Experiment 10:   The Oscillation of a loaded hacksaw blade

A metronome is an instrument like an inverted pendulum which is used for beating time in music
The frequency of the musical beats can be changed by sliding a small mass up and down an
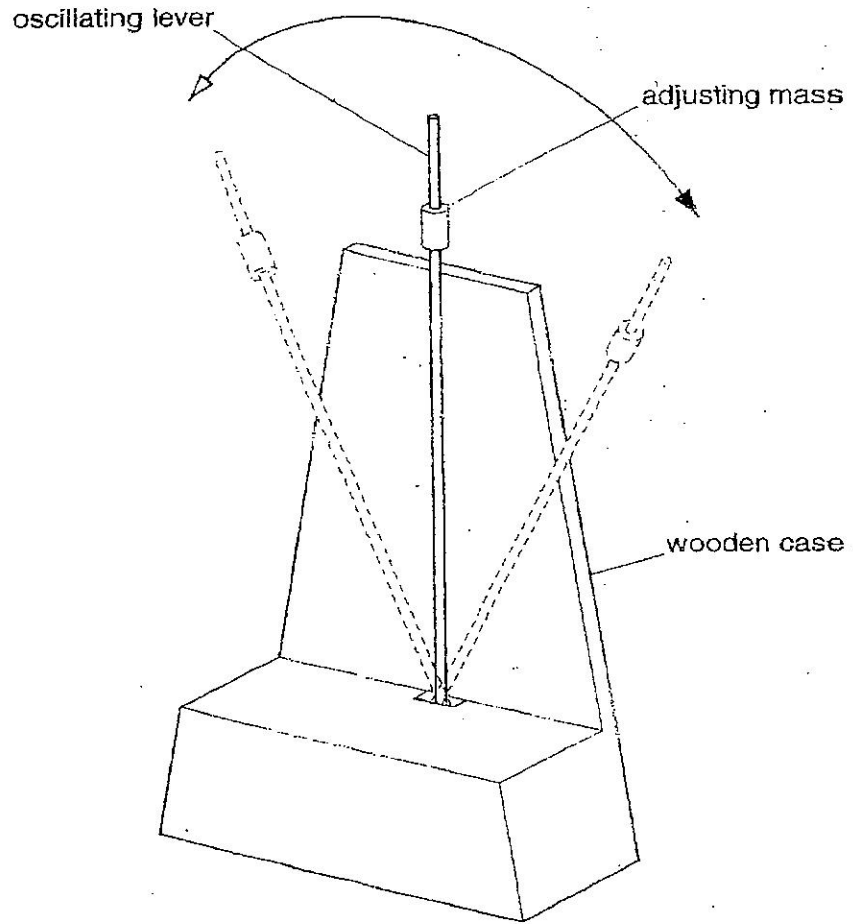oscillating lever as illustrated in Fig. 1.1.

Fig. 1.1

In this experiment you will model the behaviour of a metronome.

(a) (i) You are provided with a vertically mounted hacksaw blade. Attach the two masses close to the top of the blade (one on either side) using sticky tape or Blu-Tack.

(ii) Measure and record the distance d between the centre of the masses and the top of the wooden blocks as shown in Fig. 1.2.
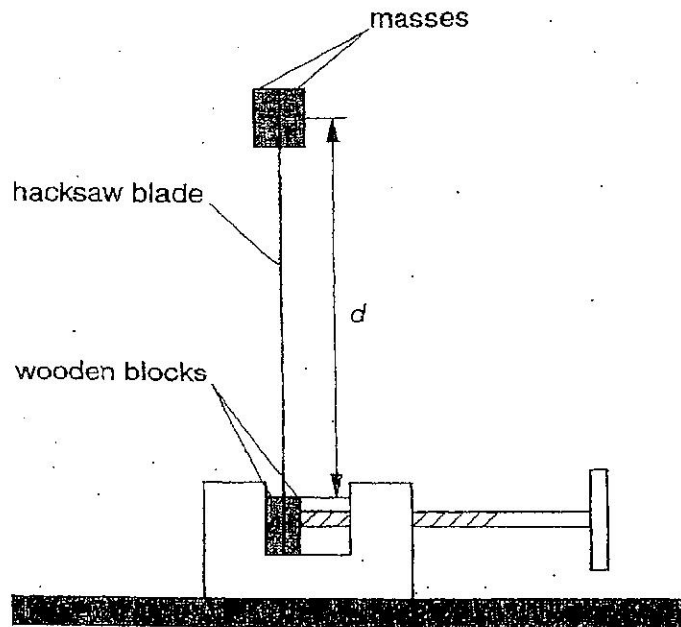

Fig. 1.2

(iii) Slightly displace the masses so that the blade performs small oscillations as in Fig. 1.3. Make and record measurements to determine the frequency f of these oscillations.
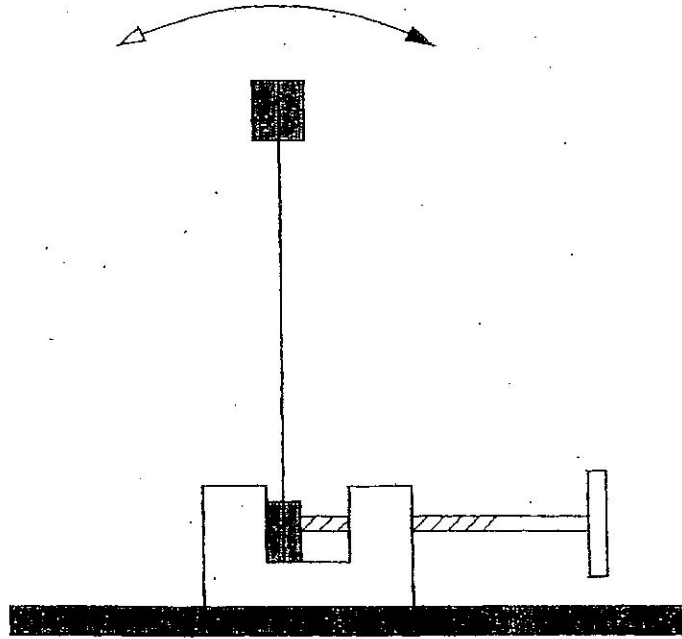

Fig. 1.3

(iv) Change the value of d and repeat **(ii)** and **(iii)** until you have six sets of readings for d and f, where d is in the range 15.0 cm $\leqslant d \leqslant$ 30.0 cm.

(v) Justify the number of significant figures which you have given for f.

(c) (i) Plot a graph of f (y-axis) against d (x-axis).

(ii) By drawing a tangent to the curve, determine the rate of change of f with d when $d = 19.0$ cm.
Include appropriate units with your value.