

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 alkanolic acid.

You are required to:

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

Procedure 1

Using a pipette and a pipette filler, place 25.0 cm³ of solution B into a 250.0 ml volumetric flask. Add about 200 cm³ of distilled water. Shake well. Add more distilled water to make up to 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 cm³ of solution D into a 250 ml conical flask. Add two drops of phenolphthalein indicator and titrate with solution C. Record your results in table 1. Repeat the titration two more times and complete the table.

	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 alkanolic 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 alkanolic acid. (1 mark)

Procedure II

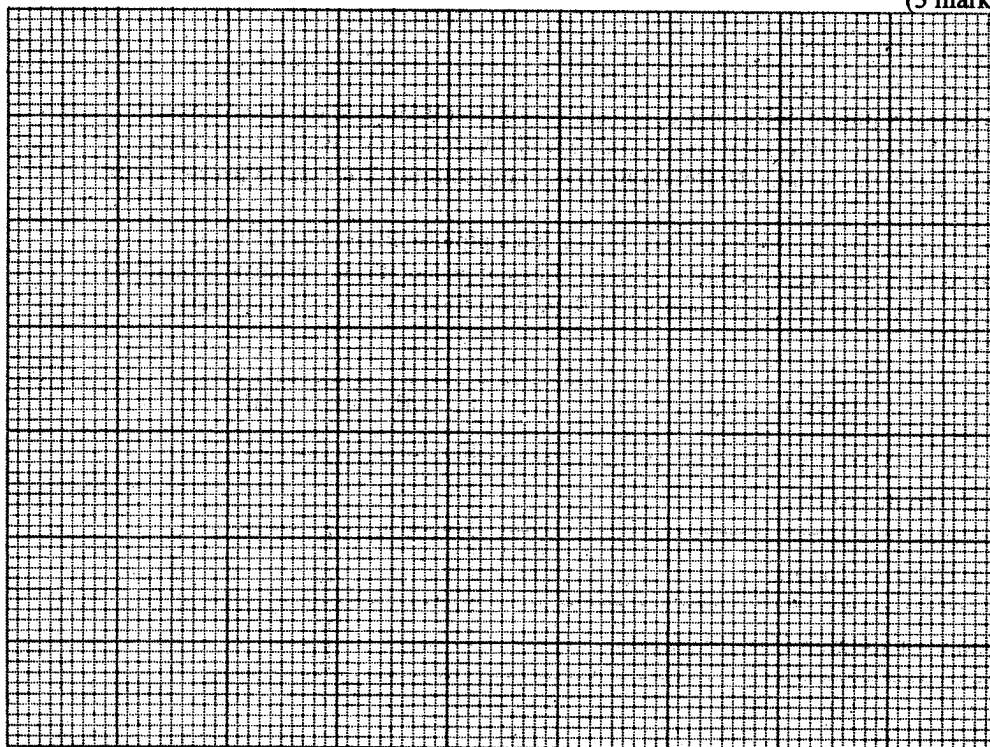
Fill a clean burette with solution A. Place 5 cm³ of solution A into a 100 ml beaker. Measure the initial temperature of solution A in the beaker and record it in table II. Using a 10 ml or a 100 ml measuring cylinder, measure 25 cm³ of solution B. Add it to solution A in the beaker and immediately stir 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:
- ratio between the volumes of solutions A and B that neutralised one another; (1 mark)
 - 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 cm³ 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 cm³ 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)