1904/106
SCIENCE LABORATORY
TECHNIQUES I (PRACTICAL)
June/July 2019
Time: 4 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN SCIENCE LABORATORY TECHNOLOGY

MODULE I

SCIENCE LABORATORY TECHNIQUES I (PRACTICAL)

4 hours

This question paper consists of 5 printed pages.

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

Turn over

1. Prepare thin epidermal tissue from the onion bulb provided, mark two slides **X** and **Y**. Stain and mount the epidermal tissue of the two slides as follows:

   Slide **X**: mount in distilled water
   Slide **Y**: mount in 2 M NaCl solution

   (a) Draw the labelled diagram of the slide marked **X**. (8 marks)

   (b) Draw the labelled diagram of the slide marked **Y**. (8 marks)

   (c) Explain the appearance of the two slides observed in (a) and (b) above. (4 marks)

   (d) Explain the staining procedure for slide **X**. (4 marks)

   (e) Outline a first aid treatment for cut that may be encountered during this practical due to broken glass slide. (5 marks)

   (f) Describe the ideal approach to avoid physical injuries in the laboratory during this practical. (5 marks)

2. You are provided with the following:

   - Pendulum bob
   - Thread (130 cm)
   - Retort stand and clamp
   - Bored cork
   - Metre rule
   - Stopwatch

You are required to determine the acceleration due to gravity using a simple pendulum.

PROCEED AS FOLLOWS:

- Hang the pendulum bob on one end of the thread; and clamp the other end firmly using the cork.
- Let the pendulum dangle over the edge of the bench.
- Place a heavy mass on the base of the retort stand to make it more firm.
- The set-up is as shown in figure 1.

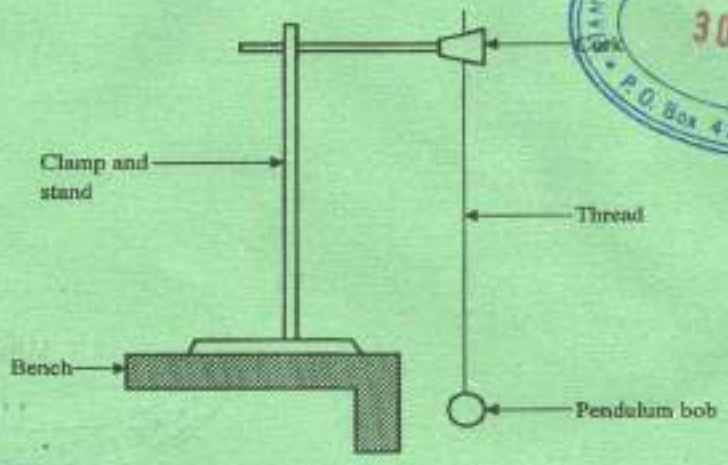

Fig. 1

- Set the length, l of the pendulum at 20 cm from the base of the cork to the centre of the bob.
- Give the pendulum bob a small displacement such that it swings with a small amplitude.
- Start the stopwatch and record the time for 10 complete oscillations, repeat for another 10 oscillations for the same length.
- Repeat the procedure with the length of the pendulum set at 40 cm, 60 cm, 80 cm, 100 cm and 120 cm.
- Complete table I below.

(24 marks)

Table I

Length (l)		Time for 10 oscillations t (sec)		Average time t (sec)	Periodic time (T) (Sec)	T^2 (sec)	$g = 4\pi^2 \frac{l}{T^2}$ (m/s²)
cm	m	1st	2nd				
20	20/100	8.75	8.69	8.715	0.8715		0.753
40	40/100	12.26	12.18	12.17	1.217	2.46	1.4016
60	60/100	14.64	15.10	14.87	1.487	2.61	2.214
80	80/100 0.8	16.94	16.70	16.815	1.6815	2.827	2.828
100	102/100 1	19.13	18.92	19.025	1.9025	3.62	2.567
120	120/100 1.2	20.35	20.16	20.25	2.025	4.101	4.153

(i) Complete the average value of g; (2 marks)

(ii) Plot a graph of $l(m)$ against T^2; (4 marks)

(iii) Obtain the gradient of the graph; (2 marks)

(iv) Calculate the value of 'g' from $g = 4\pi^2 \times gradient$. (1 mark)

3. You are provided with the following:

- Pure anhydrous sodium carbonate
- A dibasic acid H_2x containing 9.8 g/l of the acid
- Freshly prepared solution of sodium hydroxide
- Distilled water
- 250 ml volumetric flask
- Weighing balance and watch glass
- Methyl orange
- 25 ml pipette
- Titration apparatus

You are required to:-

(I) Prepare a 0.1 M standard solution of Na_2CO_3.
(II) Standardize the dibasic acid (H_2x) against the Na_2CO_3 solution.
(III) Determine the concentration of the NaOH solution.

PROCEED AS FOLLOWS

(a)
- Calculate the amount of sodium carbonate required to prepare 0.1 M solution in a 250 ml volumetric flask. (5 marks)
  (Na = 23, O = 16, C = 12).
- Weigh the calculated amount of Na_2CO_3 and dissolve in distilled water.
- Transfer to a 250 ml volumetric flask and top to the mark with distilled water. Label the solution.

(b)
- Fill the burette with the dibasic acid (H_2x).
- Pipette 25 cm^3 of the sodium carbonate solution into a conical flask.
- Add two drops of methyl orange indicator.
- Titrate the acid against the carbonate solution, until the colour changes from yellow to orange. Repeat the procedure to obtain at least three more readings.

(i) Tabulate your results and compute the average volume of the acid used. (6 marks)

(ii) Write the equation between the dibasic acid and sodium carbonate. (2 marks)

(iii) Calculate the number of moles of sodium carbonate solution used in the reaction. (2 marks)

(iv) Calculate the molarity of the dibasic acid. (2 marks)

(v) Determine the relative molecular mass of H_2x. (2 marks)

(c)
- Fill the burette with the dibasic acid (H_2x).
- Pipette 25 cm^3 of the sodium hydroxide solution into a conical flask.
- Add 2 drops of methyl orange and titrate against the acid until end point. Record the burette reading.
- Repeat the procedure to obtain at least three more readings.

(d) (i) Tabulate your results and compute the average value of the acid used. (6 marks)

(ii) Write an equation between sodium hydroxide and the dibasic acid. (2 marks)

(iii) Calculate the number of moles of the dibasic acid used in the reaction. (2 marks)

(iv) Calculate the number of moles of the sodium hydroxide used in the reaction. (2 marks)

(v) Calculate the concentration of the NaOH in moles per litre. (2 marks)

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