4.7.2 Chemistry Paper 2 (233/2)

Qn No.	Responses	Marks
1	**(a)**	
	(i) $C_nH_{2n}-alkyne$ ✓1	(1 mark)
	(ii) $C_nH_{2n}-alkene$ ✓1	(1 mark)
	(b)	
	(i) Solid because it is saturated. ✓1	(1 mark)
	(ii) I. $CH_2OHCHOHCH_2OH$ ✓ 1	(1 mark)
	II. $CH_3(CH_2)_{16}COONa$ ✓ 1	(1 mark)
	III. Cleaning agent /.cleansing agent ✓ 1	(1 mark)
	(c) (i) Calcium carbide✓ ½ and water. ✓ ½	(1 mark)
	(ii) $CaC_{2(s)} + H_2O_{(s)} \rightarrow Ca(OH)_{2(aq)} + C_2H_{2(g)}$ ✓ 1	(1 mark)
	(d) (i) When many unsaturated molecules called monomers combine to form a giant / macro molecule of high relative molecular mass called a polymer.✓ 1	(1 mark)
	(ii)	(1 mark)

(iii)	• Used as a glass substitute;✓ 1	(1 mark)
	• Electronic instruments housing;	
	• Wind screen;	
	• Safety glasses;	
	• vehicle headlamps;	
	• Bullet proofing.	

(iv)		
	• Emit toxic fumes when burned affecting human life. ✓ ½	
	• They are non-biodegradable hence pollutes the environment. ✓ ½	
	• Accelerates fires when burned / highly flammable.	
	(Any two correct @½ mk)	**(1 mark)**
2(a)		
(i)	**G** ✓ 1 – Contains delocalized electrons ✓ 1 present in solid and molten state.	
(ii)	In solid state, the ions are rigidly held in position and cannot move, hence will not conduct. ✓ 1	**(2 marks)**
	In molten/aqueous state, the ions are mobile and will be able to conduct electric current. ✓ 1	
(b) (i)		
	• The blue electrolyte fades and finally changes from blue to colourless. ✓ ½	**(2 marks)**
	• Effervescence / bubbles of a colourless gas. ✓ ½	
	• A brown deposit forms on the cathode. ✓ ½	**(1½ marks)**
(ii)	$4OH^-(aq) \rightarrow O_{2(g)} + 2H_2O_{(l)} + 4e^-$ ✓ 1	**(1 mark)**
(iii)	The pH will change from 6 to less than 4 i.e. the resulting solution will be acidic. ✓ ½	**(½ mark)**
(c)	With copper electrodes:	
	Anode will go into solution as copper ions hence it decreases in mass/size. ✓ ½	**(½ mark)**
	Brown deposit forms at the cathode hence the cathode increases in mass. ✓ ½	**(½ mark)**
(d) (i)	This is the coating of an article / object with another metal by electrolytic method./ electrolysis. ✓ 1	**(1 mark)**

(ii) To prevent articles from rusting and to make them attractive.   (1 mark)

(iv) Quantity of electricity $= \dfrac{3}{2} \times 60 \times 60 \times 0.6$ ✓1

$= 3240$ coulombs. ✓ ½

$108g \quad Ag \equiv 96,500$ coulombs

$? \qquad \equiv 3240$ coulombs

$= \dfrac{108 \times 3240}{96,500}$ ✓1

$= 3.626g$ ✓½

OR

$= \dfrac{0.6 \times 1.5 \times 60 \times 108}{96,500}$ ✓2½

$= 3.626 \text{ g}$ ✓ ½   (3 marks)

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3 (a) (i) To remove oxide layer on the metal. ✓ 1   (1 mark)

(ii) **Beaker I:**
- Bubbles of a colourless gas / effervescence ; ✓1
- Solution turns green; ✓   (1 mark)
- the size of iron rod decreases ✓.

Beaker II:
- The solution remained colourless. ✓1   (1 mark)
- No bubbles/effervescence

(iii) **Beaker I:**
Iron is above hydrogen in the reactivity

Series therefore will react with the acid to form iron(II) sulphate ($FeSO_4$)   (1 mark)

which is green and produces hydrogen gas. ✓1

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OR

Iron is more reactive than hydrogen hence it reacts with sulphuric(VI) acid to

produce hydrogen gas and iron(III) sulphate which is green.

Beaker II:
Copper is below hydrogen hence no reaction will take place. ✓ 1

(b) (i) To dry hydrogen gas. ✓ 1   (1 mark)

(ii) Calcium oxide /anhydrous calcium chloride /silica gel.✓ 1   (1 mark)

(Accept the formulae)   (1 mark)
(Any one correct @ 1mk)

(iii) To suck the products of the burning into the boiling tube. ✓ 1
(iv)   Water ✓ 1   (1 mark)
(v)   Boil the liquid. If it boils at 100°C/ constant, then this confirms that it is   (1 mark)
       water.✓ 1   (1 mark)

OR

Freeze the liquid. If it freezes at 0°C, then this confirms that it is water✓/
Determine density of liquid, if it is 1g/cm^3 then it is water.
(Accept any one correct @ 1mk)
(vi)   Dry -The substance is free from moisture.✓ 1   (2 marks)

Anhydrous - The substance has lost its water of crystallization through heating,

to form anhydrous substances.✓ 1

4 (a)

   (i)   **W** is acidic. ✓1   (1 mark)

   (ii)   Sulphuric(VI) acid, H_2SO_4. ✓1   (1 mark)

   (iii)   (II) - Magnesium sulphate. ✓1   (1 mark)

           (III) - Sodium sulphate. ✓1   (1mark)

   (iv) $Ba^{2+}(aq) + SO_4^{\,2-}(aq) \rightarrow BaSO_{4(s)}$ ✓1   (1 mark)

(b) (i)

    (I)

	V	**Cl**
Mass (g)	19.75	80.25
RAM	27	35.5
Moles	$\dfrac{19.75}{27}$	$\dfrac{80.25}{35.5}$ ✓½
÷ smaller	$\dfrac{0.73}{0.73}$	$\dfrac{2.26}{0.73}$ ✓½
	1	3 ✓½

Empirical - **VCl₃** ✓½   (2 marks)

    (II)   Molar mass $= 267$

              Empirical mass $VCl_3 = 27 + 35.5 \times 3$

                           $= 27 + 106.5$

                           $= 133.5$ ✓½

    (Empirical mass) n $=$ molecular mass

          $133.3n = 267$

              $n = 267 \div 133.5$

              $n = 2$ ✓1
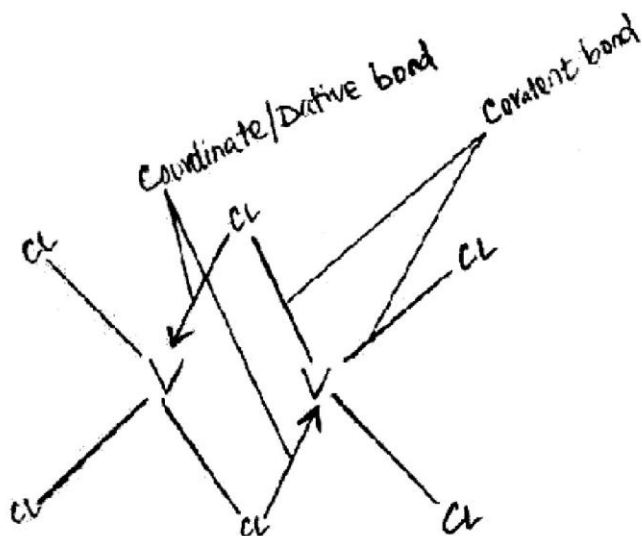
   $(VCl_3)_2 = V_2Cl_6$ (2 marks)

$\therefore$ Molecular formula $= V_2Cl_6$ ✓ ½

(ii)

Coordinate/Dative bond

Covalent bond

(1 mark)

(iii) $VCl_3(s) + 3NaOH(aq) \longrightarrow V(OH)_3(s) + 3NaCl(aq)$ ✓ [1]

(1 mark)

OR

$V_2Cl_6(s) + 6NaOH(aq) \longrightarrow 2V(OH)_3(s) + 6NaCl(aq)$

OR

$V^{3+} + 3(OH^-)_{3(aq)} \longrightarrow V(OH)_{3(S)}$

5. (a)

(i)

Syringe

— Dilute hydrochloric acid
— Magnesium.
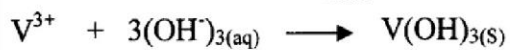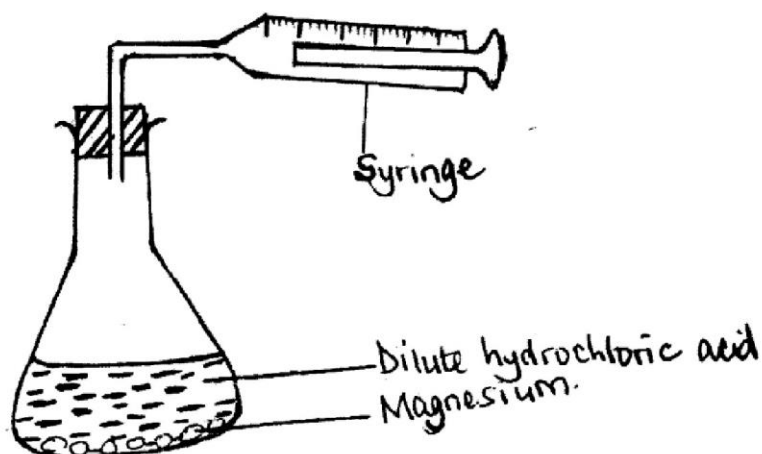
Workability - 1mark
Measurement of the gas- 1 mark
Labeling of reactants and gas - 1mark

(ii) $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$ ✓ 1

(iii) $Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2(aq)} + H_{2(g)}$
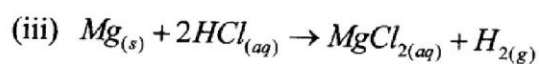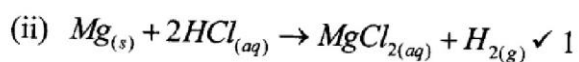
Moles of Mg $= \dfrac{0.048}{24} = 0.002$ ✓½

Moles of Mg = Moles of $H_2 = 0.002$ ✓½

Volume of hydrogen gas $= 0.002 \times 0.048$ litres ✓½

$= 0.048 dm^3$ ✓½

(iv) Moles of HCl = 2 x 0.002 ✓½ = 0.004. ✓½

$\dfrac{volume \times 0.1}{1000} = 0.004$ ✓ ½

Volume $= \dfrac{0.004 \times 1000}{0.1}$ ✓ ½

$= 4/0.1 = 40 cm^3$ ✓1

(3 marks)

(1 mark)

(2 marks)

(3 marks)

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6. (a) Sulphur(IV) oxide ✓ [1]   (1 mark)

(b) Oxygen ✓ [1] and nitrogen(IV) oxide. ✓ [1]   (2 marks)

(c) Lead(II) oxide/ PbO. ✓ [1]   (1 mark)

(d) Lead. ✓ [1]   (1 mark)

(e) (i) Grey beads formed at cathode ; ✓ [1]

       Bubbles/ effervescence.of a colourless gas at the anode ✓ [1]   (2 marks)

     (ii) $2O^{2-}(l) \longrightarrow 2O_2(g) + 4e^-$ ✓ [1]   (1 mark)

(f) $Pb^{2+}_{(aq)} + 2I^-(aq) \rightarrow PbI_2(s).$ ✓ [1]

                                             (1 mark)

(g) A white precipitate ✓ [½] was formed which dissolves in excess to form a   (1 mark)

     colourless solution. ✓ [½]

(h) (i) Displacement / Redox reaction ✓ [1]   (1 mark)

     (ii) $Pb^{2+}(aq) + Zn(s) \rightarrow Pb(s) + Zn^{2+}(aq).$ ✓ [1]   (1 mark)

7 (a)

(i)

½

Disintegration rate (s⁻¹) vs Time (hours) graph showing a decay curve from about 730 at time 0 down to about 220 at time 25.

Plotting ✓ 1
Scale ✓ 1
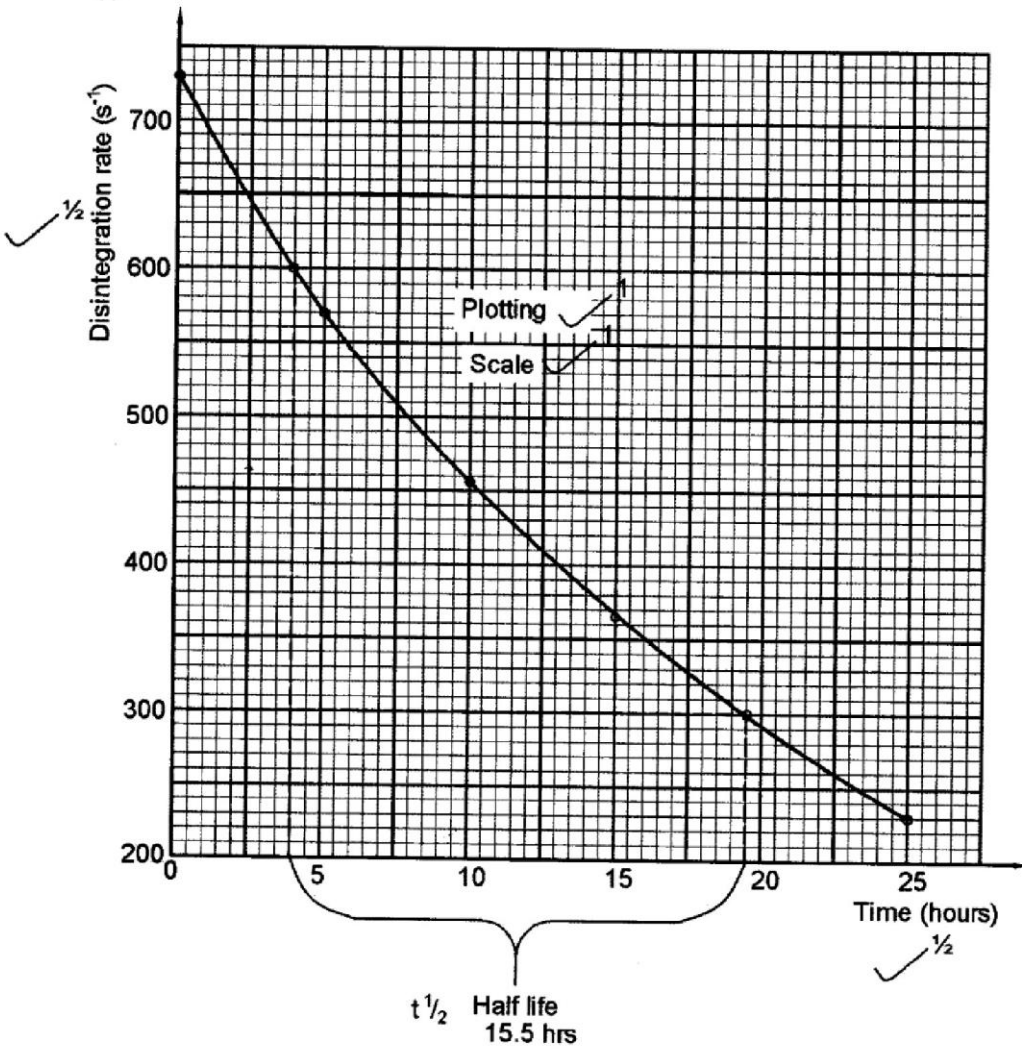
t ½ Half life
15.5 hrs

Plotting ✓ 1
Scale ✓ 1
Labeling ✓ 1

(3 marks)

(i)   600 counts to 300 counts
Half-life = 19.5 − 4 = 15.5 hours ± 0.1 ✓ 1

OR

500 counts to 250 counts
23.0 - 7.5 = 15.5

(1 mark)

(ii)   It would have no effect on the curve as the quantity of bismuth does not affect half-life. ✓ 1   (1 mark)

(b) (i)   **Applications in medicine**

  • Sterilizing surgical instruments.

  • Destroying cancerous tissues during   ✓ 1

    radiotherapy.

  • Provide power to the heart pace setters.   (1 mark)

  (Any one correct @ 1mk)

(ii)   **Applications in agriculture**

  • Monitor photosynthesis and other related processes.

  • Preservation of foodstuffs, by exposing   ✓1

    Micro-organisms to gamma rays.

  • Rate of absorption of a fertilizer by the plant.   (1 mark)

  (Any one correct @ 1mk)

(iii)**Applications in Tracers**
  • Detecting leakages in underground water or oil
pipes. ✓ 1   (1 mark)

(iv)**Applications in Nuclear power stations.**

  • To generate electricity.   ✓ 1   (1 mark)

(d) **Dangers of radioactivity**

  • Long term exposure causes genetic mutation;✓ 1

  • Radioisotopes can be used as weapon of mass   ✓ 1

    Destruction;

  • Causes skin cancer;   (2 marks)

  • When tested causes environmental pollution.

(**Any 2 correct @ 1mk)**