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

731/2A

PHYSICS 2A
ACTUAL PRACTICAL A

Time: 3 Hours **Year: 2020**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** the questions.
3. Question **one (1)** carries **twenty (20)** marks and the rest carry **fifteen (15)** marks each.
4. Mathematical tables and non-programable calculators may be used.
5. Communicative devices and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. The following information may be useful:

   Pie, $\pi = 3.14$.

1. In this experiment you are required to determine the Young's modulus E of a meter rule. The apparatus should be set as shown in the Figure 1.

Proceed as follows:

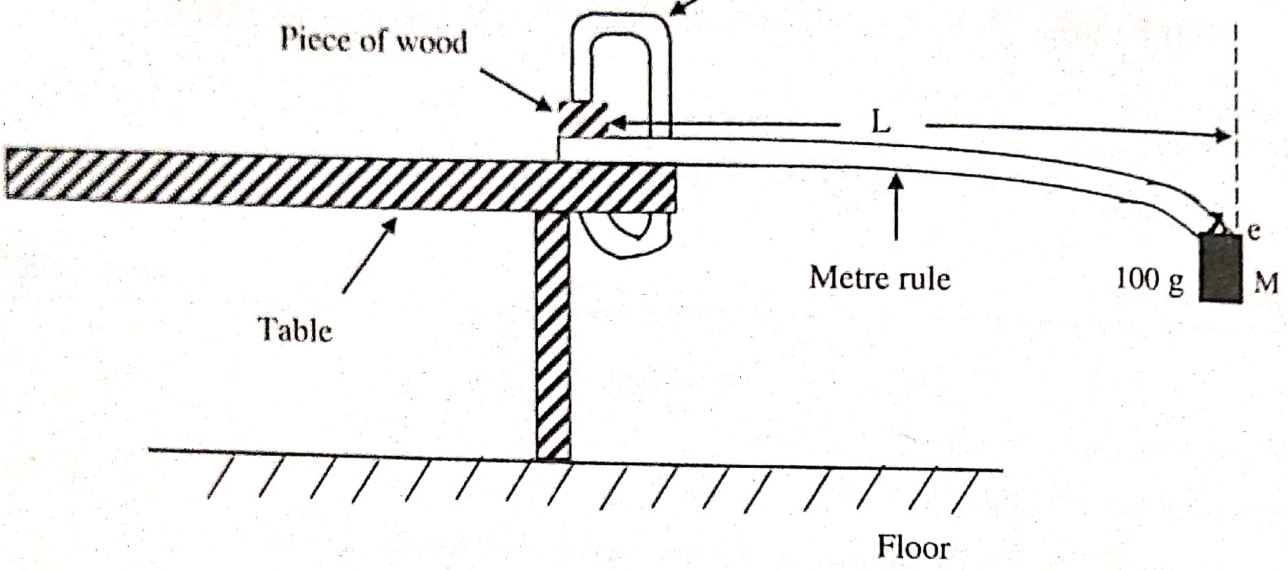

Figure 1

(a) Clump firmly a given meter rule to the edge of the bench by using G-clamp.

(b) Adjust the length of the rule such that the free end, L is 80 cm.

(c) Secure 100 g mass, M using a rubber band almost at the free end, (e) point.

(d) Depress slightly the loaded end and release it so that it oscillates vertically.

(e) Record the time taken for 20 oscillations.

(f) Repeat procedures (d) and (e) using L = 70 cm, 60 cm, 50 cm and 40 cm.

Questions

(i) Tabulate your results including the column for the values of periodic time, T, T^2 and L^3.

(ii) Measure and record the width 'b' and thickness 'd' of the metre rule.

(iii) Plot a graph of T^2 (sec^2) against L^3 (cm^3).

(iv) Determine the slope of your graph.

(v) Determine the value of Young's Modulus E of the metre rule given that;

$$T = 2\pi\sqrt{\frac{ML^3}{3IE}} \quad \text{where } I = \frac{bd^3}{12}.$$

2. The aim of this experiment is to determine the specific heat capacity of a liquid L by the method of cooling.

Proceed as follows:

(a) Weigh the calorimeter with its lid and stirrer, record the mass as M.

(b) Fill to two-thirds level the calorimeter with hot water heated to about 75 °C.

(c) Place the copper calorimeter on a wooden base and support it with jacket as shown in Figure 2. When the temperature of the water reaches 70 °C, start the stopwatch and stir. Record the temperature of water for every 1 minute up to when the temperature falls to 55 °C.

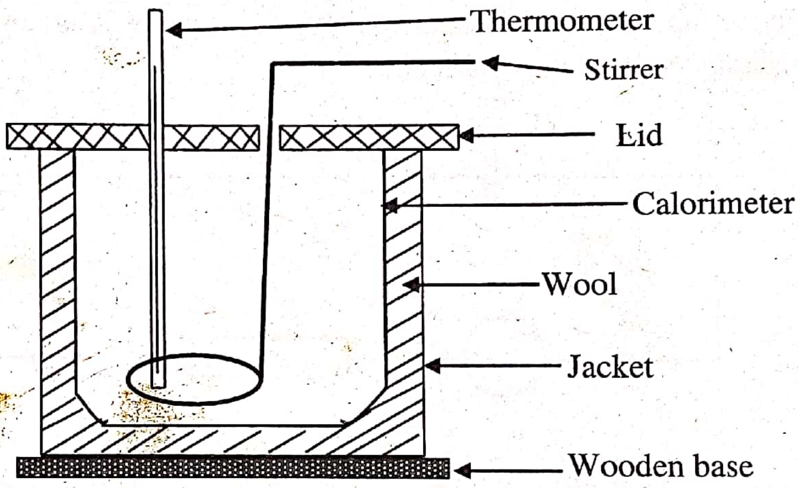

Figure 2

(d) Remove the calorimeter from the jacket and weigh it with the lid, stirrer and water. Find the mass of water and record as M_1.

(e) Empty the calorimeter, clean and dry it then re-fill with the same volume (two-thirds) of heated liquid L to about 75 °C.

(f) Repeat steps (c) and (d) then find the mass of liquid L and record as M_2.

Questions

(i) Tabulate your results as shown in the Table.

Time (t) sec	Temperature (θ) °C, (Liquid L)	Temperature (θ) °C, (Water)

(ii) Draw the cooling curves for the water and the liquid L on the same axes, obtain the gradient at 60 °C.

(iii) Determine the rates of cooling of water and liquid L.

(iv) Use the following formula to calculate the specific heat capacity, C_L of the liquid L:

$$(M_1C_1 + M_cC_2)\frac{d\theta_1}{dt} = (M_2C_L + M_cC_2)\frac{d\theta_2}{dt}$$

Where M_1 and M_2 are masses of water and liquid L respectively. The $C_1 = 4200\ Jkg^{-1}K^{-1}$ and $C_2 = 400\ Jkg^{-1}K^{-1}$ are the specific heat capacities of water and copper respectively.

3. The aim of this experiment is to determine the e.m.f. E of the given dry cell.

Proceed as follows:

(a) Carefully set up the circuit as shown in Figure 3, where A is an ammeter, R is a resistance box, E is a dry cell and K is a switch.

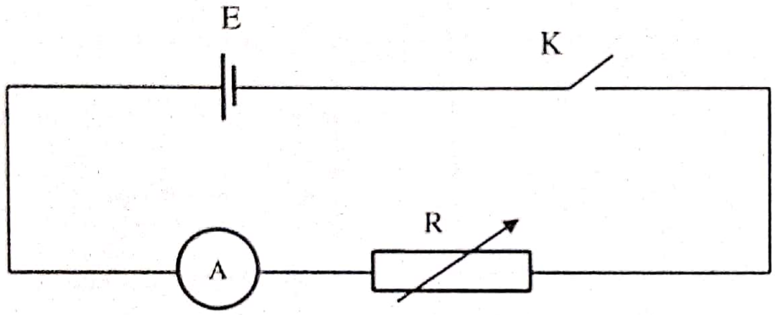

Figure 3

(b) Starting with R = 2 Ω, close the switch K and record the current I from the ammeter.

(c) Repeat the procedure in (b) for values of R equal to 4 Ω, 6 Ω, 8 Ω, 10 Ω, 12 Ω, 14 Ω and 16 Ω.

Questions

(i) Tabulate the results obtained in 3 (b) and (c), including the column for the values of $\frac{1}{I}$.

(ii) Plot a graph of R (Ω) against $\frac{1}{I}$ (A^{-1}).

(iii) Determine the slope from your graph.

(iv) Use your graph to determine the e.m.f. E of the dry cell.

(v) State two sources of errors in this experiment and suggest ways of eliminating them.