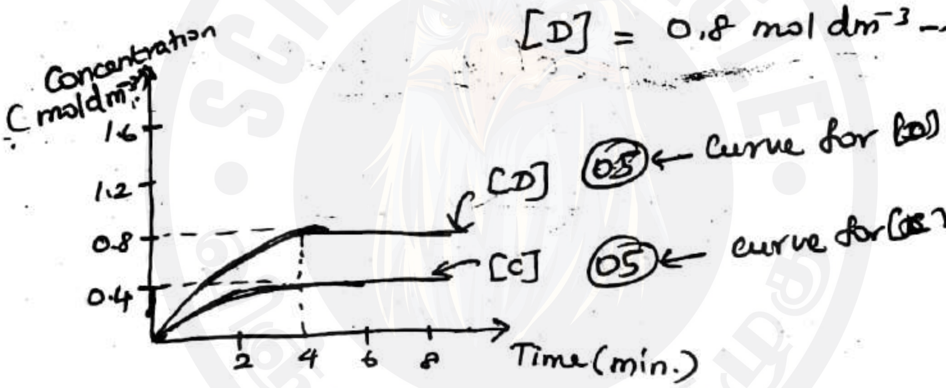
$$= 26.6\ mol^{-1} dm^3 min^{-1} \times (2\ mol\,dm^{-3})(1\ mol\,dm^{-3})$$

05

$$R_f = 53.2\ mol\,dm^{-3}\,min^{-1}$$

(iii) At equilibrium, $[C] = 0.4\ mol\,dm^{-3}$ ---- 05

$[D] = 0.8\ mol\,dm^{-3}$ ---- 05



(iv) $$K_c = \frac{[C][D]^2}{[A][B]} \text{------} \quad 05$$

$$= \frac{(0.4\ mol\,dm^{-3})(0.8\ mol\,dm^{-3})^2}{(1.6\ mol\,dm^{-3})(0.6\ mol\,dm^{-3})} \text{---} \quad 05$$

for substitution

$$= \frac{4}{15}\ mol\,dm^{-3} \text{-----} \quad 05$$

(v) $R_f = K_f [A][B]$

$R_r = K_r [C][D]^2$

At equilibrium, $R_f = R_r$

$\therefore K_f [A][B] = K_r [C][D]^2$

$$\frac{K_f}{K_r} = \frac{[C][D]^2}{[A][B]} = K_c$$

Derivation of $K_c = \frac{K_f}{K_r}$ --- 10

(vi) Using $k_r = \frac{k_f}{K_c}$, k_r can be calculated

$$k_r = \frac{26.6\ mol^{-1}\ dm^3\ min^{-1}}{4/15\ mol\ dm^{-3}} \text{ --- } 05$$

$$= 99.75\ mol^{-2}\ min^{-1} \text{ --- } 05$$

(vii) When the volume of the equilibrium mixture is doubled, concentrations of the species become half

$$Q_c = \frac{\left(\frac{0.4}{2}\ mol\ dm^{-3}\right)\left(\frac{0.8}{2}\ mol\ dm^{-3}\right)^2}{\left(\frac{1.6}{2}\ mol\ dm^{-3}\right)\left(\frac{0.6}{2}\ mol\ dm^{-3}\right)} \ 05$$

$$= \frac{2}{15} < K_c \ 05$$

Since $Q_c < K_c$, the net re^n occurs in the forward direction --- 05 (for prediction) Q(5)(a) ⇒ 90

60

(b) (i) $\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$ ------ 10

2×05 = 10

- In real gases, due to intermolecular attractions pressure exerted by the gas is reduced.
  ∴ A correction factor is added to P.
  $$P_{ideal} = P + \frac{n^2a}{V^2}$$
- Since individual volume of the real gas molecule is not neglible, volume available for gas molecules to move about is decreased
  ∴ A correction factor is subtracted from V.
  $$V_{ideal} = V - nb$$

(ii) High pressure and low temperature --- 2×05 = 10

(iii) Applying $PV = nRT$:--- 05

2×10 = 20

for gas A : $1 \times 10^5\ Nm^{-2} \times V = \frac{2}{M_A} \times R \times 300k$ ——— ①

for gas B : $3 \times 10^5\ Nm^{-2} \times 2V = \left(\frac{2}{M_A} + \frac{6}{M_B}\right) \times R \times 400$ ——— ②

From ① and ②, $\frac{M_A}{M_B} = \frac{7}{6}$ --- 05 Q(b) ⇒ 60

Q 7 (a) 75

$CH_3-CH=CH_2 \xrightarrow{\text{dil } H_2SO_4} CH_3-CH(OH)-CH_3$

$CH_3-CH(OH)-CH_3 \xrightarrow{PBr_3} CH_3-CH(Br)-CH_3 \xrightarrow{KCN} CH_3-CH(CN)-CH_3 \xrightarrow{LiAlH_4} CH_3-CH(CH_2NH_2)-CH_3$

$CH_3-CH(OH)-CH_3 \xrightarrow{KMnO_4/\text{dil. } H_2SO_4} CH_3-CO-CH_3$

$CH_3-CO-CH_3 + CH_3-CH(CH_2NH_2)-CH_3 \rightarrow CH_3-C(CH_3)=N-CH_2-CH(CH_3)-CH_3$

Reagents $5 \times 07 = 35$

Products $5 \times 08 = 40$

(b) 35

$R_1 \Rightarrow$ (i) $LiAlH_4$ (ii) H_2O

$R_2 \Rightarrow$ PCC

$R_3 \Rightarrow PCl_3$

$R_4 \Rightarrow$ Mg / Dry ether

$R_5 \Rightarrow$ Conc. H_2SO_4 Δ / Al_2O_3 Δ

$5 \times 03 = 15$

$P \Rightarrow CH_3-CH(OH)-CH(CH_3)-CH_3$ 05

$X_1 \Rightarrow CH_3COOH$

$X_2 \Rightarrow CH_3CH_2OH$

$X_3 \Rightarrow CH_3CHO$

$Y_1 \Rightarrow CH_3CH(OH)CH_3$

$Y_2 \Rightarrow CH_3-CH(CH_3)-Cl$

$Y_3 \Rightarrow CH_3-CH(CH_3)-MgCl$

$6 \times 2\frac{1}{2} = 15$

(c) (I) 40

(i) $ROH + H_3O^+ \rightleftharpoons R\overset{+}{O}H_2 + H_2O$

alkyl oxonium ion

$RNH_2 + H_3O^+ \rightleftharpoons R\overset{+}{N}H_3 + H_2O$

alkyl ammonium ion

Explanation

Since 'O' atom is more electronegative than 'N' atom ability to donate the lone pair ~~of~~ electrons on 'N' is higher than that of O. Therefore, alkyl ammonium ion is more stable relative to amine compared to alkyl oxonium ion relative to alcohol.

$2 \times 15 = 30$

(ii) Due to delocalization of lone pairs of O in phenol with benzene ring, C–O bond has partial double bond character. Bond length short and hence high bond energy.

∴ Phenol does not undergo nucleophilic substitution

10

(iii) $CH_3CONH_2 < C_6H_5NH_2 < NH_3 < CH_3NH_2 < (CH_3)_2NH$

Q 8 (a) 70

(i) $[Fe(H_2O)_6]^{2+}$ – hexaaquairon(II) ion $2\times 10 = 20$

(ii) $D = Fe(OH)_2$, $E = BaSO_4$, $G = Fe(OH)_3$ $3\times 05 = 15$

(iii) NH_3 ---- 05

(iv) $2Fe^{3+}_{(aq)} + Zn_{(s)} \longrightarrow 2Fe^{2+}_{(aq)} + Zn^{2+}_{(aq)}$ ---- 05

(v) Cations : NH_4^+ and Fe^{2+} ---- $2\times 05 = 10$

Anion : SO_4^{2-} ---- 05

Compound A may be $FeSO_4 \cdot (NH_4)_2SO_4$. ---- 10

(b) 80

(i) $X = Cr$, $Y = Ti$, $Z = Mn$ $\Big\}$ $3\times 08 = 24$

(ii) $[Cr(NH_3)_6]^{3+}$ yellow brown

$[Ti(H_2O)_6]^{3+}$ violet

$[MnCl_4]^{2-}$ greenish yellow

$6\times 04 = 24$

(iii) CrO basic

Cr_2O_3 amphoteric

CrO_3 acidic

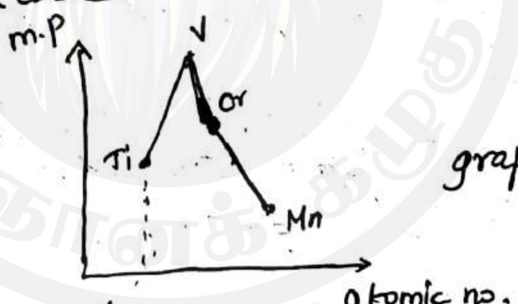
$3\times 02 = 06$

(iv) $+2, +3, +4, +6, +7$

$5\times 05 = 05$

(v) $MnO_4^- + 2H_2O + 3e \longrightarrow MnO_2 + 4OH^-$ 05

(vi) $Q = V$ 05



graph 05

Q 9 (a) 60

(i) $8NH_3 + 3Cl_2 \longrightarrow N_2 + 6NH_4Cl$

(ii) $PbS + 4H_2O_2 \longrightarrow PbSO_4 + 4H_2O$

(iii) $4HNO_3 \longrightarrow 2H_2O + 4NO_2 + O_2$

(iv) $3S + 6NaOH \longrightarrow 2Na_2S + Na_2SO_3 + 3H_2O$

or : $4S + 6NaOH \longrightarrow Na_2S + Na_2S_2O_3 + H_2O$

(v) $\underset{(excess)}{H_2S} + NaOH \longrightarrow NaHS + H_2O$

(vi) $3NO_3^- + 8Al + 5OH^- + 2H_2O \longrightarrow 3NH_3 + 8AlO_2^-$

$\Big\}$ $6\times 10 = 60$

(b) (i) $Q = KMnO_4$ ----- 10

50

(ii) $2KMnO_4 \longrightarrow K_2MnO_4 + MnO_2 + O_2$ ---- 10

(iii) $3MnO_4^{-} + 2H_2O \longrightarrow 2MnO_4^{-} + MnO_2 + 4OH^{-}$ 05

(iv) Observations :

2x05 = 10

- Green coloured solution turns to violet colour
- Brown coloured ppt. formed.

(v) $MnO_2 + 2NaBr + 2H_2SO_4 \longrightarrow MnSO_4 + Na_2SO_4 + Br_2 + 2H_2O$ 10

Orange/reddish brown solution obtained. 05

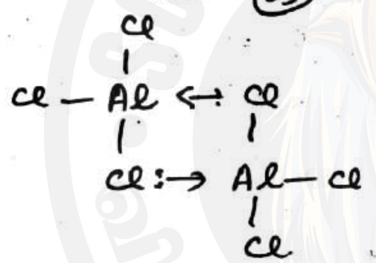
(I)

(c) (i) Group IIIA / 13 05

40

(ii) A = Al 05

(iii)



05

(iv) A gelatinous white precipitate is formed first and it dissolves in excess NaOH 10

(II) (i) $HF/H_2O \Rightarrow$ H-bond

(ii) $I^{-}/H_2O \Rightarrow$ Ion-dipole interaction / London forces

(iii) $CO_2/H_2O \Rightarrow$ Dipole-induced dipole / London forces

3x05 = 15

Q 10 (a) (i) Starch indicator---- 05

90

Colour change : blue $\longrightarrow$ colourless 05

(ii) Explanation ------- 10

(iii) $IO_3^{-} + 5I^{-} + 6H^{+} \longrightarrow 3I_2 + 3H_2O$

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

$2Cu^{2+} + 2I^{-} \longrightarrow 2Cu^{+} + I_2$

or $2Cu^{2+} + 4I^{-} \longrightarrow 2CuI + I_2$

3x 10 = 40

Procedure I

Molar mass of KIO_3 = 214 $g\,mol^{-1}$ (02)

$$n_{KIO_3} = \frac{1.07\,g}{214\,g\,mol^{-1}} = 0.005\ mol \quad (02)$$

No of moles of IO_3^- in 10 cm^3 = 5×10^{-4} mol. (02)

$IO_3^- : S_2O_3^{2-} = 1:6$ (02)

$n_{S_2O_3^{2-}}$ required = $(5\times10^{-4})\times 6$ mol (02)

If c is the concentration of $S_2O_3^{2-}$(aq),

$$\frac{c\times 12.5}{1000} = 5\times10^{-4}\times 6$$

$$\Rightarrow c = \frac{3}{12.5} = 0.24\ mol\,dm^{-3} \quad (05)$$

Procedure II : No of moles of $S_2O_3^{2-}$

$$= \frac{0.24}{1000}\times 7.25\ mol$$

$$= 1.74\times10^{-3}\ mol \quad (05)$$

$Cu^{2+} : S_2O_3^{2-} = 1:1$ (05)

$$\therefore n_{Cu^{2+}} = 1.74\times10^{-3}\ mol$$

$n_{Cu^{2+}}$ in 1 dm^3 = 1.74×10^{-1} = 0.174 mol

∴ Concentration of $CuSO_4$

$$= 0.174\ mol\,dm^{-3} \quad (05)$$

(b) (i) X = Co (10)

60

(ii) $[Co(NH_3)_6]^{2+}$ (10) shape : octahedral (10)

(iii) hexaamminecobalt (II) ion (10)

(iv) $[CoCl_4]^{2-}$ (10) blue (10)

Part I - 50 × 01 = 50%.

Part II : Structure 4×100 = 400
Essay 4 × 150 = 600

II : $\frac{(400+600)}{20}$ = 50%.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