

- 4 A metal ball of mass 40 g falls vertically onto a spring, as shown in Fig. 4.1.

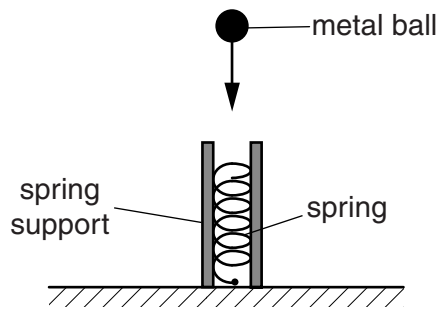


Fig. 4.1 (not to scale)

The spring is supported and stands vertically. The ball has a speed of 2.8 m s^{-1} as it makes contact with the spring. The ball is brought to rest as the spring is compressed.

- (a) Show that the kinetic energy of the ball as it makes contact with the spring is 0.16 J.

[2]

- (b) The variation of the force F acting on the spring with the compression x of the spring is shown in Fig. 4.2.

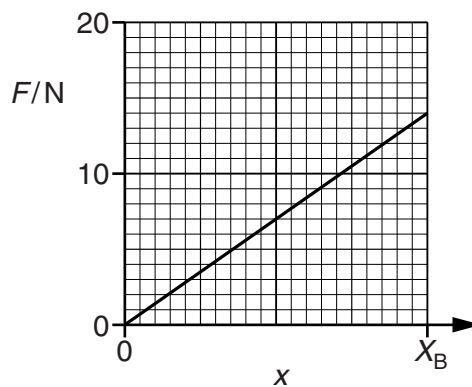


Fig. 4.2

The ball produces a maximum compression X_B when it comes to rest. The spring has a spring constant of 800 N m^{-1} .

Use Fig. 4.2 to

- (i) calculate the compression X_B ,

$$X_B = \dots\dots\dots \text{ m [2]}$$

- (ii) show that not all the kinetic energy in (a) is converted into elastic potential energy in the spring.

[2]