4 A small steel sphere is oscillating vertically on the end of a spring, as shown in Fig. 4.1.

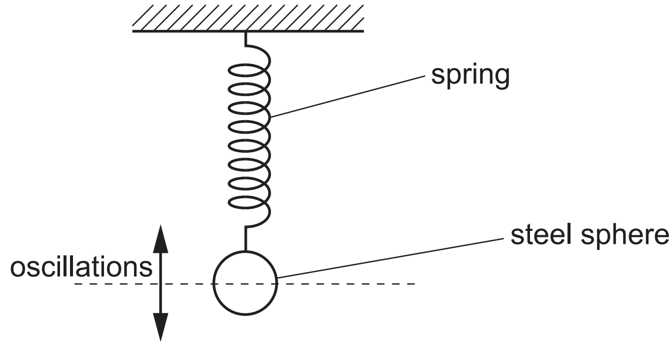

Fig. 4.1

The velocity v of the sphere varies with displacement x from its equilibrium position according to

$$v = \pm\, 9.7\sqrt{(11.6 - x^2)}$$

where v is in $\mathrm{cm\,s^{-1}}$ and x is in cm.

(a) **(i)** Calculate the frequency of the oscillations.

frequency = ... Hz [2]

(ii) Show that the amplitude of the oscillations is 3.4 cm.

[1]

(iii) Calculate the maximum acceleration a_0 of the sphere.

a_0 = ... $\mathrm{m\,s^{-2}}$ [2]

(b) On Fig. 4.2, sketch the variation with x of the acceleration a of the sphere.

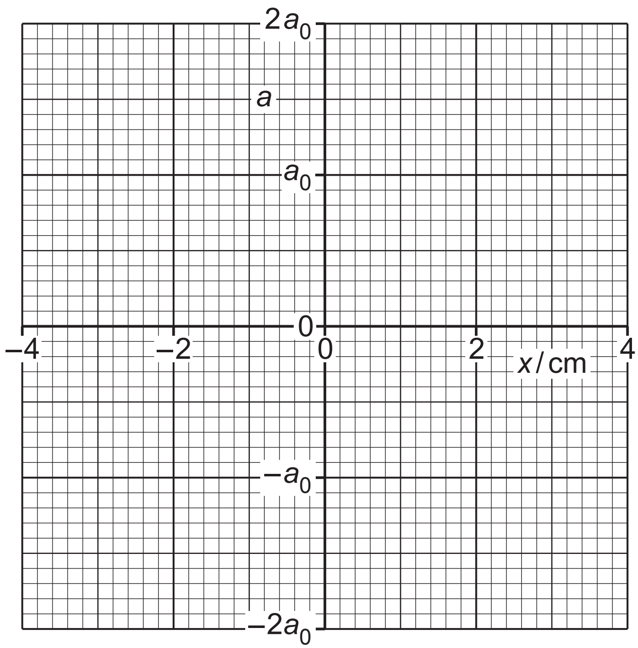

Fig. 4.2

[3]

(c) Describe, without calculation, the interchange between the potential energy and the kinetic energy of the oscillations.

....

....

....

....

.... [3]

[Total: 11]