THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATIONS

131/3C **PHYSICS 3C**

(PRACTICAL C)

(For Both School and Private Candidates)

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

Instructions

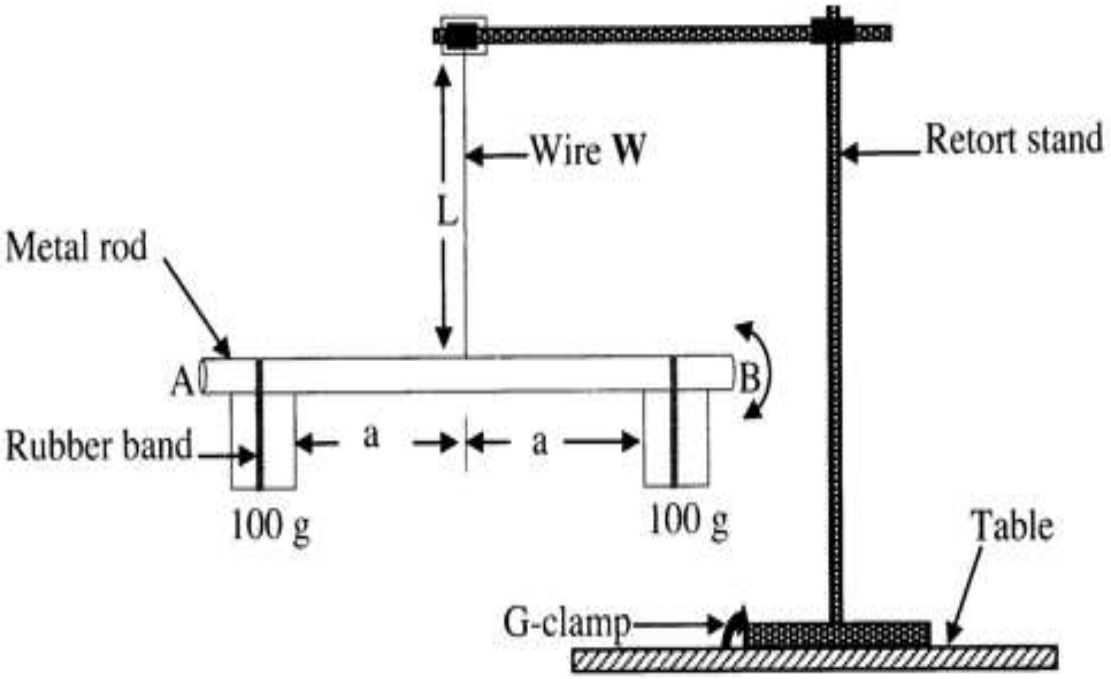
1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **one (1)** carries **twenty (20)** marks and the other **two (2)** carry **fifteen (15)** marks each.
4. Mathematics tables and non-programmable calculators may be used.
5. All writing must be in **black** or **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 have been provided with wire **W**. Perform an experiment to determine the shear modulus of the wire given. Proceed as follows:
   (a) Arrange the apparatus as shown in Diagram 11.



   (b) Mount a metal rod AB at its centre point, then adjust the length, L of wire, W about 50 cm so that when the metal rod AB is twisted through A at a small angle in the horizontal plane about its centre point, it executes oscillations.
   (c) Fasten the two masses firmly on the rod by using a rubber band, at equal distance in centimetres measured from the suspended wire, W to the mid-point of each mass.
   (d) Twist the metal rod and record the time, t for 10 oscillations of the rod when the distance from the wire to the mass, a=3 cm. Hence obtain its periodic time T
   (e) Repeat the procedure outlined in 1 (d) for the values of a = 5 cm, 7 cm, 9 cm and 11 cm.

Questions:

(i) Tabulate your results, including the values of t, T, T^2, a, a^2 and $10a^2$.

(ii) Read and record the diameter of the wire W hence find its radius.

(iii) Plot a graph of $10a^2$ against T^2.

(iv) Determine the slope of your graph.

(v) Evaluate the shear modulus η of the wire **W**, from the equation,

$$\eta = \frac{80a^2\pi L}{r^4 T^2}$$

2. You are provided with hot water of about 70^o C, a copper calorimeter and a thermometer. You are required to determine the effect of the mass of an object on the cooling process. Proceed as follows:
   (a) Measure and record the mass of the empty calorimeter.
   (b) Half filled the calorimeter with hot water of about 70^o C
   (c) Observe and record the temperature of water at an interval of 2 minutes as water cools from 60^0 C to 45^0 C.
   (d) Weigh the calorimeter that is half filled with hot water.
   (e) Repeat the procedures in 2 (c) and (d) when the calorimeter is 2/3 full of hot water.

Questions.

(i) What are the masses of water obtained in 2 (d) and (e)?

(ii) Tabulate the results obtained in 2 (c) and (e).

(iii) Plot the cooling curves of two setting in the same plane of axis.

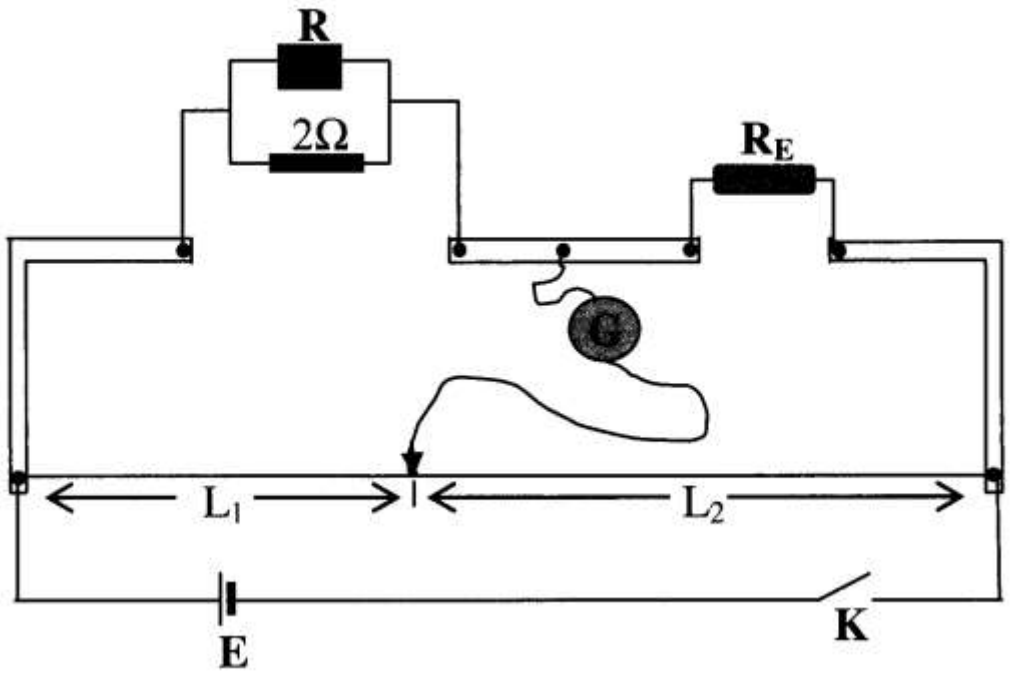
(iv) From the graph in 2 (iii), determine the ratio between the time taken to cool half full of water to that of two third full of water at the following intervals; $60^0C - 50^0C$ and $60^0C - 45^0C$.

(v) Using the data obtained in2 (c) and (e), determine the thermal capacities of water.

(vi) Determine the ratios of thermal capacities obtained in 2 (v).

(vii) How do the ratios obtained in 2 (iv) and (vi) relate?

3. You are provided with a meter bridge with its accessories, resistance box (1Ω-10Ω) labelled R, 2 Ω standard resistor, galvanometer labelled **G**, dry cell soldered both ends labelled E, key **K**, connecting wires and hard paper wrapped with wires of resistance 6 Ω labelled RE. Referring to the information provided, perform the experiment in order to determine the number of wires that the resistor, **RE** contains if each wire has a resistance of 6 Ω as follows in Diagram.



(a) Starting with R =10 Ω, close the key, K and determine the length, L_1 where by, the galvanometer reads 0 and hence determine the corresponding value of length, L_2.

(b) Repeat the procedure ion 3(a) for values of R=5 Ω, 3 Ω, 2 Ω, and 1 Ω.

Questions

(i) Prepare a table of results including of values of R, $\frac{1}{R}$, L_1, L_2 and of $\frac{L_2}{L_1}$

(ii) Plot a graph of $\frac{1}{R}$ against $\frac{L_2}{L_1}$ and determine its slope.

(iii) Develop the relation that governs this experiment.

(iv) Use your results in 3(ii) and (iii) to determine the number of wires that the resistor, RE contains if each wire has a resistance of 6 Ω.