THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION
NOVEMBER 2003

031/2B

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

Time: 2 Hours 30 Minutes *Friday November 14, 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. Cellular phones are **not** allowed in the examination room.
6. Electronic calculators are **not** allowed in the examination room.
7. Write your Examination Number on every page of your answer booklet(s).

Use $g = 10\ ms^{-2}$.

This paper consists of 4 printed pages.

1. The aim of this experiment is to determine Young's Modulus of a given metre rule (L). Proceed as follows:

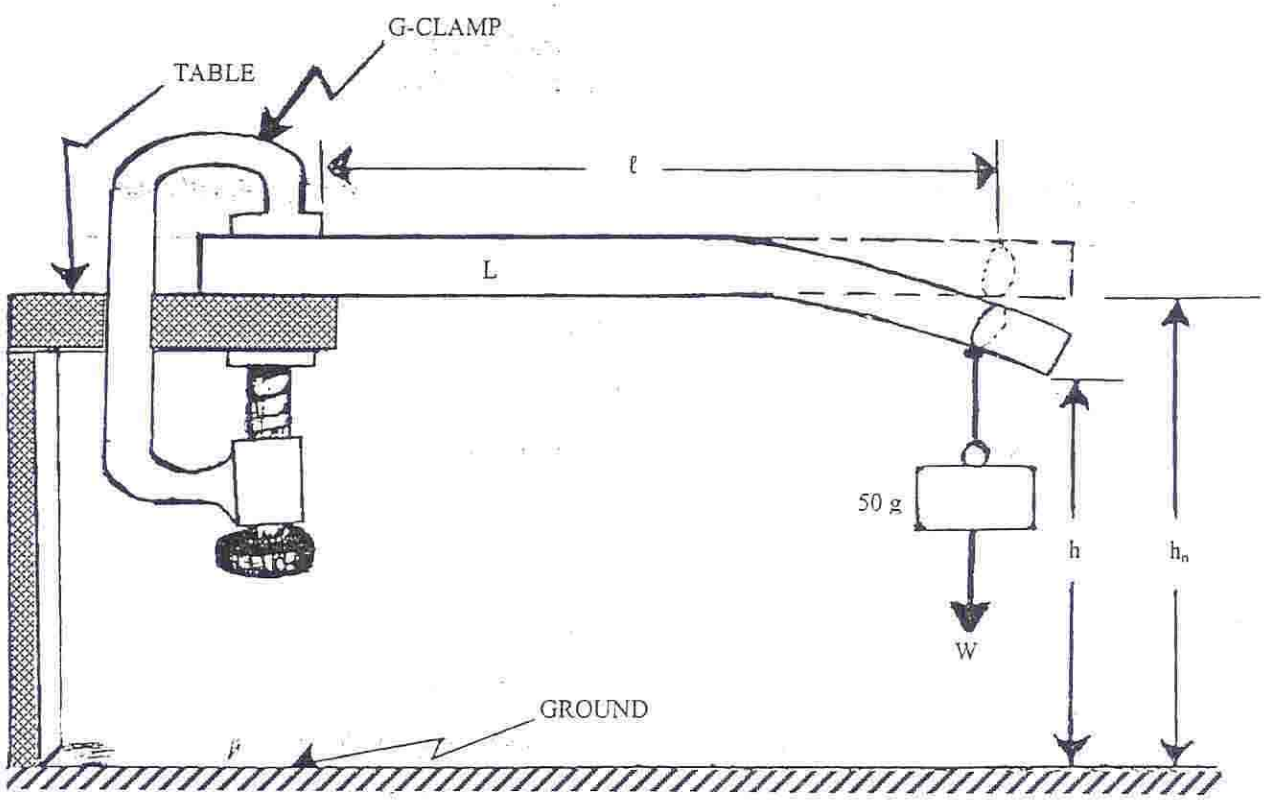


Fig. 1

(a) Take the metre-rule (L) whose weight is provided and fix it at its 10 cm mark by means of a G-Clamp. Record the height (h_o) above the ground of the 50 cm mark of the rule. Take the 50 g weight provided and suspend it on the metre-rule at the 50 cm mark using a string. Note the length (ℓ) of the rule between the position of the clamp and the position of the 50 g weight. Note also the new height (h) of the 50 cm mark above the ground. (See figure 1).

(b) Change the position of the 50 g weight to 60 cm, 70 cm, 80 cm and 90 cm respectively and repeat the measurements as in (a) above for each new position.

(c) Record your readings in a suitable table and include columns for $y = (h_o - h)$ and ℓ^3.

(d) Plot a graph of ℓ^3 (vertical-axis) against $y = (h_o - h)$ (horizontal-axis).

(e) Determine the slope of the graph.

(f) Measure the width (b) and the thickness (d) of the metre-rule provided by using the vernier callipers provided.

(g) Calculate "Young's Modulus (E)" using the relation $y = \frac{W\ell^3}{3IE}$ giving your answer in SI units.

Where **W = 50 g weight + weight of the rule** and $I = \frac{bd^3}{12}$

Note: Weight of the rule will be given by the supervisor. **(25 marks)**

2. The aim of this experiment is to determine the relative refractive index of glass for light passing from air to glass. Proceed as follows:

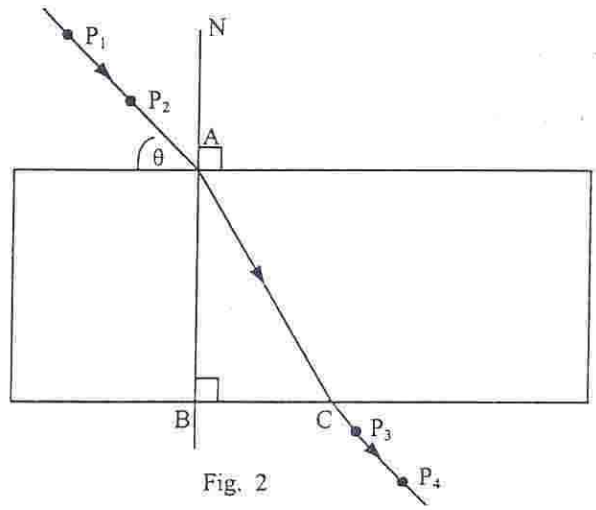


Fig. 2

(a) Place the rectangular glass block flat on the drawing paper fixed on the board. Using a sharp pencil, trace the outline of the block. Remove the block and draw the normal NAB (Fig. 2) near the left end of the block. Draw a line making an angle $\theta = 20°$ with the **surface** of the block. Erect two pins P_1 and P_2 on this line at a suitable distance apart. Replace the block and erect two more pins P_3 and P_4 at positions which appear to be in a straight line with the other two as seen through the block. Again remove the block and draw the complete path of the ray as shown in fig. 2. Measure the distances BC and AC.

(b) Repeat the procedure in (a) above for values of $\theta = 30°, 40°, 50°$ and $60°$, each time make your drawing on a fresh part of the drawing paper,

Record clearly the values of θ, BC, AC. Find the cos θ and calculate $k = \frac{BC}{AC}$

(c) Plot a graph of cos θ (vertical axis) against k (horizontal axis).

(d) Determine the relative refractive index η, given that $\eta = \frac{\cos\theta}{k}$, the slope of your graph.

(e) State any two sources of errors and precautions that should be taken for this experiment.
(25 marks)

NB: HAND IN THE DRAWING PAPERS WITH YOUR ANSWER BOOKLET.

3. The aim of this experiment is to determine the value of an unknown resistor labelled R_x and the internal resistance r, of the cell.

Proceed as follows:

Connect the given dry cell, ammeter, switch and resistor R = 2 ohms in series. Close the switch and record the reading I of the ammeter. Repeat the procedure with the resistor R of 4 ohms, 6 ohms, 8 ohms, 10 ohms and R_x respectively.

(a) Tabulate your results and include the quantity $\frac{1}{I}$ in your table.

(b) Plot a graph of $\frac{1}{I}$ (vertical axis) against R (horizontal axis).

(c) From the graph, determine the value of R_x

(d) Calculate the slope of the graph.

(e) Deduce the e.m.f. E and internal resistance, r, of the cell. **(25 marks)**