FWC

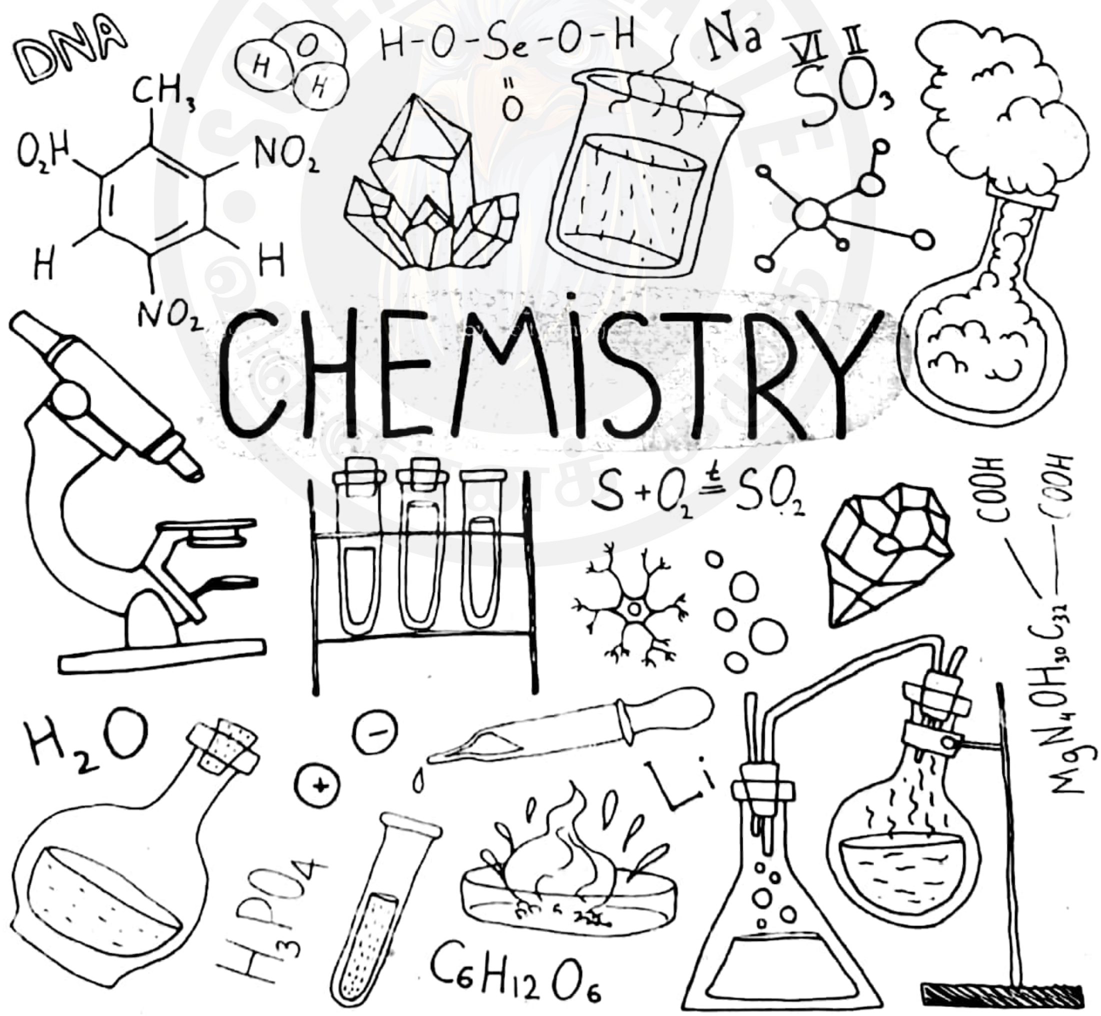
வடமாகாணக் கல்வித் திணைக்களத்துடன் இணைந்து
தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
தவணைப் பரீட்சை, நவம்பர் - 2019

Conducted by Field Work Centre, Thondaimanaru
In Collaboration with Provincial Department of Education Northern Province
Term Examination, November - 2019

Grade - 12 (2021) **Chemistry** **Marking Scheme**

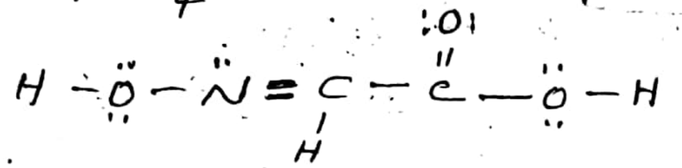
Part - I MCQ

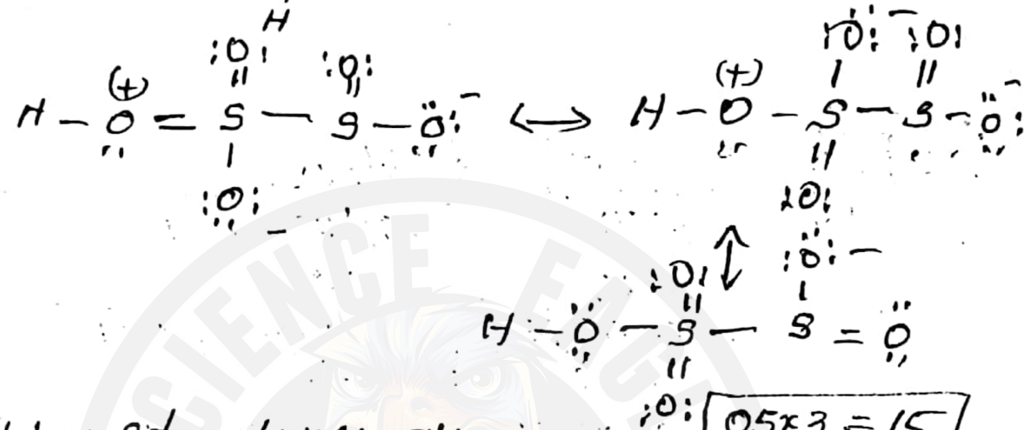
01) 4	06) 4	11) 1	16) 2	21) 1
02) 1	07) 1	12) 4	17) 4	22) 3
03) 5	08) 2	13) 5	18) 3	23) 1
04) 1	09) 5	14) 2	19) 5	24) 4
05) 3	10) 2	15) 3	20) 5	25) 3



Gr 12 Structure Essay

01] (a) (i) H_3O^+ (ii) SF_6 (iii) NH_4Cl (iv) SiO_2 (v) CO_3^{2-}
(vi) $HClO_4$ $\boxed{06 \times 4 = 24}$

(b) (i)  06

(ii) 

$\boxed{05 \times 3 = 15}$

Possible structures also acceptable.

(iii)

	C^1	N^3	C^4	O^5
I	3	4	3	4
II	Trigonal Planar	Tetrahedral	Trigonal Planar	Tetrahedral
III	Trigonal Planor	Trigonal Pyramidal	Trigonal Planar	angular
IV	sp^2	sp^3	sp^2	sp^3

$\boxed{01 \times 16 = 16}$

(iv)

C^1	sp^2	C^2	sp^2
C^2	sp^2	N^3	sp^3
N^3	sp^3	C^4	sp^2
C^4	sp^2	O^5	sp^3
C^4	sp^2	O^6	sp^2

$\boxed{01 \times 10 = 10}$

(v) C^1 2p (a.o) C^2 2p (a.o)
C^4 2p (a.o) O^6 2p (a.o)

$\boxed{01 \times 4 = 04}$

(c) (i) SF_4, CO

$\boxed{02 \times 2 = 4}$

(ii) 1) Ion – dipole , Hydrogen bond, London force
2) Induce dipole – Induce dipole, London force.
(3) Ion- Induce dipole,
(4) dipole- Induce dipole,

$\boxed{03 \times 7 = 21}$

100

02 (i) CO_2 : H_2O

$\frac{1.738}{44}$ $\frac{0.711}{18}$ mol

0.0395   0.0395 mol

C : H

0.0395   0.079 mol   05

$W_C = 0.474g$ $W_H = 0.079g$ ∴ $W_O = 0.947g$ 05

$n_O = 0.059$ mol

C : H : O

0.0395   0.079   0.059   5

2   4   3.

Empirical formula $C_2H_4O_3$. 05

(ii) molecular formula $(C_2H_4O_3)_n = 15$

$(24+4+48)n = 15$

$n = 2$ 03

$C_4H_8O_6$ 05

$\boxed{28}$

(I) Total number of valance electron pairs around P = 5

VSEPR pairs = 4

σ pairs = 4

Lone pairs = 0

shape - Tetrahedral

$02 \times 5 = 10$

II Total number of valance electron pairs around 'O' = 4

VSEPR pairs = 4

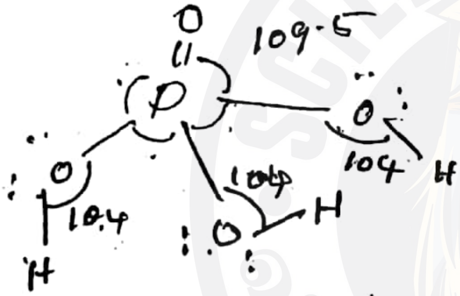
σ pairs = 2

Lone pairs = 2

shape angular.

$02 \times 5 = 10$

III



$\boxed{01 \times 7} = 7$

IV Charge of P = [Number of valance electrons in the atom] - [number of bonds] - [number of electrons in lone pairs]

05

$= 5 - 5 - 0 = 0$ 05

(C) (1) Cl

(2) $1s^2 2s^2 2p^6 3s^2 3p^5$

(3) -1, +1, +3, +5, +6, +7

(4) Possible answer NaCl,

$7.5 \times 4 = 30$

100

ⓐ ① $5e + MnO_4^- + 8H^+ \longrightarrow Mn^{2+} + 4H_2O$ (05)

② $Fe^{2+} \longrightarrow Fe^{3+} + e$ (05)

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e$ (05)

③ $3MnO_4^- + 5C_2O_4^{2-} + 5Fe^{2+} + 24H^+ \longrightarrow 5Fe^{3+} + 10CO_2 + 12H_2O + 3Mn^{2+}$ (10)

④ $6KMnO_4 + 10FeC_2O_4 + 24H_2SO_4 \longrightarrow 5Fe_2(SO_4)_3 + 6MnSO_4 + 20CO_2$

$24H_2O + 3K_2SO_4$ (15)

⑤ $M\ KMnO_4 = 158\,g\,mol^{-1}$ (04+01)

moles of $MnO_4^- = \dfrac{0.948g}{158g\,mol^{-1}}$ (04+01)

Volume of FeC_2O_4 $V cm^3$

$$\frac{n\,MnO_4^-}{n\,FeC_2O_4} = \frac{3}{5} = \frac{\frac{0.948}{158}\ mol}{\frac{0.2\times V}{1000}\ mol}$$ (05) (04+01) x 2 = (10)

$$= \frac{0.948\times1000\times5}{158\times0.2\times3} = 50\,cm^3$$ (05)

ⓑ ① $6H^+ + IO_3^- + 5I^- \longrightarrow 3I_2 + 3H_2O$ (05)

$I \longrightarrow -1, +5 \longrightarrow 0$ (01x3 = 03)

② $4Mg + 10HNO_3 \longrightarrow 4Mg(NO_3)_2 + NH_4NO_3 + 3H_2O$ (04)

$N \Rightarrow +5 \longrightarrow -3$ (01x2 = 02)

③ $6NaOH + 3Cl_2 \longrightarrow 5NaCl + NaClO_3 + 3H_2O$ (05)

$Cl \Rightarrow 0 \longrightarrow -1, +5$ (01x3 = 03)

④ $2H_2S + 1SO_2 \longrightarrow 3S + 2H_2O$ (05)

$S \Rightarrow -2, +4 \longrightarrow 0$ (01x3 = 03)

④

9) i It is the formula which represents the simplest whole number ratio among the atoms of different element of a molecule. (10)

ii

	C	H	O	N	
Mass ratio	53.93	12.35	17.97	15.73	(05)
Mole ratio	$\frac{53.93}{12}$	$\frac{12.35}{1}$	$\frac{17.97}{16}$	$\frac{15.73}{14}$	(05)
	4.494	12.35	1.123	1.123	
Simplest ratio	$\frac{4.494}{1.123}$:	$\frac{12.35}{1.123}$:	$\frac{1.123}{1.123}$:	$\frac{1.123}{1.123}$	(05)
	4 :	10.99 :	1 :	1	(05)
	4 :	11 :	1 :	1	

Emphrical formula $C_4H_{11}ON$ (05)

b) i volumetricflask (03), funnel (03), watchglass (03), fourbeambalance (05), washbottle (03), distilled water. (03)

ii $M_{Na_2CO_3} = 106\,gmol^{-1}$ (05)

$c = \frac{n}{v}$ (05) $\quad n = 0.1\,mol\,d\cancel{m^{-3}} \times \frac{250}{1000}\,\cancel{dm^3}$ (05)

$= 0.025\,mol$ (05)

$n = \frac{W}{M}$ (05)

$0.025\,mol = \frac{W}{106\,gmol^{-1}}$ (05)

$W = 2.65\,g$ (05)

* Measure and get the 2.65g of Na_2CO_3 on the watchglass by using fourbeam balance. (05)
* Add the 2.65g of Na_2CO_3 into the $250cm^3$ of volumetricflask by adding water step by step until it reaches the $250cm^3$ of volume level. (05)

A/L 2021 (NOV) Chemistry Answer.

NO. Date: / /

PART – II

(5) I. • give to fluoresce
• produce to positive rays
• Rotate the blades of the paddle wheel
• heat the metal substances
• produce to x-rays

(4 x 05 = 20 marks)

II. • They observed that the majority of particles penetrated the foil either unreflected.
• They also noticed that a few α – particles were scattered at a large angle.
• Very few α – Particles bounced back in the direction from which it came.

(3x5 = 15 marks)

III. The display of electromagnetic radiation arranged in order of increasing wave length is called the electromagnetic spectrum.

(08 marks)

IV. • The principal quantum number – This quantum number defines the main energy level that the electron occupies in the atom.

• The angular momentum quantum number:– This quantum number defines the shape of the orbital.

• The magnetic quantum number:– This quantum number describes the orientation of the orbital in space

* the spin quantum number :-
Two possible values are allowed $-\frac{1}{2}$ or $+\frac{1}{2}$ which indicate the two opposite directions in which the electron can spin.
($4 \times 05 = 20$ marks)

V. • Resonance for equal resonance structures the bond length in the resonating unit becomes equal.

• The resonance hybrid has comparatively lower energy and thus a greater stability than any of the contributing structures

• Equivalent reasonance structures make equal contribution to the reasonance hybrid.

• Reasonance structures do not have real existence.
($3 \times 05 = 15$ marks)

VI. Directly
• Distribution of valence electrons
• Charges of atoms.
($2 \times 05 = 10$ marks)

not directly
• shape
• hybridization
• nature of orbitals occupied by lone pairs
• bond angle.
($2 \times 05 = 10$ marks)

VII. Anion Same
cation charge same
but size increases $Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+}$
so, Polarizing powder decreases $Mg^{2+} > Ca^{2+} > Sr^{2+} > Ba^{2+}$
(5×05 = 25 marks)
Therefore ionic character $MgCl_2 < CaCl_2 < SrCl_2 < BaCl_2$

VIII.

	H_2S	SO_3^{2-}	SO_4^{2-}
hybridization of S	sp^3	sp^3	sp^3
Charge of S	0	0	0
Oxidation state of S	−2	+4	+6

(3×3 = 09 marks)

hybridization and charge are same. So electronegativity depends on oxidation state of S. —(04) (04)
Higher oxidation state greater the electronegativity than neutral —(05)
Therefore electronegativity of ~~H~~ S
$SO_4^{2-} > SO_3^{2-} > H_2S$ —(05)

18 marks

150

(b) I. In 100g Sodium hydroxide Solution

Mass of NaOH = ~~20g~~ = 10g
mole of NaOH = $\frac{\cancel{20g}}{\cancel{40gmol^{-1}}}$ = $\frac{10g}{40gmol^{-1}}$ ✓
= ~~0.5 mol~~ = 0.25 mol ✓
mass of H_2O = 90g
mole of H_2O = $90g / 18gmol^{-1}$ ✓
= 5 mol ✓

mole fraction of NaOH = $\frac{0.25mol}{5mol + 0.25mol}$ ✓
(✓6×3 = 18 marks) = 0.048 ✓

9

II. $ppm = \frac{4\times10^{-3}g}{2000g} \times 10^{6}$

$= 2$ — (5) marks

III. • extremely pure

• stable

• not hydrated and highly water soluble

• high molecular weights

($4\times5 = 20$ marks)

IV.

Mass Percentage of O $= \frac{48g}{160g} \times 32g$

$= 9.6g$

(07 marks)

50

b) No. of mole of C $= \frac{54.55 \times 88}{100 \times 12}$ mol

$= 4$ mol — 5

let, $C_4H_xO_y = 88\ g\,mol^{-1}$

$4 \times 12\,g\,mol^{-1} + x \times 1\,g\,mol^{-1} + y \times 16\,g\,mol^{-1} = 88\ g\,mol^{-1}$ — 5

$x + 16y = 40$ — 5

$y = 1 \quad x = 24$ not possible

$y = 2 \quad x = 8$ possible — 5

So, Molecular formula $C_4H_8O_2$ — 5

25

c) mass of solution in $1\,cm^3 = 1.84\,g$

mass of solution in $1000\,cm^3$ = ~~98 g~~ 1840 g ✓

mass of H_2SO_4 in 100 g soln = 98 g

mass of H_2SO_4 in 1840 g soln $= \frac{98}{100} \times 1840\,g$ ✓

mass of H_2SO_4 in $1\,dm^3$ soln $= \frac{98 \times 1840}{100}\,g$ ✓

No. of mole H_2SO_4 in $1\,dm^3$ soln $= \frac{98 \times 1840\,g}{100 \times 98\,g\,mol^{-1}}$ ✓

$= 18.4$ mol ✓

Molarity of H_2SO_4 = $18.4\ mol\ dm^{-3}$ ✓

Amount of ~~HCl~~ H_2SO_4 moles in $600\ cm^3$ of $2.3\ mol\ dm^{-3}$ H_2SO_4 solution

$$= 2.3\ mol\ dm^{-3} \times 600 \times 10^{-3}\ dm^3 ✓$$
$$= 1380 \times 10^{-3}\ mol ✓$$

The required volume of the concentrated H_2SO_4 solution is $V\ cm^3$ ✓

$$1380 \times 10^{-3}\ mol = \frac{18.4\ mol \times V}{1000\ cm^3} ✓$$

$$V = 75\ cm^3 ✓$$

$11 \times 5 = 55$

Accurately measured volume of $75\ cm^3$ of concentrated H_2SO_4 is diluted up to the mark of the volumetric flask to prepare the solution of $600\ cm^3$ of $2.3\ mol\ dm^{-3}$ H_2SO_4. 20

$50 + 25 + 55 + 20 = 150$

(8) (7)

a) I. Molar masses of NO and O_2 are comparable but boiling point of NO is greater than O_2. Hence the relative strength of inter molecular interaction forces among NO molecules should be greater than the O_2 molecules.

~~15 mo~~

Oxygen molecular is a non polar molecule. polar NO has dipole-dipole attractions among the molecules.
So, Inter molecular force NO > O_2
boiling point NO > O_2

1.5 marks

II. • Number of electrons donated by atoms to create the metallic bond
• Ionic radius
• Ionic nature

09 marks

III.

$$3Mg + N_2 \longrightarrow Mg_3N_2$$ ✓

No. of moles of Mg $= \dfrac{0.48g}{24g\,mol^{-1}}$ ✓

$= 2 \times 10^{-2}$ mol ✓

No. of moles of N_2 $= \dfrac{0.14g}{28g\,mol^{-1}}$ ✓

$= 5 \times 10^{-3}$ mol ✓

$$\frac{n_{Mg}}{n_{N_2}} = 3/1$$ ✓

The no. of moles N_2 required to complete consumption $= \frac{1}{3} \times 2 \times 10^{-2}$

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

$= 6.6 \times 10^{-3}$ mol ✓

So, limiting reagent is N_2 ✓

$8 \times 02 = 16$ marks

(IV) a) $2AgNO_3 + BaCl_2 \rightarrow 2AgCl + Ba(NO_3)_2$

$Ba(OH)_2 + 2HCl \rightarrow BaCl_2 + 2H_2O$

(10 marks)

b) No. of mole of HCl $= 20 \times 10^{-3}$ mol dm^{-3} $\times 100 \times 10^{-3}$ dm^3 ✓

$= 2 \times 10^{-3}$ mol ✓

$\frac{n_{Ba(OH)_2}}{n_{HCl}} = \frac{1}{2}$ ✓

$n_{Ba(OH)_2} = \frac{1}{2} \times 2 \times 10^{-3}$ mol ✓

$= 1 \times 10^{-3}$ mol ✓

$C_{Ba(OH)_2} = 1 \times 10^{-3}$ mol $/ 0.1$ dm^3 ✓

$= 0.01$ mol dm^{-3} ✓

(✓ 7 × 5 = 35 mark)

c) $\frac{n_{BaCl_2}}{n_{HCl}} = \frac{1}{2}$ ✓

VII.

$n_{BaCl_2} = \frac{1}{2} \times 2\times10^{-3}$ mol ✓

$= 1\times10^{-3}$ mol ✓

$\frac{n_{AgCl}}{n_{BaCl_2}} = \frac{2}{1}$ ✓

$n_{AgCl} = 2\times10^{-3}$ mol ✓

$W_{AgCl} = 2\times10^{-3}$ mol $\times 143.5$ g mol^{-1} ✓

$= 0.287$ g ✓

(✓ 7 × 05 = 35 marks)

V.

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O \quad \text{—(5)}$$

$$HCl + NaOH \longrightarrow NaCl + H_2O \quad \text{—(5)}$$

Number of moles of intial HCl

$= 1\,mol\,dm^{-3} \times 30 \times 10^{-3}\,dm^{3}$ ✓

$= 30 \times 10^{-3}\,mol$ ✓

Number of moles of NaOH

$= 1\,mol\,dm^{-3} \times 10 \times 10^{-3}\,dm^{3}$ ✓

$= 10 \times 10^{-3}\,mol$ ✓

$n_{NaOH} : n_{HCl} = 1 : 1$ ✓

So, remaining HCl mole $= \cancel{30 \times 10^{-3} - 20 \times 10^{-3}}$

$= 10 \times 10^{-3}\,mol$ ✓

Therefore, Reacted moles of HCl with $CaCO_3 = 30 \times 10^{-3} - 10 \times 10^{-3}$ ✓

$= 20 \times 10^{-3}\,mol$ ✓

$$\frac{n_{CaCO_3}}{n_{HCl}} = \frac{1}{2}$$ ✓

No. of moles of $CaCO_3 = \frac{1}{2} \times 20 \times 10^{-3}\,mol$ ✓

$= 10 \times 10^{-3}\,mol$ ✓

Weight of $CaCO_3 = 10 \times 10^{-3}\,mol \times 100\,g\,mol^{-1}$ ✓

$= 1\,g$ ✓

mass percentage of $CaCO_3 = \frac{1\,g}{1.25\,g} \times 100$ ✓

(15 × 2 = 30 marks) $= 80\%$ ✓

30