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: 2½ Hours 10 November 2000 A.M.

Instructions

1. This paper consists of THREE questions.
2. Answer TWO questions including question number 1.
3. Wherever calculations are involved, show your work clearly.
4. Marks for questions are shown in parentheses at the end of each question.
5. Write your Examination Number on every page of your answer booklet(s).
6. Wherever necessary use

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

This paper consists of 5 printed pages.

1. The aim of this experiment is to determine the acceleration due to gravity g.

Proceed as follows.

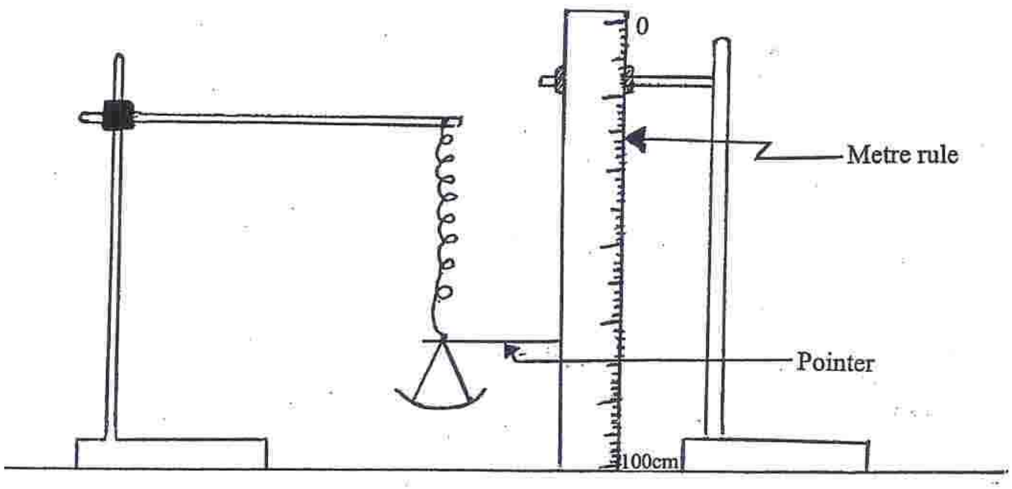

Fig. 1

(a) Set up the apparatus as shown in fig. 1.

Note that the metre rule has its zero mark at the top.
Record the pointer reading x_o.
Put on the scale a mass of 50 g and record the new pointer reading x on the metre rule.
Calculate the extension $s = x - x_o$ corresponding to the added mass.

Repeat the procedure for a series of masses in steps of 50 g until you obtain five more readings.
Tabulate your results for m, x and s.

(b) With a mass m_1 of 200 g on the scale pan, pull the spring through a small distance and release it. Record the time for 10 oscillations and determine the periodic time T_1. Repeat this procedure for another mass m_2 of 300 g and find its periodic time T_2.

(c) (i) Plot a graph of extension s (vertical axis) against mass m (horizontal axis)

(ii) Determine the slope G of the graph.

(d) Calculate the acceleration due to gravity g given that

$$g = 4\pi^2 G \left(\frac{m_2 - m_1}{T_2^2 - T_1^2} \right)$$

(e) State any sources of errors and precautions to be taken. (25 marks)

2. You are provided with a rectangular glass block, a drawing board, four optical pins and a white sheet of paper.

Proceed as follows

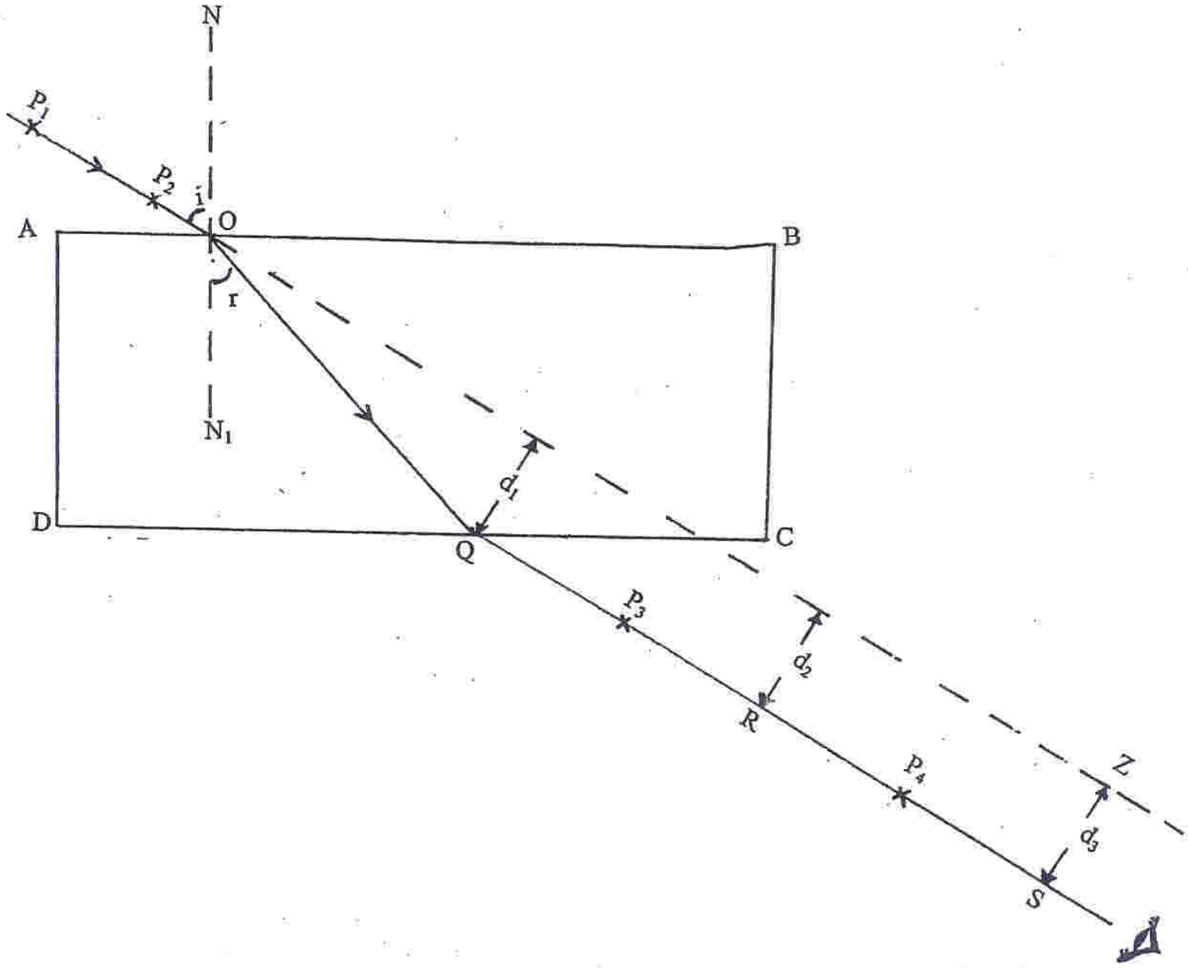

Fig. 2

(a) Place a rectangular glass block on the drawing paper fixed on the board. Using a sharp pencil trace the outline of the block ABCD. Remove the block and draw a normal NON_1 at a point O on AB near A.

Draw a line making an angle of incidence i of 60° and 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 block from side DC.

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

(b) (i) Produce the direction of the incident ray from O to Z as shown by the dotted line in fig. 2.

(ii) Measure the perpendicular distance between line OZ (direction of incident ray) and the emergent ray QS at three different positions Q, R and S call them d_1, d_2 and d_3 respectively. Find the mean d of the three measurements where

$$d = \frac{d_1 + d_2 + d_3}{3}$$

(c) Repeat the procedures in (a) and (b) for angles of incidence 50°, 40° and 30° in each case make your drawings on a fresh part of the drawing paper.

(d) Tabulate your results as shown below.

Incident angle i(°)	Refracted angle r(°)	(i – r)	Sin(i – r)	Cos r	$\frac{\text{Sin}(i-r)}{\text{Cos } r}$	d_1 cm	d_2 cm	d_3 cm	d cm
60									
50									
40									
30									

(i) Plot a graph of d (vertical axis) against $\frac{\text{Sin}(i-r)}{\text{Cos } r}$ (horizontal axis)

(ii) Determine the slope M of the graph.

(iii) Measure the width W of the glass block (equal to AD). Give your answer in centimetres.

(iv) How do the results in (ii) and (iii) above compare?

(v) What do you think is the aim of this experiment?

HAND IN YOUR DIAGRAMS (DRAWINGS) TOGETHER WITH THE OTHER ANSWER SHEETS.
(25 marks)

3. You are provided with the apparatus. Proceed as follows.

(a) Set up the circuit as shown in fig. 3.

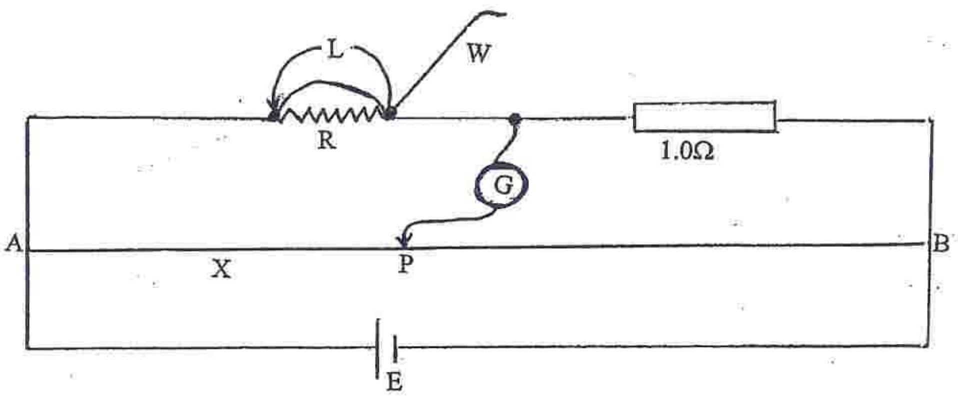

Fig. 3

(b) Obtain a balance point when the length of wire W, $\ell = 15$ cm record the distance x between A and P.

(c) Repeat the procedure for ℓ = 20 cm, 25 cm, 30 cm, 40 cm and 50 cm respectively.

(d) Tabulate the values of ℓ, x, $\frac{1}{\ell}$ and $\frac{1}{x}$

(e) (i) Plot a graph of $\frac{1}{\ell}$ against $\frac{1}{x}$

(ii) Determine the slope S of your graph.

(iii) From the graph obtain the value of x for ℓ = 80 cm. (25 marks)