THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
DIPLOMA IN SECONDARY EDUCATTION EXAMINATION

731/2A **PHYSICS 2**

(ACTUAL PRACTICALS 2A)

Time: 3 Hours **Year: 2024**

Instructions.

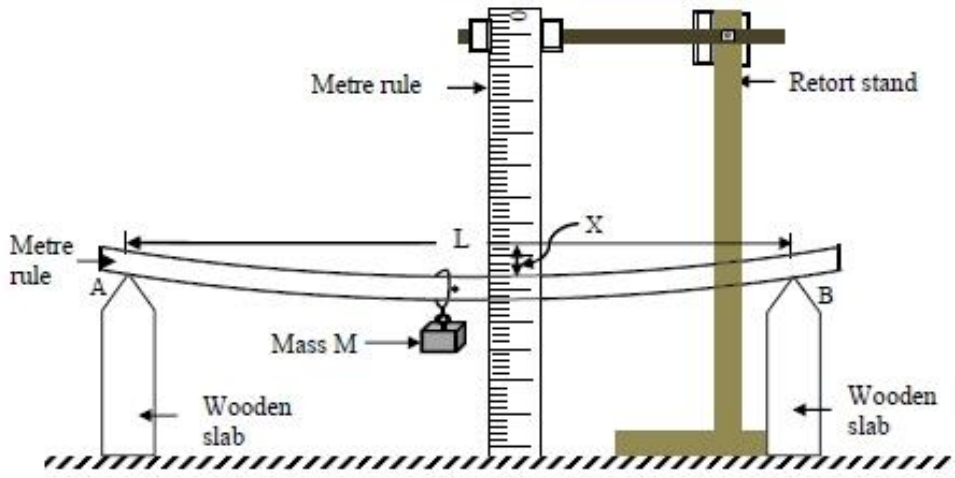
1. This paper consists of **three (3)** questions
2. Answer **all** questions
3. Cellular phones are **note** allowed in the examination room.
4. Write your **examination Number** on every page of your answer booklet(s).

SECTION A (40 Marks)

1. Timbers used in bridge construction are chosen and arranged depending on the maximum load they are supposed to carry. An engineer wants to construct a bridge in one of the highways using timbers which are the same as those used in making common metre rule. Since metre rules are available in your Laboratory, conduct an experiment through the given procedures to ascertain whether such timber will meet the requirement.

Procdures:

(a) Arrange the apparatus as illustrated in Figure 1.



(b) Using sellotape, fix a pin at the middle of the horizontal metre rule so that it serves as a pointer. Make sure the vertical metre rule is in the line with the centre of the horizontal metre rule.

(c) Measure l = 90 cm as the distance AB. Record the pointer reading Xo on the vertical rule when there is no any mass on the horizontal metre rule.

(d) Load the horizontal metre rule by suspending a mass M = 500 g at the centre using a piece of thread, then record the pointer reading X on the vertical rule. Determine the depression d = $(x\text{-}x_o)$ cm.

(e) Without changing the position of 500 g mass, repeat the procedure in (c) by changing distance between the wooden slabs to 80 cm, 70 cm, 60 cm and 50 cm.

(f) Using a vernier caliper, measure the breadth and thickness t of the metre rule.

Questions

(i) Tabulate your results including the values for log d and log l.

(ii) Plot a graph of log d and log l.

(iii) Determine the Young's Modulus of the metre rule given that; log d = 3logl + log k

(iv) Justify whether the material represented by a metre rule meet the requirements.

2. You are assigned a task to investigate the relationship through experiment between the loss of heat from a copper calorimeter and the excess temperature over the surroundings under the conditions of forced convection. Given the following apparatus and materials; copper calorimeter with lid, thermometer, hot water and cardboard, perform the experiment through the given procedures and answer the questions that follow.

Procedures:

(a) Record the room temperature as θo.

(b) Fill about three quarter of the calorimeter with hot water heated to about 85 °C or more.

(c) Place the copper calorimeter on a wooden base and cover it with lid. When the temperature of water reaches 80 °C start a stopwatch and gently stir the hot water while recording the temperature for every 1 minute. Take your readings for 14 minutes.

Questions

(i) Tabulate your results as shown in the following table:

Time t (sec)	temperature θ^o	$(\theta - \theta_o)\ ^oC$	$\log(\theta - \theta_o)$

(ii) Plot a graph of $\log(\theta - \theta_o)$ against time, (t).
(iii) State if your results obey the relation $\log(\theta - \theta_o) = -kt + C$
(iv) What is the physical meaning of k?
(v) Mention any two sources of errors in doing this experiment.

3. To avoid faulty of electrical appliances, wire cables are specified basing on the resistivity of materials making up the wire. You are provided with the following materials; a wire of length 1 m, a metre bridge, galvanometer, jockey, a switch, a standard resistor of 2 Ω, two dry cells connected in series and micrometre screw gauge. Carry out an experiment to determine the resistivity and corresponding resistance of a 1m wire whose labels have been removed.

Procedures:

(a) Connect the circuit by fixing a wire of length, x = 0.1 m on the left gap of a metre bridge and standard resistor of 2 Ω on the right gap.

(b) Close the switch and move the sliding contact along the bridge wire to the balancing point. Measure and record the lengths l_1 on the left and l_2 on the right of the balancing point.

(c) Repeat the procedures in 3 (a) to (b) for the values of x = 0.2 m, 0.3 m, 0.4 m, 0.5 m, 0.6 m, 0.7 m and 0.8 m.

(d) Measure and record the diameter of the wire.

Questions

(i) Draw the circuit diagram showing your experimental set up.

(ii) Tabulate your results including the values of $\frac{l_1}{l_2}$.

(iii) Plot a graph of $\frac{l_1}{l_2}$ against x and determine its slope, S.

(iv) Compute the resistivity of the wire.
(v) Determine the resistance of the whole wire.
(vi) What precautions would you take to minimize sources of errors?