தொண்டைமானாறு வெளிக்கள நிலையம் நடாத்தும்
1ம் தவணைப் பரீட்சை
Field Work Centre, Thondaimanaru
1st Term Examination

Grade - 12 (2022) | Chemistry | Marking Scheme

Part - I

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

திருத்தம்

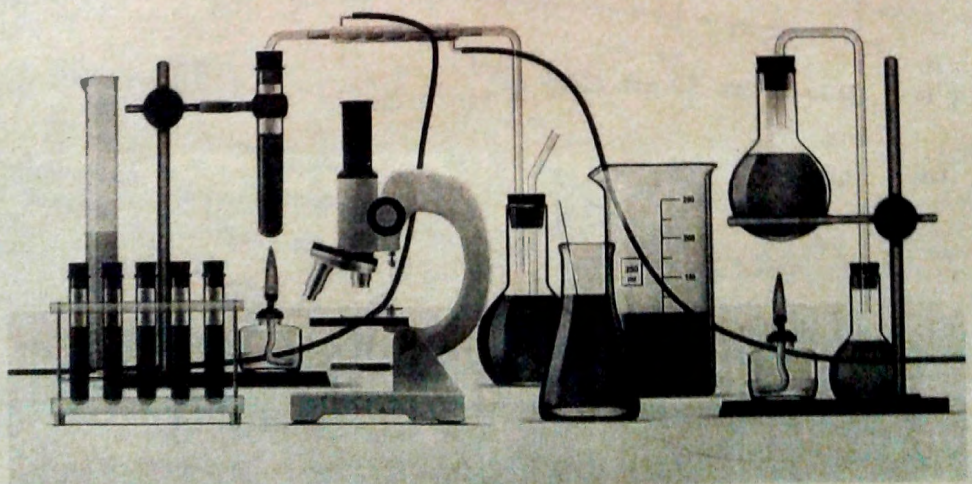
அமைப்புக்கட்டுரை வினா இல – 02

02 (A) - 15018

(V) AF_4

B) (3) ICl_4^-

MCQ (15) கரைசலின் அடர்த்தி $1.10g\ cm^{-3}$



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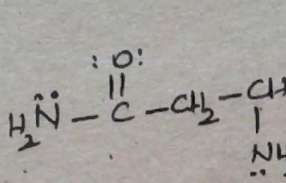
Marking scheme

Part II-A – Structured Essay

(I) (a) (i) SiC (ii) BF_3 (iii) I_3^- (iv) KIO_3 (v) SF_6

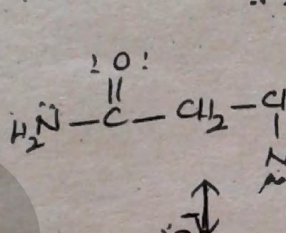
100 (vi) SO_3 --- (6 × 05 = 30 marks)

(b) (I) (i)



--- 04 marks

(ii)



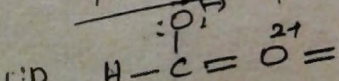
} 2 × 02 = 04 marks

(II) (i)

Atoms	Electron pair geometry	Shape	Hybridization	Oxidation number
C^x	trigonal planar	trigonal planar	sp^2	+2
O^y	tetrahedral	angular/V-shaped	sp^3	−2
C^z	linear	linear	sp	+4

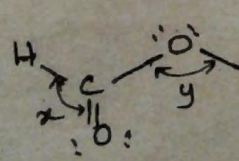
– 12 × 01 = 12 marks

(ii)



--- 02 marks

(iii)



04

$x \simeq 120°$
$y \simeq 104° – 105°$
$z \simeq 180°$

} marking the correct value 03

(iv) electronegativity $C^x < C^z$ --- 02

C^x – sp^2 hybridized C^z – sp hybridized

Higher the s-character, greater is the electronegativity 02

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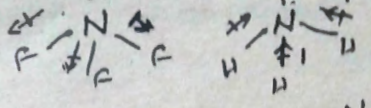
(b) (i) False

Reason —



F is more electro-negative than N whereas H is less electro negative compared to N. Net dipole moment is higher in NH_3 than in NF_3.

(ii) True

Reason: NH_3 has both dipole moment and London forces whereas CCl_4 has London forces as their intermolecular attraction.

Due to higher molar mass of CCl_4, London forces are dominat and hence overall seondary interaction is greater in CCl_4.

(iii) True.

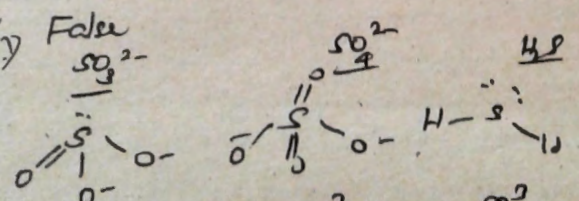
In both compounds, anion is the same. Of the cations Be^{2+} and Ca^{2+}, charge is the same but size $Be^{2+} < Ca^{2+}$

∴ Polarizing power of $Be^{2+} > Ca^{2+}$

∴ Ionic nature of $CaCO_3$ is greater than that of $BeCO_3$ and hence the decomposition temperature for $CaCO_3$ is higher than that of $BeCO_3$

(c)

(i) False



	SO_3^{2-}	SO_4^{2-}	H_2S
Hybridization	sp^3	sp^3	sp^3
Oxidation state	+4	+6	−2

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Reason : Factors dealing electronegativity are hybridization, charge and oxidation state of the central atom.

In the given species SO_3^{2-}, SO_4^{2-} and H_2S, hybridization is the same (sp^3).

The more the positive charge on the atom, the more its ability to attract electrons.

∴ Electronegativity follows the order

$SO_4^{2-} > SO_3^{2-} > H_2S$

(v) True

Reason : O is more electronegative than S.

∴ The bond pair electrons are attracted more towards the central atom in H_2O than in H_2S.

∴ Greater repulsion between bond pairs.

True / false → 02 marks

Reason → 05 marks.

$07 \times 5 = 35$

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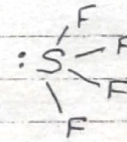
(A) NO. Date: / /

02. (i) 16 — (10) (ii) S — (08)

(iii) $1s^2 2s^2 2p^6 3s^2 3p^4$ — (08) (iv) −2, −1, 0, +1, +2, +4, +5, +6 — (08)

(v) 

, sea saw 06 + 06

46

(B) (i) $BaCl_2 > CaCl_2 > MgCl_2 > BeCl_2$

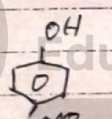
(ii) $NO_4^- > NO_3^- > NO_2^- > NO$

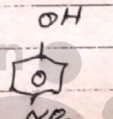
(iii) $BCl_3 > CCl_4 > NCl_3 > PCl_4^+$

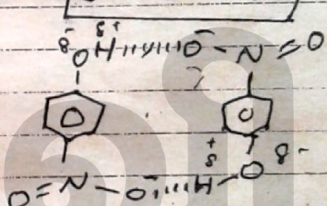
(iv) $SO_3 > SO_2 > SO_4^{2-} > S_2O_6^{2-}$

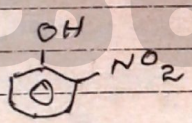
(v) $ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

5 × 06 = 30

(C) (i) 

(ii) 

(iii) 

(iv) 

4 × 06 = 24

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3) (a) I. $2SCN^- + 12H_2O \longrightarrow N_2 + 2SO_4^{2-} + 2CO_2 + 24H^+ + 22e$ — (5)

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

III. $56H^+ + 22MnO_4^- + 10SCN^- \longrightarrow 22Mn^{2+} + 28H_2O + 10CO_2 + 10SO_4^{2-} + 5N_2$ — (10)

IV (i) $n_{MnO_4^-} = 0.25 \text{ mol dm}^{-3} \times 10 \times 10^{-3} \text{ dm}^3$

$= 2.5 \times 10^{-3}$ mol. — (5)

$n_{SCN^-} = 0.05 \text{ mol dm}^{-3} \times 20 \times 10^{-3} \text{ dm}^3$ — (5)

$= 1 \times 10^{-3}$ mol.

(ii) $\frac{n_{MnO_4^-}}{n_{SCN^-}} = \frac{22}{10}$ — (4)

2·2 mol MnO_4^- is needed to react with 1 mol of SCN^-

$\therefore MnO_4^-$ is in excess. — (4)

$\therefore$ limiting reagent is SCN^- — (4)

(iii) $\frac{n_{CO_2}}{n_{SCN^-}} = \frac{1}{1}$ — (5)

$n_{CO_2} = 1 \times 10^{-3}$ mol. — (5)

(b) I. $Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$.

II. $3Cl_2 + 6NaOH \longrightarrow 5NaCl + NaClO_3 + 3H_2O$.

III. $IO_3^- + 5I^- + 6H^+ \longrightarrow 3I_2 + 3H_2O$.

IV $Cr_2O_7^{2-} + 3SO_2 + 2H^+ \longrightarrow 2Cr^{3+} + 3SO_4^{2-} + H_2O$.

$4 \times 6 = (24)$

(c) I. Iron (II) sulfide

II. dihydrogen monoxide.

III. sodium hydrogen carbonate.

IV. perchloric acid.

$4 \times 6 = (24)$

Total 100

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4) (a) (i) A formula, which indicates the number of atoms of each element in a molecule of a compound —(5)

(ii)

	C		H		O
mass ratio	42.1	:	6.43	:	51.46
mole ratio	$\frac{42.1}{12}$	:	$\frac{6.43}{1}$	:	$\frac{51.46}{16}$ —(5)
	3.508	:	6.43	:	3.21
simplest ratio	$\frac{3.508}{3.21}$	:	$\frac{6.43}{3.21}$	:	$\frac{3.21}{3.21}$
	1.09	:	2.00	:	1
	11.99	:	22	:	11 —(5)

$C_{12}H_{22}O_{11}$ —(5)

$(\text{empirical formula})_n$ = molecular formula.

$342\,n = 342$ —(5)

$n = 1$ —(5)

molecular formula $C_{12}H_{22}O_{11}$ —(5)

(b)

Let volume of $3\,mol\,dm^{-3}$ taken as $V\,cm^3$

n_{HNO_3} in $2\,mol\,dm^{-3}$ solution = n_{HNO_3} in $3\,mol\,dm^{-3}$ Sol^n + n_{HNO_3} in $0.2\,mol\,dm^{-3}$ Sol^n

$2\,mol\,dm^{-3} \times 200\times10^{-3}\,dm^3 = 3\,mol\,dm^{-3} \times V \times 10^{-3}\,dm^3 + 0.2\,mol\,dm^{-3} \times (200-V) \times 10^{-3}\,dm^3$ —(10)

$400 = 3V + 0.2(200-V)$ —(5)

$400 = 3V + 40 - 0.2V$

$360 = 2.8V$

$V = \frac{360}{2.8} = \frac{900}{7}\,cm^3$ —(5)

Volume of $3\,mol\,dm^{-3}$ of HNO_3 = $128.57\,cm^3$ —(5)

Volume of $0.2\,mol\,dm^{-3}$ of HNO_3 = $(200-128.57)\,cm^3$

= $71.43\,cm^3$ —(5)

5

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(c) $Na_2CO_3 \xrightarrow{\Delta} X$

$2\,NaHCO_3 \longrightarrow Na_2CO_3 + H_2O + CO_2$ — (5)

$2 \times 84 \quad 106 \quad 18 \quad 44$

If lose of mass is 62g, $W_{NaHCO_3} = 168\,g$. — (1)

" " " 2.48g, $W_{NaHCO_3} = \frac{168\,g}{62\,g} \times 2.48\,g$. — (2)

$= 6.72$ — (3)

$n_{NaHCO_3} = \frac{6.72\,g}{168\,g\,mol^{-1}}$ — (2)

$= 0.04\ mol.$ — (2)

$n_{NaHCO_3} : n_{Na_2CO_3} = 2 : 1$ — (1)

$n_{Na_2CO_3}$ produced from $NaHCO_3 = 0.02\ mol.$ — (1)

initial $W_{Na_2CO_3} = (8.84 - 6.72)\,g$

$= 2.12\,g.$ — (5)

initial $n_{Na_2CO_3} = \frac{2.12\,g}{106\,g\,mol^{-1}}$

$= 0.02\ mol$ — (5)

final $n_{Na_2CO_3} = 0.02 + 0.02 = 0.04\ mol.$ — (3)

$\frac{\text{initial } n_{Na_2CO_3}}{\text{final } n_{Na_2CO_3}} = \frac{0.02\ mol}{0.04\ mol} = \frac{1}{2}$ — (5)

Total (35)

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Part II B Essay Question.

(5) (a) (i) Observations :

- Major part of α-particles penetrated without any deflection.
- A small fraction was deflected by small angles.
- Only a tiny fraction of α particles was deflected in the opposite direction (180°)

$3 \times 05 = 15$

Inferences :

- Major portion of the atom is vacuum
- There must be a positively charged portion which is responsible for the deflection of +tively charged α particles. (It is called the nucleus)
- The size of the nucleus is negligible in comparison to the size of the whole atom.

$3 \times 05 = 15$

(ii) Particle nature : • Having momentum or mechanical energy (rotating the peddle wheel)

Wave nature : Diffraction / formation of shadows

$2 \times 05 = 10$

(iii) Definition ---- 05 10

(iv) $\nu = \frac{c}{\lambda} = \frac{3 \times 10^8 \text{ ms}^{-1}}{460 \times 10^{-9}}$ ---- 05 10

$= 6.52 \times 10^{14} \text{ s}^{-1}$ -- 05 15

Energy of a photon $= h \frac{c}{\lambda}$

$= 6.63 \times 10^{-34} \text{ Js} \times 3 \times 10^8 \text{ ms}^{-1} / 460 \times 10^{-9} \text{ m}$

$= 4.32 \times 10^{-19} \text{ J}$ 10 05

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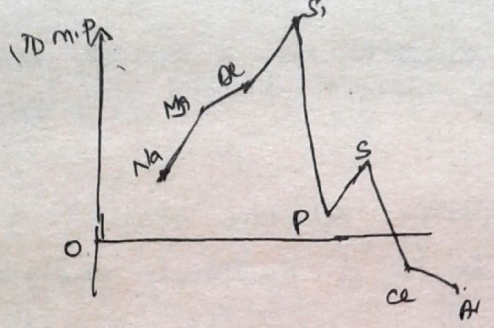
Energy of 1 mole of photon

$= 4.32 \times 10^{-19}\ J \times 6.022 \times 10^{23}\ mol^{-1}$

$= 26.01 \times 10^{4}\ J\ mol^{-1}$ --- (05)

(b) (i) $S^{2-} > Cl^- > O^{2-} > F^- > O > F$ --- (04)



Plot → (05)

Explanation for the variation trend → (05)

(ii) $BeF_2 < BaCl_2 < CaCl_2 < MgBr_2$ ---- (04)

Explanation based on polarizability and polarizing power. ——— (04)

(iii) Electronegativity is a measure of the ability of an atom bonded with others in a molecule/ion to attract the (bonded) electrons towards itself. ---- (04)

Factors :
- hybridization
- charge
- oxidation state.
- surrounding of the atom.

any three $3 \times 03 =$ (09)

(c) (i) XeF_4 (ii) SF_4 (iii) IF_5 (iv) NF_3 (v) SO_4^{2-}

$5 \times 06 =$ (30)

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6) (a) (i) If two or more Lewis structures could be drawn for a molecule or ion, which differ only by the arrangement of electrons in their structures can be called resonance. — (10)

(ii) (i) The resonance hybrid has comparatively lower engry and thus a greater stability than any of the contributing structures.

(ii) Equal resonance structures contributes equally in the hybridisation of resonance.

(iii) Unequal resonance structures do nd contribute equally in resonance. Also a structure with higher stability contributes more.

(iv) bond lengths of resonance units of equal resonance strudures are equal

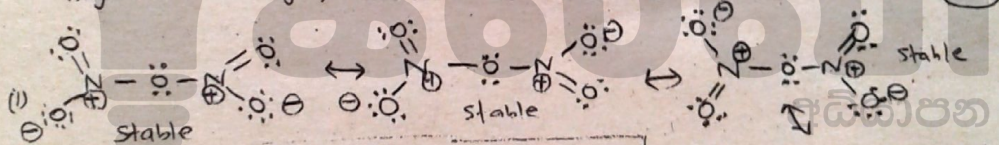
— (20)

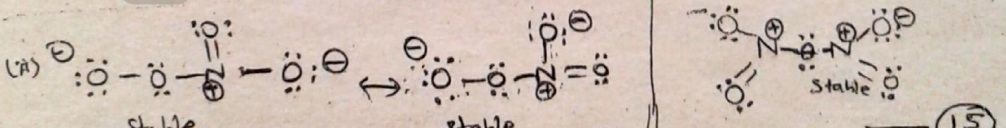
(iii) (i) The most stable resonance structure must have the highest covalent bond and least formal charge.

(ii) If a neighbouring atom contains similar charge, it is unstable.

(iii) When atoms possess opposite charges, the eledro negative atom must be negatively charged and the electropositive atom must be positively charged.

(iv) If the atoms F and O which are electronegative atoms, contain negative charge, then it is unstable — (20)

(iv) (i) 

(ii) 

— (10) — (15)

(b) I. The abitity of attracting the electron cloud of an anion, by the electric field of a cation is known as polarisability. — (10)

II When an cation moves towards an anion, the spherical electron cloud of the anion changes into elliptical shape by the positive electric field is called polarisation. — (15)

(i) $BeCO_3 < MgCO_3 < CaCO_3 < SrCO_3$

There is no change in size and charge of anion.
There is no change in the charge of cation. Size increases along group. Polarising ability of cation decreases.
covalency reduces / ionic property increases.
Melting point increases. — (25)

(ii) $LiI < LiBr < LiCl < LiF$.

There is no change in the charge and size of cation.
There is no change in the charge of cation. The size increase along the group.
The polarisability of anion increases.
The property of covalency increases / ionic property decreases.
Melting point is in the above order — (25)

Q6. 75 + 75 = 180

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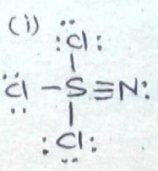
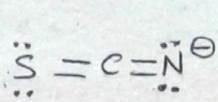
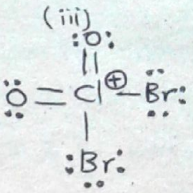
7 (a) I

(i) 

(ii) 

(iii) 

$3 \times 5 = (15)$

II)

	$XeOF_4$	ICl_2^-	SF_4
Number of VSEPR pairs	6	5	5
Number of σ bonds	5	2	4
Number of lone pairs	1	3	1
Shape.	square pyramid	Straight line	distorted tetrahedral or see saw.

$12 \times 1 = (12)$

III) that could be obtained directly ; * charge of atoms
* distribution of valence electrons (5)

that could not be obtained directly ; shape, bond angle, type of hybridisation, which orbitals are used for the formation of bonds, geometry of electron pair (6)

IV) * water being in liquid state at room temperature.
* ice floating in the polar area.
* specific heat capacity of water being high.
* latent heat of vaporisation of water being high.
* DNA acquires hardness
* surface tension of water being high

$3 \times 4 = (12)$

Total 50

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b) Number of moles of H_2SO_4 $= 0.5 \text{ mol dm}^{-3} \times 40 \times 10^{-3} \text{ dm}^3$

$= 20 \times 10^{-3}$ mol. — (5)

number of H_2SO_4 moles required to react with $250 \text{ cm}^3 = \frac{20 \times 10^{-3} \text{ mol}}{50 \text{ cm}^3} \times 250 \text{ cm}^3$

$= 100 \times 10^{-3}$ mol.

$= 0.1$ mol — (5)

$Ba(OH)_2 + H_2SO_4 \longrightarrow BaSO_4 \downarrow + 2H_2O$ — (5)

$\frac{n_{Ba(OH)_2}}{n_{H_2SO_4}} = \frac{1}{1}$ — (5)

$n_{Ba(OH)_2} = 0.1$ mol — (5)

mass of $Ba(OH)_2 = 0.1 \text{ mol} \times 171 \text{ g mol}^{-1}$

$= 17.1$ g. — (5)

mass of KCl $= 30 \text{ g} - 17.1 \text{ g}$

$= 12.9$ g. — (5)

$\frac{n_{H_2SO_4}}{n_{BaSO_4}} = \frac{1}{1}$ — (5)

$n_{BaSO_4} = 0.1$ mol — (5)

mass of $BaSO_4 = 0.1 \text{ mol} \times 233 \text{ g mol}^{-1}$

$= 23.3$ g. — (5)

Total 50

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c) Let initial moles of $CaCO_3 = n_1$ and $MgCO_3 = n_2$ — (S)

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$
$$n_1 \qquad\qquad\qquad n_1$$ — (S)

$$MgCO_3 \xrightarrow{\Delta} MgO + CO_2$$
$$n_2 \qquad\qquad\qquad n_2$$ — (S)

initial mixture, $100 n_1 + 84 n_2 = 4.4$ — (1) (S)

for CO_2, $44 n_1 + 44 n_2 = 2$ — (2) (S)

$\frac{(1)}{(2)} \Rightarrow \frac{100 n_1 + 84 n_2}{44 (n_1 + n_2)} = \frac{4.4}{2}$ — (S)

$\frac{100}{44} \left(\frac{n_1}{n_1 + n_2} \right) + \frac{84 n_2}{44 (n_1 + n_2)} = 2.2$ — (S)

$\frac{100 x + 84 (1 - x)}{44} = 2.2$ — (S)

$\frac{16x + 84}{44} = 2.2$ — (S)

$16x = 12.8$

$x = 0.8$ — (S)

Total 50

Q5. 50 + 50 + 50 = 150