தேசிய வெளிக்கள நிலையம் தொண்டைமானாறு
முதலாம் தவணைப் பரீட்சை - 2023
National Field Work Centre, Thondaimanaru.
1st Term Examination - 2023

Grade - 12 (2024) chemistry Marking Scheme

CHEMISTRY

Part I

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

$\boxed{25 \times 02 = 50 \text{ marks}}$

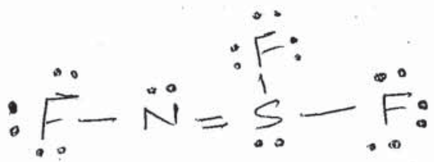
Part II

(1)

(a) (i) True
(ii) True
(iii) True
(iv) False
(v) True
(vi) False.

$6 \times 03 = 18$

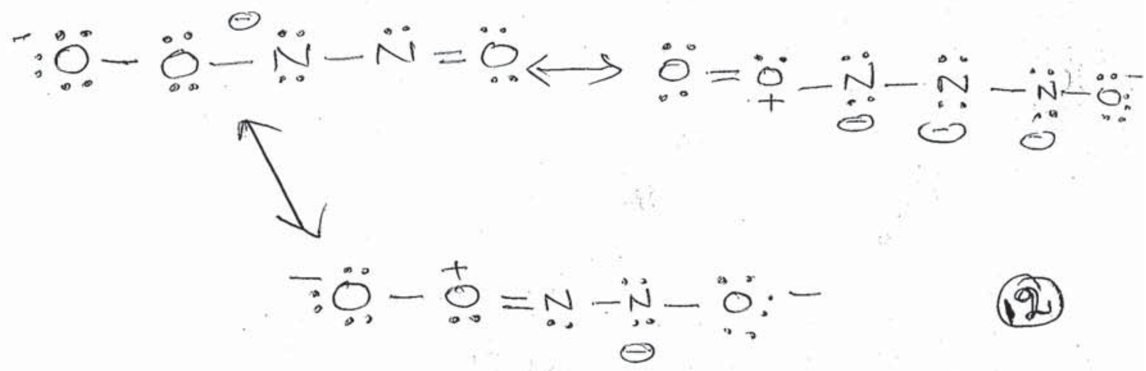
(b) (i)



(6)

(ii) N = angular / V shape (3) S - Trigonal planer (3)
N = (−1) (3) S = (+4) (3)

c)



12

d) C^1 N^2 N^3 N^4

	C^1	N^2	N^3	N^4
I	3	3	4	2
II	Trigonal planer	Trigonal planer	Tetrhedral	linear
(III)	Trigonal planer	angular	angular	linear
(IV)	sp^2	sp^2	sp^3	sp

$16 \times 01 = 16$

(V)

I $H - 1s$ $C^1 = sp^2$

(II) $C^1 - sp^2$ $N^2 - sp^2$

(III) $N^2 - sp^2$ $N^3 - sp^3$

(IV) $N^3 - sp^3$ $N^4 - sp$

(V) $N^4 - sp$ $N - 2p$.

$10 \times 01 = 10$

(VI)

I $C^1 - 2p$ $N^2 - 2p$

(II) $N^4 - 2p$ $N - 2p$

$N^4 - 2p$ $N - 2p$

$01 \times 6 = 06$

(VII)

$C^1 = 120'$

$N^2 = 118'$

$N^3 = 105'$

$N^4 = 180'$

$4 \times 04 = 16$

(VIII) $N^3 < N^2 < N^4$.

04

100.

(2)

(2) (a) (i) Lyman 15

(ii) $-36, -327 \text{ kJmol}^{-1}$ 05 + 05

(iii) $-36-(-327) = 291 \text{ kJmol}^{-1}$ 5

Energy of one photon $= \dfrac{291 \text{ kJmol}^{-1}}{6.022 \times 10^{23} \text{ mol}^{-1}}$

$= 48.322 \times 10^{-23} \text{ kJ}$

$= 4.832 \times 10^{-22} \text{ kJ}$ 4

(iv) $E = h\nu$

$\nu = E/h = \dfrac{4.832 \times 10^{-22} \times 10^{3} \text{ J}}{6.626 \times 10^{-34} \text{ Js}}$ 4

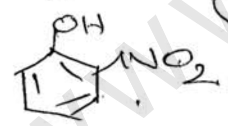
$= 7.29 \times 10^{14} \text{ s}^{-1}$ 5

(v) $E = 0 - (-1311) \text{ kJmol}^{-1}$

$= 1311 \text{ kJmol}^{-1}$ 5

(b)

(i) I_2, $CH_{4(g)}$

(ii) 

(iii) $NaCl_{(aq)}$

(iv) HCHO, HBr

(v) $CaCl_{2(s)}$ $7 \times 04 = 28$

(c) (i) XeF_4.

No of bond pairs = 4

No of lone pairs = 2

Electron pair geometry = Octahedral

Shape = Square planar

6

(II) $HClO_3$

No of bond pairs = 3
No of lone pairs = 1
Electron pair geometry = Tetrahedral.
Shape = Trigonal pyramidal

(III) H_2CO_3 6

No of bond pairs = 3
No of lone pairs = 0
Electron pair geometry = Trigonal planar
Shape Trigonal planar.

(IV) CF_4 6

No of bond pairs = 4
No of lone pairs = 0
Electron pair geometry = Tetrahedral
Shape Tetrahedral. 6

100

3 (a) (I) Al.

(II) $1s^2 2s^2 2p^6 3s^2 3p^1$

(III) Al^{3+}

(IV) $1s^2 2s^2 2p^6$

(V) Al_2O_3. $5 \times 07 = 35$

(3)

(b). (I) $Al(OH)_3 < Mg(OH)_2 < Ba(OH)_2$

(II) $NH_2^- < N_2H_4 < NH_2OH$

(III) $SF_6 < SF_4 < SF_2$

(IV) $O_2 < O_3 < H_2O_2$

(V) $Na < Zn < V$

$5 \times 07 = 35$

(C) (I) Molecules of Br_2 and ICl are Iso-electronic.
($Br_2 = 160 g mol^{-1}$) ($ICl = 162.5 g mol^{-1}$)
Bromine molecules are non-polar and Br_2 boils at (59°C). ICl consists of polar molecules and boils at 97°C

∴ Boiling point of $Br_2 <$ ICl.

(10)

(II) Sodium atom can donate one electon as it has one electron in the valance shell while Mg atom donates 2 electrons to the ~~metallic~~ metallic bond.
($Na = 1s^2 2s^2 2p^6 3s^1$) ($Mg = 1s^2 2s^2 2p^6 3s^2$)
When the number of electrons donated by an atoms increases, the strength of the metalic bond is enhanced as well.
radius of Na > Mg
∴ Strength of Metallic bond Na < Mg
∴ Melting of point of Mg > Na.

(10)

(iii) $Mg = 12 = 1s^2 2s^2 2p^6 \underline{3s^2}$

$Al = 13 = 1s^2 2s^2 2p^6 3s^2 \underline{3p^1}$.

Mg - $3s^2$ type full filled. More Stable than Al.

$\therefore I_1$ of Mg > I_1 of Al.

10

100

(4)

(a)

	C	H	O
Mass comp^n.	40	6.67	53.33
mole comp^n.	$\frac{40}{12}$	$\frac{6.67}{1}$	$\frac{53.33}{16}$
	3.33	6.67	3.33
mole ratio	$\frac{3.33}{3.33}$	$\frac{6.67}{3.33}$	$\frac{3.33}{3.33}$
	1	2	1

35

Empirical formula = CH_2O

Empirical formula mass $= 12+2+16$

$= 30$

$(CH_2O)n = 90$

$30n = 90$

$n = 3$

$\therefore$ Molecular formula is $C_3H_6O_3$ 5

4 (b) (4)

i molecular mass of Na_2CO_3

$= 2\times 23 + 12 + 16\times 3$

$= 106\,g\,mol^{-1}$

$n = w/M = \frac{1.06\,g}{106\,g\,mol^{-1}}$ 5

$= 0.01\,mol$

II $[Na_2CO_{3(aq)}] = \frac{0.01\,mol}{\frac{400}{1000}\,dm^3} = \frac{0.1}{4}$ 5

$= 0.025\,mol\,dm^{-3}$

(III) $Na_2CO_{3(aq)} \longrightarrow 2Na^+_{(aq)} + CO_{3(aq)}^{2-}$

$[Na^+_{(aq)}] = 0.025\times 2$ 5

$= 0.05\,mol\,dm^{-3}$

(IV) $[CO_{3(aq)}^{2-}] = 0.025\,mol\,dm^{-3}$ 5

(C) $d = m/V$

$m = Vd$

$= 10\,ml \times 1.15\,g\,ml^{-1} = 11.5\,g$ 10

$W/W\,\% = \frac{2.3\,g}{11.5\,g}\times 100 = 20\%$

(d) (I) $KMnO_4$ +7

(II) K_2MnO_4 +6

(III) MnO_2 +4

(IV) Mn_2O_3 +3.

$4\times 05 = 20$

(e) Assume the volume required from $6\,mol\,dm^{-3}$ HCl solution is $V\,cm^3$.

amount of HCl $= 6\,mol\,dm^{-3} \times \frac{V}{1000}\,dm^3 = 6V \times 10^{-3}\,mol$

amount of HCl $= 1\,mol\,dm^{-3} \times \frac{250}{1000}\,dm^3$
$= 0.25\,mol$

$\therefore 6V \times 10^{-3}\,mol = 0.25\,mol$

$V = 41.6\,cm^3$ (10)

Explanation.

100

Part II - Essay

Q5 (a) (I) Answers (15)
(II) Answers (15)
(III) Answers (15)
(IV)

Lyman Series	Ultra Violet (UV) region (10)
Balmer Series	Visible region (10)
Pachan Series	Infrared region (10)

(V) $E = h\nu$
(I) $E = hc/\lambda = \frac{6.63 \times 10^{-34}\,Js \times 3 \times 10^{8}\,ms^{-1}}{700 \times 10^{-9}\,m}$ (10)
$= 2.841 \times 10^{-19}\,J$

(5)

(V) (II) 1 mol photon.

$$E = 2.841 \times 10^{-19}\,J \times 6.022 \times 10^{23}\,mol^{-1}$$
$$= 171.08\,kJ \quad (8)$$

(III) Visible region. (7)

$a \rightarrow$ 100

(b) (I) $Fe^{2+} \longrightarrow Fe^{3+} + e$ (5)

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

(III) $5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$ (5)

(IV)

$$n_{Fe^{2+}} : n_{MnO_4^-} = 5:1 \quad (5)$$

Amount of $Fe(NO_3)_2 = n_{Fe^{2+}} = 0.25\,mol\,dm^{-3} \times \frac{27}{1000}\,dm^3$ (5)

$= 6.75 \times 10^{-3}\,mol$ (5)

The amount of MnO_4^- required $= 6.75 \times 10^{-3} \times 5\,mol$ (5)

$0.6\,mol\,dm^{-3} \times \frac{V}{1000}\,dm^3 = 6.75 \times 10^{-3} \times 5\,mol$ (5)

$V = 2.25\,cm^3$ (10)

150

(6)

(a) C_2H_5OH இன் மூலக்கூற்றுத் திணிவு $= 12 \times 2 + 6 \times 1 + 16 = 46\,g\,mol^{-1}$ (5)

CH_3OH இன் மூலக்கூற்றுத் திணிவு $= 12 + 4 + 16 = 32\,g\,mol^{-1}$ (5)

H_2O இன் மூலக்கூற்றுத் திணிவு $= 2 + 16 = 18\,g\,mol^{-1}$ (5)

$$X_{C_2H_5OH} = \frac{n_{C_2H_5OH}}{n_{C_2H_5OH} + n_{H_2O} + n_{CH_3OH}} = \frac{46g / 46\,g\,mol^{-1}}{\frac{46g}{46\,g\,mol^{-1}} + \frac{90g}{18\,g\,mol^{-1}} + \frac{32g}{32\,g\,mol^{-1}}} \quad (10)$$

$X_{C_2H_5OH} = 1/7$, $n_{CH_3OH} = 32g / 32 g mol^{-1}$
$= 1 mol.$

$X_{CH_3OH} = 1/7$ (5) $n_{H_2O} = 90g / 18 g mol^{-1} = 5 mol.$ (5)

$X_{H_2O} = 1 - 1/7 - 1/7 = 5/7$ (5).

(b) 1) $Ba(OH)_{2(aq)} + H_2SO_{4(aq)} \rightarrow BaSO_{4(s)} + 2H_2O_{(l)}$ (10)

(2) Amount of H_2SO_4 Reacted $= 0.2 mol dm^{-3} \times \frac{30}{1000} dm^3$
$= 6 \times 10^{-3} mol$ (10)

(3) Amount of $BaSO_4$ Precipitated $= 6 \times 10^{-3} mol.$ (10) $n_{BaSO_4} : n_{H_2SO_4} = 1:1$

(4) Molar mass of $BaSO_4 = 137 + 32 + 64 = 233 g mol^{-1}$ (5)

Mass of $BaSO_4$ precipitated $= 0.006 mol \times 233 g mol^{-1}$
$= 1.398 g$
$\simeq 1.4 g$ (5)

(C)
FeS = ferrous sulfide (10)
Fe_2S_3 = ferric sulfide (10)
CuCl = cuprous chloride (10)
$CuCl_2$ = cupric chloride (10)

(d) $BeCO_3 < MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$
Thermal stability of Group 2 Carbonates increases with the size of the Cation. The charge of the Cations are same. Anion CO_3^{2-} is same. but the polarising power of Cation decreasing down the group due to the decrease of the charge density of the Cation.

so the ionic character of carbonates increases down the group. Therefore thermal decomposition temperature increases down the group. (6) (20)

$Q_6 \rightarrow 150$

(7)

(a) (i) Def^n (10)

(ii) Def^n (10)

(iii) Def^n (10)

(b) (i) Iron (Name only) (10)

(ii) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6$ (10)

(iii) Fe^{2+}, Fe^{3+} (5) + (5)

(iv) $Fe^{2+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^6$ (5)

$Fe^{3+} = 1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$ (5)

(v) Stable $Fe^{3+} > Fe^{2+}$ (5)

$Fe^{3+} \rightarrow 3d^5$ type of electronic conf^n half filled more stable than that of Fe^{2+}

(c) (i) $2MnO_{4\,(aq)}^- + 5H_2O_{2\,(aq)} + 6H^+_{(aq)} \longrightarrow 2Mn^{2+}_{(aq)} + 5O_2 + 8H_2O$

(ii) $MnO_{2\,(s)} + 4H^+_{(aq)} + 2Cl^-_{(aq)} \longrightarrow Mn^{2+}_{(aq)} + Cl_{2\,(g)} + 2H_2O_{(l)}$

(iii) $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \longrightarrow 2Mn^{2+}_{(aq)} + 10CO_{2\,(g)} + 8H_2O_{(l)}$

(iv) $Cr_2O_7^{2-} + 3C_2O_4^{2-} + 14H^+_{(aq)} \longrightarrow 2Cr^{3+}_{(aq)} + 6CO_2 + 7H_2O$

(v) $Cr_2O_7^{2-} + 6I^- + 14H^+ \longrightarrow 2Cr^{3+}_{(aq)} + 3I_2 + 7H_2O$

$5 \times 05 = 25$

d) $AgNO_{3\,(aq)} + NaCl_{(aq)} \longrightarrow AgCl\downarrow + NaNO_{3\,(aq)}$ (5)

$AgNO_{3\,(aq)} + KCl_{(aq)} \longrightarrow AgCl\downarrow + KNO_{3\,(aq)}$ (5)

$^{\omega}(NaCl + KCl) = 5.48g$

Let x be the mass of NaCl.

$\therefore$ mass of KCl is $(5.48 - x)$ g

molecular mass of AgCl $= 108 + 35.5$
$= 143.5\ g\ mol^{-1}$ (5)

molecular mass of NaCl $= 23 + 35.5$
$= 58.5\ g\ mol^{-1}$ (5)

Molecular mass of KCl $= 39 + 35.5$
$= 74.5\ g\ mol^{-1}$ (5)

amount of AgCl $= \frac{12.7g}{143.5\ g\ mol^{-1}} = 0.088$ mol. (5)

$$\frac{x}{58.5} + \frac{5.48 - x}{74.5} = \frac{12.7}{143.5}$$ (5)

$$\frac{x}{58.5} + \frac{5.48 - x}{74.5} = 0.088$$ (5)

$x = 3.9341\ g$ (5)

W/W % of NaCl $= \frac{3.9341 g}{5.48 g} \times 100$ (5)

$= 71.7\%$ (Check it)

Part I $\rightarrow$ 50 marks

Part II Str $4 \times 100 = 400$

Essay. $2 \times 150 = 300$

700

$\frac{700}{14} = 50$ marks

150