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: 2022**

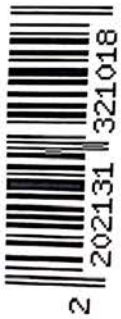
Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **Number 1** carries 20 marks and the other **two (2)** carry 15 marks each.
4. Mathematical tables and non-programmable calculators may be used.
5. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
6. 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, $\pi = 3.14$.



1. You are provided with a wire W, metre rule, two cork pads, test tube, micrometer screw gauge, slotted mass of 20 g, retort stand with its accessories, masking tape and optical pin.

Proceed as follows:

(a) Measure and record the length, *l* and diameter, d of a wire **W**.

(b) Wind the whole length of the wire, **W** tightly on the test tube making sure the turns are as close as possible but not overlapping.

(c) Measure the length x of the coil made as shown in Figure 1 and count the number of turns.

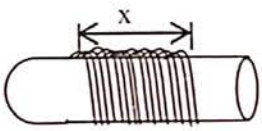


Figure 1

(d) Remove the coil from the test tube; straighten the first and last coil. Clamp one end on the retort stand while bending the other end to make a hook. Count the number of complete turns, n, remaining and measure the distance h_1 between the ends of coil as shown in Figure 2.

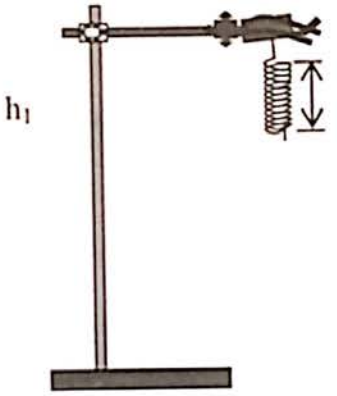


Figure 2

(e) Load a 20 g mass on the other end of the coil and arrange as shown in Figure 3. Measure and record the distance, h_2 between the ends of the turns.

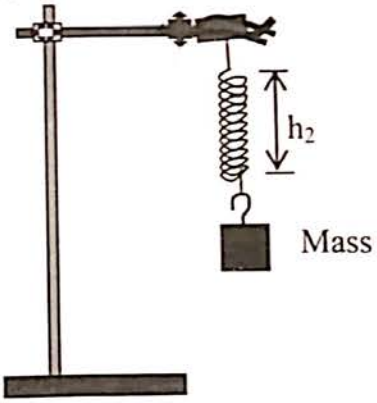


Figure 3

(f) Remove the mass, reduce the number of turns by straightening three turns of the coil from the upper end and adjust the point of suspension of the coil. Record the number of turns, n remaining and measure the distance, h_1. Load 20 g mass on the coil and then measure and record the distance, h_2.

(g) Repeat procedures in 1 (f) so as to obtain other three readings to make a total of five readings for n, h_1 and h_2.

Questions

(i) Record the values of n, h_1 and h_2 and find extension e as shown in the following table:

Number of turns n remaining						
Distance, h_1 (cm)						
Distance, h_2 (cm)						
Extension, $e = (h_2 - h_1)$ (cm)						

(ii) Plot a graph of extension, e against the number of turns, n.

(iii) Determine the slope S of the graph.

(iv) Compute the value of constant G from the equation; $\frac{1}{n} = \frac{Gx}{de}$.

2. Form Five Physics students were debating on whether hot objects made with the same materials but having different masses have the same rate of cooling or not. Conclude their debate by performing the experiment using the following procedures:

(a) Measure the mass of an empty calorimeter provided.

(b) Fill the calorimeter with hot water of 90 °C to three quarters, then cover the calorimeter with a lid.

(c) While fanning with hard board, record the time (t) in seconds for every 5 °C drop of temperature of water starting from the temperature of 80 °C to 55 °C.

(d) Record the mass of the calorimeter with water.

(e) Repeat procedures 2 (c) to (d) when the calorimeter is half filled with hot water.

Questions

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

(ii) Determine the mass of water m_1 and m_2 as obtained from procedures in 2 (a) and (e) respectively.

(iii) Plot the graph of time obtained in 2 (c) against that in 2 (e).

(iv) Determine the slope of the graph plotted in 2 (iii).

(v) Determine the ratio of the masses m_1 and m_2.

(vi) Use the slopes and the ratio of masses obtained from this experiment to conclude the debate of the students.

3. Laboratory equipment dealer wants to know from you the specifications of the wire which was not indicated. You are required to perform an experiment to obtain the required specifications of the wire using the metre bridge, standard resistor of 2 Ω, a dry cell, 100 cm wire of unknown resistivity, zero centred galvanometer, switch, micrometer screw gauge, metre rule and several pieces of connecting wires.

Proceed as follows:

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

(b) Connect a 2 Ω resistor in the right hand gap and in the left hand gap connect the wire at length, x = 15 cm. Close the switch and quickly determine the balancing point. Record the balance length L on the metre bridge being on the left hand side of the jockey of the galvanometer, then open the switch.

(c) Repeat procedures in 3 (b) by connecting the wire at lengths, x = 25 cm, 40 cm, 50 cm and 65 cm. In each experiment, record the corresponding values of L.

Questions

(i) Draw a clearly labelled circuit diagram of this experiment.

(ii) Tabulate your results including the values of x (m), $\frac{1}{x}$ (m^{-1}), L (m) and $\frac{1}{L}$ (m^{-1}).

(iii) Plot a graph of $\frac{1}{x}$(m^{-1}) against $\frac{1}{L}$ (m^{-1}).

(iv) Determine the slope and the intercept of the graph in 3 (iii).

(v) Determine the average value of unknown resistivity of the wire from the results in 3 (iv).

(vi) If a customer wants to buy a piece of this wire, what will be the length of the wire required to make a resistance equivalent to 10 Ω?