

- 3 An object is suspended from a spring that is attached to a fixed point as shown in Fig. 3.1.

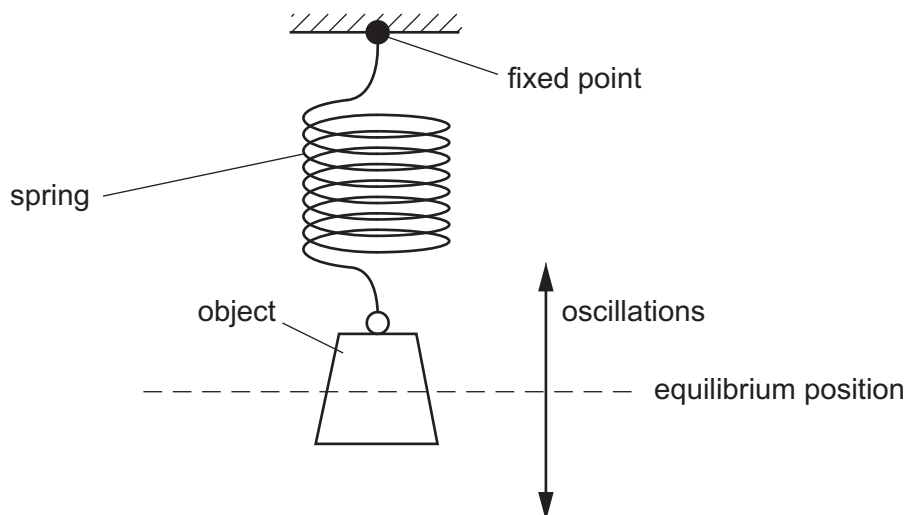


Fig. 3.1

The object oscillates vertically with simple harmonic motion about its equilibrium position.

- (a) State the defining equation for simple harmonic motion. Identify the meaning of each of the symbols used to represent physical quantities.

.....
.....
..... [2]

- (b) The variation with displacement x from the equilibrium position of the velocity v of the object is shown in Fig. 3.2.

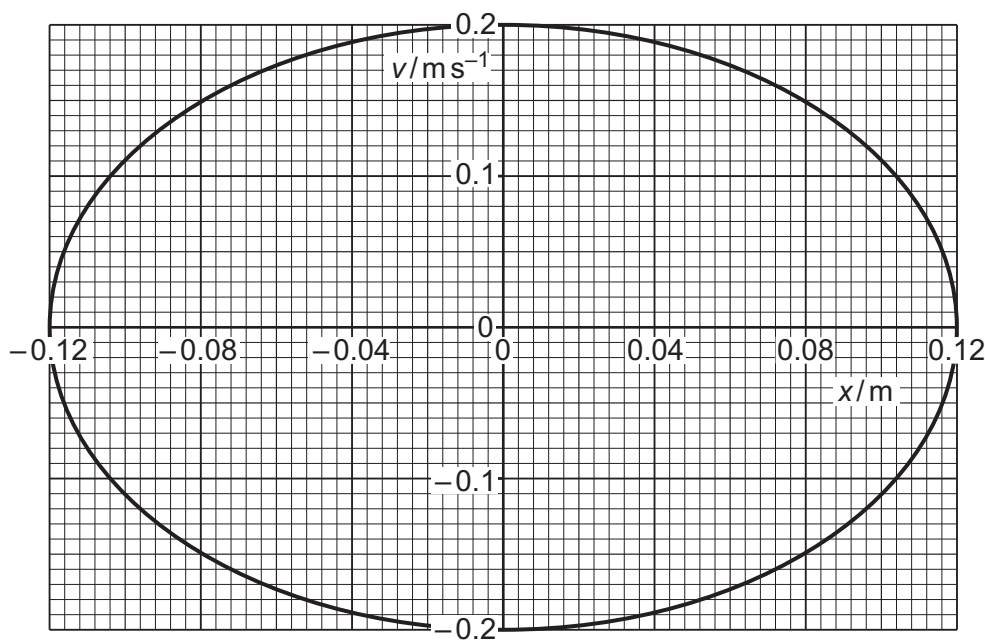


Fig. 3.2

The variation with x of the potential energy E_P of the oscillations of the object is shown in Fig. 3.3.

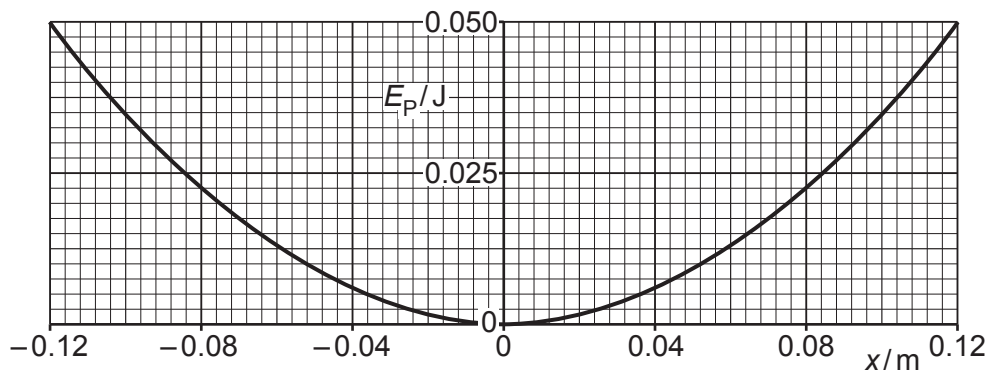


Fig. 3.3

Use Fig. 3.2 and Fig. 3.3 to:

- (i) determine the amplitude x_0 of the oscillations

$$x_0 = \dots\dots\dots \text{ m [1]}$$

- (ii) show that the angular frequency of the oscillations is 1.7 rad s^{-1}

[2]

- (iii) determine the mass M of the object.

$$M = \dots\dots\dots \text{ kg [2]}$$

(c) The oscillations of the object are now lightly damped.

(i) State what is meant by damping.

.....

.....

..... [2]

(ii) Assume that the damping does not change the angular frequency of the oscillations.

On Fig. 3.2, sketch the variation with x of v when the amplitude of the oscillations is 0.060 m. [2]