

- 3 A ball of mass  $M$  of 750 g is held on a smooth horizontal surface between two identical springs at their natural lengths as shown in Fig. 3.1.

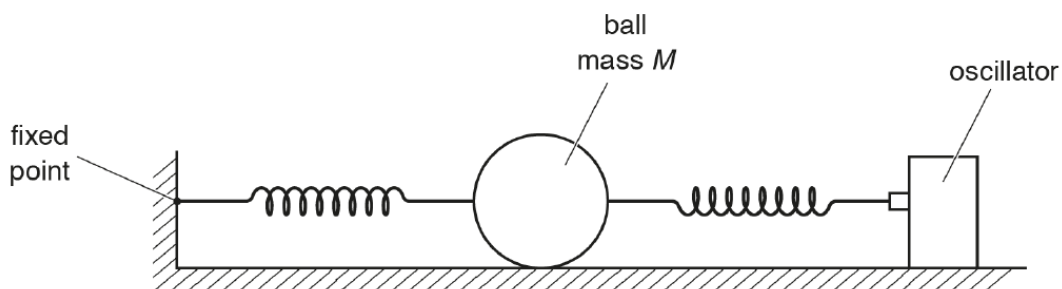


Fig. 3.1

One spring is attached to a fixed point while the other spring is attached to a mechanical oscillator. At  $t = 0$  the ball is displaced to its amplitude position. The variation with time  $t$  of the displacement  $L$  of the ball is shown in Fig. 3.2.

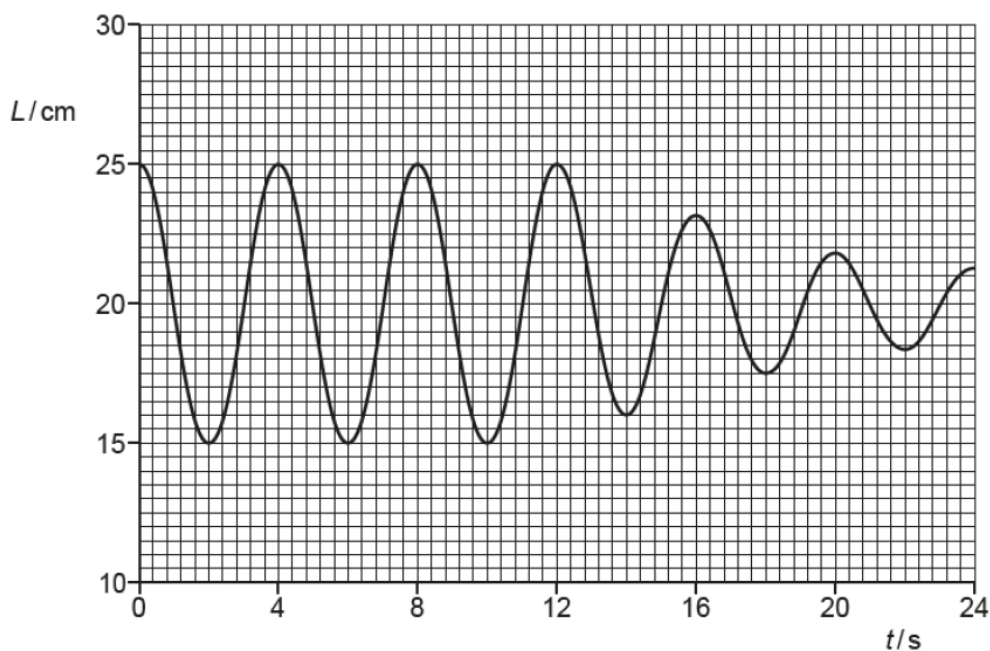


Fig. 3.2

(a) For the first 12 s of the oscillations,

(i) state one time at which the ball is moving with maximum speed,

time = ..... s [1]

(ii) state one time at which the springs have maximum elastic potential energy,

time = ..... s [1]

(iii) calculate the angular frequency  $\omega$  of the ball,

$\omega = \dots\dots\dots$  rad s<sup>-1</sup> [1]

(iv) calculate the maximum acceleration of the ball.

maximum acceleration = .....  $\text{m s}^{-2}$  [2]

(b) Some salt is sprinkled on the horizontal surface at  $t = 12.0 \text{ s}$ .

Calculate the loss in total energy of the oscillations during the first 24 s of the oscillations.

Show your working clearly.

[3]

[Total: 8]