1408/315
SCIENCE LABORATORY PRACTICE
(PRACTICAL)
June/July 2017
Time: 4 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

SCIENCE LABORATORY PRACTICE (PRACTICAL)

4 hours

INSTRUCTIONS TO CANDIDATES

This question paper consists of 5 printed pages.

Candidates must check the question paper to ascertain that all the pages are printed and that no questions are missing.

Turn over

1. A. You are provided with specimen W. You are required to make thin sections from the stem of this specimen and make temporary mounts for microscopic examination. Stain with aniline dye and observe under low power.

(a) Draw a labelled low-power diagram of your observation. (12 marks)

(b) Explain the significance of using low-power only in the experiment. (5 marks)

(c) Outline the safety precautions taken during the staining process and the proper disposal of the dye used. (6 marks)

B. You are provided with specimen X, Y and Z.

(i) identify each of the specimen; (2 marks)

(ii) Describe how X, Y and the content of Z are sterilized; (5 marks)

(iii) Describe the proper disposal of non-used substance contained in Z. (4 marks)

2. You are provided with following set of apparatus:

- spring;
- 1 retort stand, with a clamp;
- 6 standard weights (20 grams each);
- 1 pointer;
- 1 metre rule.

Arrange the apparatus as shown in **Figure 1**.

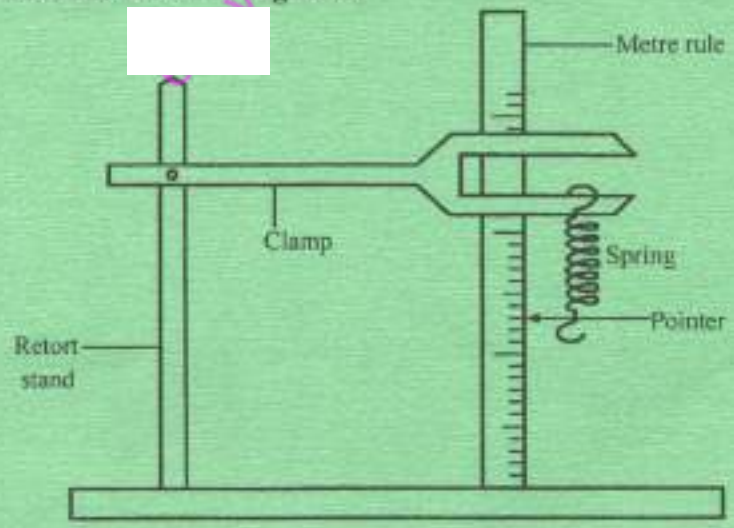


Fig. 1

(a) Set the clamp level in such a way that the pointer is at least 40 cm above the bottom end of the metre rule.

(b) Note the pointer's reading on the rule. Record it as X_0. 40 (1 mark)

(c) (i) Load the spring with a mass of 20 grams (i.e. one standard weight). Read and record the pointer's reading in **Table I**.

(ii) Repeat c(i) above, using loads of 40 g, 60 g, 80 g, 100 g, and 120 g (i.e. use suitable combinations of the standard weights). Fill and complete **Table I** for the extension, e.

Table I

Mass, m (Grams)	Metre rule reading, x (cm)	Extension, e (cm)
0	40	
20		
40		
60		
80		
100		
120		

(14 marks)

(d) Plot the graph of e against m. (10 marks)

(e) (i) From the graph, determine the extension when:

I. m = 30 g;
II. m = 90 g. (2 marks)

(ii) Hence, calculate the gradient of the graph. (2 marks)

(iii) Using e(ii) above, determine the spring constant in Newtons per metre.
(Take g = 9.81 N Kg^{-1}) (4 marks)

3. (a) You are provided with the following:

- Finely ground limestone based white chalk.
- 1 M hydrochloric acid.
- X M sodium hydroxide solution.
- Phenolphthalein indicator.
- Four conical flasks, 250 cm^3 each.
- 25 cm^3 pipette.
- Three 100 cm^3 beakers.
- Distilled water.
- Wash bottles.
- Stirring rods.
- Analytical balance.
- 100 cm^3 measuring cylinder.
- Burette and other titration apparatus.
- 0.1 M oxalic acid solution.

(b) You are required to:

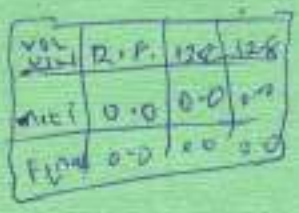
(i) standardise the sodium hydroxide solution;
(ii) determine the percentage of calcium carbonate in chalk by back titration.

Proceed as follows:

PART I

I. Pipette 25 cm³ of the sodium hydroxide solution into a clean conical flask and add three drops of phenolphthalein indicator.

II. Fill the burette with oxalic acid solution and titrate against the sodium hydroxide until end point. Repeat the titration three more times and tabulate your results. Calculate the volume of oxalic acid used. (7 marks)



III. Write the equation for the reaction between sodium hydroxide and oxalic acid. (1 mark)

IV. Use the results to calculate the molarity of the sodium hydroxide solution. (4 marks)

PART II

I. Weigh approximately 2.5 g of the finely ground chalk. Record the exact mass weighed. (1 mark)

II. Transfer the weighed mass into a 250 cm³ conical flask and add 50 cm³ of 1 M hydrochloric acid and make it to the mark with distilled water.

III. Pipette 25 cm³ of the solution in (II) above, into a clean conical flask and add three drops of phenolphthalein indicator.

IV. Fill the burette with the sodium hydroxide solution and titrate against the above solution until end point. Repeat the titration three more times and tabulate your results.

Calculate the average volume of the sodium hydroxide used. (7 marks)

V. Write the equation for the reaction that took place. (1 mark)

VI. Calculate:

(i) Number of moles of sodium hydroxide used. (1 mark)

(ii) Number of moles of hydrochloric acid in 25 cm³. (1 mark)

(iii) Number of moles of hydrochloric acid in 250 cm³. (1 mark)

(iv) Original number of moles in 50 cm^3 of 1 M hydrochloric acid. (2 marks)

(v) Number of moles of hydrochloric acid that reacted with the calcium carbonate in the chalk. (1 mark)

VII. Write down the equation for the reaction between calcium carbonate and hydrochloric acid. (1 mark)

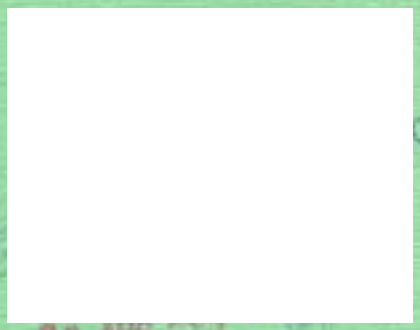
VIII. Calculate:

(i) Number of moles of calcium carbonate that reacted with the hydrochloric acid. (1 mark)

(ii) Mass of calcium carbonate in the chalk. (Ca = 40, C = 12, 0 = 16) (2 marks)

(iii) Calculate the percentage of calcium carbonate in the chalk. (1 mark)

(iv) State **one** assumption made in the above determination. (1 mark)



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