THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

131/3A **PHYSICS 3**

ALTERNATIVE A PRACTICAL

(For Both School and Private Candidates)

Time: 3 Hours 10 Minutes **ANSWERS** **Year : 2006**

Instructions

1. This paper consists of three (3) questions.
2. Answer all questions
3. Non-programmable calculators may be used.
4. Communication devices and any unauthorised materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. The aim of this experiment is to determine the radius of gyration r of the rectangular sheet of hardboard provided and the acceleration due to gravity g.

(i) Set up the apparatus as shown in figure 1 below; (G – is the centre of gravity of the hardboard). Suspend the hardboard from a hole nearest to the centre of gravity G. Record the distance, d, which is the distance of the hole from G.

The hardboard is fixed on a pin through a small hole, ensuring it can oscillate freely. The distance d is measured from the center of gravity G of the board to the hole where it is suspended.

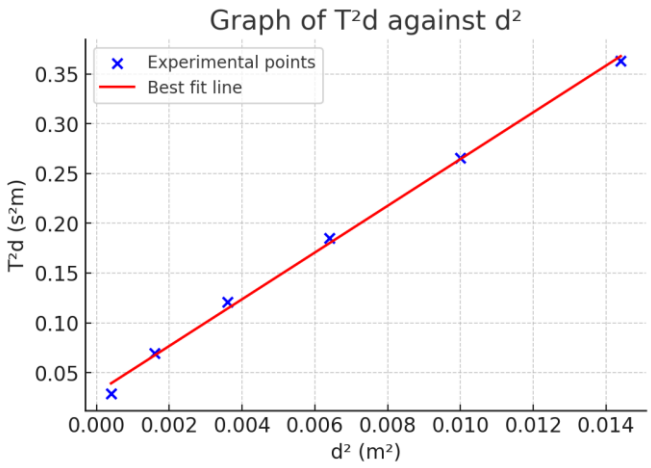
(ii) Using the stopwatch (or stopclock) provided, obtain the time t for 20 small complete oscillations of the hardboard, and hence calculate the periodic time, T.

The time t for 20 oscillations is divided by 20 to get the periodic time T. This step is repeated for accuracy.

(a) Repeat the above procedure (1(ii)) with 5 other values of d and obtain the corresponding values of T. Tabulate your results.

Values of distance d are varied by suspending the board from different holes. The time for 20 oscillations is recorded in each case, and the corresponding values of T are calculated. The table is filled with values of d, T, and T^2d.

(b) Plot the graph of T^2d against d^2, with both axes starting at the origin.



(c) Given that $T/2\pi = \sqrt{((r^2 + d^2)/gd)}$, determine the:

(i) radius of gyration r.

(ii) acceleration due to gravity g.

From the relation $T^2d = (4\pi^2/g)(r^2 + d^2)$, the slope and intercept of the graph can be used to determine r and g. The slope gives $4\pi^2/g$, and the intercept corresponds to $(4\pi^2r^2)/g$. By evaluating these values, the radius of gyration r and the acceleration due to gravity g are obtained.

2. You are provided with a lid, a thermometer, a stirrer, a stopwatch, a wooden base and a source of liquid L whose initial temperature is above 80 °C.

Using the items provided, carry out an experiment to determine whether or not a sample of liquid L obeys Newton's law of cooling. Take readings at 1.0 minute intervals for 15 minutes.

The liquid is heated to above 80 °C and the initial temperature recorded. The thermometer is inserted into the liquid through the lid, with stirring to maintain uniform temperature. A stopwatch is started, and the temperature is noted at 1-minute intervals for 15 minutes. The results are tabulated, and a graph of temperature θ against time t is plotted. If the cooling follows Newton's law, the rate of fall of temperature is proportional to the difference between the liquid's temperature and room temperature, giving an exponential decay graph.

3. The aim of this experiment is to determine the electrical resistivity ρ of the wire labelled X.

Proceed as follows:

(i) Set up the slide wire metre bridge as shown in figure 2 below, where E is a 3 V source (2 dry cells in series) and G the galvanometer. Length l_x of the nichrome wire is connected across the right hand gap of the bridge and the jockey is placed at 50 cm mark.

The apparatus is connected with the wire X in the right-hand gap, and resistance box R in the left gap. The jockey is tapped at the 50 cm mark of the slide wire, and the galvanometer is used to check for null deflection.

(ii) With R = 60 cm, find the value of l_x which the galvanometer gives zero deflection when the slider is tapped onto the 50 cm mark.

The balance length l_x is recorded for null deflection.

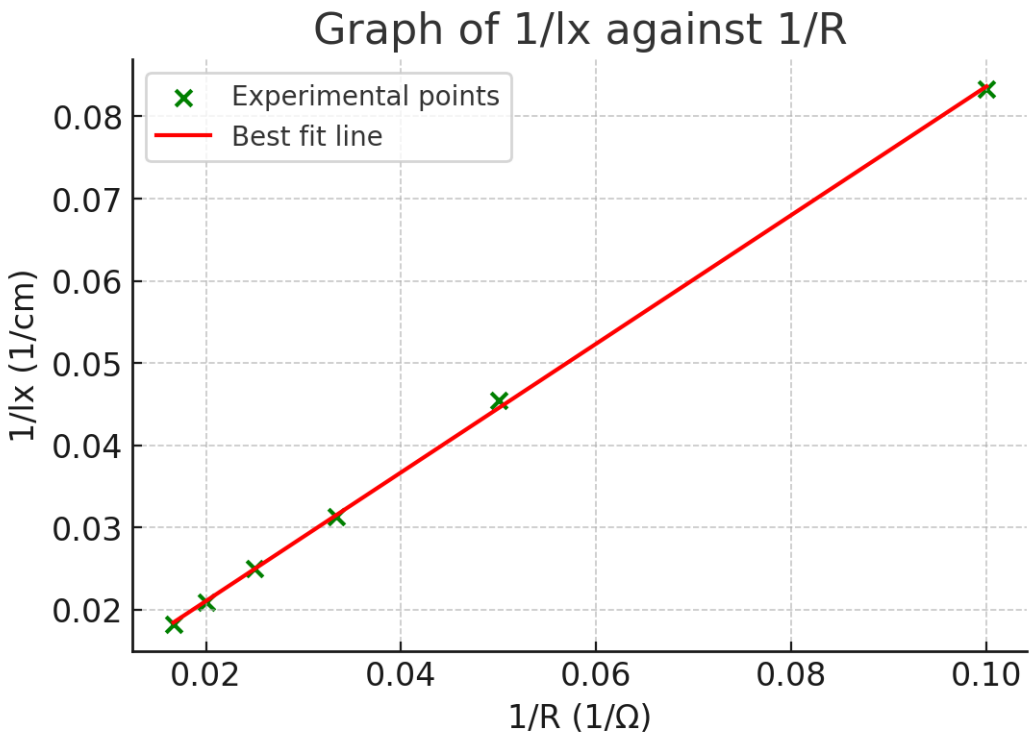
(iii) Repeat the procedure in 3(ii) for values of R = 50 cm, 40 cm, 30 cm, 20 cm and 10 cm. Tabulate the values of R, l_x, 1/R and $1/l_x$.

The readings of R and l_x are taken and recorded. The reciprocals 1/R and $1/l_x$ are calculated and added to the table.

(b) (i) Measure the diameter of wire R.

The micrometer screw gauge is used to measure the diameter of the wire at different points, and the mean value is taken.

(ii) Plot a graph of $1/l_x$ against 1/R.



From the tabulated data, a graph of $1/l_x$ on the y-axis against 1/R on the x-axis is drawn. The plot is expected to be a straight line.

(iii) Determine the slope and the intercept along $1/l_x$ axis.

The slope and intercept are determined from the straight-line graph.

(c) Calculate the resistivity ρ of wire X given that $l_x/R = (l_x/2A)\rho + (\rho/2A)$, where A is the cross-sectional area of wire X.

Using the relation obtained from the graph, the slope gives ρ/2A and the intercept gives ρ/2A as well. With $A = \pi d^2/4$, resistivity ρ is calculated accurately.