NAME: …… **INDEX NO**…….……..…..……

SCHOOL: …… **DATE:** …….....….……

CLASS ……**ADM. NO**……**SIGNATURE**……

CATHOLIC DIOCESE OF KAKAMEGA EVALUATION TEST JULY/AUGUST EXAM 2025

Kenya Certificate of Secondary Education (K.C.S.E.)

233/3
CHEMISTRY
PAPER 3
JULY/AUGUST - 2025
TIME: $2^{1}/_{4}$ HRS

INSTRUCTIONS TO CANDIDATES:

- *Answer **all** the questions in the spaces provided.*
- *Write your **name** and **index number** in the spaces provided above.*
- *You are **not allowed** to start working with the apparatus for the first 15 minutes of the $2\ ^{1}/_{4}$ hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you needed.*
- *Mathematical tables and electronic calculators may be used for calculations.*
- *All workings **must** be clearly shown where necessary*

For Examiner's Use only:

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	**19**	
2	**11**	
3	**10**	
Total Score	**40**	

This paper consists of 6 printed pages

QUESTION 1

You are provided with:

- **Solution A**, 0.5M Copper (II) sulphate.
- **Solid B_1**, metal B powder.
- **Solid B_2**, Iron powder.
- **Solution C**, 0.02M acidified potassium Manganate (VII).

You are required to determine the;

- Enthalpy change for the displacement reaction between metal B and copper (II) sulphate.
- Mass of Iron that reacts with Copper (II) sulphate in the displacement reaction.

PROCEDURE I

(a) (i) Using a pipette and pipette filler, place 25.0 cm^3 of solution A into 100ml plastic beaker. Allow to stand for about 1 minute and then measure the temperature of the solution. Record the reading in **Table 1** as the initial temperature. Add all of solid **B_1** to the solution. Stir the mixture carefully with the thermometer and measure the highest temperature reached, this will take about 5 minutes. Record the reading in **Table 1** as maximum temperature reached.

Table 1

Maximum temperature reached (°C)	
Initial temperature (°C)	
Change In temperature, ΔT_1 (°C)	

(3 marks)

ii) Calculate the:

I) Number of moles of copper (II) sulphate used. (1 mark)

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II) Enthalpy change for the reaction of metal B with one mole of copper (II) sulphate. (Assume that for the mixture, Specific heat capacity = $4.2Jg^{-1}K^{-1}$ and density = $1.0gcm^{-3}$) (1 mark)

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b) Repeat the **procedure** I,(a) (i) with all metal **B_2** (iron powder) in place of metal **B_1**. The maximum is temperature reached after about 8 minutes. Record the temperature readings in **Table 2. Retain the mixture for use in procedure II.**

Table 2

Maximum temperature reached (°C)	
Initial temperature (°C)	
Change In temperature, ΔT_2 (°C)	

(3 marks)

(c) Compare the changes in temperature ΔT_1 and ΔT_2 and comment on the differences.

(2 marks)

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PROCEDURE II

(i) Fill a burette with **solution C**.

(ii) Filter the mixture obtained in **procedure I (b)** into 250 ml volumetric flask. Wash the residue with distilled water and add into the flask. Add more distilled water to make up to the mark. Label this as **solution B_2**.

(iii) Using a pipette and a pipette filler, place 25.0cm^3 of **solution B_2** into a 250 ml conical flask. Titrate **solution B_2** with **solution C** until a permanent pink colour just appears. Record the readings in **Table 3**.

Repeat step (iii) and complete **Table 3**.

(d) **Table 3**

	I	**II**	**III**
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **solution C** used, cm^3.			

(4 marks)

(e) Calculate the average volume of solution C used. (1 mark)

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(f) The equation for the reaction between manganate (VII) and iron (II) ions is:

$$MnO_4^-{}_{(aq)} + 5Fe^{2+}{}_{(aq)} + 8H^+{}_{(aq)} \longrightarrow Mn^{2+}{}_{(aq)} + 5Fe^{3+}{}_{(aq)} + 4H_2O_{(l)}$$

Calculate the number of moles of:

(i) Potassium manganate (VII) used. (1 mark)

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(ii) Iron (II) ions in 25.0cm^3 **solution B**. (1 mark)

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(iii) Iron that reacted with Copper (II) sulphate. (1 mark)

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(g) Determine the mass of iron that reacted. (R.A.M = 55.8) (1 mark)

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QUESTION 2

You are provided with **solid R**, carry out the tests below and record your observations an inferences in the spaces provided.

(a) Describe the appearance of **solid R**. (1 mark)

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(b) Place about one-third of solid **R** in a dry test-tube. Heat the solid gently and the strongly. Test any gases produced with both blue and red litmus papers.

Observations	**Inferences**

(1 mark) (1 mark)

(c) Place the remaining amount of **solid R** in a boiling tube. Add about 10 cm^3 of distilled water and shake. Divide the mixture into **five** test tubes each containing about 2cm^3.

(i) To the first portion, add aqueous sodium hydroxide dropwise until in excess.

Observations	**Inferences**

(1 mark) (1 mark)

(ii) To the second portion, add aqueous ammonia dropwise till in excess.

Observations	Inferences

(1 mark) (1 mark)

(iii) To the third portion, add three drops of acidified Barium Chloride.

Observations	Inferences

(1 mark) (1 mark)

(iv) To the fourth portion, add about $2cm^3$ of hydrogen peroxide, then about $1cm^3$ of sodium hydroxide solution.

Observations	Inferences

(1 mark) (1 mark)

QUESTION 3

You are provided with **liquid Q**. Carry out the following tests and record your observations and inferences in the spaces provided.

(a) Place 2 drops of **liquid Q** on a watch glass. Ignite the liquid with a Bunsen burner flame.

Observations	Inferences

(1 mark) (1 mark)

(b) Place about $2cm^3$ of **liquid Q** in a test-tube. Add about $2cm^3$ of distilled water and shake the mixture.

Observations	Inferences

(1 mark) (1 mark)

(c) To about $2cm^3$ of **liquid Q** in a test-tube, add all the solid sodium hydrogen carbonate provided.

Observations	Inferences

(1 mark) (1 mark)

(d) To about $2cm^3$ of **liquid Q** in a test-tube, add 3 drops of bromine water.

Observations	Inferences

(1 mark) (1 mark)

(e) To about $2cm^3$ of **liquid Q** in a test-tube, add 3 drops of acidified potassium dichromate (VI) and warm the mixture.

Observations	Inferences

(1 mark) (1 mark)

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