1. In this experiment, you will determine the constant, β, of the pendulum bob provided. *(30 marks)*

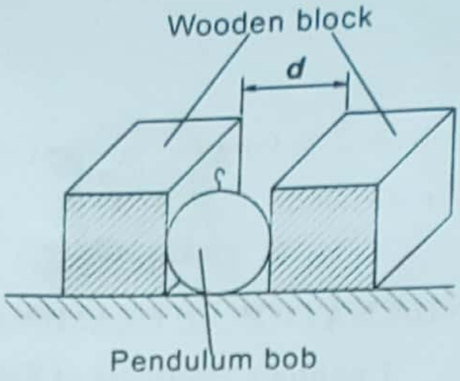

Fig. 1.1

(a) Place the pendulum bob on the table and place the wooden blocks on either side of the bob such that they are parallel and pressing against the bob as shown in Figure **1.1**.

(b) Measure and record the separation, d, between the wooden blocks.

(c) Dismantle the arrangement in Figure **1.1**.

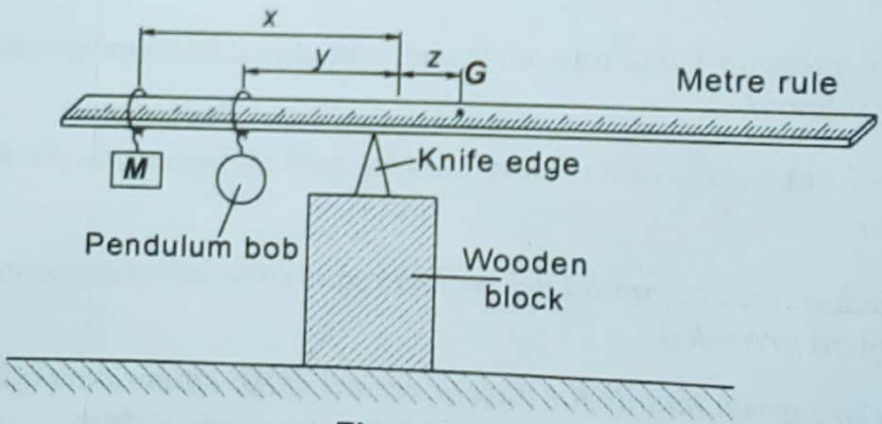

Fig. 1.2

(d) Balance the metre rule on a knife edge.

(e) Read and record the position, G, where the metre rule balances.

(f) Suspend a mass, $M = 20$ g at the 2 cm mark of the metre rule.

(g) Suspend the pendulum bob and adjust the position of the knife edge to a distance, $x = 36.0$ cm from the mass M.

(h) Adjust the position of the pendulum bob so that the metre rule balances horizontally as shown in Figure **1.2**.

(i) Measure and record the distances y and z.

(j) Repeat procedure (g) to (i) for x = 35.5, 35.0, 34.5, 34.0, and 33.5 cm.

(k) Record your results in a suitable table including values of $\frac{x}{z}$ and $\frac{y}{z}$.

(l) Plot a graph of $\frac{x}{z}$ (**along the vertical axis**) against $\frac{y}{z}$ (**along the horizontal axis**).

(m) Find the slope, S, of the graph.

(n) Calculate M_1 from the expression:

$$M_1 = -SM.$$

(o) Calculate M_2 from the expression:

$$M_2 = \frac{D\pi d^3}{6}, \qquad \text{where } D = 8.73 \text{ gcm}^{-3}.$$

(p) Calculate the constant, β, of the pendulum from the expression:

$$\beta = \frac{M_1 + M_2}{2}.$$

2. In this experiment you will determine the constant, γ, of the material of the glass block provided. *(30 marks)*

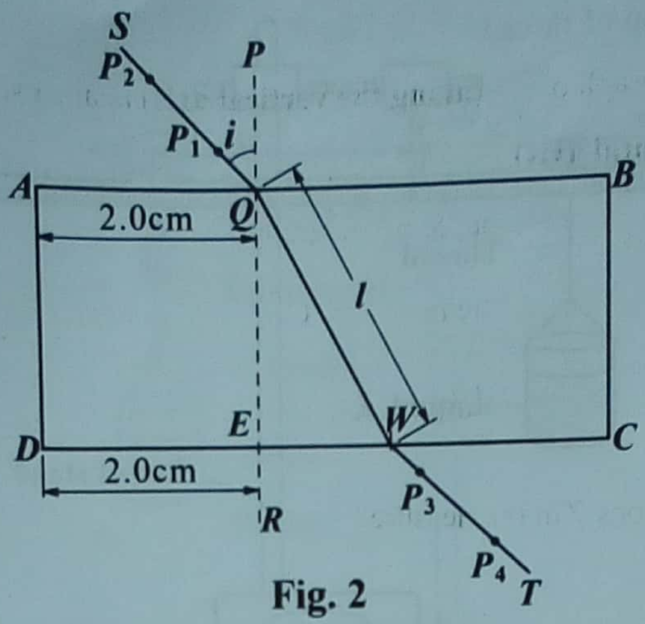

Fig. 2

(a) Fix a plain sheet of paper on a soft board using drawing pins.

(b) Place the glass block on the plain sheet of paper and draw its outline *ABCD*.

(c) Remove the glass block.

(d) Draw a normal *PR* to *AB* such that $AQ = 2.0$ cm.

(e) Draw a line *SQ* such that angle $i = 15^\circ$.

(f) Replace the glass block on its outline.

(g) Fix pins P_1 and P_2 vertically along line *SQ*.

(h) Looking through the glass block, from side *DC*, fix pins P_3 and P_4 such that they appear to be in line with the images of P_1 and P_2.

(i) Remove the glass block and the pins.

(j) Draw a line through points P_3 and P_4 to meet *DC* at *W* as shown in Figure **2**.

(k) Join *Q* to *W*.

(l) Measure and record distance $QW = l$.

(m) Repeat procedure (e) to (l) for values of $i = 25^\circ$, 35°, 45°, 55° and 65°.

(n) Record your results in a suitable table including values of l^2, $\frac{1}{l^2}$, $\sin i$, and $\sin^2 i$.

(o) Plot a graph of $\frac{1}{l^2}$ **(along the vertical axis)** against $\sin^2 i$ **(along the horizontal axis)**.

(p) Determine the slope, S, of the graph.

(q) Read and record the intercept, C, on the $\frac{1}{l^2}$ axis.

(r) Calculate the constant, γ, from the expression: $\gamma = \sqrt{\frac{C}{-S}}$.

(s) What does γ in (r) measure?

3. In this experiment you will determine the constant, ρ, of the bare wire, W, provided. *(30 marks)*

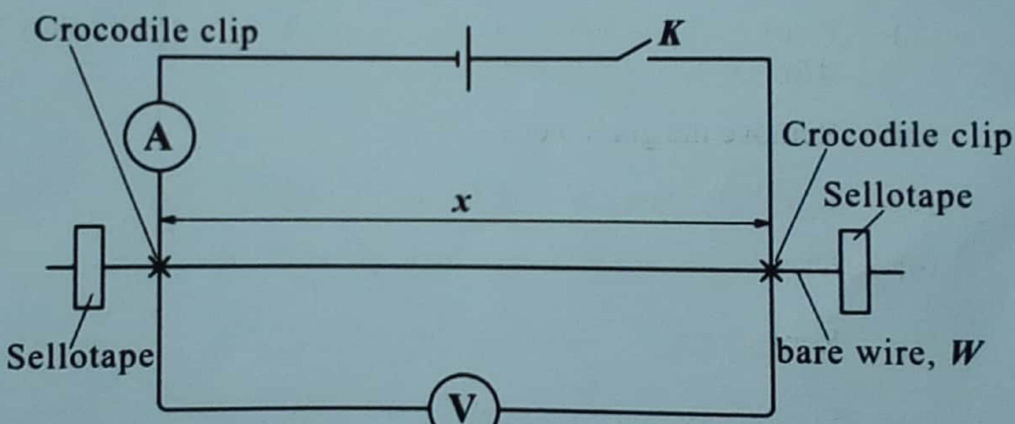

Fig. 3

(a) Fix the bare wire, W, provided firmly on the table using pieces of sellotape.

(b) Connect the circuit as shown in Figure **3**.

(c) Adjust the length x of the bare wire, W, to 0.90 m.

(d) Close switch, K.

(e) Read and record the ammeter reading, I, and the voltmeter reading, V.

(f) Open switch, K.

(g) Repeat procedure (c) to (f) for values of $x = 0.80,\ 0.70,\ 0.60,\ 0.50$ and 0.40 m.

(h) Record your results in a suitable table including values of Ix.

(i) Plot a graph of V (**along the vertical axis**) against Ix (**along the horizontal axis**).

(j) Find the slope, S, of the graph.

(k) Calculate the constant, ρ, of the bare wire from the expression:

$$S\rho^2 = 6.238 \times 10^{-7}.$$

END