THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATIONS

131/3A **PHYSICS 3A**

(PRACTICAL A)

(For Both School and Private Candidates)

Duration: 3:20 Hours **Year: 2025**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **one (1)** carries **twenty (20)** marks and the other **two (2)** carry **fifteen (15)** marks each.
4. Mathematics tables and non-programmable calculators may be used.
5. All writing must be in **black** or **blue** ink except for drawings which must be in pencil
6. Communication devices 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:

Pie, $\pi = 3.14$

Specific heat capacity of water = 4.2×10^3 $Jkg^{-1}K^{-1}$

1. You are provided with the plastic ruler (30 cm), metre rule, retort stand with its accessories, mass, **M**, thread, masking tape, micro meter screw gauge and weighing balance. Proceed as follows:

   (a) By using cork pads on the retort stand, clamp the given 30 cm ruler so that its flat side is horizontal and the protruding length, l = 27 cm. Using a masking tape, fix the thread with length L = 110 cm at the end of the ruler and the mass, **M** hanging at the bottom as shown in Diagram 9.

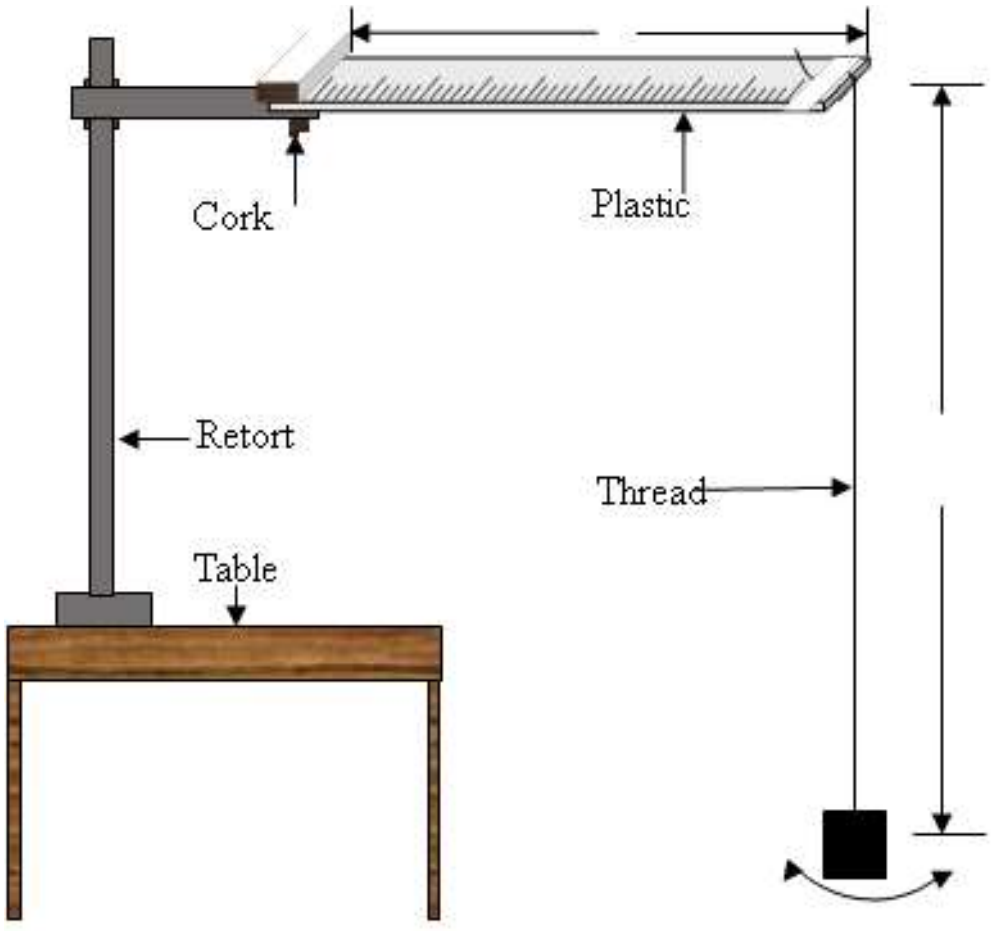


Diagram 6

(b) Displace the mass, **M** a small distance from its equilibrium and release it so that it executes oscillations in a plane parallel to the ruler. Measure and record the time, t_{10} for ten oscillations and hence compute its periodic time T.

(c) Repeat the procedures in 1 (b) when the lengths of the thread is L= 90 cm, 70 cm ,50 cm and 30 cm

(i) Tabulate your results including the values of L (m), t_{10}(s), T(s) and $T^2(s^2)$

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

(iii) If T and L are related by $T^2 = 4.03L + T^2_c$, what is the value of T^2_c?

(iv) State the physical meaning of T_c

(v) Measure and record the mass of the solid, **M** and the breadth, b and thickness, t of the ruler.

(vi) Compare the Young's modulus E of the plastic ruler in SI, given that

$$E = \frac{16\pi^2 M}{bT_c}\left(\frac{l}{t}\right)^3$$

2. You are required to investigate the cooling behavior of a copper calorimeter under different conditions. Proceed as follows:

(a) Half-filled the calorimeter with hot water of about 90^0. Cover the calorimeter with a lid and insert the calorimeter through the opening so as to read the temperature of water.

(b) Starting with temperature of 80^o, read and record the temperature of water at the interval of one minute for 10 minutes while stirring and fanning using cardboard.

(c) Wet the given cloth normal tap water.

(d) Repeat the procedures in 2 (a) and (b), but in this case wrap the calorimeter with a wet cloth just before starting recording the temperature.

Questions:

(i) Tabulate your results obtained in 2 (b) and (d).

(ii) Plot the cooling curves for the results in 2 (b) and (d) on the same plane of axes.

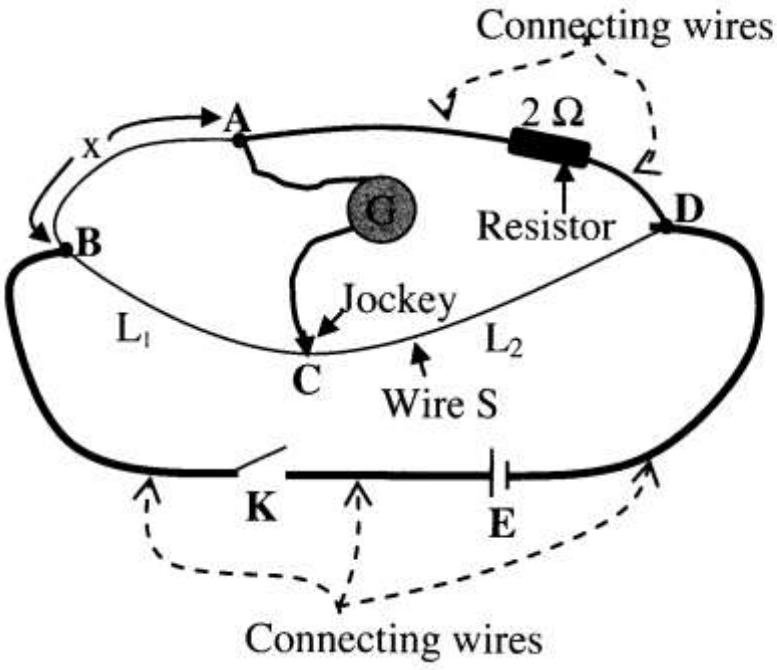
(iii) Determine the temperature of water at 7^{th} minute for both cooling curves.

(iv) In which of the two settings did water cools faster? Justify the answer by giving two points.

3. You have been provided with a 2 Ω standard resistor, resistance wire **S**, galvanometer G, dry cell E (1.5 V, size D), switch K, jockey and connecting wires. Determine the resistivity of wire, **S** through the following procedures.

(a) Connect 80 cm of wire S together with 2 Ω resistor in series to make a loop.

(b) Connect wires from the terminals of the dry cell E, at junction B and junction D, then connect resistance wire **S** from the junction A to junction B and complete the circuit as shown in a Diagram 9.



(c) Close the switch, K and determine the balancing point C. Read and record the lengths, L_1 and L_2

(d) Repeat the procedures in 3(b) and (c) for the value of x equal to 20cm, 30cm, 40cm, and 50cm.

Questions:

(i) Tabulate your results including the value of x, L_1, L_2 and $\frac{L_1}{L_2}$

(ii) Plot a graph of x (cm) against $\frac{L_1}{L_2}$

(iii) Determine the slope of the graph.

(iv) Measure and record the diameter of the wire, S by using micro meter screw gauge.

(v) Determine the resistivity of a wire, S using the answer obtained in 3 (iii) and (iv).