THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

031/2A

PHYSICS 2A
ALTERNATIVE A PRACTICAL
(For Both School and Private Candidates)

TIME: 2 Hours 30 Minutes ***Monday November 10, 2003 a.m.***

Instructions

1. This paper consists of **THREE (3)** questions.
2. Answer **TWO (2)** questions including question **number 1.**
3. Calculations should be clearly presented.
4. Mathematical tables or slide rules may be used.
5. Electronic calculators are **not** allowed in the examination room.
6. Cellular phones are **not** allowed in the examination room.
7. Write your Examination Number on every page of your answer booklet(s).

1. The aim of this experiment is to determine "Young's modulus" of a given metre rule.

   Proceed as follows:

   Use vernier callipers to measure the breadth and thickness of the metre rule provided.

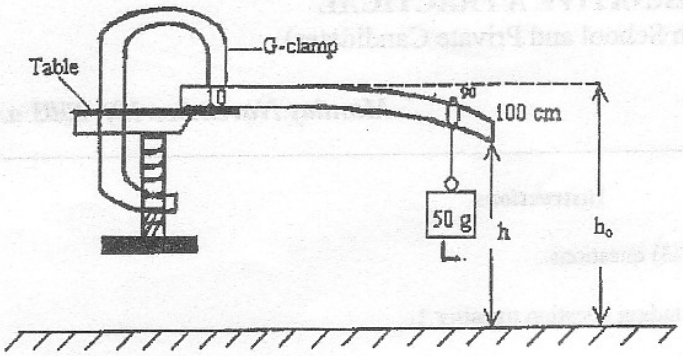


Figure 1

Take a metre rule and fix it at its 10 cm mark by means of a G-clamp. Record the height h_o above the ground. Take a 50 g weight (L) provided and suspend it on the metre-rule at 90 cm mark using a string. Note the new height h, above the ground. Repeat the above procedure by suspending the weights of 100 g, 150 g, 200 g, 250 g and 300 g from the same position, each time recording the new height h.

(a) Record your readings in a suitable table and include column for $(h_o - h)$.

(b) Plot a graph of L (load) vertical axis against $(h_o - h)$ horizontal axis.

(c) From your graph find the slope G.

(d) Determine Young's modulus Y of the wooden metre-rule given that $Y = \frac{4}{Gb}\left(\frac{\ell}{t}\right)^3$ where ℓ is the distance of point of the weight from the clamp, **b** is the breadth of the metre rule and **t** is the thickness of the wooden metre rule.

(25 marks)

2. In this experiment you are provided with two plane mirrors, one optical pin, a sheet of plane paper, drawing board, protractor and mirror holders. Proceed as follows:

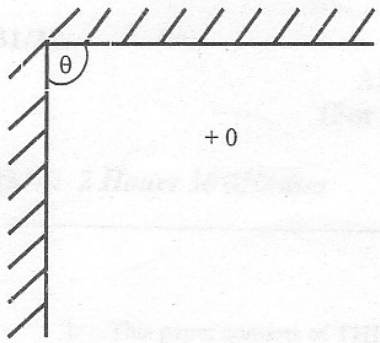


Figure 2

Draw two lines at right angles by using your ruler and protractor on the plane sheet of paper and place the plane sheet of paper securely fixed on the drawing board. Place one mirror on each of lines of the sheet of paper. Fix an optical pin on point 0 and look into both mirrors and count the number of images and record the total number of images for $\theta = 90°$. Repeat the procedure for $\theta = 72°, 60°, 45°$ and $30°$.

(a) Tabulate your results as follows:

Number of images, n	Angle between mirrors, θ (deg)	$\frac{1}{\theta}(\text{deg}^{-1})$

(b) Plot the graph of n (vertical axis) against $\frac{1}{\theta}$ (horizontal axis).

(c) From your graph,

(i) determine the slope of the graph, G to the nearest tenth

(ii) determine n-intercept of the graph, P

(iii) equation relating **n** with θ and **P** is given by $\mathbf{n} = \frac{\mathbf{G}}{\theta} + \mathbf{P}$. Rewrite it with the values of **G** and **P** you have calculated.

(d) (i) What happens to the number of images when $\theta = 0°$?

(ii) Suggest the aim of this experiment.

(25 marks)

3. The aim of this experiment is to determine the e.m.f. and internal resistance of a cell using an ammeter and a voltmeter.

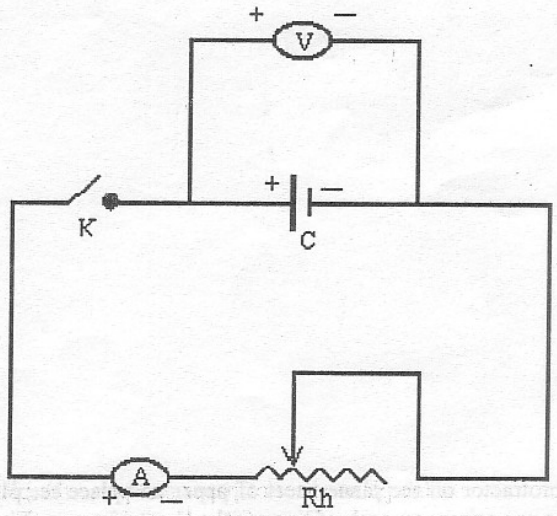


Figure 3

Proceed as follows:

Connect the circuit as shown in Figure 3. With the key K open, record the reading of the voltmeter. Close the key K and adjust the rheostat so that the cell supplies a small current through the circuit. Record this current I amps as registered by the ammeter A, and the new reading V volts on the voltmeter. Keep the key closed and adjust the rheostat so that a slightly larger current flows through the circuit. Again record the values of I and V. Repeat the procedure above to obtain a set of five pairs of readings of I and V, each time slightly adjusting the rheostat to increase the current I.

(a) Tabulate your readings.

(b) Plot a graph of V (vertical axis) against I (horizontal axis).

(c) Find the slope of the graph.

(d) Assuming that $\mathbf{V = E - Ir}$ where **r** is the internal resistance of the cell and **E** its e.m.f., use your graph to determine **r** and **E**.

(25 marks)