

In this experiment, you will investigate the equilibrium of a wooden rod.

Some of the apparatus has been set up for you.

- (a) (i) • Fig. 1.1 shows the rod with two eyes.

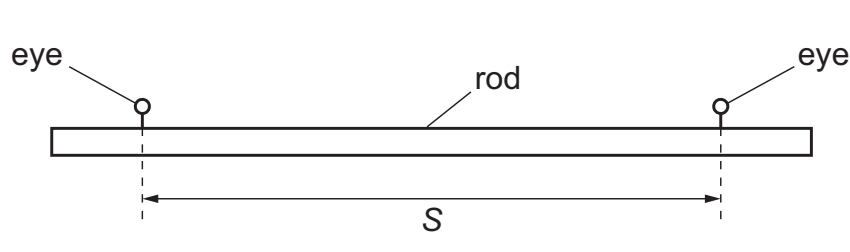


Fig. 1.1

The distance between the two eyes on the rod is S .

Measure and record S .

$S =$

- Complete the set-up of the apparatus as shown in Fig. 1.2.

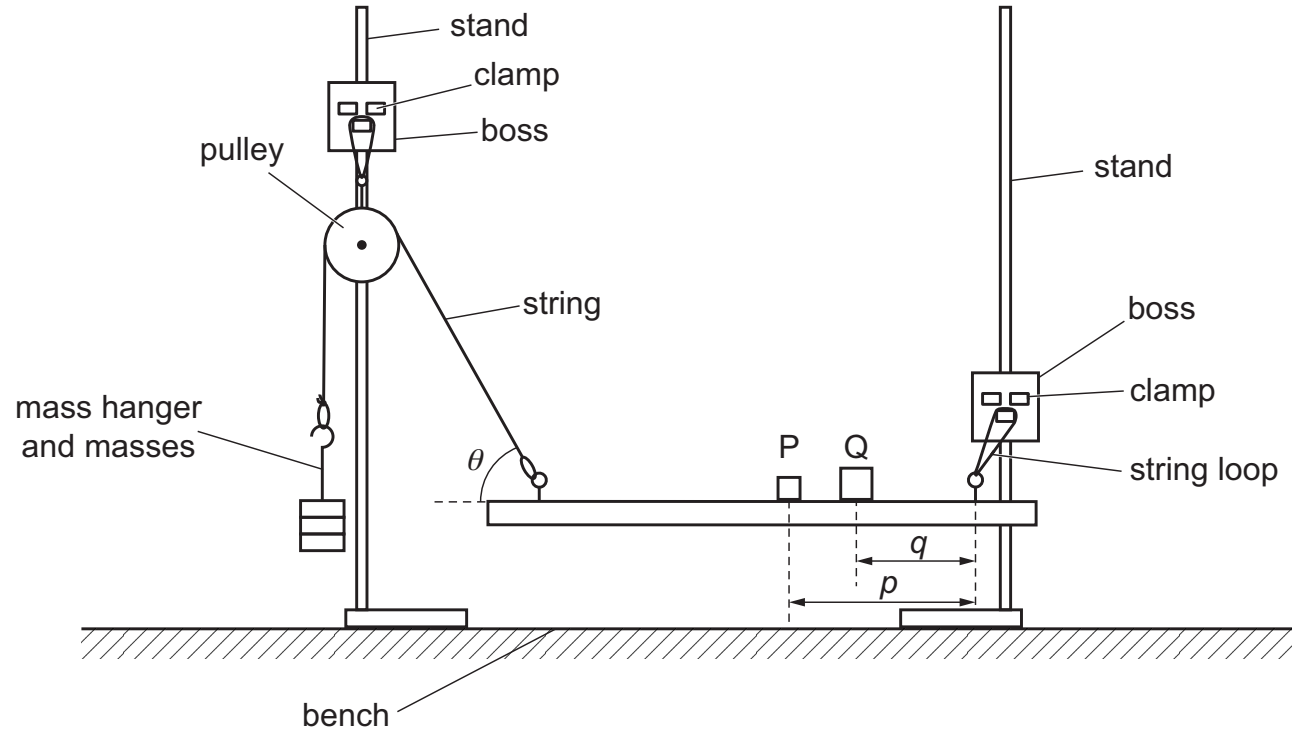


Fig. 1.2

- P and Q are masses.

The distance between the centre of mass P and the centre of the right-hand eye is p , as shown in Fig. 1.2.

The distance between the centre of mass Q and the centre of the right-hand eye is q , as shown in Fig. 1.2.

The angle between the string and the rod is θ .

Use some of the adhesive putty to attach Q to the rod so that q is approximately 26 cm.

- Use some of the adhesive putty to attach P to the rod. Adjust the position of P and the position of the stand with the pulley so that the rod is parallel to the bench and θ is approximately 45° .

Do not move the stands for the remainder of the experiment.

- Measure and record θ , p and q .

$\theta =$ $^\circ$

$p =$

$q =$

[2]

- (ii) The moment of the force about the eye due to mass P is T_P .

The moment of the force about the eye due to mass Q is T_Q .

The values of T_P and T_Q are given by:

$$T_P = 5Wp \quad \text{and} \quad T_Q = 7Wq$$

where W has the value 0.0981 N.

Calculate T_P and T_Q .

$T_P =$

$T_Q =$

[1]

- (b) Change the position of Q and adjust the position of P until the rod is again parallel to the bench. Measure p and q . Repeat until you have six sets of values of p and q .

Record your results in a table. Include values of T_P and T_Q in your table.

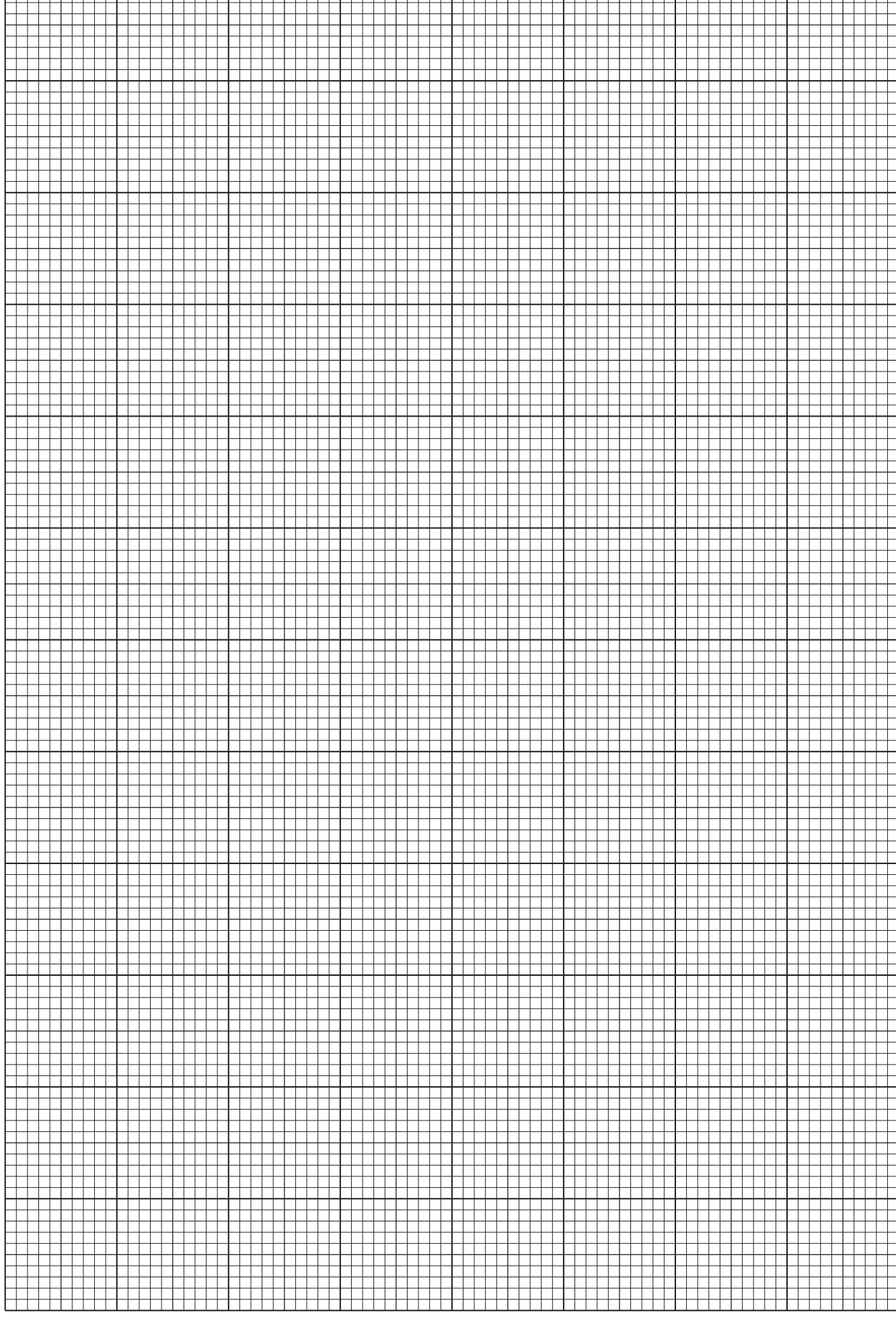
[8]

- (iii) Determine the gradient and y -intercept of this line.

gradient =

y -intercept =

[2]



- (d) (i) It is suggested that the quantities T_Q and T_P are related by the equation

$$T_Q = A + BT_P$$

where A and B are constants.

Using your answers in (c)(iii), determine the values of A and B .

Give appropriate units.

$A =$

$B =$

[2]

- (ii) Theory suggests that

$$R = F \sin \theta - \frac{2A}{S}$$

where R is the weight of the rod and F has the value 2.94 N.

Use your answers in (a)(i) and (d)(i) to determine a value for R .

Give an appropriate unit.

$R =$ [1]

[Total: 20]

You may not need to use all of the materials provided.