3.3.3 Chemistry Paper 3 (233/3)

1 You are provided with:

- 1.60g of solid **A**, a dibasic acid.
- Solution **B** containing 4.75g per litre of salt **B**.
- Aqueous sodium hydroxide, solution **C**.
- Phenolphthalein indicator.

You are required to prepare a solution of solid **A** and use it to determine the:-

- Concentration of sodium hydroxide, solution **C**
- React salt **B** with excess sodium hydroxide and then determine the relative molecular mass of salt **B**.

Procedure I

(a) Using a burette, place 25.0cm^3 of solution **B** in each of two 250ml conical flasks. Using a pipette and **pipette filler**, add 25.0cm^3 of solution **C** to each of the two conical flasks. (The sodium hydroxide added is in excess). Label the conical flasks 1 and 2.

(b) Heat the contents of the first conical flask to boiling and then let the mixture boil for 5 minutes. Allow the mixture to cool.

(c) Repeat procedure (b) with the second conical flask.

While the mixtures are cooling, proceed with procedure II.

Procedure II

(a) Place **all** of solid **A** in a 250 ml volumetric flask. Add about 150cm^3 of distilled water, shake well to dissolve the solid and then add water to make up to the mark. Label this as solution **A**.

(b) Place solution **A** in a clean burette. Using a pipette and **pipette filler**, place 25.0cm^3 of solution **C** in a 250ml conical flask. Add 2 drops of phenolphthalein indicator and titrate with solution **A**. 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 **A** used (cm^3)			

(4 marks)

Calculate the:-

(i) average volume of solution **A** used: (½ mark)

(ii) concentration in moles per litre of the dibasic acid in solution **A**; (2 marks)
(Relative molecular mass of **A** is 126).

(iii) moles of the dibasic acid used; (1 mark)

(iv) moles of sodium hydroxide in 25.0cm^3 of solution **C**. (1 mark)

(v) concentration of sodium hydroxide in moles per litre. (2 marks)

Procedure III

Add 2 drops of phenolpthalein indicator to the contents of the first conical flask prepared in procedure I and titrate with solution A. Record your results in Table 2. Repeat the procedure with the contents of the second conical flask and complete the table.

Table 2

	1st conical flask	2nd conical flask
Final burette reading		
Initial burette reading		
Volume of solution **A** used (cm^3)		

(3 marks)

Calculate the:-

(i) average volume of solution **A** used; (½ mark)

(ii) moles of the dibasic acid used; (1 mark)

(iii) moles of sodium hydroxide that reacted with the dibasic acid. (1 mark)

(iv) moles of sodium hydroxide that reacted with 25.0cm^3 of salt **B** in solution **B**;
(2 marks)

(v) Given that 1 mole of salt **B** reacts with 2 moles of sodium hydroxide, calculate the:

I. number of moles of salt **B** in 25.0cm^3 of solution **B**; (1 mark)

II. concentration in moles per litre of salt **B** in solution **B**; (1 mark)

III. relative molecular mass of salt **B**; (2 marks)

2 (a) You are provided with solid **D**. Carry out the following tests and write your observations and inferences in the spaces provided.

(i) Place about one half of solid **D** in a test-tube and heat it strongly. Test any gases produced with both red and blue litmus papers.

Observations	**Inferences**
(2 marks)	(1 mark)

(ii) Place the rest of solid **D** in a boiling tube. Add about 10cm^3 of distilled water. Shake well.

To a 2cm^3 portion of the solution, add about 1cm^3 of hydrogen peroxide and shake well. To the resulting mixture, add aqueous sodium hydroxide dropwise until in excess.

Observations	**Inferences**
(1 mark)	(1 mark)

(b) You are provided with solution **E**. Carry out the following tests and write your observations and inferences in the spaces provided.
Divide solution **E** into **two** portions.

(i) To one portion of solution **E** in a test-tube, add 3 drops of barium nitrate. **Retain the mixture for use in test (ii) below**.

Observations	Inferences
(1 mark)	(2 marks)

(ii) To the mixture obtained in (i) above, add about 5 cm^3 of 2M nitric (V) acid.

Observations	Inferences
(1 mark)	(1 mark)

(iii) To portion two of solution **E** in a test-tube, add 2 drops of acidified potassium dichromate (VI) and warm the mixture.

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

(a) Place five drops of liquid **F** on a clean dry watch glass and ignite it.

Observations	Inferences
(1 mark)	(1 mark)

(b) Place about $2cm^3$ of liquid **F** in a clean dry test-tube, add all the sodium hydrogen carbonate provided.

Observations	Inferences
(1 mark)	(1 mark)

(c) Place about $2cm^3$ of liquid **F** in a test-tube, add about $1cm^3$ of acidified potassium dichromate (VI) and warm the mixture.

Observations	Inferences
(1 mark)	(1 mark)