4 A long strip of springy steel is clamped at one end so that the strip is vertical. A mass of 65 g is attached to the free end of the strip, as shown in Fig. 4.1.

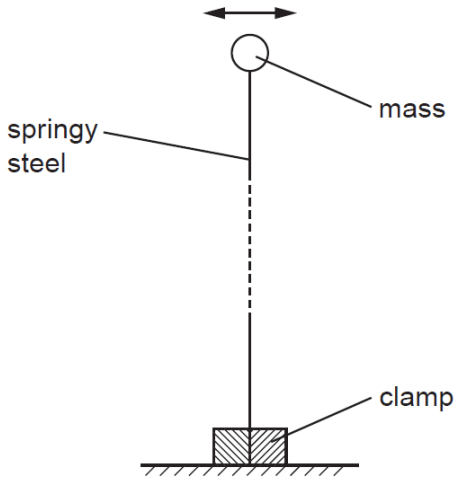

Fig. 4.1

The mass is pulled to one side and then released. The variation with time *t* of the horizontal displacement of the mass is shown in Fig. 4.2.

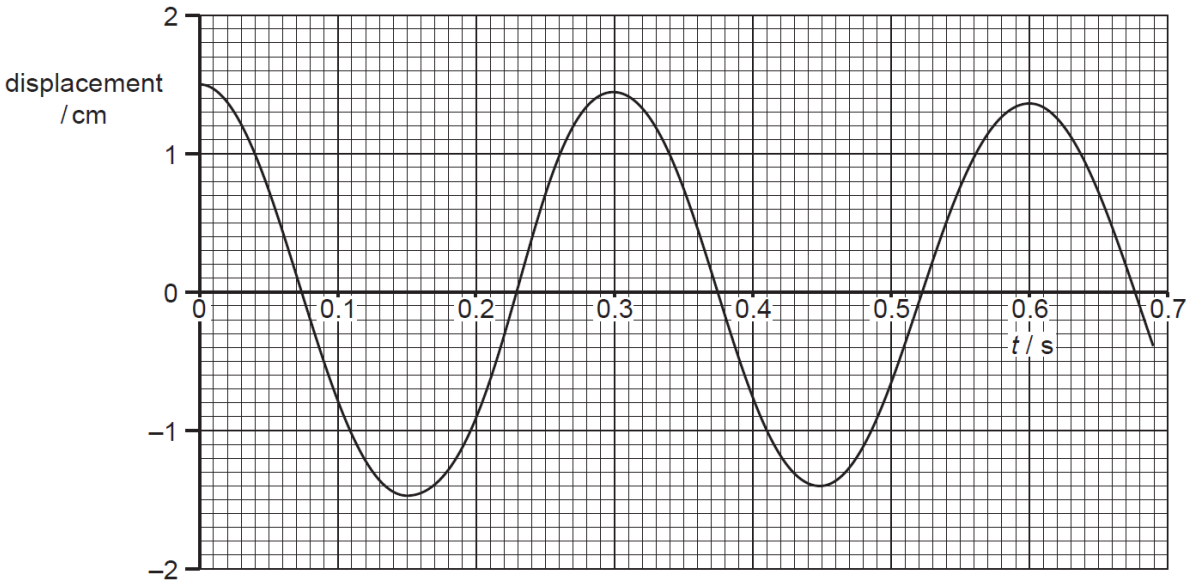

Fig. 4.2

The mass undergoes damped simple harmonic motion.

(a) (i) Explain what is meant by *damping*.

……

……

…… [2]

(ii) Suggest, with reason, whether the damping is light, critical or heavy.

……

……

…… [2]

(b) (i) Use Fig. 4.2 to determine the frequency of vibration of the mass.

frequency = …… Hz [1]

(ii) Hence show that the initial energy stored in the steel strip before the mass is released is approximately 3.2 mJ.

[2]

(c) After eight complete oscillations of the mass, the amplitude of vibration is reduced from 1.5 cm to 1.1 cm. State and explain whether, after a further eight complete oscillations, the amplitude will be 0.7 cm.

……

……

…… [2]

(d) State an example and its associated type of damping that is useful in the real world.

…… [1]

[Total: 10]