



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).

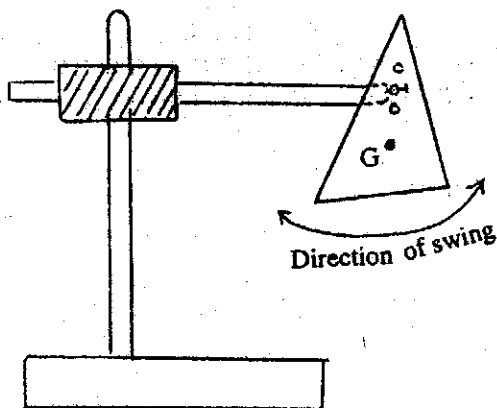


Figure 1

- (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  $T^2 h = \frac{4\pi^2}{g}(k^2 + h^2)$ , 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:

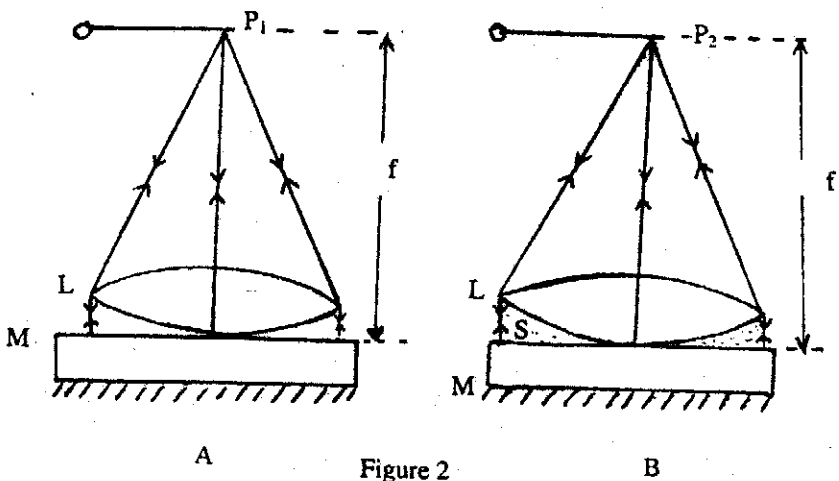


Figure 2

- (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<sub>2</sub> 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 <sub>1</sub> M (cm)				
f' = P <sub>2</sub> M (cm)				

- (e) Find the focal length, f<sub>L</sub> of liquid S given that

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

- (f) Calculate the refractive index, η<sub>L</sub>, 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<sub>1</sub> is accumulator (3V)

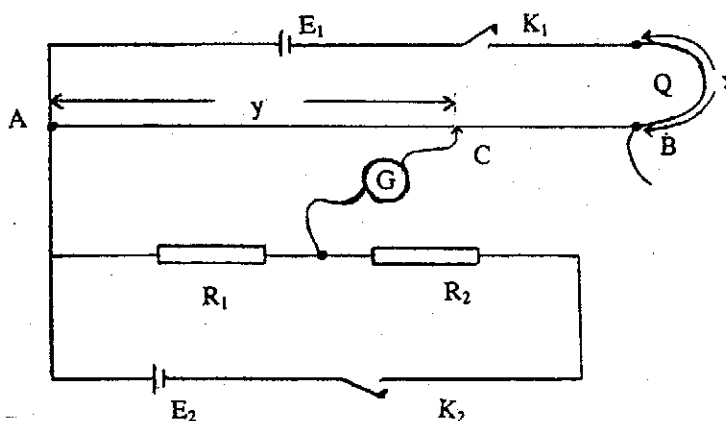


Fig. 3

- (ii) Set up the secondary circuit which consists of two resistors, R<sub>1</sub> and R<sub>2</sub> connected in series with the dry cell E<sub>2</sub> as shown in figure 3. R<sub>1</sub> = 5 Ω and R<sub>2</sub> = 10 Ω.
- (iii) Connect the positive terminal of R<sub>1</sub> 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<sub>1</sub> and K<sub>2</sub> and determine the balance length y along AB. Record y in cm and open K<sub>1</sub> and K<sub>2</sub>.
- (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<sub>s</sub> of 2 Ω and determine the balance length y<sub>s</sub>.

(c)  $y$  is related to  $x$  by the equation  $y = a\rho x + aR$ ,  
where  $a$  is a constant  $\rho$  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  $x = x_0$  when  $y = y_0$ .

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

(iv) Hence compute the value of  $R$

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

$x_0$

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

(15 marks)