தேசிய வெளிக்கள நிலையம் தொண்டைமானாறு

இரண்டாம் தவணைப் பரீட்சை - 2023

National Field Work Centre, Thondaimanaru.

NFWC

2nd Term Examination - 2023

Gr : 12 (2024)	இரசாயனவியல்	புள்ளித்திட்டம்

Part I

1) 4
2) 3
3) 1
4) 5
5) 4
6) 3
7) 2
8) 5
9) 1
10) 2
11) 4
12) 5
13) 3
14) 3
15) 1
16) 5
17) 5
18) 4
19) 5
20) 2
21) 1
22) 2
23) 3
24) 1
25) 2

Part I $25 \times 2 = 50$ marks

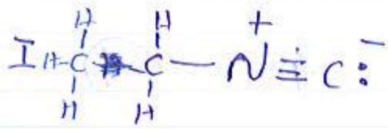
Part II $400 + 300 = \frac{700}{14} = 50$ marks

Part II A

I true II true III False IV true V true VI False

[03 marks × 6 = 18 marks]

b] I

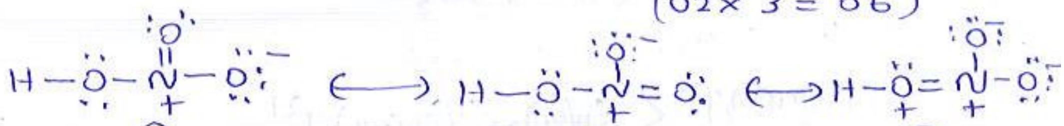


(5)

II C_1 $\underline{-3}$ C_2 $\underline{-1}$ N_2 $\underline{-3}$ C_4 $\underline{+2}$

$(02 \times 3 = 06)$

III



(4) stable (1) (4) stable (1) (4) unstable (1)

IV all 3 N-O bond length are not equal (02)

[05×3=15]

V

C^1	O^2	N^3	C^4	C^5
4	4	3	2	3
Tetrahedral	Tetrahedral	Trigonal Planar	Linear	Trigonal planar
Tetrahedral	Angular	Angular	Linear	Trigonal planar
sp^3	sp^3	sp^2	sp	sp^2
109° ($\pm$ 109)	105° ($\pm$ 104)	118° ($\pm$ 118)	180° ($\pm$ 180)	120° $\pm$ (120)

25x 01 = 25

VI

H 1S
C^1 sp^3
O^2 sp^3
N^3 sp^2
C^4 sp

C_1 sp^3
O^2 sp^3
N^3 sp^2
C^4 sp
C^5 sp^2

10x01 = 10

VII

N^3 2P
C^4 2P
C^4 2P
C^5 2P

4x01 = 04

VIII
i $NF_3 < NH_3 < NO_2^- < NO_3^-$
ii $H_2S < SCl_2 < SO_2 < SO_3$
iii $AgI < AgBr < AgCl < AgF$
iv $[Cu(H_2O)_6]^{2+} < Cu(OH)_2 < [Cu(NH_3)_4]^{2+}$
v $O < S < F < Cl$

5x03 = 15

2) I

X - H_2O_2 y - H_2O Z - CrO_4^{2-}

3×05 = 15

II $3H_2O_2 + Cr_2O_3 + 4\,\bar{O}H \longrightarrow 2CrO_4^{2-} + 5H_2O$

05

III a) $H_2O_2 + 2H^+ + 2e \rightarrow H_2O$

b) $H_2O_2 \longrightarrow O_2 + 2H^+ + 2e$

2×05 = 10

~~IV~~

(B) I $2Mg + O_2 \longrightarrow 2MgO$

$3Mg + N_2 \longrightarrow Mg_3N_2$

2×05 = 10

II E - MgO F - Mg_3N_2 G - $Mg(OH)_2$

J - NH_3 I - HCl

5×5 = 25

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

05

V added with Nessler's reagent or Nessler's reagent is dipped paper becomes brown colour

7.5

VI Any amonium ions salt heated with NaOH or $\bar{O}H$ solution produces NH_3 gas

7.5

$NH_4^+ + OH^- \longrightarrow NH_3 + H_2O$

or

$NH_4Cl + NaOH \longrightarrow NaCl + NH_3 + H_2O$

05

(any ammonium salt)

eg $(NH_4)_2SO_4$, NH_4NO_3, $(NH_4)_2Cr_2O_7$ ----

VII

I $2NH_3 + 2Na \rightarrow 2NaNH_2 + H_2$

II $2NH_3 + 3Cl_2 \rightarrow N_2 + 6HCl$

$2 \times 05 = 10$

$Q_2 = 100$

---

(3) I $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ (10)

II $NaOH + HCl \rightarrow NaCl + H_2O$ (5)

III $= 2\ mol\,dm^{-3} \times 50 \times 10^{-3}\ dm^{3}$ (2+1)

$= 100 \times 10^{-3}$ / $0.1\ mol$ (1+1)

IV No of mol of NaOH $= 1\ mol\,dm^{-3} \times 32 \times 10^{-3}\ dm^{3}$

$= 32 \times 10^{-3}\ mol$ (4+1)

∴ No. of mol of HCl $= 32 \times 10^{-3}\ mol$ or $0.032\ mol$ (4+1)

V No of mol of HCl react with $CaCO_3 = 68 \times 10^{-3}\ mol$

or $= 0.068\ mol$ (4+1)

VI No. of mol of $CaCO_3 = 34 \times 10^{-3}\ mol$ or

$0.034\ mol$ (4+1)

VII Mass of $CaCO_3 = 0.034\ mol \times 100\ g\,mol^{-1}$

$= 3.4\ g$ (5)

∴ mass percentage $= \frac{3.4}{4} \times 100$

$= 85\%$ (5)

b) I $H = V d C \theta$ (5)

$= 50\ cm^3 \times 1\ g\,cm^{-3} \times 4.5\ J\,g^{-1}\,°C^{-1} \times 5\ °C$ (4+1)

$= 1125\ J$ (4+1)

$= 1.125\ kJ$

II ∴ No. of mole of $CaCO_3$ that reacted with $HCl = 0.034\ mol$

∴ realesed energy that 1 mol $CaCO_3$ reacted with HCl $= \frac{1.125}{0.034} \times 1$ (4+1)

$= 33.1\ kJ$

∴ $\Delta H_{N\ CaCO_3} = -33.1\ kJ\,mol^{-1}$ (4+1)

4 (A)

I

	N	H	O
mole ratio	$\frac{35}{14}$	$\frac{5}{1}$	$\frac{60}{16}$
	$\frac{2.5}{2.5}$	$\frac{5}{2.5}$	$\frac{3.75}{2.5}$ — (5)
	1	2	1.5 — (5)
×2	2	4	3 —

$N_2H_4O_3$ — (5)

II $(N_2H_4O_3)_n = 80$

$80n = 80$

$n = 1$

∴ molucular formula ⇒ $N_2H_4O_3$ (5)

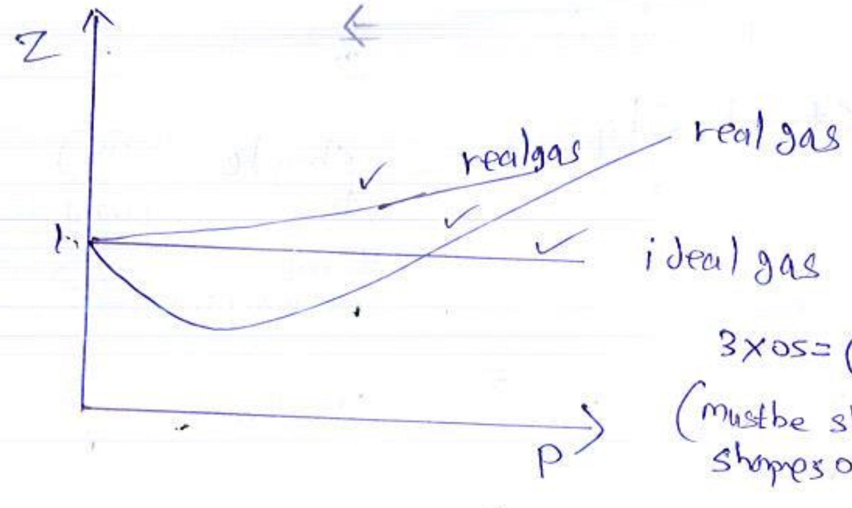
III NH_4^+ NO_3^- 2×5 = (10)

IV $NH_4NO_3 \longrightarrow N_2O + 2H_2O$ (5)

V dinitrogen monoxide (5)

VI Brown ring test or any sutable test (10)

(B)



3×05 = (15)

(mustbe shown 2 diffren shapes of real gas)

III $CaCO_{3(s)} + 2HCl_{(aq)} \xrightarrow{-33.1\,kJmol^{-1}} CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$

$+16.9\,kJmol^{-1}$ ↓ ΔH_R (5)

$CaCO_{3(aq)} + 2HCl_{(aq)}$

எசுவின் விதிப்படி

$\Delta H_R + 16.9\,kJmol^{-1} = -33.1\,kJmol^{-1}$ (4+1)

$\Delta H_R = -50\,kJmol^{-1}$ (4+1)

OR

Rx ① — $CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$ $\Delta H = -33.1\,kJ$

Rx ② — $CaCO_{3(s)} \longrightarrow CaCO_{3(aq)}$ $\Delta H_{dis} = +16.9\,kJmol^{-1}$

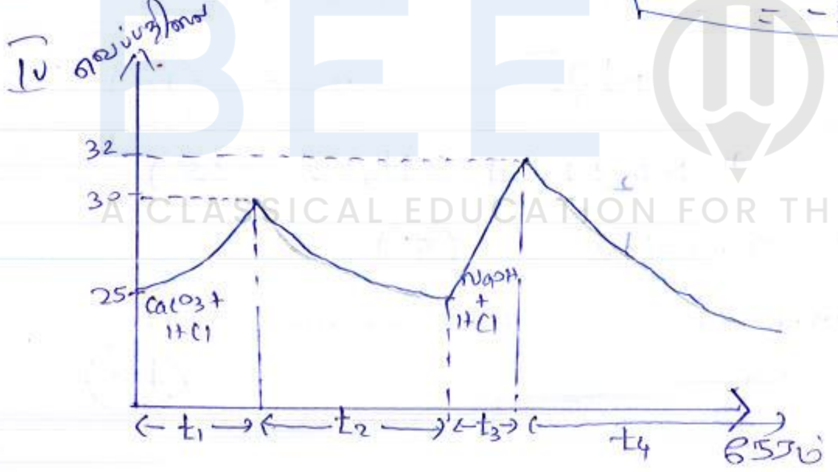
Rx① − Rx② $CaCO_{3(aq)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$

(10)

$\Delta H = -33.1 - 16.9$

$= -50\,kJmol^{-1}$ (4+1)

IV



$t_3 < t_1 < t_2 < t_4$

shape (05)
Ax (02+02)
time comparison (06)

Q3 ⇒ 100 Marks

ii real gases molucules have high Intermolecular force but ideal gases no forces of attraction or repulsion operate amoung gas particles

The actual volume of the ideal gas molecule is very small compared to the total volume occupied by the gas but real gas molucule has higher molucular volume

$2 \times 05 = 10$

iii $2 = \frac{V_{real}}{V_{ideal}}$ 5

iv lower pressure 5 higher temprature 5

v $PV = nRT$

$P = \frac{n}{V} RT$

$\frac{n}{V} = c$

$P = CRT$ — 5

Constant temprature $RT = K$ — 5

$P \propto C$

$24 = 100$

Part II B

(5) (A)

I $PV = \frac{1}{3} mNc^{\overline{2}}$ — (10)

P - pressure
V - volume
m - mass of a molecule
N - No. of molecule
$\overline{c^2}$ - mean square speed

— 5 × 03 = (15)

II molecule travel with different speeds at constant temperature. There is a distribution of speeds from zero to values considerably. This is because as individual molecules collide and exchange energy their speeds vary (20)

[வாயு மூலக்கூறுகள் யாவும் ஒரே கதியுடன் இயங்குவதில்லை அவற்றின் வேகப்பரம்பல் பூச்சியம் தொடக்கம் உயர் பெறுமானம் வரை வேறுபடும்
மூலக்கூறுகளிற்கிடையிலான மோதுகைகளின் போது மொத்த சக்திமாறாது சக்தி பரிமாற்றப்படும் இதனால் வேகம் நேரத்துடன் மாறுபடும்]

$\therefore \overline{c^2} = \frac{c_1^2 + c_2^2 + c_3^2 - - - - c_N^2}{N}$ — (5)

[5A II 25 marks]

III $\sqrt{\overline{c^2}} = \sqrt{\frac{3RT}{M}}$ — (10)

$$\frac{\sqrt{\overline{c^2}_{He}}}{\sqrt{\overline{c^2}_{O_2}}} = \sqrt{\frac{\frac{3R \times 300}{4 \times 10^{-3}}}{\frac{3R \times 400}{32 \times 10^{-3}}}} \text{ - (15)} = \frac{\sqrt{6}}{1} \text{ - (15)}$$

[5A III 40 marks]

B I Boyle's low — (10)

II $PV = nRT \rightarrow$ (10)

$5 \times 10^5 \text{ Pa } V = 0.25 \text{ mol} \times R \times 320 \text{ K}$ — (1) (10)

$1.25 \times 10^6 \text{ Pa } 2V = (0.25 + n) \text{ mol } R \times 400 \text{ K}$ — (2) (10)

$\frac{(2)}{(1)}$ $\frac{1.25 \times 10 \times 2}{5 \times} = \frac{(0.25 + n)}{0.25} \times \frac{400}{320}$

$n = 0.75 \text{ mol}$ (5)

molecular mass of x = $\frac{21 g}{0.75 \text{ mol}} = 28 \text{ g mol}^{-1}$ (10)

X and CH_4 show ideal behavior (5)

[5A IV 60 marks]

(6) (A) A - Na_2CO_3 B - $CaCl_2$ C - $CaCO_3$ D - $Ca(HCO_3)_2$

E - AgCl F - $[Ag(NH_3)_2]^+$ / $[Ag(NH_3)_2]Cl$

(6 x 06 = 36 marks)

I $Na_2CO_3 + CaCl_2 \longrightarrow CaCO_3 \downarrow + 2NaCl$

II $CaCO_3 + CO_2 + H_2O \longrightarrow Ca(HCO_3)_2$

III $CaCl_2 + 2AgNO_3 \longrightarrow 2AgCl + Ca(NO_3)_2$

IV $AgCl + 2NH_3 \longrightarrow [Ag(NH_3)_2]Cl$

OR $AgCl + 2NH_4OH \longrightarrow [Ag(NH_3)_2]Cl + 2H_2O$

(6A ⇒ 60 marks) (4 x 06 = 24 marks)

(B) $[Al(H_2O)_6]^{3+}$ forms H_3O^+/H^+ ions when it goes Hydrolysis reaction

$[Al(H_2O)_6]^{3+}_{(aq)} + H_2O_{(l)} \rightleftharpoons [Al(OH)(H_2O)_5]^{2+}_{(aq)} + H^+_{(aq)}$

when adding of Na_2CO_3, CO_3^{2-} ions react with H_3O^+/H^+ ions and ~~of~~ form CO_2 gas therefore CO_3^{2-} ions cannot be formas precipitate contenue to removal of H^+ ions above equbilim shifted to right side therefore $Al(OH)_3$ / $[Al(OH)_3(H_2O)_3]$ form as precipitate

(20)

II X - $Al(OH)_3$ y = CO_2 ⇒ (2x10 = 20)

III $Al(OH)_3 + NaOH \longrightarrow Na[Al(OH)_4]$ ⇒ (10)

or

$Al(OH)_3 + NaOH \longrightarrow NaAlO_2 + 2H_2O$

IV $Al(OH)_3$ white colour precipitate forms again but contenue adding of HCl precipitate will be dessolved

(15)

6B ⇒ 65 marks

c) i $2Na + 2NH_3 \rightarrow 2NaNH_2 + H_2$

or $6Li + 2NH_3 \rightarrow 2Li_3N + 3H_2$

ii $SO_2 + 2Fe^{3+} + 2H_2O \rightarrow SO_4^{2-} + 2Fe^{2+} + 4H^+$

or $5SO_2 + 2MnO_4^- + 2H_2O \rightarrow 5SO_4^{2-} + 2Mn^{2+} + 4H^+$

or $3SO_2 + Cr_2O_7^{2-} + 2H^+ \rightarrow 3SO_4^{2-} + 2Cr^{3+} + H_2O$

iii $Na + H_2O \rightarrow NaOH + H_2$

iv $C_6H_{12}O_{6(s)} \xrightarrow{con\ H_2SO_4} 6C_{(s)} + 6H_2O_{(g)}$

v $Cl_2 + H_2S \rightarrow 2HCl + S$

Q6c ⇒ $5 \times 05 = 25$

Q7 $Fe_2O_3 + 6HCl \rightarrow 2FeCl_3 + 3H_2O$ — 5

$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ — 5

$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$ — 8

No. of mole of $Na_2S_2O_3 = 0.1 \times 25 \times 10^{-3}$ — 5

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

No. of mole of $I_2 = 1.25 \times 10^{-3}$ mol — 5

∴ No. of mole of $Fe^{3+} = 2.5 \times 10^{-3}$ mol — 5

∴ No of mole of Fe_2O_3 in Hamatite $= 1.25 \times 10^{-3}$ mol — 5

mass of Fe_2O_3 in hamatite $= 1.25 \times 10^{-3}$ mol $\times 160$ g mol^{-1}

$= 0.2$ g — 5

mass percentage of $Fe_2O_3 = \frac{0.2}{0.5} \times 100$

$= 40\%$ — 5

Q7 a) ⇒ 50 marks

(7) b) I $\Delta H_R^0 = \sum \Delta H_{f\,Product}^0 - \sum \Delta H_{f\,reagents}^0$ — 5

$= \Delta H_{f\,Na_2CO_3}^0 + \Delta H_{f\,CO_2}^0 + \Delta H_{f\,H_2O}^0 - 2\Delta H_{f\,NaHCO_3}^0$ — 5

$= [-1130 - 395 - 285]\,kJmol^{-1} - [2 \times -950]\,kJmol^{-1}$ — (4+1)

$= +90\,kJmol^{-1}$ — (4+1)

II $\Delta S^0 = \sum S_{Product}^0 - \sum S_{Reagent}^0$ — 5

$= S_{Na_2CO_3}^0 + S_{CO_2}^0 + S_{H_2O}^0 - 2S_{NaHCO_3}^0$ — 5

$= [136 + 214 + 70] - [2 \times 102]\,Jmol^{-1}K^{-1}$ — (4+1)

$= 216\,Jmol^{-1}K^{-1}$ — (4+1)

III $\Delta G^0 = \Delta H^0 - T\Delta S^0$ — 10

$= 90\,kJmol^{-1} - 298\,K \times 216 \times 10^{-3}\,kJmol^{-1}K^{-1}$ — (4+1)

$= 25.632\,kJmol^{-1}$ — (4+1)

This reaction will not take place at 25°C — 5

IV $\Delta G = 0$ — 10

$T\Delta S^0 = \Delta H^0$ — 5

$T = \frac{\Delta H^0}{\Delta S^0} = \frac{+90\,kJmol^{-1}}{0.216\,kJmol^{-1}K^{-1}}$ — (4+1)

$= 416.67\,K$ — (4+1)

Reaction will take place above 416.67K — 5

assumption ⇒ ΔH and ΔS will not change with raising of temprature — 5

7b ⇒ 100 marks