THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

131/3B

PHYSICS 3

ALTERNATIVE B PRACTICAL

(For Both School and Private Candidates)

TIME: 3 Hours 10 Minutes **12 May 2000 A.M.**

Instructions

1. Answer ALL questions.
2. Read each question carefully.
3. All calculations must be clearly presented in the answer booklet provided.
4. Mathematical tables, graph papers and calculators may be used.
5. Write your examination number on every page of your answer booklet provided.
6. If needed the following information may be used:

$g = 9.8 \text{ ms}^{-2}$

This paper consists of 4 printed pages.

1. You are required to determine the radius of gyration k of a triangular plate. Proceed as follows:
   (a) Clamp a pin tightly between the two pieces of wood provided.
   (b) Suspend the triangular plate from a hole nearest the point marked G on the plate (fig. 1). Record the distance of suspension from G as h (in meters).

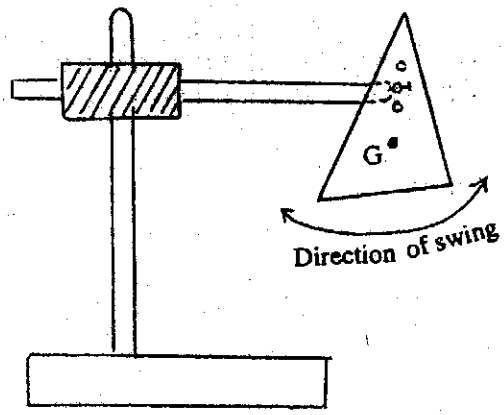

Figure 1

   (c) Determine the time t for 10 small oscillations of the plate and hence the periodic time T. Repeat the procedure for five other holes and record the corresponding values of h, t and T.
   (d) Plot a graph of $T^2 h$ (ordinates) against h^2 (abscissae)
   (e) Find the slope of the graph in (d) above.
   (f) Given that $T^2h = \frac{4\pi^2}{g}(k^2 + h^2)$, determine the radius of gyration, k, of the triangular plate. (20 marks)

2. You are required to determine the refractive index of the transparent liquid labelled S by using a converging lens and a plane mirror. Proceed as follows:

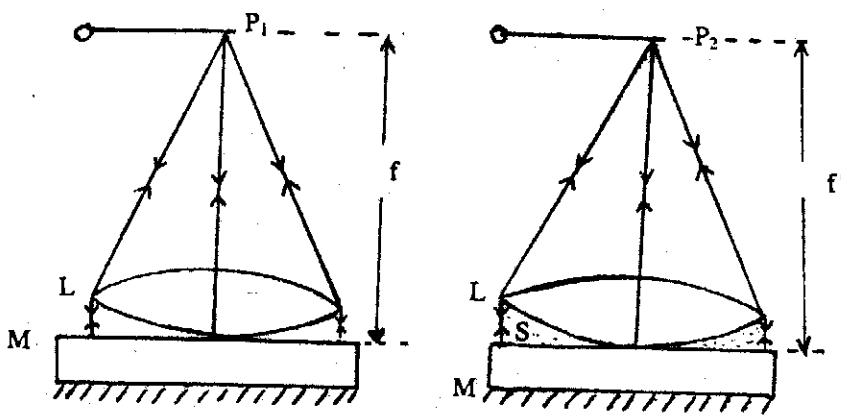

Figure 2

   (a) Place the mirror M and lens L (of known radius of curvature r) provided on a horizontal smooth surface as shown in figure 2A. Fix the pin p provided horizontally in a clamp so that its tip is vertically above the centre of the lens L.
   (b) Place your eye at least 25 cm above the pin then adjust it until at P_1 it has no parallax with its inverted image. Measure the distance f. Repeat this procedure of the no parallax position two more times and each time measure the distance (f).

(c) Then moisten the mirror with a little of the given transparent liquid S so that the space between L and M is filled with the liquid S (figure 2B). Find the new position P_2 of no parallax and measure the distance f'. Repeat this procedure of no parallax position two more times.

(d) Tabulate your results as follows:

				AVERAGE
$f = P_1M$ (cm)				
$f' = P_2M$ (cm)				

(e) Find the focal length, f_L of liquid S given that

$$\frac{1}{f_L} = \frac{1}{f'} - \frac{1}{f}$$

(f) Calculate the refractive index, η_L, of liquid S give that

$$\frac{1}{f_L} = (\eta_L - 1)\frac{1}{r}$$

where r is the radius of curvature of the lens used.

(g) State the sources of error in your experiment. (15 marks).

3. You are required to determine the resistance R of the potentiometer wire. Proceed as follows:

(a) (i) Set up the potentiometer circuit which includes the wire Q, connected between the key, K, and the terminal B as shown in Figure 3. E_1 is accumulator (3V)

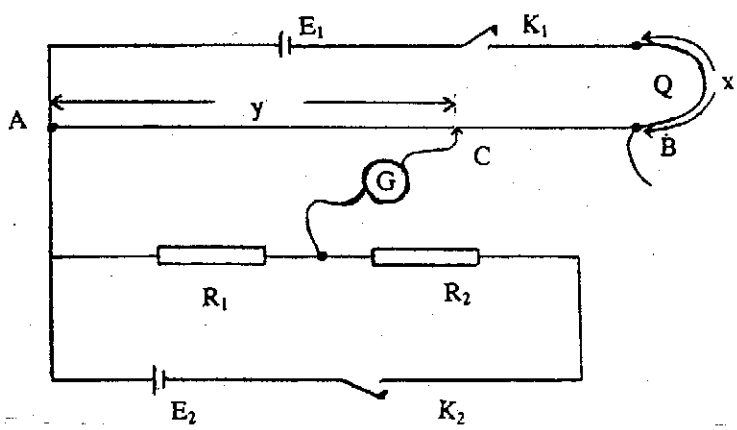

Fig. 3

(ii) Set up the secondary circuit which consists of two resistors, R_1 and R_2 connected in series with the dry cell E_2 as shown in figure 3. $R_1 = 5\ \Omega$ and $R_2 = 10\Omega$.

(iii) Connect the positive terminal of R_1 to point A and its other terminal to the galvanometer G.

(b) (i) With the length x of wire Q equal to 100cm in the circuit, close the keys K_1 and K_2 and determine the balance length y along AB. Record y in cm and open K_1 and K_2.

(ii) By reducing the length of the wire Q by 15cm at a time repeat the procedure in (b) (i) for five more values of x. Record the values of x and y in a table.

(iii) Replace the wire x with the standard resistor R_s of 2 Ω and determine the balance length y_o.

(c) y is related to x by the equation $y = a\rho x + aR$.
where a is a constant ρ is the resistance per unit length of wire Q and R is the resistance of the potentiometer wire AB.

(i) Plot a graph of y against x

(ii) Determine the value of $x = x_o$ when $y = y_o$.

(iii) Determine the slope of the graph and the y – intercept.

(iv) Hence compute the value of R

Given: $\rho = \frac{2}{x_o}\ \Omega\ cm^{-1}$

(d) State any precautions you have taken in this experiment. (15 marks)