SCI94

1408/315
SCIENCE LABORATORY PRACTICE
(PRACTICAL)
June/July 2016
Time: 4 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

SCIENCE LABORATORY PRACTICE (PRACTICAL)

4 hours

This paper consists of 6 printed pages.

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

Turn over

QUESTION 1

1. (a) You are provided with:

- 0.6 g of potassium iodate.
- Concentrated sulphuric acid.
- Acidified 2 M potassium iodide.
- A solution of sodium thiosulphate.
- Iodized table salt.
- Pipette filler.
- five conical flasks (250 cm^3).
- One 250 cm^3 beaker.
- 10 cm^3 measuring cylinder.
- Distilled water.
- De-ionized water (200 cm^3).

(b) You are required to:

- Standardise the sodium thiosulphate solution.
- Determine the concentration of iodine in the table salt in parts per million.

PROCEED AS FOLLOWS:

PART I

(a) Fill the burette with the sodium thiosulphate solution.

(b) Place 0.6 g of potassium iodate provided into a 250 cm^3 beaker.

(c) Add 200 cm^3 of the acidified 2 M KI and stirr thoroughly and top up to the mark with de-ionized water.

(d) Using a pipette filler, pipette 25 cm^3 of the reaction mixture in step (c) above and transfer the aliquot into a clean 250 cm^3 conical flask.

(e) Titrate the reaction mixture with the sodium thiosulphate ($Na_2S_2O_3$) until the solution changes from dirty brown to colourless. Repeat the experiment three more times and tabulate the results.

	1st	2nd	3rd	4th
Final burette reading in cm^3	39.5	39.5	34.5	34.5
Initial burette reading in cm^3	0.0	0.0	0.0	0.0
Titre volume in cm^3	39.5	39.5	34.5	34.5

(5 marks)

(f) When KIO_3 is mixed with acidified KI, the following reaction takes place:

$$IO^-_{3(aq)} + 5I^-_{(aq)} + 6H^+_{(aq)} \longrightarrow 3I_{2(aq)} + 3H_2O_{(l)}$$

Calculate:

(i) Moles of KIO_3 in 0.6 g sample. (3 marks)
(K = 39, I = 127, O = 16)

(ii) Moles of I_2 produced. (1 mark)

(iii) Moles of I_2 in 25 cm^3 aliquot that was titrated with $Na_2S_2O_3$. (2 marks)

(g) The reaction that takes place during the titration is:

$$2Na_2S_2O_{3(aq)} + I_{2(aq)} \longrightarrow Na_2S_4O_{6(aq)} + 2NaI_{(aq)}$$

Use this equation to calculate the molarity of the $Na_2S_2O_3$ solution. (2 marks)

PART II

(a) Transfer 0.1 g of table salt into a clean 250 cm^3 conical flask and add 5 cm^3 concentrated sulphuric acid in a fume chamber and add 50 cm^3 of 2M KI. After the production of fumes ceases, top up to the mark with distilled water.

(b) Using a pipette filler, pipette 25 cm^3 of the reaction mixture into a clean conical flask and titrate with the sodium thiosulphate until the reaction mixture turns colourless. Repeat the experiment three more times and tabulate the results as shown below. (5 marks)

	1st	2nd	3rd	4th
Final burette reading in cm^3	35			
Initial burette reading in cm^3	0·0			
Titre volume in cm^3				

(c) The reaction that takes place during the titration is between iodine and sodium thiosulphate. Calculate:

(i) Moles of $Na_2S_2O_3$ used. (3 marks)

(ii) Moles of iodine produced by 0.1 g of table salt. (3 marks)

(iii) The concentration of iodine in the table salt in ppm. (5 marks)

(d) (i) Define ppm. (1 mark)

(ii) Describe the preparation of 250 cm^3 of concentration 200 ppm with respect to $S_2O_8^{2-}$ using analar grade $(NH_4)_2S_2O_8$.

(N = 14, H = 1, S = 32, O = 16) (4 marks)

QUESTION 2

You are provided with the following apparatus:

- Spring balance (graduation interval 0.2 N or less).
- 5 pieces of masses each 100 gm.
- Cylindrical tube of at least 30 cm depth and 4 cm diameter.
- Retort stand and clamp.
- Blotting papers (5 per person).

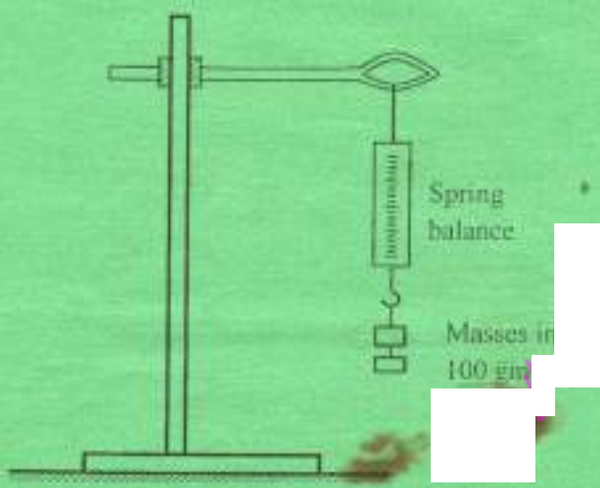

Fig. 1(a)

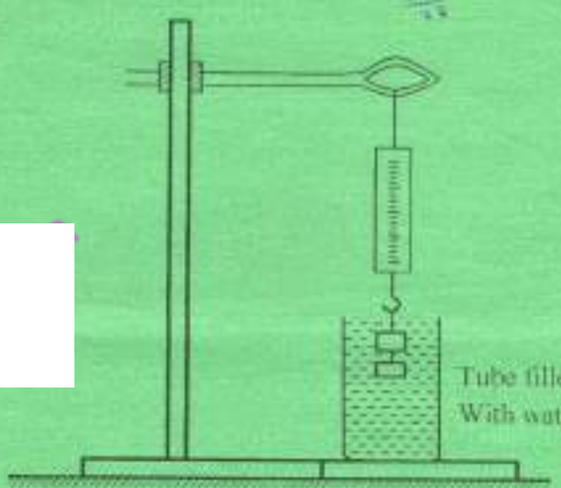

Fig. 1(b)

(a) Assemble the apparatus as shown in figure 1 (a). Weigh 100 gm mass in air and record the weight (W_a) in Newtons.

(b) Insert the suspended mass in water such that the mass is completely immersed (figure 1 b) and record the reading of spring balance W_w.

(c) Dry the mass using a blotting paper and attach another mass such that the mass attached in series is 200 grams then record the weight in air (W_a) and also while immersed in water W_w.

(d) Attach additional masses in steps such that the total is 300 gm, 400 gm and 500 gm. In each case repeat step (c). Record your data in table I.

Table I

Masses in grams	100	200	300	400	500
Weight in air (W_a)	1	2	3	4	5
Weight in water W_w	0.8	1.6	2.6	3.6	4.6
$W_a - W_w$	0.4	0.4	0.4	0.4	0.4
$\frac{W_a}{W_a - W_w}$					

(20 marks)

(e) (i) Plot a graph of weight in air (W_a) against $W_a - W_w$ in Newton. (7 marks)

(ii) Determine the gradient of graph. (2 marks)

(iii) State the physical quantity represented by the:

I) Gradient. (1 mark)

II) $W_a - W_w$. (1 mark)

(iv) Determine the average value of $\frac{W_a}{W_a - W_w}$ from the table. (1 mark)

(v) State what you expect about the value obtained in C (ii) and C (iv). (1 mark)

QUESTION 3

You are provided with the following:

- Solution A
- Solution B
- Test tubes - 4
- Test tube racks
- Blotting paper/tissue paper
- Bunsen burner
- Benedicts reagent
- Droppoer - 1
- Dilute hydrochloric acid
- Labels - 4
- Sodium hydroxide solution
- 1% copper sulphate solution
- Reagent Q

PROCEED AS FOLLOWS:

(a) To 2 cm^3 of solution labelled A in a test tube, add 5 drops of iodine solution. Repeat the procedure using solution B. Tabulate your results and conclusion. (4 marks)

(b) To 2 cm^3 of solution labelled A in a test tube add 2 cm^3 of Benedicts reagent. Heat the mixture and bring to boil. Repeat the procedure using solution B. Tabulate your observation and conclusions. (4 marks)

(c) To 2 cm^3 of solution A, add 5 drops of dilute hydrochloric acid using a dropper. Warm then cool under running tap water. Add 5 drops of reagent labelled Q then add Benedicts reagent to the mixture. Heat and bring to boil.

(i) Tabulate your results and conclusion in the format below. (2 marks)

Solution	Observation	Conclusion
A		
B		

(ii) Explain the results obtained using solution A. (6 marks)

(iii) State the role of reagent Q in the experiment. (2 marks)

(iv) State **two** roles of each of the compounds investigated in experiment (a), (b) and (c) above. (5 marks)

(d) Label two test tubes 1 and 2.

To test tube 1 add 2 cm^3 of solution A.
To test tube 2 add 2 cm^3 of solution B.
To each of the test tubes add 1 cm^3 of sodium hydroxide solution. Then add 1% copper sulphate solution drop by drop, shaking after each addition.

(i) Tabulate your observation and conclusion in the format used in C (i) above. (4 marks)

(ii) State **five** uses of the chemical substance in solution B found in living systems. (6 marks)

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