# MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education

PRE-MOCK EXAMINATIONS 2022

233/2 CHEMISTRY Paper 2

JUNE 2022 TIME: 2Hours

Name: ....Marking Guide..... Adm No: .....

Class: .....Candidate's Signature: .....Date: ...../6/2022.

Instructions to candidates

(a) Write your name and index number in the spaces provided above.

(b) Answer **ALL** the questions in the spaces provided and show **ALL** working

(d) KNEC mathematical tables & silent non-programmable electronic calculators may be used.

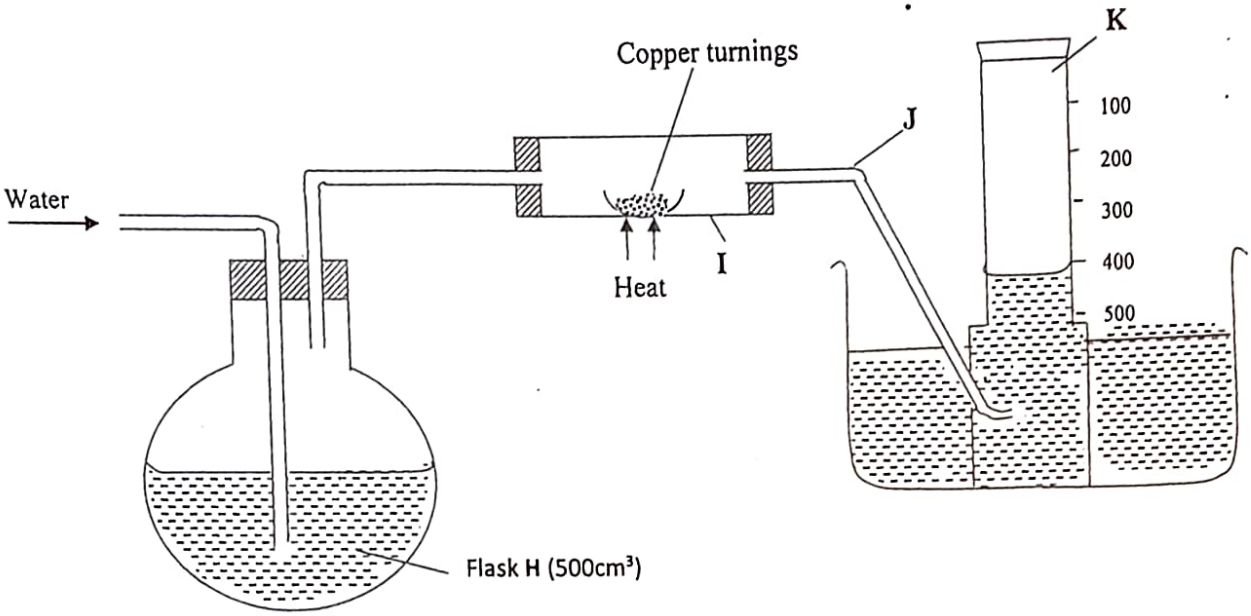
(f) This paper consists of 13 printed pages

(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

FOR EXAMINER'S USE ONLY.

| Questions | Maximum Score | Candidate's Score |
|---|---|---|
| 1 | 10 | |
| 2 | 12 | |
| 3 | 10 | |
| 4 | 12 | |
| 5 | 13 | |
| 6 | 13 | |
| 7 | 10 | |
| TOTAL | 80 | |

1.A. In an experiment to determine the percentage of oxygen in air, the apparatus below were set up. Study the set up and the information provided to answer the questions that follow.




A 500cm³ measuring cylinder K was filled with water and assembled for gas collection. Copper turnings were heated red hot and water was slowly passed into 500cm³ flask H until it reached the 500cm³ mark. A colourless gas was collected in K.

(i) What was the purpose of passing water into flask H? (1 mark)

To displace air in flask H over hot copper turnings

(ii) What observations were made in the tube I? (1 mark)

Brown copper metal changes to black copper (II) oxide

(iii) Name one of the gases that is likely to be found in J. (1 mark)

Nitrogen // Carbon (IV) oxide // Argon/Neon ... a2 1mk

(iv) What was the volume of the gas collected in the measuring cylinder at the end of the experiment? (1 mark)

~~390 - 400~~ cm³ ✓1 (400 - 420)

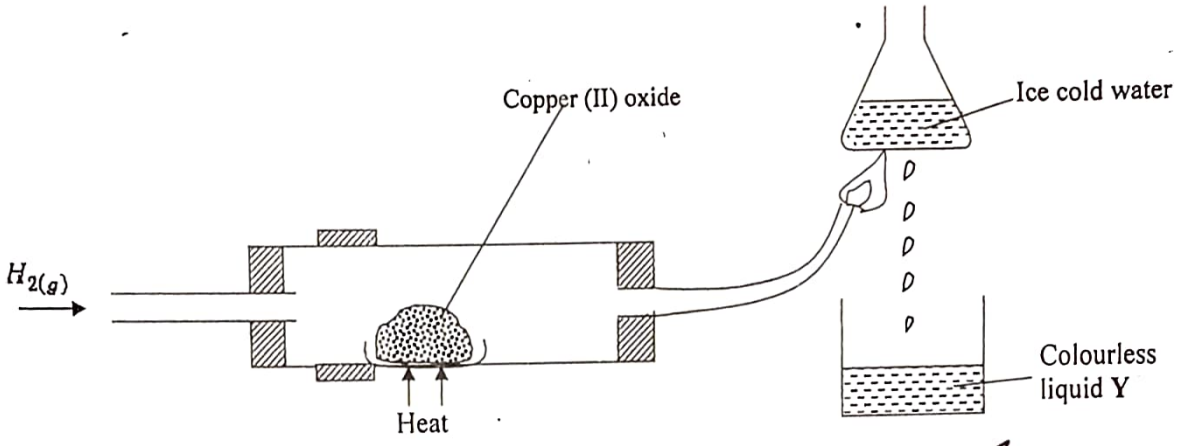
(v) Calculate the percentage of oxygen in air using the above results. (2 marks)

$\frac{500 - \text{Value above}}{500} \times 100\%$ ✓ Ans ✓1

2

Tim

**B.** Study the diagram below and answer the questions that follow.




(a) Give *one* observation made in the combustion tube after some time. **(1 mark)**

Black copper (II) oxide changes to brown copper metal (Cu)

(b) Write an equation for the formation of the colourless liquid Y. **(1 mark)**

$H_2(g) + CuO(s) \rightarrow Cu(s) + H_2O(l)$ // $2H_2 + O_2 \rightarrow 2H_2O$

$H_2O(g) \rightarrow H_2O(l)$

(c) What was the aim of the above experiment as demonstrated in the combustion tube? Explain. **(2 marks)**

To determine/investigate the reducing property of hydrogen. Hydrogen is above copper in the reactivity series.

2. Use the information below to answer the questions that follow. The letters are not the actual symbols of the elements.

| Element | Atomic No. | M.P$^0$C | B.P$^0$C | Ionic radius (nm) |
|---|---|---|---|---|
| P | 11 | 98 | 890 | 0.095 |
| Q | 12 | 650 | 1110 | 0.065 |
| R | 13 | 660 | 2470 | 0.050 |
| S | 14 | 1410 | 2360 | 0.041 |
| T | 15 | 44.2 & 590 | 280 | 0.034 |
| U | 16 | 113 & 119 | 445 | 0.184 |
| V | 17 | -101 | -35 | 0.181 |
| W | 18 | -189 | -186 | - |



Elijah

(a) (i) Write the electronic configuration of the atoms represented by letters T and W. (1 mark)

T - 2.8.5 ½ W - 2.8.8 ½

(ii) State the nature of the oxides of the elements represented by Q and U. (2 marks)

Q - Basic ✓1

U - Acidic ✓1

(b) Why does the elements represented by the letters T and U have two values of melting points? (1 mark)

Exhibit allotropy ✓1

(c) Explain the following observations in terms of structure and bonding.

(i) There is an increase in boiling point from P to R. (2 marks)

Increase in number of deloralised electrons ✓1 / Decrease in atomic radius which in turn increases the strength of metallic bond.

(ii) Element S has a high boiling point. (2 marks)

S atoms are held by strong covalent bonds ✓1 within the giant covalent atomic structure.

(iii) There is a decrease in boiling points from U to W. (2 marks)

U, V, W have simple molecular structures ✓1 in which the molecules are held by weak Van der Waals forces. There is decrease in the strength of Van der Waals.

(d) (i) Compare the atomic radius of U and V. Explain. (1 mark)

V has a smaller atomic radius than U. V has more protons leading to excess effective nuclear charge.



Odungo / Edwine / HOD
B, C, G, M R, P, Or, V W, Y.

(ii) Why is there no ionic radius for W reported in the table? **(1 mark)**

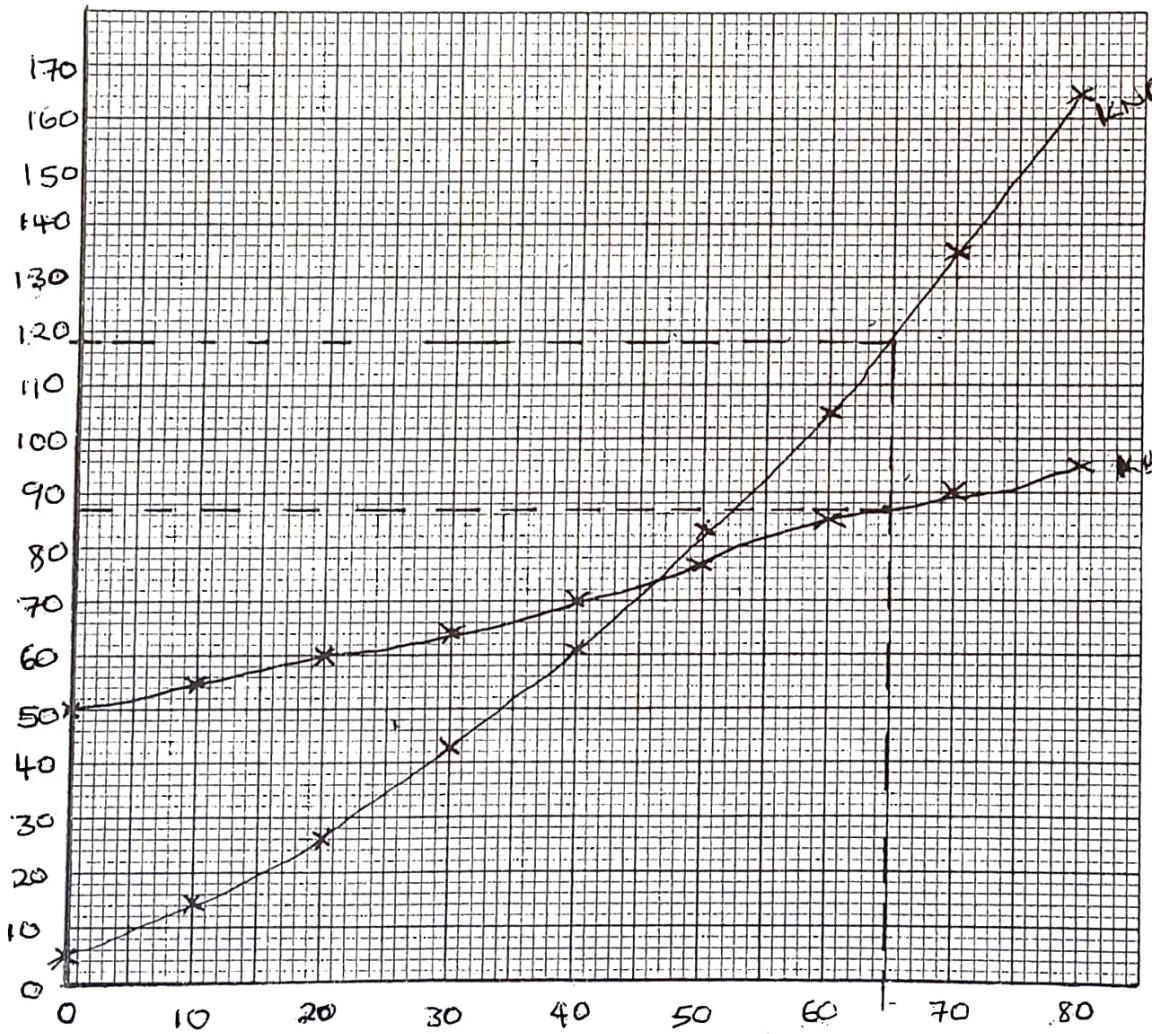
Stable; neither gains nor loses electrons/ does not ionize. QWTTE

3. (a) The solubilities of potassium nitrate and potassium bromide at different temperatures was determined. The following data was obtained.

| Temperature °C | | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
|---|---|---|---|---|---|---|---|---|---|---|
| Solubility g/100g $H_2O$ | $KNO_3$ | 5 | 15 | 26 | 43 | 61 | 83 | 105 | 135 | 165 |
| | KBr | 50 | 55 | 60 | 65 | 70 | 77 | 85 | 90 | 95 |

P1 C1 S1

(i) Draw solubility curves for both salts on the same axis. **(3 marks)**




S1/2 A1/2 P1 C1 03



Peter.

(ii) From your graph, determine the solubility of each salt at 65°C? **(1 mar**

$KNO_3 \rightarrow$ 119g/100g of water ± 1 ½

KBr → 87g/100g of water ± 1 ½

(iii) 100g of a saturated solution of potassium nitrate at 70°C was cooled to 20°C. What mass of the crystals will be crystallized? **(2 marks)**

At 70°C

If 235g of solution contain 135g of salt

160g → $\frac{100 \times 135}{235}$ = 57.446g ✓

(57.45g)

At 20°C

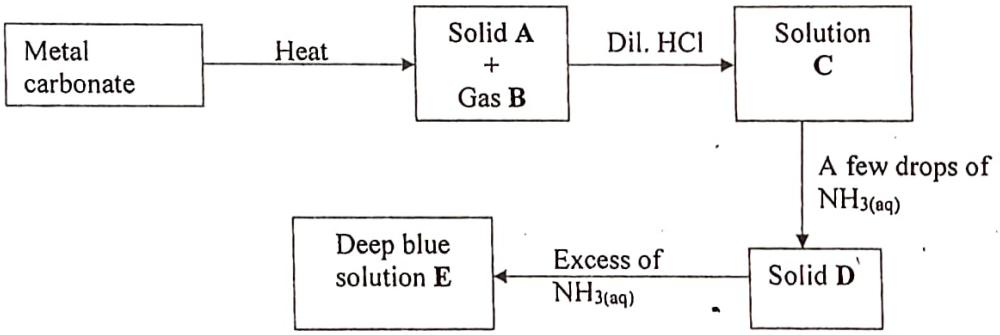
If 126g of sln → 26g of salt

100g → $\frac{100 \times 26}{126}$ = 20.634 (20.63)

Mass crystallised = 57.446 − 20

= 36.81g ✓½

(b) Study the flow chart below and answer the questions that follow.




(i) Write an equation for the formation of solid A and gas B. **(1 mark)**

$CuCO_3(s) \xrightarrow{heat} CuO(s) + CO_2(g)$ ✓1

(ii) Name: Solution C - Copper (II) chloride ✓1 $CuCl_2$ **(1 mark)**

Solid D- Copper (II) hydroxide ✓1 $Cu(OH)_2$ **(1 mark)**

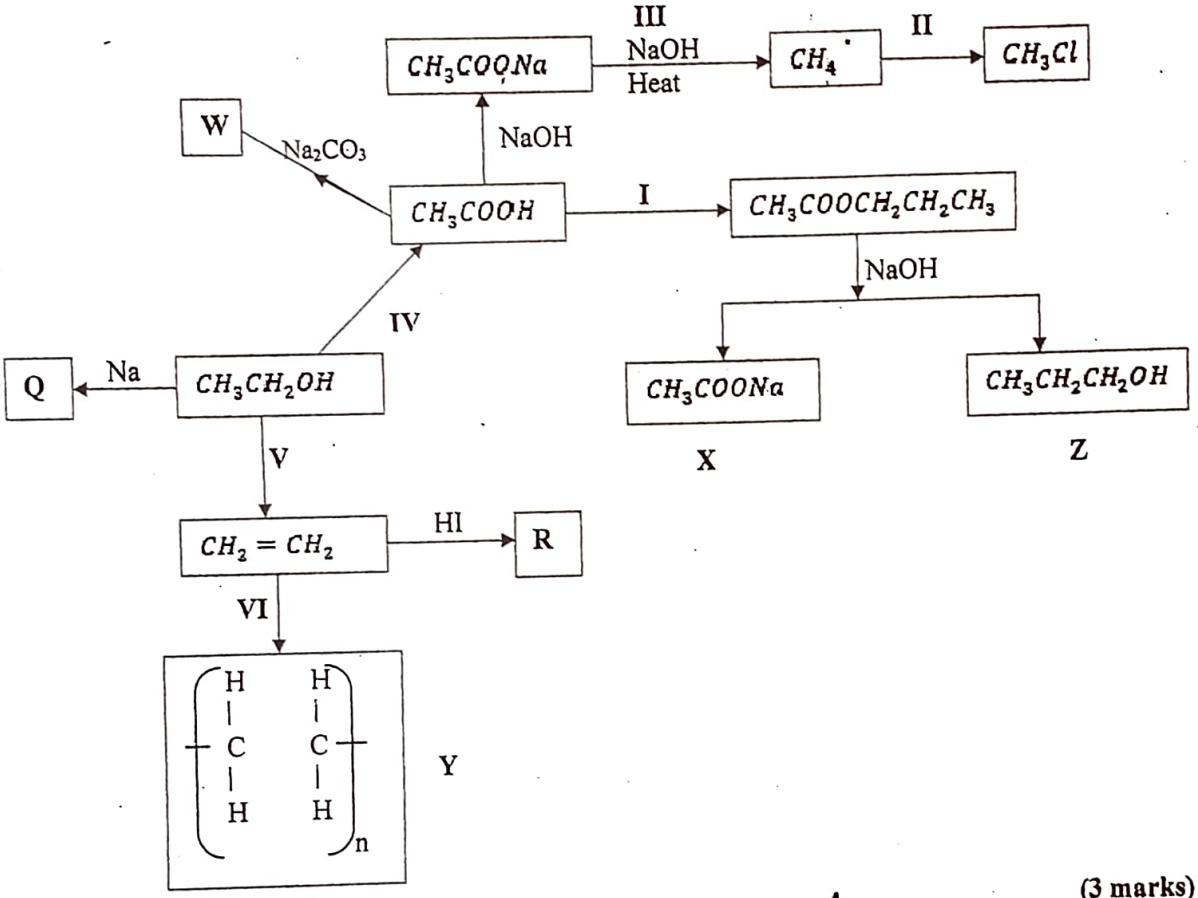
(c) Write the formula of the complex ion in solution E. **(1 mark)**

$[Cu(NH_3)_4]^{2+}$ ✓1

Jesse. / Alago

B, G, C, M, V R, P, Y, W, Or

4. Study the flow chart below and answer the questions that follow.




(3 marks)

(a) Name substance.

X - Sodium ethanoate ✓1

Q - Sodium ethoxide ✓1

R - 1-iodoethane ✓1 // iodoethane

(b) Write down an equation for the reaction represented by step III. (1 mark)

$CH_3COONa(s) + NaOH(s) \rightarrow CH_4(g) + Na_2CO_3(s)$ ✓1

ignore state symbols

(c) What are the conditions and reagent required for steps?

(i) I - Reagent - Propanol ✓1 // Propan-1-ol. Symbols

Condition - Warming / heat ✓½ / ΔH

- Conc. $H_2SO_4(l)$ ✓½ e.g. 60-80°C.

(2 marks)

7

Rose

(ii) IV- Reagent - $H^+/K_2Cr_2O_7$ // $KMnO_4(aq)$ ✓1

Condition - Heat ✓1 // High temperature / Warm (2 marks)

(b) Name the process represented by: (4 marks)

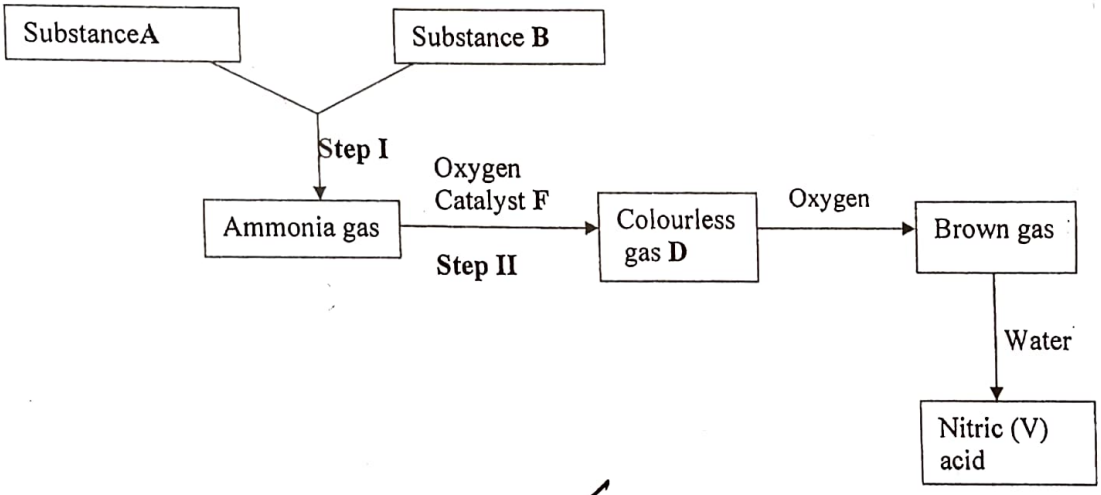
I - Esterification ✓1

II - Halogenation / Chlorination ✓1

IV - Oxidation ✓1

V - Dehydration ✓1

5. **I.** Study the scheme below and answer the questions that follow.




(a) Identify substances. (3 marks)

A - Hydrogen ✓(g) / $H_2$ ✓(g)

B - Nitrogen ✓(g) ✓ $N_2$ ✓(g)

D - Nitrogen(II) Oxide // NO

(b) State the catalyst necessary for; (2 marks)

Step I - (Finely divided) iron ✓ / Iron

Step II - Platinum-Rhodium / (Platinum)

(c) Write an equation for the reaction taking place in step II. (1 mark)

$4NH_3(g) + 5O_2(g) \longrightarrow 4NO(g) + 6H_2O(g)$ ✓(1)



Joshua

(d) Write **two** balanced chemical equations for the reaction between chlorine gas and; **(1 mark)**

(i) Hot and concentrated sodium hydroxide.

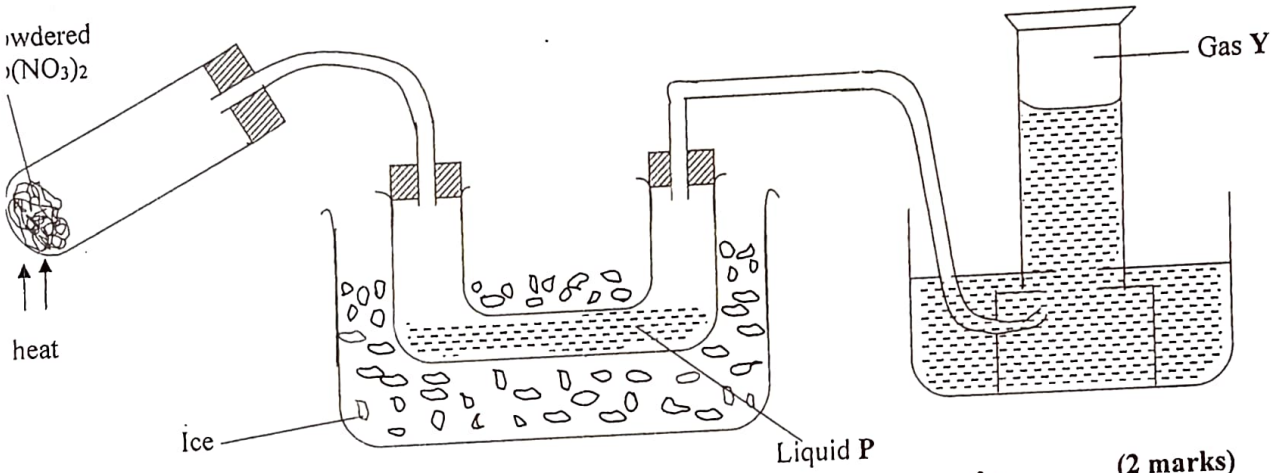
$6NaOH(aq) + 3Cl_2(g) \rightarrow NaClO_3(aq) + 5NaCl(aq) + 3H_2O(l)$ ✓4

(ii) Dilute and cold sodium hydroxide. **(1 mark)**

$2NaOH(aq) + Cl_2(g) \rightarrow NaClO(aq) + NaCl(aq) + H_2O(l)$ ✓1

NaOCl

**II.** The diagram below shows an experiment in which the Lead (II) nitrate crystals are heated.




(a) Name; **(2 marks)**

(i) Liquid P - Dinitrogen tetraoxide ✓1 $N_2O_4$

(ii) Gas Y - Oxygen ✓1

(b) Write a balanced chemical equation for the decomposition of Lead (II) nitrate. **(1 mark)**

$2Pb(NO_3)_2(s) \xrightarrow{heat} 2PbO(s) + 4NO_2(g) + O_2(g)$

(c) Explain how you can distinguish between nitrogen (II) oxide and nitrogen (I) oxide. **(2 marks)**

- NO has is odourless while $N_2O$ has a pleasant smell ✓1
- $N_2O$ rekindles a glowing splint while NO does not. ✓1
- NO gets oxidized to $NO_2$ (brown) ✓1 while $N_2O$ does not

(a) 1mk 9

Dr. Getrude / Joshua
B, C, G, M, Or, P, R, V W, Y

6. a) i) State Hess' Law (1 mark)

Enthalpy Changes (in) when converting reactants to products is the same regardless of the route by which the chemical change occurs. (OWTTE)

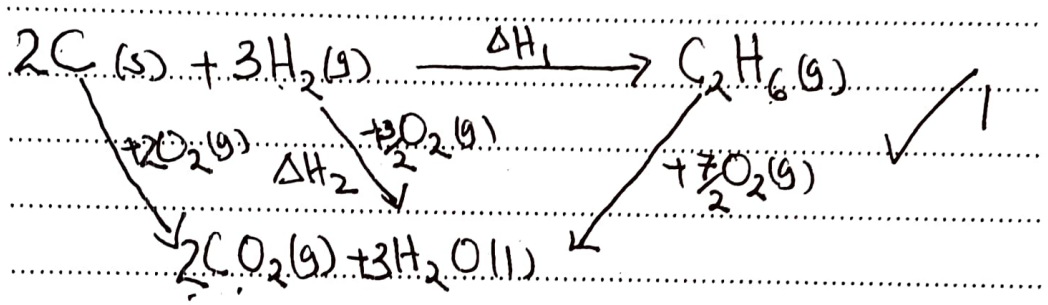
ii) Use the equations given below to answer the questions that follow.

$C_2H_6(g) + 7/2\ O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ $\Delta H = -1560$ kJ/mole

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H = -394$ kJ/mole

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(g)$ $\Delta H = -286$ kJ/mole

I) Draw an energy cycle diagram that links the enthalpy of formation of ethane to combustion of carbon, hydrogen and ethane. (1 mark)



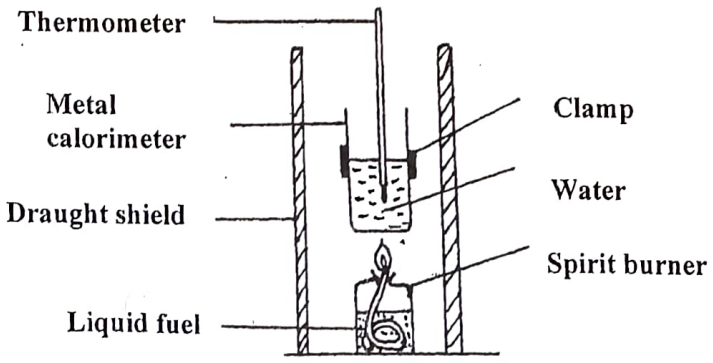

II) Determine the enthalpy of formation of ethane (2 marks)

$\Delta H_1 = \Delta H_2 - \Delta H_3$

but $\Delta H_2 = (2 \times -394) + (3 \times -286) = -1646$ ½

$\therefore \Delta H_1 = -1646 + 1560 = -86$ kJ/mol ½

b) The diagram below shows the set-up of the apparatus used by a student to determine the enthalpy change of combustion of ethanol. The heat produced by burning fuel warms a known mass of water.






Obonyo

Results

| | |
|---|---|
| Volume of water in the beaker = | 500 $cm^3$ |
| Initial temperature of water= | $12^0C$ |
| Final temperature of water = | $31.5^0C$ |
| Mass of ethanol burnt = | 1.50g |
| Density of water = | 1 $g/cm^3$ |
| Specific heat capacity = | 4.2 $Jg^{-1}K^{-1}$ |

(i) Calculate the heat required to raise the temperature of the water from $12^0C$ to $31.5^0C$. **(2 marks)**

$\Delta H = mc\Delta T$ ✓

$= 500 \times 4.2 \times 19.5$ ✓

$= -40,950J$ // $-40.95kJ$. ignore sign.

(ii) Find the molar enthalpy of combustion of ethanol. **(2 marks)**

$(C = 12, H = 1, O = 16)$

Moles of $C_2H_5OH = \frac{1.5}{46} = 0.0326$ moles ✓½ ✓½

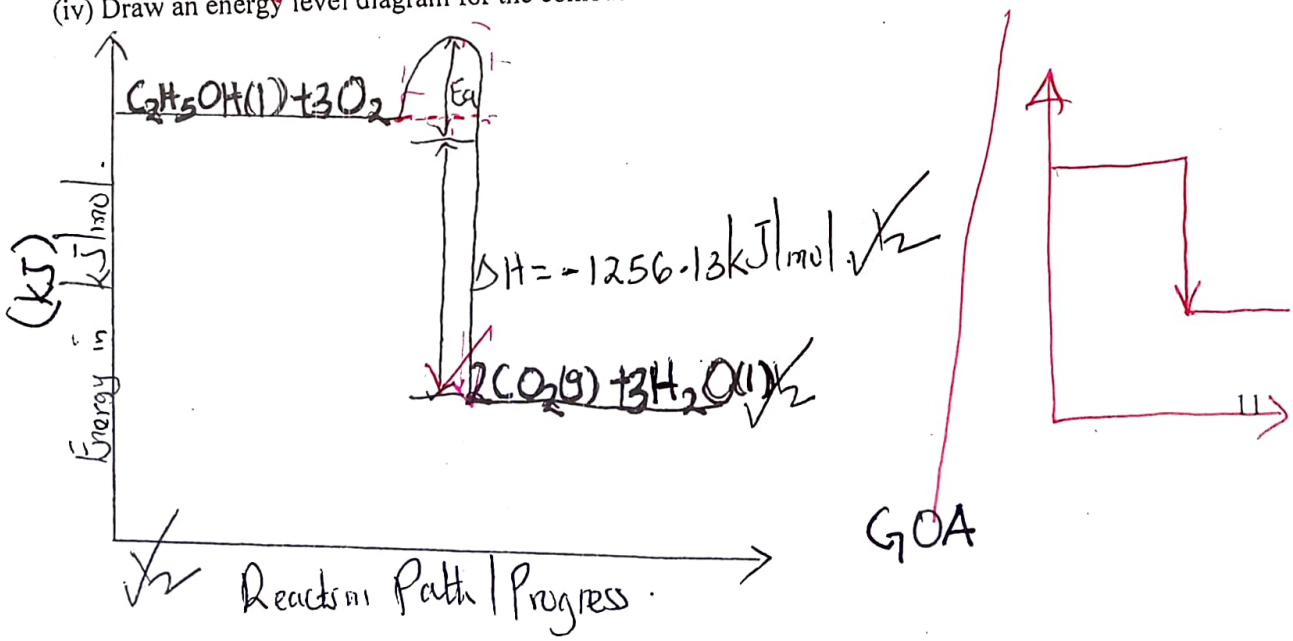
$\Delta H = \frac{40.95}{0.0326}$ ✓ // $\frac{40,950}{0.0326}$ =

$= -1256.13 kJ/mol$ ✓

(iii) An accurate value for $\Delta H_c$ of ethanol is -1368 $kJmol^{-1}$. State two sources of errors for the low figure obtained. **(2 marks)**

- Heat lost to the surrounding ✓
- Incorrect temperature readings ✓ (a) 1mk
- Faulty apparatus
- Incomplete combustion

(iv) Draw an energy level diagram for the combustion of ethanol. **(2 marks)**

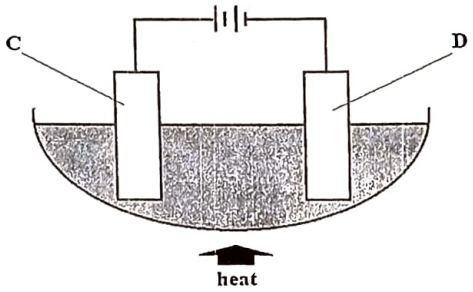


(v) Calculate the heating value of ethanol from the above experiment. **(1 mark)**

$(C = 12, H = 1, O = 16)$

$\frac{1256.13}{46} = 27.31 kJg^{-1}$

7. a) The diagram below represents a setup of apparatus used in the electrolysis of lead (II) bromide




i) Name electrodes **C** and **D** **(1 mark)**

C ..... Anode ✓½

D ..... Cathode ✓½

ii) State and explain the observation made at **electrode D** **(2 marks)**

Grey deposits of lead metal observed due to reduction ✓1 of $Pb^{2+}$ to $Pb(s)$

iii) Write the ionic equation for the reaction at **electrode C** **(1 mark)**

$2Br^-(l) \longrightarrow Br_2(g) + 2e^-$ ✓1

iv) State **two** applications of electrolysis **(2 marks)**

- Purification of metals.
- Extraction of highly reactive Metals (Na & Al)
- Electroplating

(a) 1mk.



Imbuga

b) The table below gives some properties of substances **A, B, C,** and **D**. Study it and answer the questions that follow.

| Substance | Electrical Conductivity | | Melting Point (°C) | Boiling Point (°C) |
|---|---|---|---|---|
| | Solid | Molten | | |
| A | Does not conduct | Conducts | 801 | 1420 |
| B | Conducts | Conducts | 650 | 1107 |
| C | Does not conduct | Does not conduct | 1700 | 2200 |
| D | Does not conduct | Does not conduct | 113 | 440 |

i) Which particles are responsible for conductivity in substances: **(2 marks)**

A ... (mobile) ions ✓1 .....

B ... Delocalised electrons ✓1 .....

ii) Which substance is likely to be silicon (IV) oxide? Explain. **(2 marks)**

C ✓ It does not conduct electricity in both solid and molten state and has high m.p & B.p.

.....

Jared