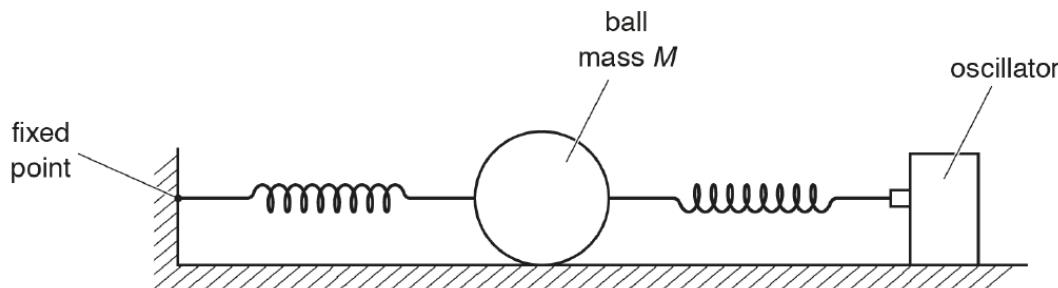
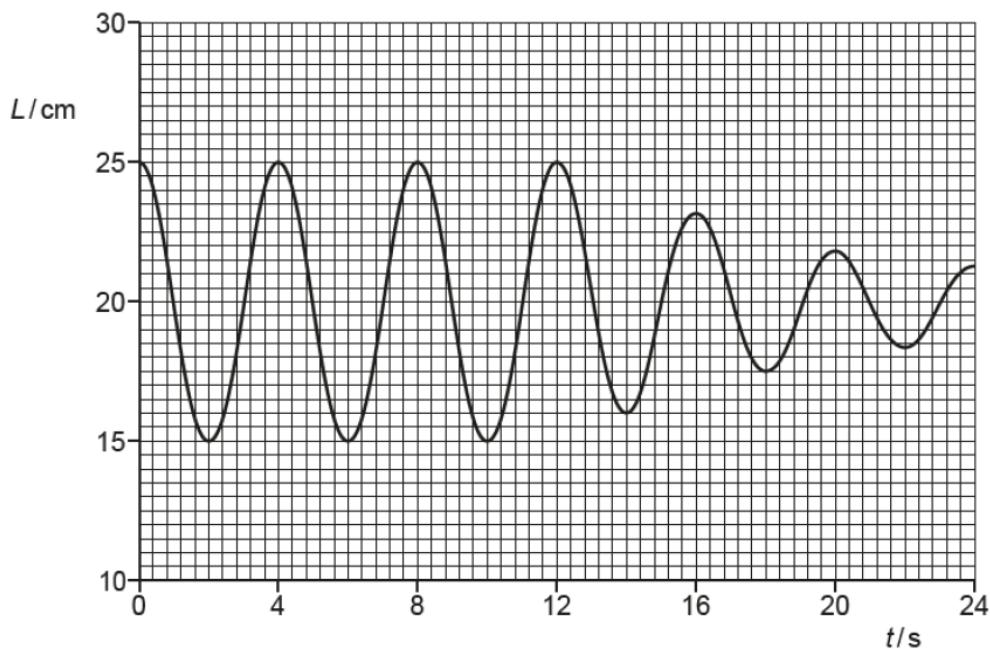


- 3 A ball of mass  $M$  of 750 g is held on a smooth horizontal surface between two identical springs at their natural lengths as shown in Fig. 3.1.



**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,

$$\text{time} = \dots \text{ s} [1]$$

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

$$\text{time} = \dots \text{ s} [1]$$

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

$$\omega = \dots \text{ rad s}^{-1} [1]$$

(iv) calculate the maximum acceleration of the ball.

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

(b) Some salt is sprinkled on the horizontal surface at  $t = 12.0$  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]