THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

131/3A

PHYSICS 3A
(PRACTICAL A)

(For Both School and Private Candidates)

Time: 3:20 Hours **Year: 2023**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **one (1)** carries **20** marks and the other **two (2)** carry **15** marks each.
4. Mathematical tables and non-programmable calculators may be used.
5. All writing must be in **blue** or **black** ink **except** drawing which must be in pencil.
6. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).

The following information may be useful:

Specific heat capacity of water $C_w = 4.2$ J/gK.

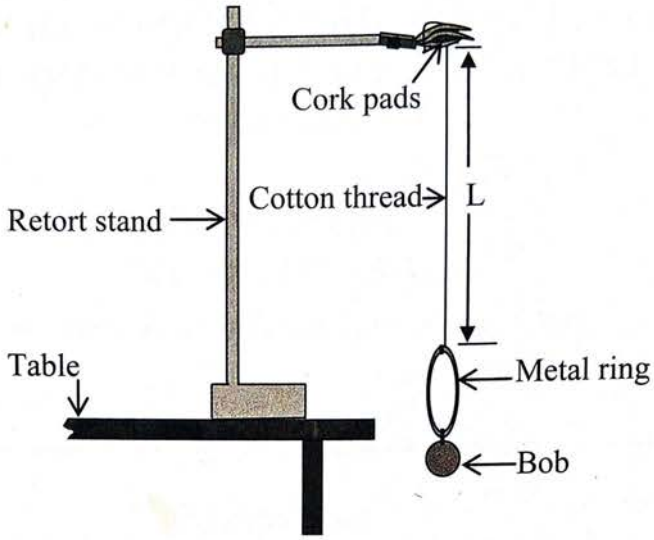
Pie, $\pi = 3.14$.

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1. You are required to perform an experiment according to the following instructions:

(a) Tie up the given metal ring and suspend it from the retort stand, then tie a pendulum bob at the lower position of the ring as shown in the following Figure:



(b) Starting with length L = 30 cm, displace the bob slightly sideway and then release it in such a way that it oscillates in a horizontal plane. Determine the time, t for 20 complete oscillations and the periodic time, T.

(c) Repeat the procedures in 1 (a) and (b) for L = 40 cm, 50 cm, 60 cm and 70 cm in each experiment and record the value of t and T.

Questions

(i) Tabulate the results of L, t, T and T^2.

(ii) Plot a graph of L (cm) against T^2 (s^2).

(iii) From the graph, read and record the value of L at $T^2 = 0$.

(iv) What is the significance of the value obtained in 1 (iii)?

(v) What is the aim of doing this experiment?

2. You are provided with a beam balance, thermometer, calorimeter with its lid and stirrer and hot liquid labelled **B**.

Proceed as follows:

(a) Weigh an empty calorimeter with its lid and stirrer and record its mass as M_1.

(b) Fill the calorimeter to about two-thirds full with a liquid **B** that has been heated to a temperature of about 85°C.

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(c) While stirring, insert the thermometer and start the stopwatch. Read and record the temperature after every 2 minutes interval as liquid cools under forced condition to a temperature of about 55°C.

(d) After cooling the liquid **B** to about 55°C, remove the thermometer and weigh the calorimeter with its content and record its mass as M.

(e) Find the mass of liquid **B** and record it as M_2.

Questions

(i) Tabulate the results of time (seconds) and the temperature (°C).

(ii) Plot a cooling curve for liquid **B**.

(iii) Draw the tangent at the temperature of 70 °C and obtain the rate of cooling of the liquid **B**.

(iv) Use the equation $(M_2C_B + 400M_1)\frac{d\theta}{dt} = 10.096\ Js^{-1}$ and the value obtained in 2 (iii) to calculate the specific heat capacity of liquid **B** (C_B).

3. You are provided with a battery **E**, a key **K**, ammeter **A**, voltmeter **V**, resistance box **S**, unknown resistor **R** and pieces of connecting wires.

Proceed as follows:

(a) Connect the given components in series except the voltmeter which should be connected in parallel with the unknown resistor.

(b) Set the resistance of 10 Ω in a resistance box. Close the key and record the readings of the ammeter and voltmeter.

(c) Repeat the procedures in 3 (b) each time by setting the resistance to 15 Ω, 20 Ω, 25 Ω and 30 Ω.

Questions

(i) Draw a circuit diagram for the connection.

(ii) Tabulate the results obtained in 3 (b) and (c).

(iii) Plot a graph of voltage (V) against current (I).

(iv) Compute the value of unknown resistance.

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