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

031/2A

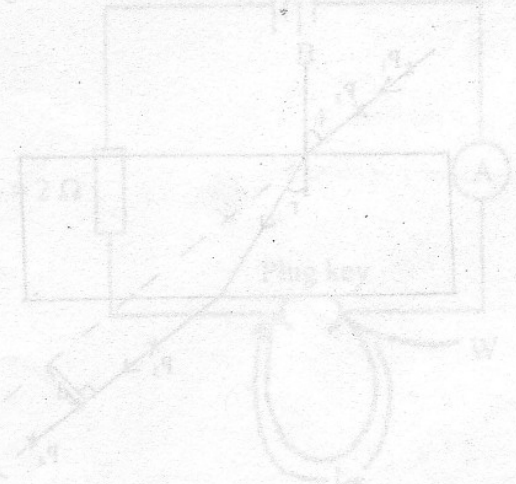
PHYSICS 2A
ALTERNATIVE A PRACTICAL
(For Both School and Private Candidates)

Time: 2 Hours 30 Minutes **Monday November 08, 2004 a.m.**

Instructions

1. This paper consists of **three** questions.
2. Answer **two (2)** questions including question **number 1**.
3. Where calculations are involved show your work clearly.
4. All questions carry equal marks.
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).
8. Use the following information where necessary:

$$\pi = \frac{22}{7}.$$



This paper consists of 4 printed pages.

1. The aim of this experiment is to determine the mass of a given dry cell, size "AA".

You are provided with a dry cell, a knife edge, two weights 50 g and 20 g, and a metre rule.

Proceed as follows:

(a) Locate and note the centre of gravity C of the metre rule by balancing on the knife edge.

(b) Suspend the 50 g mass on one side of the metre rule, and 20 g together with the dry cell on the other side of the metre rule adjusting their position until the metre rule balances horizontally, as shown in Figure 1 below.

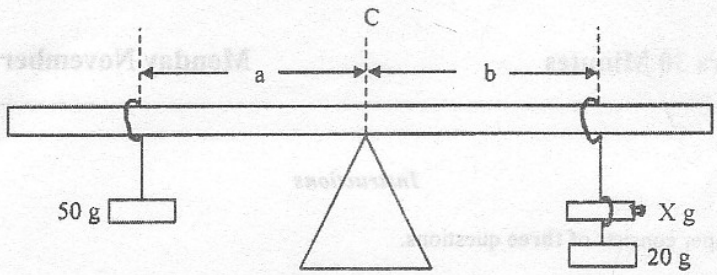


Fig. 1

(c) By fixing a = 5 cm from C find its corresponding length, b, from C.

(d) Repeat and tabulate your results using a = 10 cm, 15 cm, 20 cm and 25 cm.

(e) Draw a graph of "a" against "b" and calculate its slope G.

(f) Calculate X from equation $G = \frac{20 + X}{50}$. **(25 marks)**

2. You are provided with a glass block, drawing board, optical pins and plane papers.
Place a white piece of paper on the drawing board. Place the glass block with one of its largest surface top most on top of the white paper. Mark the outline of the glass block on the paper with a pencil. Remove the glass block and draw a normal as shown in Figure 2 below.

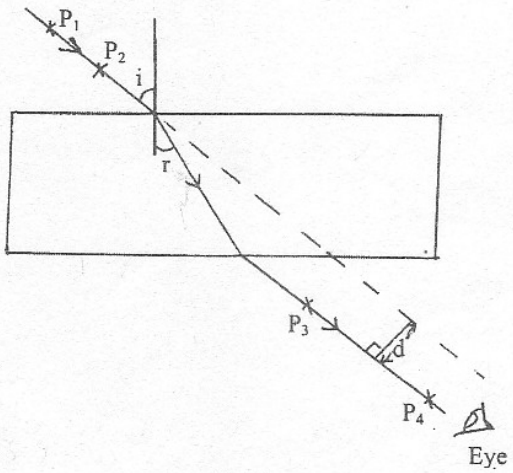


Fig. 2

(a) Draw a line making an angle of incidence, i of 30°. Erect two pins P_1 and P_2 on this line at a suitable distance apart. Replace the glass 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 pins as seen through the glass block from the other side.

Remove the glass block and draw the complete path of the ray (see Fig. 2). Measure the angle of refraction, r.

(b) (i) Extend the direction of the incident ray as shown by the dotted line.

(ii) Measure the perpendicular distance 'd' between extended incident ray and the emergent ray.

(c) Repeat the procedure in (a) and (b) above for angles of incidence of 40°, 50°, 60° and 70°. (In each case make your drawings on a fresh part of the drawing paper).

(d) Tabulate your results as shown in table 1 below.

i (deg)	r (deg.)	d (cm)	d cos r	Sin (i - r)
30				
40				
50				
60				
70				

Table 1

(i) Plot a graph of d cos r against sin (i - r).
(ii) Find the gradient of the graph.
(iii) Measure the width of the glass block.
(iv) How is the gradient of the graph in 2.(a)(ii) and the width of the glass block in 2.(a)(iii) related?

NB: Hand in your diagrams (drawings) together with your answer booklet. **(25 marks)**

3. Determine the resistivity ρ of the wire labelled W and the internal resistance of the battery provided. Proceed as follows:

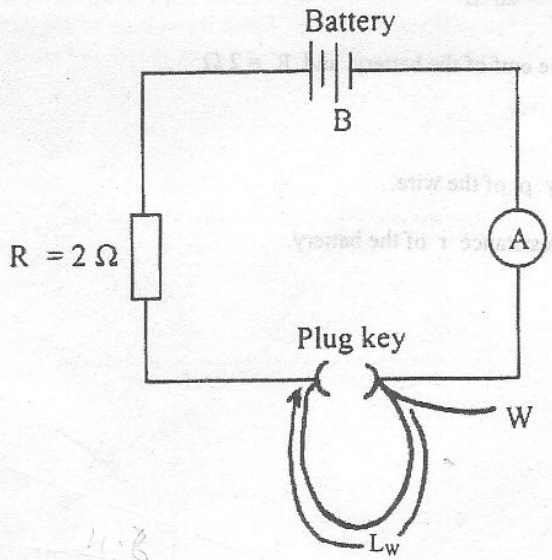


Fig. 3

Connect the circuit as shown in fig. 3 above. With the plug key open adjust the length of wire W to a value of 20 cm. Note the ammeter reading.

NB: The plug key should remain open throughout the experiment.

(a) Repeat the procedure above for L_W = 40 cm, 60 cm, 80 cm and 100 cm each time recording the ammeter reading.

(b) Tabulate your results as shown in table 2 below.

Length L_W of wire (cm)	Current I (A)	$\frac{1}{I}(A^{-1})$

Table 2

(c) (i) Plot a graph of $\frac{1}{I}$ (vertical) against L_W (horizontal).

(ii) Determine the slope G.

(iii) Determine the intercept Y on the vertical axis.

(d) Measure and record the diameter at four different places on the wire. Hence find the mean value of diameter d.

(e) Given that $G = \frac{4\rho}{\pi d^2 E}$ and $Y = \frac{R + r}{E}$

Where E is the emf of the battery, and $R = 2\ \Omega$

Find the

(i) Resistivity ρ of the wire.

(ii) Internal resistance r of the battery. **(25 marks)**