29.6.3 Chemistry Paper 3 (233/3)

1 You are provided with:

acid **A** labelled solution **A**;
2.0 M sodium hydroxide solution labelled solution **B**;
Solution **C** containing 25.0 g per litre of an alkanoic acid.

You are required to:

(a) prepare a dilute solution of sodium hydroxide, solution **B**.
(b) determine the:
(i) molar mass of the alkanoic acid
(ii) reaction ratio between sodium hydroxide and acid **A**.

Procedure 1

Using a pipette and **a pipette filler**, place 25.0 cm^3 of solution **B** into a 250.0 ml volumetric flask. Add about 200 cm^3 of distilled water. Shake well. Add more distilled water to make upto the mark. Label this solution **D**. **Retain the remaining solution B for use in procedure II.**

Fill a burette with solution **C**. Using a clean pipette and a **pipette filler**, place 25.0 cm^3 of solution **D** into a 250 ml conical flask. Add two drops of phenolpthalein indicator and titrate with solution **C**. Record your results in **table 1**. Repeat the titration two more times and complete the table.

Table 1	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution **C** (cm^3) added			

(4 marks)

Determine the:

(i) average volume of solution **C** used; (1 mark)

(ii) concentration of solution **D** in moles per litre; (1 mark)

(iii) concentration of the alkanoic acid in solution **C** in moles per litre (1 mole of the acid reacts with 3 moles of the base); (1 mark)

(iv) molar mass of the alkanoic acid. (1 mark)

Procedure II

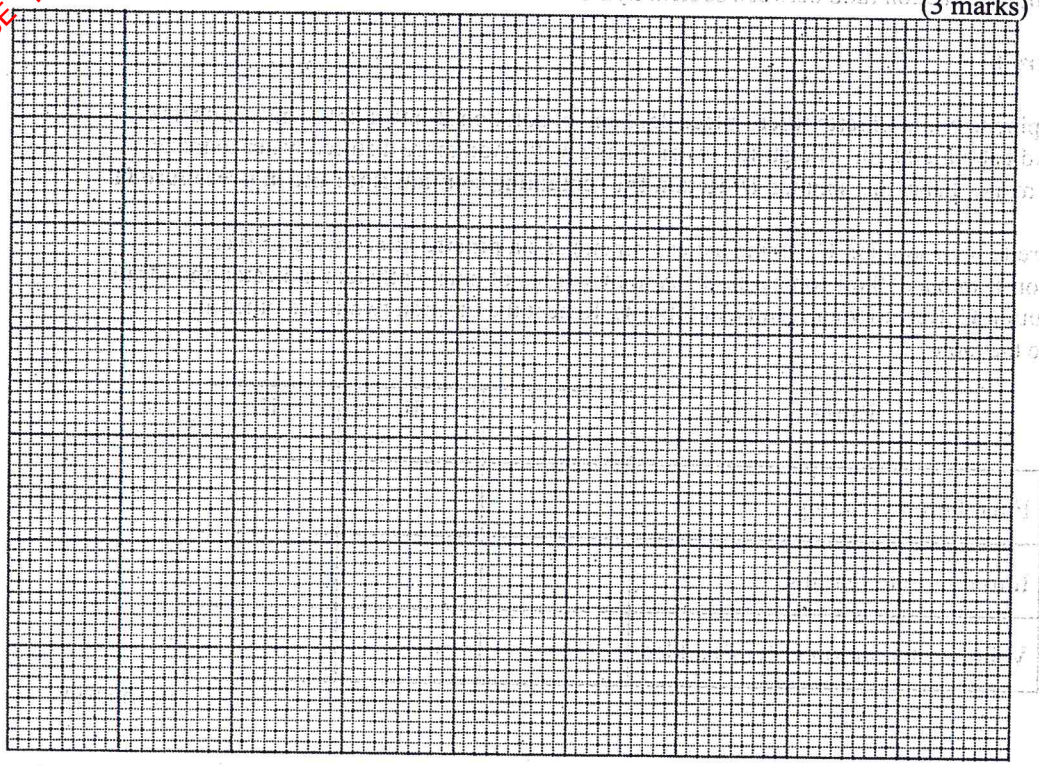
Fill a **clean** burette with solution **A**. Place 5 cm^3 of solution **A** into a 100 ml beaker. Measure the initial temperature of solution **A** in the beaker and record it in **table II**. Using a 10 ml or a 100 ml measuring cylinder, measure 25 cm^3 of solution **B**. Add it to solution **A** in the beaker and immediately stir the mixture with the thermometer. Record the maximum temperature reached in **table II**. Repeat the experiment with other sets of volumes of solutions **A** and **B** and complete the table.

Table II

Volume of solution **A** (cm^3)	5	9	13	17	21	25
Volume of solution **B** (cm^3)	25	21	17	13	9	5
Maximum temperature (°C)						
Initial temperature (°C)						
Change in temperature, ΔT						

(6 marks)

(a) On the grid provided; plot a graph of ΔT (Vertical axis) against the volume of solution **A**.
(3 marks)



(b) From the graph, determine the volume of solution **A** which gave the maximum change in temperature.
(1 mark)

(c) Determine the volume of solution **B** that reacted with the volume of solution **A** in (b) above.
(1 mark)

(d) Calculate the:

(i) ratio between the volumes of solutions **A** and **B** that neutralised one another;
(1 mark)

(ii) concentration in moles per litre of the acid in solution **A**.
(Assume that the volume ratio is the same as the mole ratio).
(1 mark)

2 You are provided with solids **E**, **F** and **G**.
Carry out the tests below and write your observations and inferences in the spaces provided.

(a) Place all of solid **E** in a boiling tube. Add 20 cm³ of distilled water and shake until all the solid dissolves. Label this as solution **E**.

(i) To about 2 cm³ of solution **E** in a test-tube, add 4 drops of 2 M sulphuric (VI) acid.

OBSERVATIONS	INFERENCES
(1 mark)	(2 marks)

(ii) To about 2 cm³ of solution **E** in a test-tube, add 2 M sodium hydroxide dropwise until in excess.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

(iii) Place one half of solid **F** in a test-tube. Add 2 cm³ of distilled water and shake well. Add 4 drops of this solution to about 2 cm³ of solution **E** in a test-tube.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

(iv) To about 2 cm³ of solution **E** in a test tube, add 2 drops of aqueous potassium iodide.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

(b) (i) Using a **metallic** spatula, ignite about one half of solid **G** in a Bunsen burner flame.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

(ii) Place the other half of solid **G** into a boiling tube.
Add 15 cm³ of distilled water and shake well. Label this solution **G**.
Use this solution for the following tests.

I Place 2 cm³ of solution **G** in a test-tube and determine its pH.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

II To about 2 cm^3 of the solution obtained in (ii) above, add 3 drops of acidified potassium manganate (VII).

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

III To about 2 cm^3 of the solution obtained in (ii) above, add 2 drops of bromine water.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)

(iii) To the remaining solution **G** in the boiling tube, add the other half of solid **F**.

OBSERVATIONS	INFERENCES
(1 mark)	(1 mark)