

Name: Adm No:

School: Class:

Signature: Date:

CHEMISTRY (233/2)

PAPER 2

FORM FOUR (4)

Time: 2 Hours

KCSE TOP PREDICTION MASTER CYCLE 7

Instructions to candidates

- (a) Write your name, stream, and admission number in the spaces provided above.
- (b) Answer **ALL** the questions in the spaces provided, and working **MUST** be clearly shown
- (c) This paper consists of **11 printed pages**; Candidates should check the question paper to ascertain that all the pages are printed as indicated, and that no question is missing.

FOR EXAMINERS' USE ONLY

| QUESTION | MAXIMUM SCORE | CANDIDATE'S SCORE |
|-----------------|----------------------|--------------------------|
| 1 – 6 | 80 | |

1.

a) The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters do not represent actual symbols of the elements

| | | | | | | | |
|----------|----------|--|--|----------|----------|----------|----------|
| | | | | | | | |
| C | | | | F | G | | I |
| | | | | | | H | K |
| D | E | | | | | | |
| | | | | | | | J |

i) Identify the most reactive non-metal. Explain (2 Marks)

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ii) What is the name given to the family of elements to which **I** and **J** belong? (1 Mark)

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iii) Using dots (•) and crosses (×) to represent electrons, show bonding in the compound formed between **C** and **H**. (2 Marks)

iv) How does the atomic radius of **F** compare with that of **I**? Explain. (2 Marks)

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b) Study the table below and answer the questions that follow.

| Substance | M | N | O | P | Q | R |
|--------------------|------|------|------|-----|-----|-----|
| Melting Point (°C) | 801 | 1356 | -101 | 26 | -39 | 113 |
| Boiling Point (°C) | 1410 | 2850 | -36 | 154 | 457 | 445 |

| | | | | | | |
|--|------|------|------|------|------|------|
| Electrical conductivity in solid state | Poor | Poor | Poor | Poor | Good | Poor |
| Electrical conductivity in molten state | Good | Poor | Poor | Poor | Good | Poor |

i) Explain why **substance M** is a good conductor of electricity in the molten state but not in the solid state. *(2 Marks)*

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ii) What is the most likely structure and bond in **substance N**? Explain. *(2 Marks)*

Structure Bond

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iii) Identify, with a reason, a substance that exists as a liquid at room temperature. *(2 Marks)*

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a)

i) What name is given to different forms of an element which exist in the same physical state? *(1 Mark)*

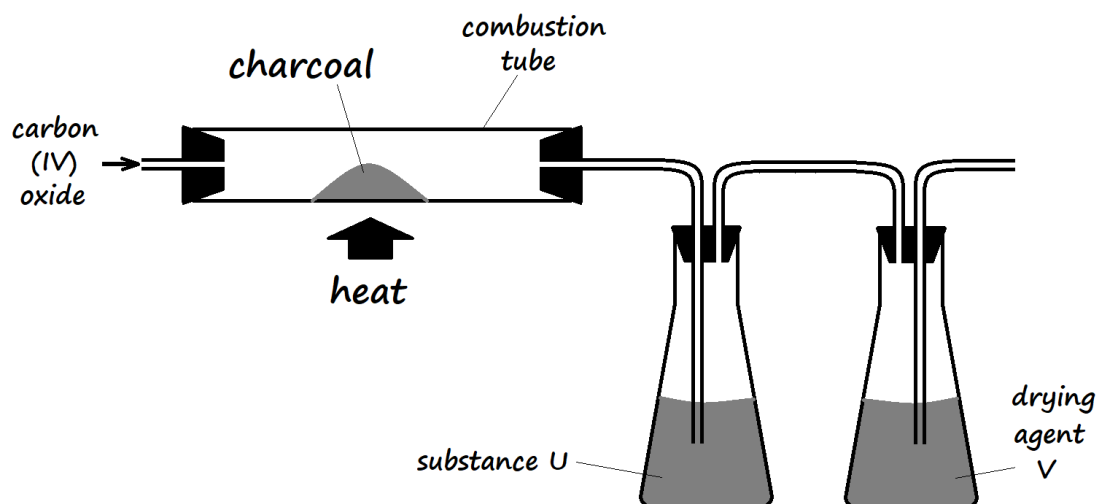
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ii) Name **two** crystalline forms of carbon *(1 Mark)*

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b) The figure below is part of a setup used to prepare and collect dry carbon (II) oxide from carbon (IV) oxide.

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i) Complete the diagram to show how dry carbon (II) oxide gas is collected. (1 Mark)

ii) Identify:

- Substance U and state its use

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- Drying agent Y

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iii) Write a chemical equation for the reaction which takes place in the combustion tube (1 Mark)

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iv) Carbon (II) oxide is a major environmental pollutant.

- Give **one** major source of carbon (II) oxide in the atmosphere (1 Mark)

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- Explain how carbon (II) oxide causes poisoning (1 Mark)

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c) State **one** use of carbon (II) oxide (1 Mark)

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d) Write an equation for the formation of water gas. (1 Mark)

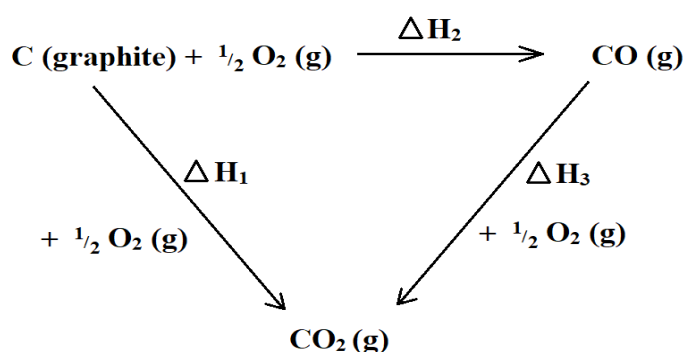
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e) Explain why sodium hydroxide solution is not used in testing for carbon (IV) oxide gas, while calcium hydroxide is preferably used. (2 Marks)

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2.

a) Study the following energy cycle diagram and then answer the questions that follow.



i) Name the enthalpy change represented by ΔH_2 . (1 Mark)

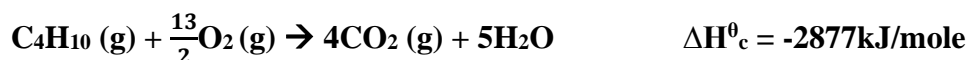
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ii) Use the following information to calculate the value of ΔH_1 for 144g of graphite. (2 Marks)

$$\Delta H_2 = -110 \text{ kJ/mole} \quad \Delta H_3 = -283 \text{ kJ/mole}$$

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b) The following are thermochemical equations for molar enthalpies of combustion for some substances. Study them and answer the questions that follow.



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i) What is molar enthalpy of combustion of a substance? *(1 Mark)*

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ii) Calculate the molar enthalpy of formation of butane (C_4H_{10}) using the information given above. *(3 Marks)*

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c) The following results were obtained in an experiment, to determine the heat of neutralization of 25cm^3 of 2M sodium hydroxide solution, using 25cm^3 of hydrochloric acid:

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|---|----------------------|
| Initial temperature of acid | = 25.0°C |
| Initial temperature of alkali | = 26.0°C |
| Final temperature of mixture of acid + alkali | = 38.5°C |
| Density of solution | = 1g/cm^3 |
| Specific heat capacity of solution | = 4.2 J/g/K |

i) Define molar heat of neutralization *(1 Mark)*

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ii) Write an **ionic equation** for the neutralization reaction involving hydrochloric acid and sodium hydroxide solution. *(1 Mark)*

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iii) Calculate:
• The enthalpy change during this experiment. *(2 Marks)*

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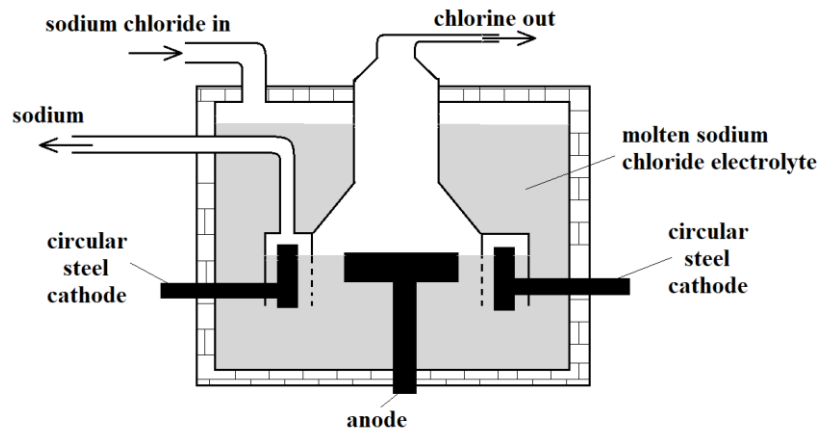
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- The molar enthalpy of neutralization for this reaction (2 Marks)

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3.

- a) Below is a simplified diagram of the Down's Cell, used for the manufacture of sodium. Study it and answer the questions that follow.



- i) What material is the anode made of? Give the reason why that material is used. (2 Marks)

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- ii) What precaution is taken to prevent chlorine and sodium from re-combining? (1 Mark)

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iii) Write an ionic equation for the reaction in which chlorine gas is formed (1 Mark)

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b) In the Downs process, (used for manufacture of sodium), a certain salt is added to lower the melting point of sodium chloride from about 800°C to about 600°C.

i) Name the salt that is added. (1 Mark)

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ii) State why it is necessary to lower the temperature in b) above (1 Mark)

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c) Explain why aqueous sodium chloride is not suitable as an electrolyte for the manufacture of sodium in the Down's Process. (2 Marks)

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d) Sodium metal reacts with air to form two oxides. Give the formulae of the two oxides (1 Mark)

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e) State two uses of sodium (2 Marks)

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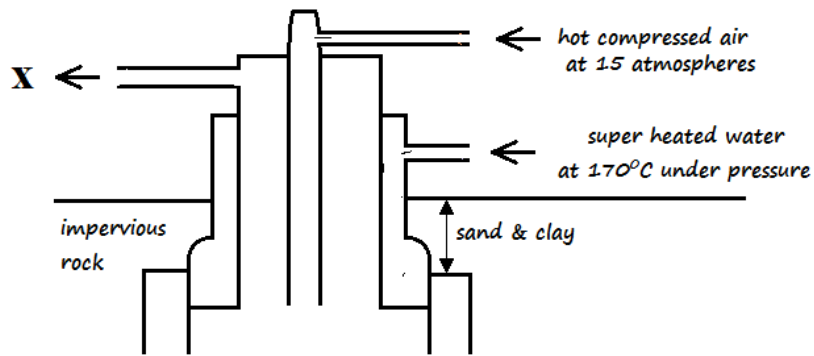
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4.

a) The diagram below shows part of the Frasch process, used for the extraction of sulphur. Use it to answer the questions that follow.

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- i) Identify X(1 Mark)
- ii) Why is it necessary to use superheated water and hot compressed air in this process? (2 Marks)

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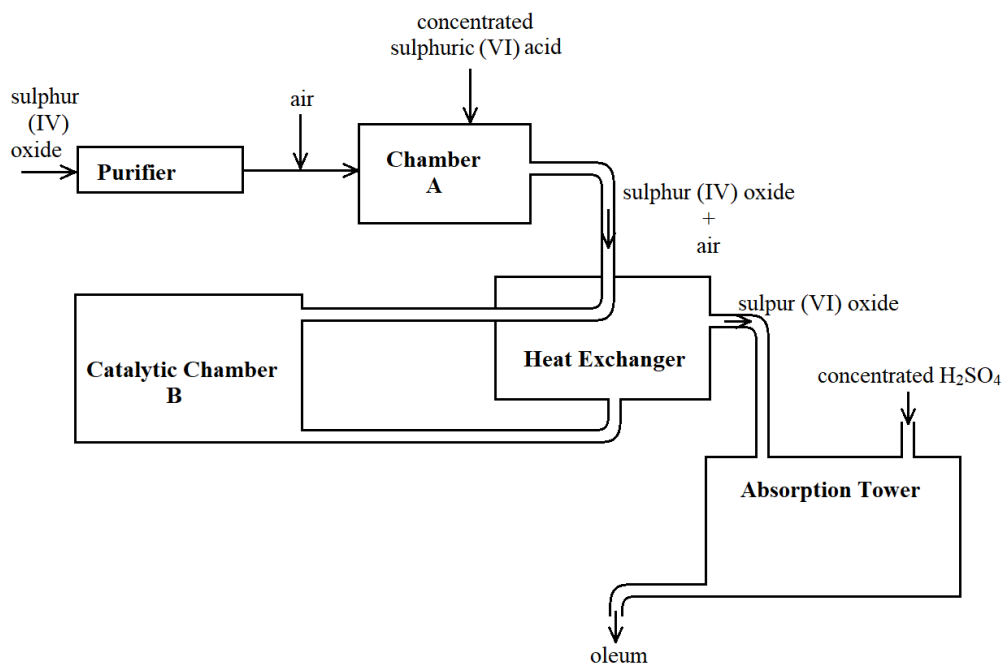
- iii) State **two** physical properties of sulphur that makes it possible for it to be extracted by this method. (2 Marks)

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b) The diagram below shows part of the process in the manufacture of sulphuric (VI) acid. Study it and use it to answer the questions that follow.

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i) Give **two** reasons why air is referred to as a mixture *(2 Marks)*

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ii) What is the role of concentrated sulphuric (VI) acid in **Chamber A**? *(1 Mark)*

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iii) Name **two** catalysts that can be used in the Catalytic **Chamber B**. *(2 Marks)*

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iv) State **two** roles of the heat exchanger *(2 Marks)*

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v) Describe the test for sulphite anion, SO_3^{2-} *(2 Marks)*

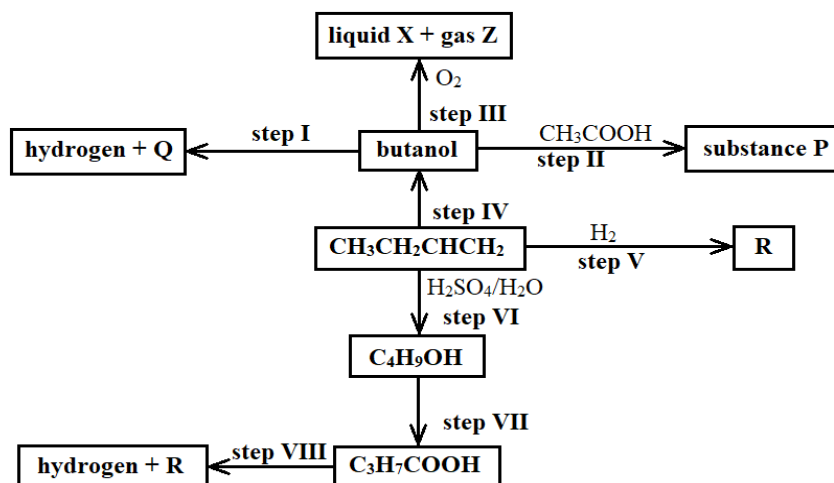
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- vi) Explain the observation made when a few drops of concentrated sulphuric (VI) acid are added to crystals of hydrated copper (II) sulphate. Explain your answer. (2 Marks)

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5. Study the reaction scheme below and answer the questions the follow:



- i) What is the distinguishing physical property of **Substance P**? (1 Mark)
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- ii) Identify a suitable reagent that can be used in **Step I**. (1 Mark)
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- iii) Describe a chemical test on how **C₃H₇COOH** can be distinguished from **C₄H₉OH**. (2 Marks)
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- iv) Write an equation for the reaction that takes place in **Step III** (1 Mark)
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- v) Name the types of reaction that occur in steps **II, III, V, and VII** (2 Marks)

II.....

III.....

V.....

VII.....

- vi) If 7.4g of butanol completely underwent Step III, determine the volume of gas Z produced at s.t.p. (MGV = 22.4 litres, C = 12, H = 1, O = 16) (3 Marks)

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- vii) Write an equation for the reaction between **R** and one mole of fluorine gas (1 Mark)

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- viii) Describe a chemical test for **liquid X** (2 Marks)

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