A.S.

Grade 13 - Chemistry

Part A - Structured Essay

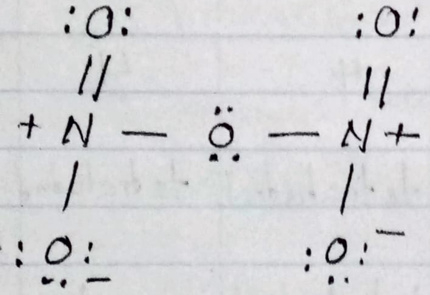
Answer sript

(01) (a) Write the answers to the question given below on the dotted lines.

i) $CHCl_3$
ii) N^{3-}
iii) CO
iv) NO_4^{3-}
v) Na^+
vi) SF_6

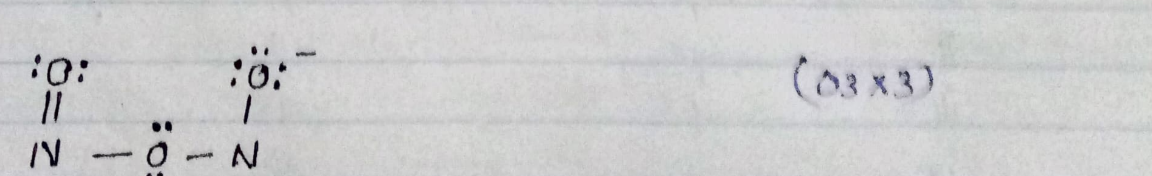
(03x6)

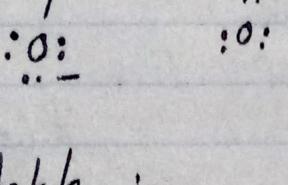
(b) i)



(06)

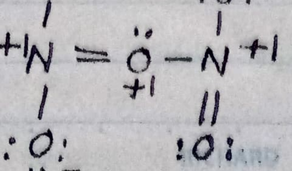
(ii)



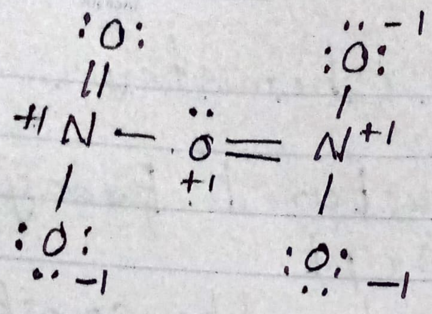


(03x3)

Unstable :-
structure



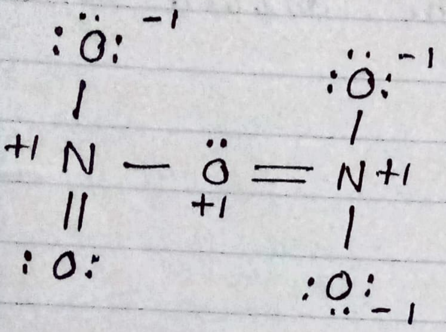
- two positive charges on adjacent atoms
- +ve charge on more electronegative Oxygen.



* two positive charges on adjacent atoms.

* -ve charge one more electronegative O

* Charge distribution is high.



* ,,

* ,,.

(III)

	C_1	C_2	O_3	N_3	N_4
I	2	4	4	3	3
II	linear	tetrahedral	tetrahedral	Trigonal planer	Trigonal planer
III	linear	tetrahedral	angular	angular	Trigonal planer.
IV	sp	sp^3	sp^3	sp^2	sp^2.

(01x20)

(IV)

I	sp	sp or 2p.
II	sp^3	1s
III	sp^3	sp^3
IV	sp^2	sp^2
V	sp^2	4p
VI	sp^2	sp^3 / 2p
V		

(01x12)

(v) 2p a o 2p a o (01×2)

(vi) C^1 180° C^2 109° - 1095°
O^3 104.5° N^4 117° - 120° (01×5)
N^5 120°.

(vii) $C^2 < C^1 < N^4 < N^5 < O^3$ (01)

(b) I. (i) $Be(NO_3)_2 < Mg(NO_3)_2 < Ca(NO_3)_2 < Sr(NO_3)_2$

(ii) $Na_2O < SiO_2 < SO_3 < Cl_2O_7$

(iii) K < Ca < Al < Si

(iv) $Mg(OH)_2 < Ca(OH)_2 < Sr(OH)_2 < NaOH$ (03×4)

II i) True ii) false iii) false. (03×3)

(Q2) (i) A - $SbCl_3$
B - ZnS
C - NCl_3
D - $(NH_4)_2Cr_2O_7$
E - $Mg(NO_3)_2$ (04×5)

(ii) $SbCl_{3(aq)} + H_2O_{(l)} \rightleftharpoons SbOCl_{(s)} + 2HCl_{(aq)}$
$ZnS_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_2S_{(g)}$
$NCl_{3(l)} + 3H_2O_{(l)} \longrightarrow NH_{3(aq)} + 3HOCl_{(aq)}$
$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2O_3 + N_2 + 4H_2O$
$2Mg(NO_3)_2 \xrightarrow{\Delta} 2MgO + 4NO_2 + O_2$
(04×5)

(iii) B - I When this gas passed to acidified $K_2Cr_2O_7$ solution with change the colour (orange) to green milky solution.

II A $NaOH_{(aq)} + H_2S_{(aq)} \longrightarrow NaHS_{(aq)} + H_2O_{(l)}$

OR

$2NaOH + \overset{\text{limitel}}{H_2S_{(g)}} \longrightarrow Na_2S_{(aq)} + 2H_2O_{(l)}$

B) $2Na_{(s)} + \overset{\text{Excess}}{2H_2S_{(g)}} \longrightarrow 2NaHS_{(s)} + H_{2(g)}$

OR

$2Na_{(s)} + \overset{\text{limited}}{H_2S_{(g)}} \longrightarrow Na_2S_{(s)} + H_{2(g)}$

OR.

$Mg_{(s)} + H_2S_{(g)} \longrightarrow MgS_{(s)} + H_{2(g)}$.

c) $2KMnO_{4(aq)} + 3H_2SO_{4(aq)} + 5H_2S_{(g)} \longrightarrow K_2SO_{4(aq)} + 5S_{(s)} + 2MnSO_{4(aq)} + 8H_2O_{(l)}$

OR

$K_2Cr_2O_{7(aq)} + 4H_2SO_{4(aq)} + 3H_2S_{(g)} \longrightarrow K_2SO_{4(aq)} + Cr_2(SO_4)_3 + 3S + 7H_2O$

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

(3) III $3Mg_{(s)} + 2NH_{3(g)} \longrightarrow Mg_3N_2 + 3H_2$.

(04×4)

(b) ~~Following~~

I $X - Ni^{2+}$

$Y - Fe^{3+}$

$Z - Cu^{2+}$. (04×3)

II

X_1 - green $Ni(OH)_2$

X_2 - deep blue $[Ni(NH_3)_6]^{2+}$.

Y_1 - reddish brown $Fe(OH)_3$

bl… (03×4) $Cu(OH)_2$ (03×4)

III A $[Cu(H_2O)_6]^{2+} + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+} + 6H_2O$ (03)

B. i) $[Ni(H_2O)_6]^{2+}_{(aq)} + 4Cl^-_{(aq)} \longrightarrow [NiCl_4]^{2-} + 6H_2O_{(l)}$ (03)

ii) yellow. (02)

(03) (a) i) $Mg(OH)_{2(s)} \rightleftharpoons Mg^{2+}_{(aq)} + 2OH^-_{(aq)}$ (05)

(ii) $K_c = \dfrac{[Mg^{2+}_{(aq)}][OH^-_{(aq)}]^2}{[Mg(OH)_{2(s)}]}$ (03)

$[Mg(OH)_{2(s)}]$ is constant (02)

$\underbrace{K_c[Mg(OH)_{2(s)}]}_{\text{Constant}} = [Mg_{(aq)}]^{2+}[OH^-_{(aq)}]^2$ (02)

$\therefore K_{sp} = [Mg^{2+}_{(aq)}][OH^-_{(aq)}]^2$ // (03)

$\boxed{15}$

(iii) $[Mg^{2+}_{(aq)}] = \dfrac{8.55 \times 10^{-5}\ mol}{500\ cm^3} \times \dfrac{1000\ cm^3}{1\ dm^3}$ (04)

$= 1.71 \times 10^{-4}\ mol\ dm^{-3}$. (03)

$[OH^-_{(aq)}] = 2[Mg^{2+}_{(aq)}]$ (02)

$= 2 \times 1.71 \times 10^{-4}\ mol\ dm^{-3}$

$= 3.42 \times 10^{-4}\ mol\ dm^{-3}$ (02)

$K_{sp} = (1.71 \times 10^{-4}\ mol\ dm^{-3})(3.42 \times 10^{-4}\ mol\ dm^{-3})$ (02)

$= 2.00 \times 10^{-11}\ mol\ dm^{-9}$ (03)

$\boxed{15}$

(iv) Ksp = 2.0×10^{-11} $mol^3\,dm^{-9}$. (04)

Ksp is constant at constant temperature (03)
It does not depends on the volume (03) $\boxed{10}$

(v) In Common ion OH^- is added. (04)
Reverse reaction is favored to decrease (03)
$[OH^-(aq)]$ to keep Ksp constant at (03)
25°C. $\boxed{10}$

50

ⓑ (i) $$K_b = \frac{[CH_3CH_2NH_3^+(aq)][OH^-(aq)]}{[CH_3CH_2NH_2(aq)]}$$ (05)

(ii) ~~[C₂H~~

$$[C_2H_5NH_2(aq)] = \frac{5.625\,g}{45\,g\,mol^{-1}} \times \frac{1000\,cm^3 \times 1}{500\,cm^3\,1\,dm^3}$$ (05)

$= 0.25\ mol\ dm^{-3}$. (05)

Consider the equilibrium.

$$C_2H_5NH_2(aq) + H_2O(l) \rightleftharpoons C_2H_5COO^-(aq) + H_3O^+(aq)$$

Initial/mol dm⁻³	0.25	0	0
Change/mol dm⁻³	−x	x	x
At equilibrium	0.25−x	x	x

(05)

$$K_b = \frac{[C_2H_5COO^-(aq)][H_3O^+(aq)]}{[C_2H_5NH_2(aq)]}$$

5.37×10^{-4} = $x \cdot x$ $\quad 0.25 - x \approx 0.25$

$x^2 = 5.37 \times 10^{-4} \times 0.25$

$x = 0.0116$ ~~mol dm⁻³~~.

$[OH^-] = 0.0116 \text{ mol dm}^{-3}$ .. (05)

At 25°C $K_w = [OH^-][H_3O^+]$. (05)

~~k×~~$[H_3O^+] = \dfrac{10^{-4} \text{ mol}^2 \text{dm}^{-3}}{1.16 \times 10^{-2} \text{ mol dm}^{-3}}$ (05)

$= 8.62 \times 10^{-13} \text{ mol dm}^{-3}$.

$pH = -\log_{10} \dfrac{[H_3O^+]}{1 \text{ mol dm}^{-3}}$ (05)

$= -\log_{10} \left(\dfrac{8.62 \times 10^{-13} \text{ mol } \cancel{\text{dm}^{-3}}}{1 \text{ mol } \cancel{\text{dm}^{-3}}} \right)$

$= 13 - 0.9355$

$= 12.0645$ (05)

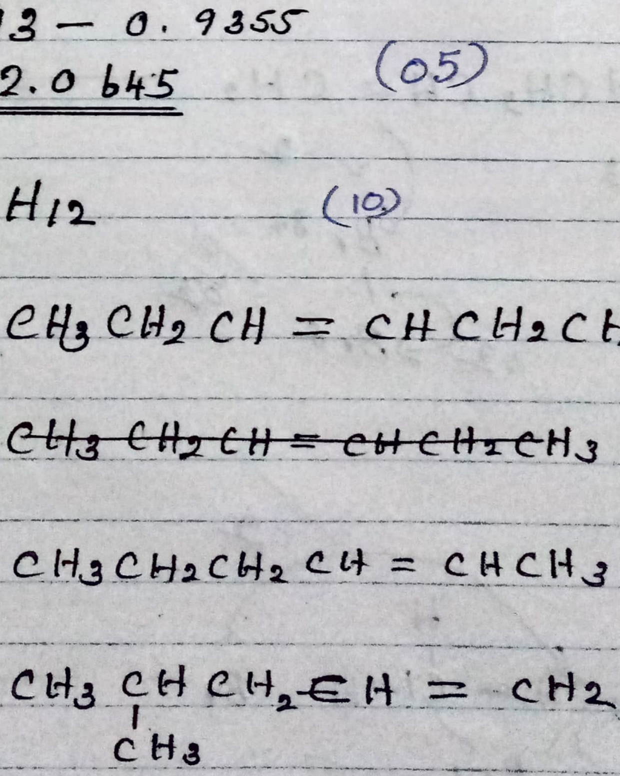
$\triangle 50$

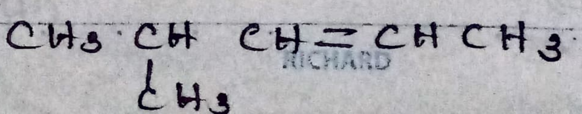
④ ⓐ I C_6H_{12} (10)

II P $CH_3CH_2CH = CHCH_2CH_3$

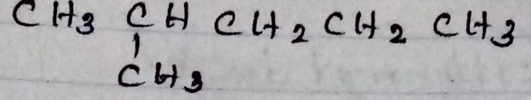
~~Q $CH_3CH_2CH = CHCH_2CH_3$~~

Q $CH_3CH_2CH_2CH = CHCH_3$

R 
$CH_3\underset{\displaystyle CH_3}{CH}CH_2CH = CH_2$

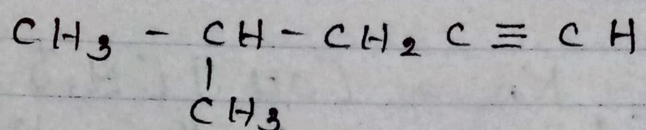
S 
$CH_3\underset{\displaystyle CH_3}{CH}CH = CHCH_3$ (05X4)

T $CH_3CH_2CH_2CH_2CH_2CH_3$

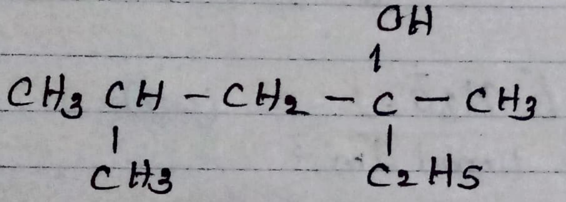
U 
$CH_3\underset{\underset{CH_3}{|}}{CH}CH_2CH_2CH_3$.

(05 x2)

ii) Diasteréoisomerism. (05)

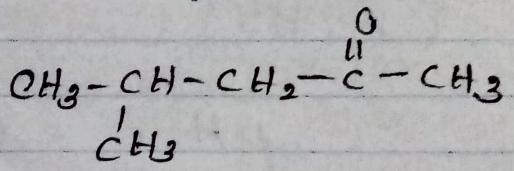
iii) A— 
$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2C\equiv CH$. (05)

(iv) Y


$CH_3\underset{\underset{CH_3}{|}}{CH}-CH_2-\overset{\overset{OH}{|}}{\underset{\underset{C_2H_5}{|}}{C}}-CH_3$

(05)

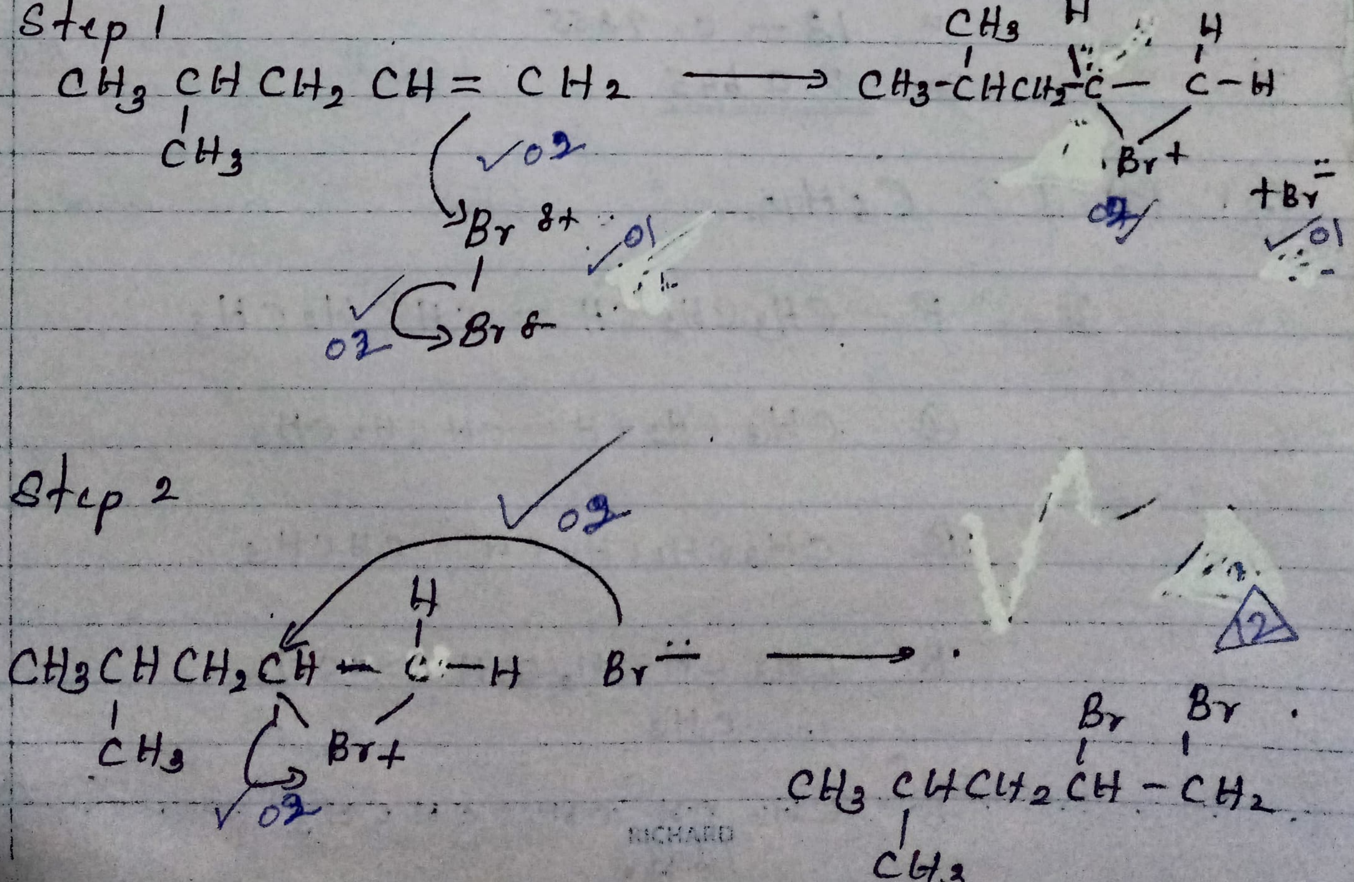
X.


$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$

(05)

60

(v) Step 1



12

1	A_E	C_8, C_9	$Br^{\delta+}$
2	S_E	C_3, C_5	NO_2^+
3	A_N	C_7	$C_2H_5^-$
4.	S_N	C_{10}	CN^-

02×14 = 28

රසායන විද්‍යාව — II   2021

ලකුණු දීමේ පටිපාටිය.

⑤ (a) (1)

	$2A_{(g)}$ $\rightleftharpoons$	$B_{(g)}$ +	$C_{(g)}$	
ආරම්භක ප්‍රමාණ	0.50	0	0	mol ✓
වෙනස	− 2×0.10	+ 0.10	+ 0.10	mol
සමතුලිත ප්‍රමාණ	0.5 − 0.20	0.10	0.10	mol ✓
	0.30	0.10	0.10	mol ✓

සමතුලිත මුළු මවුල $= (0.30 + 0.10 + 0.10)$ mol ✓

$= 0.50$ mol ✓

පද්ධ නියට $PV = nRT$ ✓

$$P = \frac{nRT}{V} = \frac{0.50\,\text{mol} \times 8.314\,\text{J mol}^{-1}\text{K}^{-1} \times 400\,\text{K}}{8.314 \times 10^{-3}\,\text{m}^3}$$ ✓

$= 2.0 \times 10^5$ Pa ✓

02×8=16

(ii) $X_A = \frac{0.30\,\text{mol}}{0.50\,\text{mol}} = \frac{3}{5}$ ✓

$X_B = X_C = \frac{0.10\,\text{mol}}{0.50\,\text{mol}} = \frac{1}{5}$ ✓✓ 02×3 = 06

$P_{A(g)} = \frac{3}{5} \times 2.0 \times 10^5$ Pa ✓

$= 1.2 \times 10^5$ Pa

$P_{B(g)} = P_{C(g)} = \frac{1}{5} \times 2.0 \times 10^5$ Pa ✓

$= 4.0 \times 10^4$ Pa ✓ 03×3 = 09

(15)

(iii) $K_p = \frac{P_{B(g)} \times P_{C(g)}}{P^2_{A(g)}}$ ✓ (05)

$= \frac{4.0 \times 10^4\,\text{Pa} \times 4.0 \times 10^4\,\text{Pa}}{(1.2 \times 10^5\,\text{Pa})^2}$ ✓ (04)

$= 0.111$ (04)

13

D.........
M.........
Y. 201

(iv) $K_p = K_c (RT)^{\Delta n}$ ✓

$\Delta n = 1+1-2 = 0$ ✓

$K_p = K_c (RT)^0$ ✓

$K_p = K_c$

$K_c = 0.111$ ✓ $\boxed{03 \times 4 = 12}$

(v)

	$2A(g)$	$\rightleftharpoons$ $B(g)$	+ $C(g)$	
මවුල ප්‍රමාණ	0.40	0.20	0.10	mol ✓
සාන්ද්‍රණ	$\frac{0.40}{8.314}$	$\frac{0.20}{8.314}$	$\frac{0.10}{8.314}$	$\frac{mol}{dm^3}$ ✓

$$Q_c = \frac{[B(g)]\,[C(g)]}{[A(g)]^2}$$ ✓

$$= \frac{\frac{0.20}{8.314}\, mol\,dm^{-3} \times \frac{0.10}{8.314}\, mol\,dm^{-3}}{\left(\frac{0.40}{8.314}\, mol\,dm^{-3}\right)^2}$$ ✓

$= 0.125$ ✓

$Q_c > K_c$ ✓

සමතුලිතතාවයේ නොපවතී. ✓

සමතුලිතතාවයට එළඹෙන තෙක් පද්ධතිය වමට ගමන් කරයි. ($Q_c = K_c$ වන තෙක්) ✓ $\boxed{02 \times 8 = 16}$

(vi) වායුන් පරිපූර්ණ ලෙස හැසිරෙන බව. $\boxed{03}$

75

(b) $2AB_3(g) \longrightarrow A_2(g) + 3B_2(g)$

(i) $\Delta H_{rxn} = \sum \Delta H_{f\,(product)} - \sum \Delta H_{f\,(reactants)}$ ✓ 05

$= (0.0 + 3 \times 0.0)\ kJ\ mol^{-1} - 2 \times (-46.0)\ kJ\ mol^{-1}$ ✓ 04

$= 92.0\ kJ\ mol^{-1}$ ✓ 04 $\boxed{12}$

(ii) $\Delta S_{rxn} = S_{products} - S_{reactants}$ ✓ 05

$= (189.0 + 3 \times 127.0)\ J\ mol^{-1}K^{-1} - 2 \times 193.0\ kJ\ mol^{-1}$ 04

$= 184.0\ J\ mol^{-1}K^{-1}$ ✓ 04 $\boxed{13}$

(iii) $\Delta G_{rxn} = \Delta H_{rxn} - T\Delta S_{rxn}$ ✓ 05

$= 92.0\ kJ\ mol^{-1} - 300K \times 184.0 \times 10^{-3}\ kJ\ mol^{-1}K^{-1}$ ✓ 04

$= 36.8\ kJ\ mol^{-1}$ ✓ 04 $\boxed{13}$

(v) $\Delta G_{rxn} > 0$ බැවින්, මෙම තත්ත්ව යටතේ ප්‍රතික්‍රියාව ස්වයංසිද්ධ නොවේ: ✓

ස්වයංසිද්ධවන අවම උෂ්ණත්වයේදී $\Delta G = 0$ වේ: ✓

$\Delta H - T\Delta S = 0$ ✓

$T = \frac{\Delta H}{\Delta S} = \frac{92.0\ kJ\ mol^{-1}}{184.0 \times 10^{-3}\ kJ\ mol^{-1}K^{-1}}$

$= 500\ K$ ✓ $03 \times 5 = 15$

(vi) $\Delta H = -92.0\ kJ\ mol^{-1}$ ⓪⑥

(vii) $2AB_3(g) \longrightarrow A_2(g) + 3B_2(g)$

$\Delta H_{rxn} = \sum$ කැඩෙන බන්ධනවල බන්ධන ශක්තීන් එකතුව $- \sum$ සෑදෙන බන්ධනවල බන්ධන ශක්ති එකතුව ✓

$= 6 \times \Delta H_{b(A-B)} - \{\Delta H_{b(A\equiv A)} + 3\Delta H_{b(B-B)}\}$

$92.0\,kJ\,mol^{-1} = 6 \times \Delta H_{D\,(A-B)} - (950\,kJ\,mol^{-1} + 3 \times 450\,kJ\,mol^{-1})$ ✓

$\Delta H_{D\,(A-B)} =$ .... ✓ (05×3 = 15)

06 (a) (i)

නව $[NH_4Cl(aq)] = \dfrac{C_1\,mol\,dm^{-3} \times V_1 \times 10^{-3}\,dm^3}{(V_1+V_2) \times 10^{-3}\,dm^3}$ ✓ $= \dfrac{C_1 V_1}{(V_1+V_2)}\,mol\,dm^{-3}$ ✓

$[NH_3(aq)]_{New} = C_2\,mol\,dm^{-3} \times \dfrac{V_2 \times 10^{-3}\,dm^3}{(V_1+V_2) \times 10^{-3}\,dm^3}$ ✓ $= \dfrac{C_2 V_2}{V_1+V_2}\,mol\,dm^{-3}$ ✓

$NH_4Cl(aq) \longrightarrow \overset{+}{N}H_4(aq) + Cl^-(aq)$ ✓

$\dfrac{C_1 V_1}{V_1+V_2}\,mol\,dm^{-3}$ ✓

$NH_3(aq) + H_2O(l) \rightleftharpoons \overset{+}{N}H_4(aq) + \overline{O}H(aq)$ ✓

ආරම්භයේදී $\dfrac{C_2V_2}{V_1+V_2}$ ~ $\dfrac{C_1V_1}{V_1+V_2}$ 0 $mol\,dm^{-3}$ ✓

සාන්ද්‍රණ වෙනස $-x$ ~ $+x$ $+x$ $mol\,dm^{-3}$

සමතුලිතතාවේදී $\dfrac{C_2V_2}{V_1+V_2} - x$ $\dfrac{C_1V_1}{V_1+V_2} + x$ x $mol\,dm^{-3}$ ✓

$$K_b = \frac{[\overset{+}{N}H_4(aq)][\overline{O}H(aq)]}{[NH_3(aq)]}$$ ✓

$$= \frac{\left(\frac{C_1V_1}{V_1+V_2} + x\right) mol\,dm^{-3} \times x\,mol\,dm^{-3}}{\left(\frac{C_2V_2}{V_1+V_2} - x\right) mol\,dm^{-3}}$$ ✓

භෂ්මය දුර්වල නිසා $K_b \ll$ ∴ $x \ll$ ✓

$\dfrac{C_1V_1}{V_1+V_2} + x \simeq \dfrac{C_1V_1}{V_1+V_2}$ ✓ ; $\dfrac{C_2V_2}{V_1+V_2} - x \simeq \dfrac{C_2V_2}{V_1+V_2}$ ✓

$$K_b = \frac{\left(\frac{C_1V_1}{V_1+V_2}\right)x}{\frac{C_2V_2}{V_1+V_2}} = \frac{x \cdot C_1V_1}{C_2V_2}$$ ✓

$$x = K_b \frac{C_2V_2}{C_1V_1}$$

$$[OH^-(aq)] = K_b \frac{C_2V_2}{C_1V_1} \text{ mol dm}^{-3}$$ ✓

$$pOH = -\log \frac{[OH^-(aq)]}{1 \text{ mol dm}^{-3}}$$ ✓

$$pOH = -\log K_b \frac{C_2V_2}{C_1V_1}$$ ✓

$$pOH = -\log K_b - \log \frac{C_2V_2}{C_1V_1}$$ ✓

$$K_w = [H_3O^+(aq)][OH^-(aq)]$$ ✓

$$-\log K_w = -\log[H_3O^+(aq)] - \log[OH^-(aq)]$$

$$pK_w = pH + pOH$$ ✓

$$pH = pK_w - pOH$$ ✓

$$= pK_w - \left(-\log K_b - \log \frac{C_2V_2}{C_1V_1}\right)$$ ✓

$$= pK_w - \log K_b + \log \frac{C_2V_2}{C_1V_1}$$

$$pH = pK_w - pK_b + \log \frac{C_2V_2}{C_1V_1}$$ ✓

02 × 25 = 50

$$pH = -\log 1\times10^{-14} - (-\log 1.8\times10^{-5}) + \log \frac{0.2 \text{ mol dm}^{-3} \times 25\times10^{-3} \text{ dm}^3}{0.1 \text{ mol dm}^{-3} \times 25\times10^{-3} \text{ dm}^3}$$

✓(05

$$= 14 - (5 - 0.2553) + 0.3010$$

$$= 9.5563 \approx 9.56$$ ✓

(05)

60

(b)(1) $BaCl_{2(aq)} \longrightarrow Ba^{2+}_{(aq)} + 2Cl^{-}_{(aq)}$

$[Ba^{2+}_{(aq)}] = 1.0 \times 10^{-3}\ mol\ dm^{-3} \times \frac{25.0\ cm^3}{(25+25)\ cm^3}$ ✓

$= 5.0 \times 10^{-4}\ mol\ dm^{-3}$ ✓

$H_2SO_{4(aq)} \longrightarrow 2H^{+}_{(aq)} + SO_4^{2-}{}_{(aq)}$

$[SO_4^{2-}{}_{(aq)}] = 1.0 \times 10^{-3}\ mol\ dm^{-3} \times \frac{25\ cm^3}{(25+25)\ cm^3}$ ✓

$= 5.0 \times 10^{-4}\ mol\ dm^{-3}$ ✓

$BaSO_{4(s)} \rightleftharpoons Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$ ✓

ද්‍රාවණයේ BaSO4 වල අයනික ගුණිතය $\} = [Ba^{2+}_{(aq)}][SO_4^{2-}{}_{(aq)}]$ ✓

$= 5.0 \times 10^{-4}\ mol\ dm^{-3} \times 5.0 \times 10^{-4}\ mol\ dm^{-3}$ ✓

$= 2.5 \times 10^{-7}\ mol^2\ dm^{-6}$ ✓

$2.5 \times 10^{-7} > K_{sp(BaSO_4)}$ ✓

∴ ද්‍රාවණය තුළ BaSO4 අවක්ෂේප වේ ✓ (03×10 = 30)

(11) $BaCl_{2(aq)} + H_2SO_{4(aq)} \longrightarrow BaSO_{4(s)} + 2HCl_{(aq)}$

ස්ටොයිකියෝමිතිය 1 1

$n_{BaCl_2} = 1.0 \times 10^{-3}\ mol\ dm^{-3} \times 25 \times 10^{-3}\ dm^3 = n_{H_2SO_4}$

∴ ද්‍රාවණය තුළ පොදු අයනක් ඉතිරි නොපවතී ✓

$BaSO_{4(s)} \rightleftharpoons Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$

සමතුලිතතාවයේදී ~ S S ✓

$K_{sp} = [Ba^{2+}_{(aq)}][SO_4^{2-}{}_{(aq)}]$ ✓

$1 \times 10^{-10}\ mol^2\ dm^{-6} = S \times S$ ✓

$S = 1.0 \times 10^{-5}\ mol\ dm^{-3}$

$[Ba^{2+}_{(aq)}] = 1.0 \times 10^{-5}\ mol\ dm^{-3}$ ✓ (02×5 = 10)

(c) (i) $K_D = \frac{[X]_{CHCl_3}}{[X]_{H_2O}} = 10$ ✓

$CHCl_3$ තුළට නිස්සාරණය වන X හි ස්කන්ධය $x\,g$ නම් ✓

$[X]_{CHCl_3} = \frac{x\,g}{100 \times 10^{-3}\,dm^3}$ හෝ $\frac{\frac{x\,g}{M \times g\,mol^{-1}}}{100 \times 10^{-3}\,dm^3}$ ✓

$[X]_{H_2O} = \frac{(10 - x)\,g}{100 \times 10^{-3}\,dm^3}$ ✓ හෝ $\frac{\frac{(10-x)\,g}{M \times g\,mol^{-1}}}{100 \times 10^{-3}\,dm^3}$

$$\frac{\frac{x}{100 \times 10^{-3}}\,g\,dm^{-3}}{\frac{(10-x)}{100 \times 10^{-3}}\,g\,dm^{-3}} = 10 \quad ✓$$

$$\frac{x}{10-x} = 10$$

$$x = 100 - 10x$$

$$11x = 100$$

$$x = \frac{100}{11} = 9.09\,g \,//. ✓$$

නිස්සාරිත වන X හි ස්කන්ධය 9.09 g ✓

පළමු නිස්සාරණයේදී
(ii) $CHCl_3$ 50.0 cm^3 තුළට නිස්සාරණය වන X හි ස්කන්ධය y g යැයි ගනිමු. ✓
උෂ්ණත්වය නියත [illegible] [illegible] K_D නියත වේ. ✓
(03×3)

$$\frac{\frac{y\,g}{50.0 \times 10^{-3}\,dm^3} ✓}{\frac{(10-y)\,g}{100 \times 10^{-3}\,dm^3} ✓} = 10 \quad ✓ \quad (03 \times 3)$$

$$2y = 10(10-y) = 100 - 10y$$

$$12y = 100 \Rightarrow y = \frac{100}{12} = \frac{25}{3}$$

$$y = 8.33 ✓ \quad (03)$$

ජලය තුළ ඉතිරි වන ස්කන්ධය $= (10 - 25/3)\,g$ ✓ (03)

$= \frac{5}{3}\,g$ ✓ (02)

ජලය තුල ඉතිරි ස්කන්ධය
මුල් ස්කන්ධයෙහි භාගයක්ලෙස } $\therefore = 10 \times \left(\frac{5/3}{10}\right)$ g ✓

$= 10 \left(\frac{5}{30}\right)$ g

$= 10 \left(\frac{1}{6}\right)$ g ✓

50.0 බැගින් දෙවරක් නිස්සාරණයේදී ජලය උල ඉතිරි ස්කන්ධය $= 10 \left(\frac{1}{6}\right)^2$ ✓

$= 0.2777$ g ✓

∴ නිස්සාරණය වන මුලු X ස්කන්ධය $= (10 - 0.2777)$ g ✓

$= 9.72$ g ✓

(03×6=18)

50

(07)

(I) ඇනෝඩය : $Al(s) \longrightarrow Al^{3+}(aq) + 3e$ ✓

කැතෝඩය : $O_2(g) + 2H^+(aq) + 2e \longrightarrow 2\overline{OH}(aq)$ ✓

(II) $2Al(s) + 3O_2(g) + 6H^+(aq) \longrightarrow 2Al^{3+}(aq) + 6\overline{OH}(aq)$ ✓

(III) $E^\ominus_{Cell} = E^\ominus_{Cathode} - E^\ominus_{anode}$ ✓

$= +0.40V - (-1.66V)$ ✓

$= +2.06V$ ✓

(04×6=24)

(IV) I වැයවන O_2 මවුල ගණන $= \frac{1}{2} \times 2.5$ mol ✓

$= 1.25$ mol ✓

II ප්‍රතික්‍රියාවන Al ප්‍රමාණය $= \frac{2}{3} \times 1.25$ mol ✓

ප්‍රතික්‍රියාවූ Al ස්කන්ධය $= \frac{2}{3} \times 1.25$ mol $\times 27$ g mol^{-1} ✓

$= 22.50$ g ✓

∴ ඇනෝඩයේ අඩුවන ස්කන්ධය $= 22.50$ g ✓

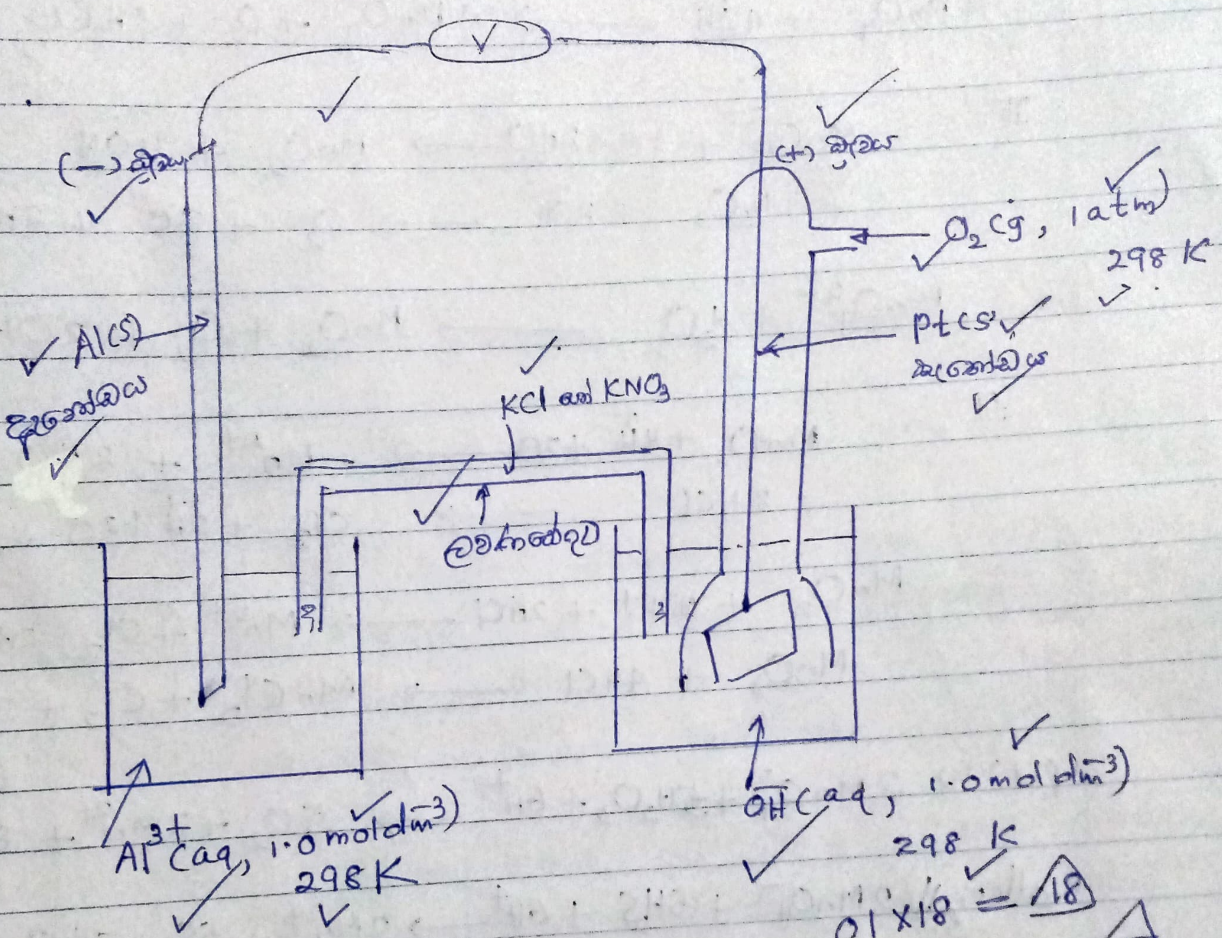
III $q = 96500$ C $mol^{-1} \times 2.5$ mol ✓

$= 241250$ C

$q = I.t$ ✓

$I = \frac{241250\ C}{400\ s} = 603.125\ A$ ✓ ✓ $(03 \times 11) = \boxed{33}$

(V)



$01 \times 18 = 18$

15

(b) (i) Mn (05)

(ii) +2 (02)

[Ar] 3d^5 (03)

(iii) $M_1 = [Mn(H_2O)_6]^{2+}$ ✓

$M_2 = Mn(OH)_2$ ✓

$M_3 = [MnCl_4]^{2-}$ ✓

$M_4 = MnO_4^-$ ✓

$M_5 = MnO_4^{2-}$ ✓

$M_6 = MnO_2$ ✓

$M_7 = MnCl_2$ ✓

(iv) M_1 - hexaaquamanganese(II) ion ✓

M_3 - tetrachloridomanganate ion ✓

(v) M_4 - දම් ✓

M_5 - කොළ ✓

M_6 - දුඹුරු හෝ දුඹුරු-

✓

$03 \times 12 = 36$

(vi) I $MnO_4^- + e \longrightarrow MnO_4^{2-}$ ✓

$4\overline{OH} \longrightarrow O_2(g) + 2H_2O + 4e$ ✓

$4MnO_4^- + 4\overline{OH} \longrightarrow 4MnO_4^{2-} + O_2 + 2H_2O$ ✓ (02×3)

II $MnO_4^{2-} + 2e + 2H_2O \longrightarrow MnO_2 + 4\overline{OH}$ ✓

$H_2O_2 + 2\overline{OH} \longrightarrow O_2 + 2e + 2H_2O$ ✓

$MnO_4^{2-} + H_2O_2 \longrightarrow MnO_2 + O_2 + 2\overline{OH}$ ✓ (02×3)

III $MnO_2 + 4H^+ + 2e \longrightarrow Mn^{2+} + 2H_2O$ ✓

$2HCl \longrightarrow Cl_2 + 2H^+ + 2e$ ✓

$MnO_2 + 2H^+ + 2HCl \longrightarrow Mn^{2+} + Cl_2 + 2H_2O$ ✓

$MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$

(02×3)

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

(04)

all(b) $2MnO_4^- + 5H_2S + 6H^+ \longrightarrow 2Mn^{2+} + 5S + 8H_2O$

(03)

(c) $2MnO_4^- + 5SO_2 + 2H_2O \longrightarrow 2Mn^{2+} + 5SO_4^{2-} + 4H^+$

(04)

15

⑨ (i) X_1 = $Cr(OH)_3$ ✓ $X_5 = PbCl_2$ ✓

X_2 = CrO_4^{2-} ✓ $X_6 = BaSO_3$ ✓

X_3 = NiS ✓ $X_7 = SO_2$ ✓

X_4 = NH_3 ✓

04×7 = 28

(ii) කැටායන Cr^{3+} ✓, Ni^{2+} ✓, NH_4^+ ✓ 05×6 = 30

ඇනායන Cl^- ✓, NO_3^- ✓, SO_3^{2-} ✓

$\triangle$ 58

Cl^-

(iii) ජලීය ද්‍රාවණ කොටසකට ත. HNO_3 සමඟ $AgNO_3$ යොදන්න. ✓ 03

ලැබෙන සුදු අවක්ෂේපය තනුක NH_3 වල දියවේ. ✓ 03

SO_3^{2-} ; ඝන මිශ්‍රණ කොටසකට තනුක HCl යොදන්න.
පිටවන වායුව H^+ / MnO_4^- ද්‍රාවණයක් තුළින් ✓ 03
බුබුලනය කරන්න.
දම් පැහැ ද්‍රාවණය අවර්ණවේ. ✓ 03

NO_3^- ; NaOH සමඟ Al කුඩු දමා රත්කරන්න.
පිටවන වායුව නෙස්ලර් ප්‍රතිකාරකය පොඟවූ ✓ 03
පෙරහන් පත දුඹුරු පැහැ ගන්වයි. ✓ 02

$\triangle$ 17

(b) (i) $5(NO_2^- + H_2O \longrightarrow NO_3^- + 2H^+ + 2e)$

$2(8H^+ + MnO_4^- + 5e \longrightarrow Mn^{2+} + 4H_2O)$

$5NO_2^- + 6H^+ + 2MnO_4^- \longrightarrow 2Mn^{2+} + 5NO_3^- + 3H_2O$ ✓ (05)

5 : 6 : 2

$5(C_2O_4^{2-} \longrightarrow 2CO_2 + 2e)$

$2(MnO_4^- + 8H^+ + 5e \longrightarrow Mn^{2+} + 4H_2O)$

$5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \longrightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$ ✓ (05)

5 : 2

$3(6H_2O + NO_3^- + 8e \longrightarrow NH_3 + 9OH^-)$

$8(Al + 4OH^- \longrightarrow [Al(OH)_4]^- + 3e)$

$18H_2O + 3NO_3^- + 8Al + 5OH^- \longrightarrow 3NH_3 + 8[Al(OH)_4]^-$ ✓ (05)

1 : 2 : 1 : 1

$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$ ✓ (02)

$2 : 1$

ඉතිරි $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$ ✓ (02)

$1 : 2$

(අ) වැයවූ NaOH ප්‍රමාණය $= 1.0\ mol\ dm^{-3} \times 40 \times 10^{-3}\ dm^3$
$= 0.040\ mol$ ✓

ඉතිරි H_2SO_4 ප්‍රමාණය $= \frac{1}{2} \times 0.040\ mol = 0.020\ mol$ ✓

යෙදූ H_2SO_4 ප්‍රමාණය $= 1.0\ mol\ dm^{-3} \times 60 \times 10^{-3}\ dm^3$
$= 0.060\ mol$ ✓

ප්‍රතික්‍රියා වූ H_2SO_4 ප්‍රමාණය $= (0.060 - 0.020)\ mol$ ✓
$= 0.040\ mol$ ✓

සෑදූ NH_3 ප්‍රමාණය $= \frac{2}{1} \times 0.040\ mol$ ✓
$= 0.080\ mol$ ✓

$\therefore$ NO_3^- ප්‍රමාණය $= 0.080\ mol$ ✓

18 g තුළ KNO_2 ප්‍රමාණය $= 0.080\ mol$ ✓

$M_{KNO_2} = (39 + 14 + 16 \times 2)\ g\ mol^{-1} = 85\ g\ mol^{-1}$ ✓

KNO_2 ස්කන්ධය $= 0.080\ mol \times 85\ g\ mol^{-1} = 6.8\ g$ ✓ ✓

$\% = \frac{6.8\ g}{18\ g} \times 100\% = 37.78\%$ ✓ ✓

NO_2^- සමග වැයවූ MnO_4^- ප්‍රමාණය $= \frac{2}{5} \times 0.08\ mol$ ✓
$= 0.032\ mol$ ✓

වැයවූ මුළු MnO_4^- ප්‍රමාණය $= 1.0\ mol\ dm^{-3} \times 50 \times 10^{-3}\ dm^3$ ✓
$= 0.050\ mol$ ✓

$C_2O_4^{2-}$ සමග වැයවූ MnO_4^- ප්‍රමාණය $= (0.050 - 0.032)\ mol$
$= 0.018\ mol$ ✓

$C_2O_4^{2-}$ ප්‍රමාණය $= \frac{5}{2} \times 0.018\ mol = 0.045\ mol$ ✓ ✓

18 g තුළ $K_2C_2O_4$ ප්‍රමාණය $= 0.045\ mol$ ✓

$M_{K_2C_2O_4} = (39 \times 2 + 12 \times 2 + 16 \times 4)\ g\ mol^{-1} = 166\ g\ mol^{-1}$ ✓

$K_2C_2O_4$ ස්කන්ධය $= 0.045\ mol \times 166\ g\ mol^{-1}$ ✓
$= 7.47\ g$ ✓

$\% = \frac{7.47\ g}{18\ g} \times 100\% = 41.5\%$ ✓ ✓

$02 \times 21 = 42$