TRAIL 1 2024

Kenya Certificate of Secondary Education
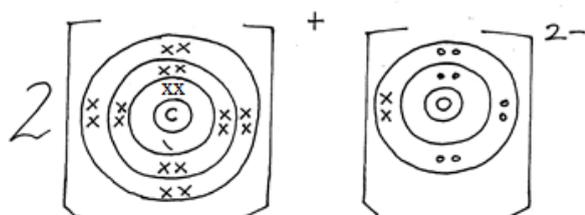
MARKING SCHEME

CHEMISTRY 233/2

PAPER 2

1. a) i) A- 2.8

   B – 2.8.8

ii)

b) Shown on the grid between (B and D)

c) i) A is <u>less reactive</u>✔[1] than C, C has <u>a larger atomic radius</u>✔[1] hence loses its outermost electrons more easily.

ii) B has a <u>smaller</u>✔[1] atomic radius than A since B has <u>stronger nucleus</u>✔[1] charge.

ii) Oxide of <u>G has a higher melting point than oxide of D</u> ✔[1] since G oxide is ionic and has <u>strong ionic bonds</u>✔[½] whereas oxide of D has a molecular structure with <u>weak vanderwaal forces</u>✔[½] between molecules.

d) Covalent bond✔[1]

E and D <u>share valence electrons</u>✔[1] to form covalent bond.

e) E forms ion by <u>gaining electrons</u> ✔[1]. There <u>exist repulsive forces</u> ✔[1] between the incoming electron and the existing electrons in E making the outer energy level bulge outward.

2. a) A – Brine/ concentrated sodium chloride. Reject sodium chloride

   B – Carbon (iv) oxide

b) i) $NH_{3(g)} + H_2O_{(l)} + CO_{2(g)} \longrightarrow NH_4HCO_{3(aq)}$ ✔[1]

$NH_4HCO_{3(aq)} + NaCl_{(aq)} \longrightarrow NH_4Cl_{(aq)} + NaHCO_{3(s)}$ ✔[1]

iii) $Ca(OH)_{2(s)} + 2NH_4Cl_{(aq)} \xrightarrow{\hspace{3cm}} CaCl_{2(aq)} + 2H_2O_{(l)} + 2NH_{3(aq)}$ ✔1

(award ½mk for correct equation without symbols)

c) i) Calcium chloride✔1

ii) I- Drying agent for gases/ as a drying agent✔1 in the desiccators

II – In extraction of sodium from molten sodium chloride✔½. It lowers the melting point✔½ of NaCl from 801^0c to above 600^0c
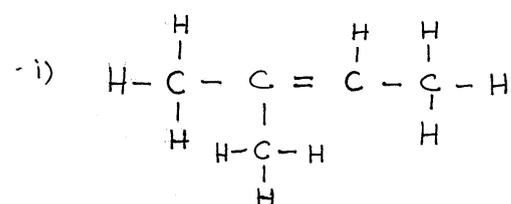
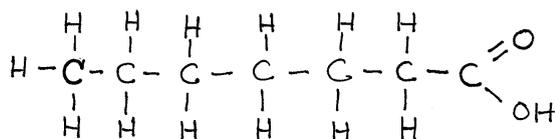d) i) Glass manufacturing industry

ii) Paper industry

e) i) Efflorescence✔1

ii) –Decrease in mass✔½

- Loss of crystalline nature✔½

3a)

b) Heat the two substances separate and determine their boiling point✔1. Hexanol has a higher boiling point than methanol. ✔1

c) i) I – Substitution

      II – Chloroethane

ii) Condition

Warming✔½

Concentrated sulphuric (vi) acid✔

Reagent

Propanoic acid ✔1
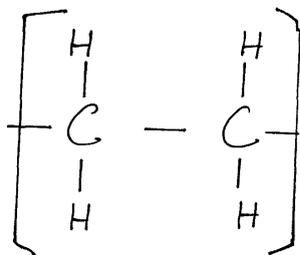
iii) CH_3CH_2ONa✔½ – Sodium Ethoxide✔½

iv) Hydrogen ✔1

Nickel catalyst✔½

Temperature $150^0c – 250^0c$✔½

v) I

$\checkmark$ ½

Polyethene $\checkmark$ ½

II – Polythene bags $\checkmark$ ¹

$4.i) MnO_{2(s)} + 4HCl_{(l)} \rightarrow MnCl_2 + Cl_{2(g)} + 2H_2O_{(l)}$ $\checkmark$ ¹

$ii) KMnO_{4(s)} / PbO_{2(s)}$ $\checkmark$ ¹
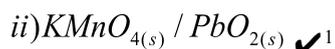
iii) By passing it through concentrated sulphuric (vi) acid. $\checkmark$ ¹

b) i) Aluminium chloride $\checkmark$ ¹

$ii) 2Al_{(s)} + 3Cl_{2(g)} \rightarrow 2AlCl_{3(s)}$ $\checkmark$ ¹

$iii) 2Al_{(s)} + 3Cl_{2(g)} \rightarrow 2AlCl_{3(s)}$ $\checkmark$ ¹
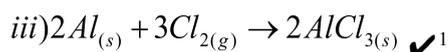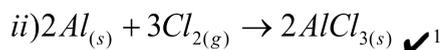
$\dfrac{0.84g}{27} = 0.03111 moles$ $\checkmark$ ½

$Cl_{2(g)} volume used = 0.03111 x 3 = 0.09333 moles$ $\checkmark$ ½

Volume of chlorine = 0.09333 x 24000 $\checkmark$ ¹

= 2240cm³

iv) – Calcium oxide prevents any moisture from outside since the $AlCl_3$ is deliquescent hence keeps combustion tube dry. $\checkmark$ ¹

- Calcium oxide reacts with moisture forms calcium hydroxide that prevents chlorine from escaping to the atmosphere. $\checkmark$ ¹

5.a) i) Energy or enthalpy change that occurs when a compound reacts completely with oxygen at standard conditions. $\checkmark$ ¹

ii) I - Molar enthalpy of formation of propane. $\checkmark$ ¹

II –
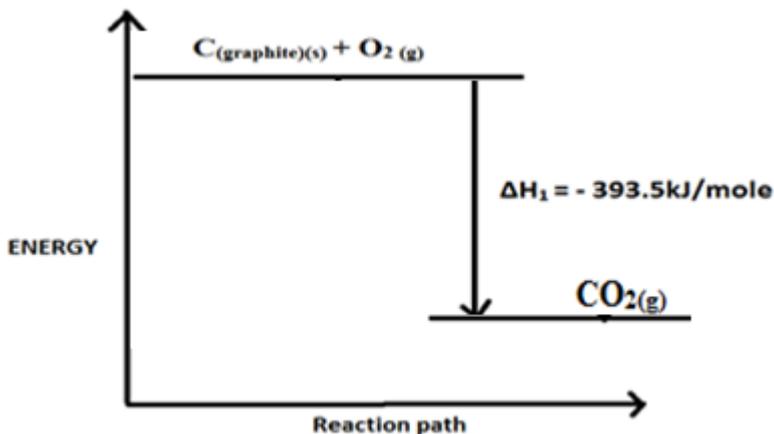
iii)
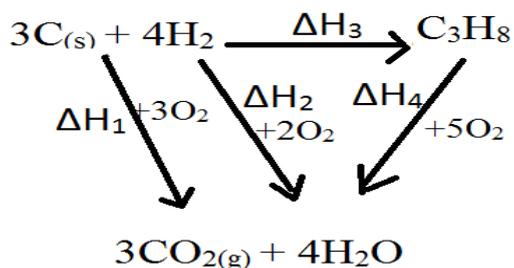
$$\Delta H_1 + \Delta H_2 = \Delta H_3 + \Delta H_4$$

$$3(-393.5) + 4(-285.8) = --103.7 kJ/mole + \Delta H_4 \quad ✔½$$

$$-1180.5 + -1143.2 = -103.7 + \Delta H_4 \quad ✔½$$

$$-2323.7 + 103.7 = \Delta H_4 \quad ✔½$$

$$\Delta H_4 = -2220 kJ/mole \quad ✔½$$

b)
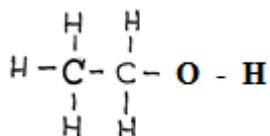
$$1(C - C) = -346 kJ$$
$$5(C - H) = -2070 kJ$$
$$1(C - O) = -360 kJ$$
$$= -2776 kJ \qquad ✔1$$

1 x -346kJ

5x -414 = - 2070kJ

1 x -360 = - 360Kj

- 2776kJ + (O – H) = -3239 ✔[1]

O – H = -463kJ ✔[1]

6. a) i)

Acid concentration	0.25 M	1.5M	1.6M	2.6M	3.5M
Time in sec	500	250	67.5	40	30
$\dfrac{1}{time(s^{-1})}$	0.002	0.004	0.015	0.025	0.033

ii)
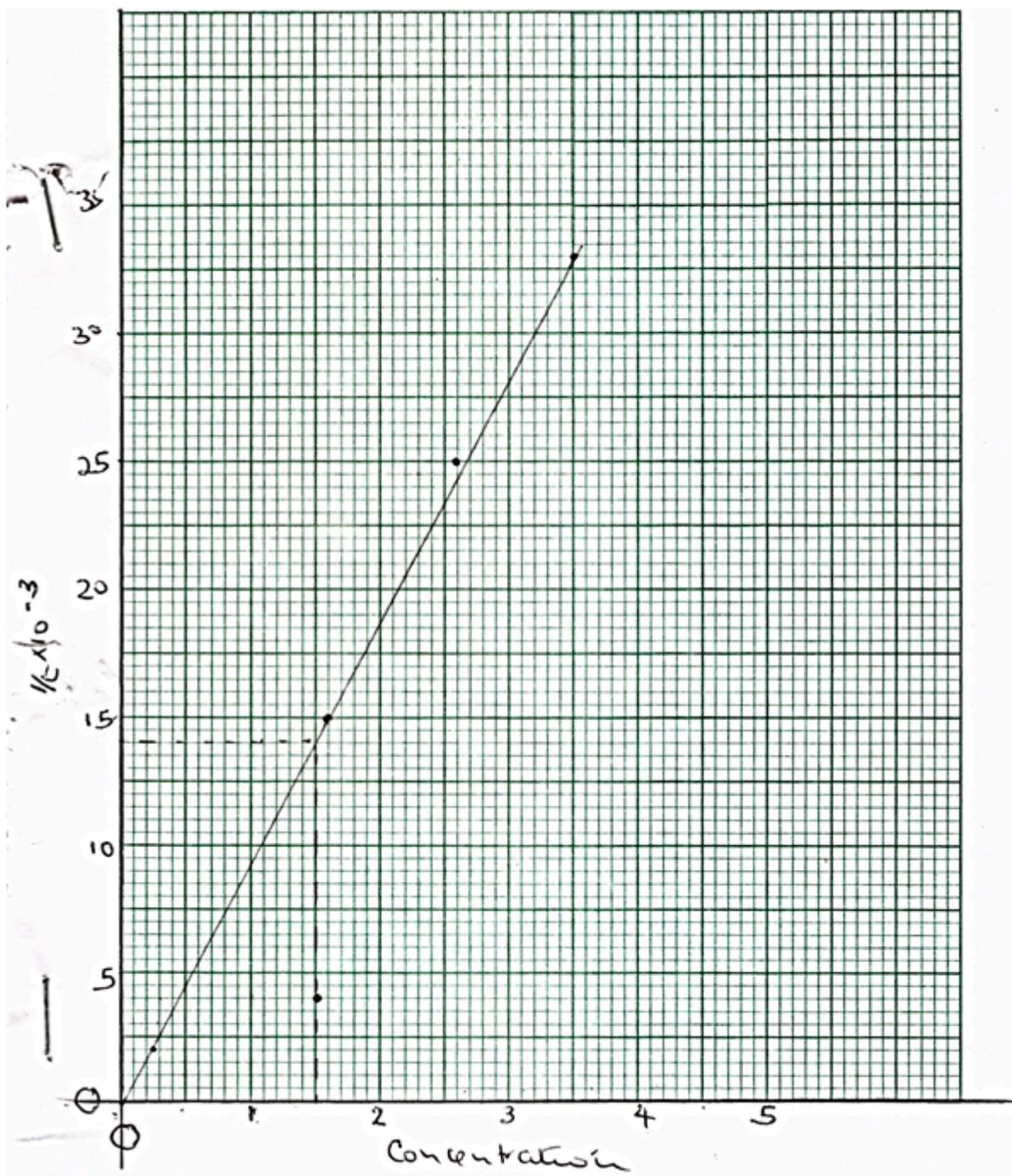
- Labelling – ✔ ½

- Scale – ✔ ½

- Plots – ✔ 1

- Line - ✔ 1

NB: Straight line passing through the origin.

ii) 0.014✔ correct showing ✔ ½

        Correct reading ✔ ½

iv) The rate of reaction increases with increase in concentration ✔ 1/ increased concentration increases the number of reacting particles and number of effective collisions ✔ 1.

v) – Increased temperature (warm the mixture) ✔ 1

- Presence of a catalyst/ add crystals of $CuSO_4$

$vi) Zn_{(s)} + H_2SO_{4(aq)} \rightarrow ZnSO_{4(aq)} + H_{2(g)}$ ✔½

     1:        1   1:   1 ✔½

65.4g of Zinc produce 22400cm³ of H_2 at STP ✔½

0.26G of Zinc produces   cm³ of H_2 at STP

$$= \frac{0.26g \times 22400cm^3}{65.45}$$ ✔1

$= 89.05cm^3$ ✔½

7. a) Mixture of soluble and insoluble salt

b) i) Lead carbonate   (Reject formula)

ii) Carbon (iv) oxide   (Reject formula)

c) $PbCl_2$

d) Zn^{2+}, SO^{2-}_4 (Reject names)

e) $Ba^{2+}_{(aq)} + SO^{2-}_{4(aq)} \rightarrow BaSO_{4(s)}$ (Penalise ½ for wrong state symbol)

f) $PbCO_3$ and $ZnSO_4$ (accept names tied to the two for 1mk)

g) i) $Zn(OH)_{2(s)} + 2OH^-_{(aq)} \rightarrow \left[Zn(OH)_4\right]^{2-}_{aq}$

(Reject fully if not balanced, penalise ½mk for wrong state symbols)

ii) Tetramine Zinc (ii) ions

h) Add excess lead (ii) oxide to dilute nitric (v) acid ✔½.

<u>Filter</u>✔½ the unreacted lead (ii) oxide;

Add <u>sodium sulphate</u>✔½/ K_2SO_4/ H_2SO_4 to the filtrate

<u>Filter</u>✔½ to obtain lead (ii) sulphate as the residue

<u>Wash the residue</u>✔½ with distilled water

Dry the residue between filter paper ✔½