3 A pendulum consists of a bob (small metal sphere) attached to the end of a piece of string. The other end of the string is attached to a fixed point. The bob oscillates with small oscillations about its equilibrium position, as shown in Fig. 3.1.

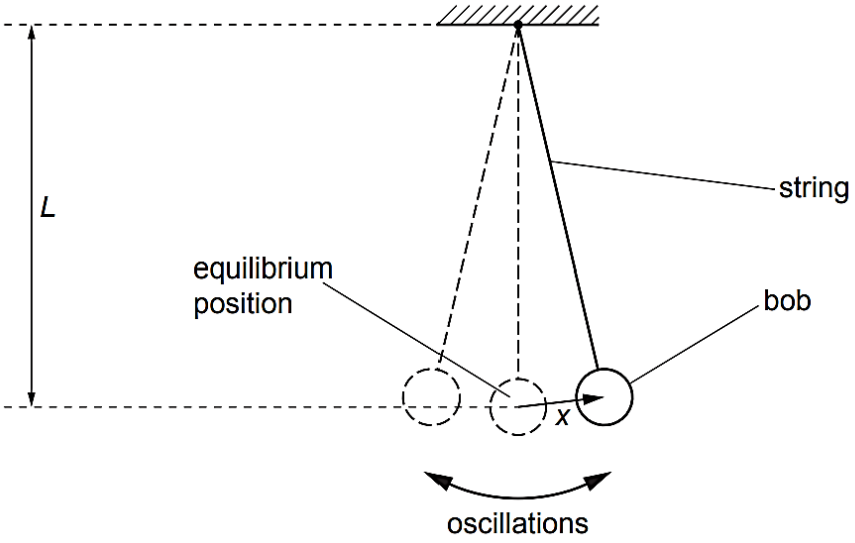

Fig. 3.1

The length *L* of the pendulum, measured from the fixed point to the centre of the bob, is 1.24 m. The acceleration *a* of the bob varies with its displacement *x* from the equilibrium position as shown in Fig. 3.2.

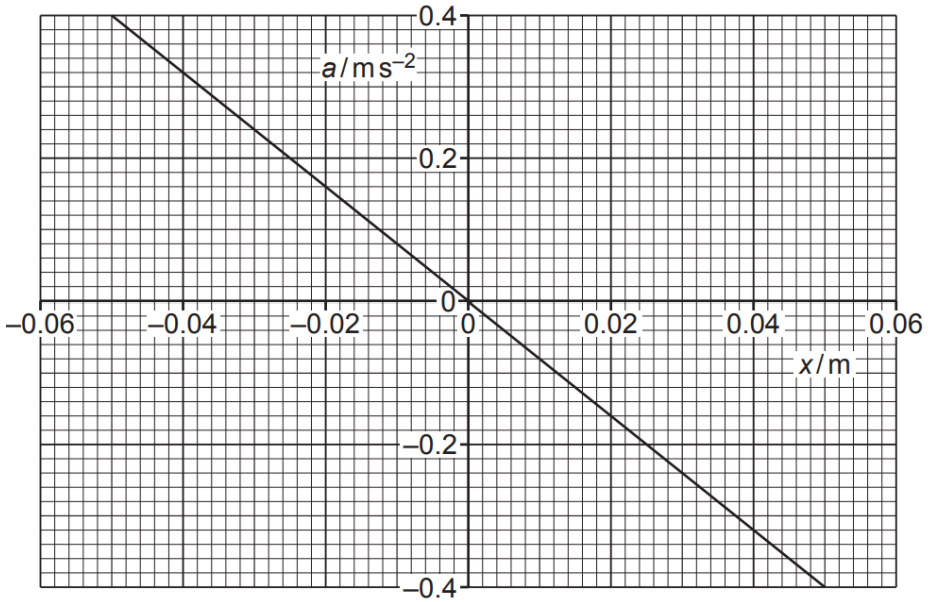

Fig. 3.2

(a) State how Fig. 3.2 shows that the motion of the pendulum is simple harmonic.

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…… [2]

(b) The angular frequency ω is related to the length L of the pendulum by

$$\omega = \sqrt{\frac{k}{L}}$$

where k is a constant.

Use Fig. 3.2 to determine k.

k = …… m s^{-2} [3]

(c) While the pendulum is oscillating, the length of the string is increased in such a way that the total energy of the oscillations remains constant.

Suggest and explain qualitatively the effect of this change on the amplitude of the oscillations.

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…… [2]

[Total: 7]