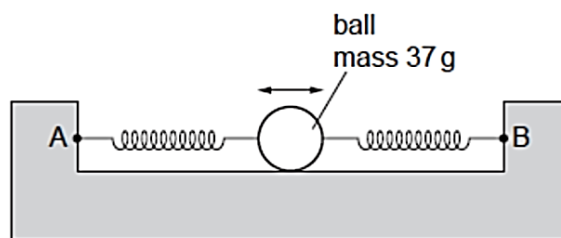


- 4 Fig. 4.1 shows a ball of mass 37 g on a smooth surface. It is held between two fixed points A and B by two identical stretched helical springs, of spring constant  $3.5 \text{ N m}^{-1}$ .



**Fig. 4.1**

The extension of each spring is 3.2 cm when the ball is at the equilibrium position. The ball oscillates along the line AB with simple harmonic motion of frequency 2.19 Hz and amplitude 3.0 cm.

- (a) (i) State the extension of the springs when the ball is at the amplitude position closest to point B.

extension of spring A = ..... cm

extension of spring B = ..... cm  
[1]

- (ii) Show that the total energy of the system is  $6.7 \times 10^{-3} \text{ J}$ .

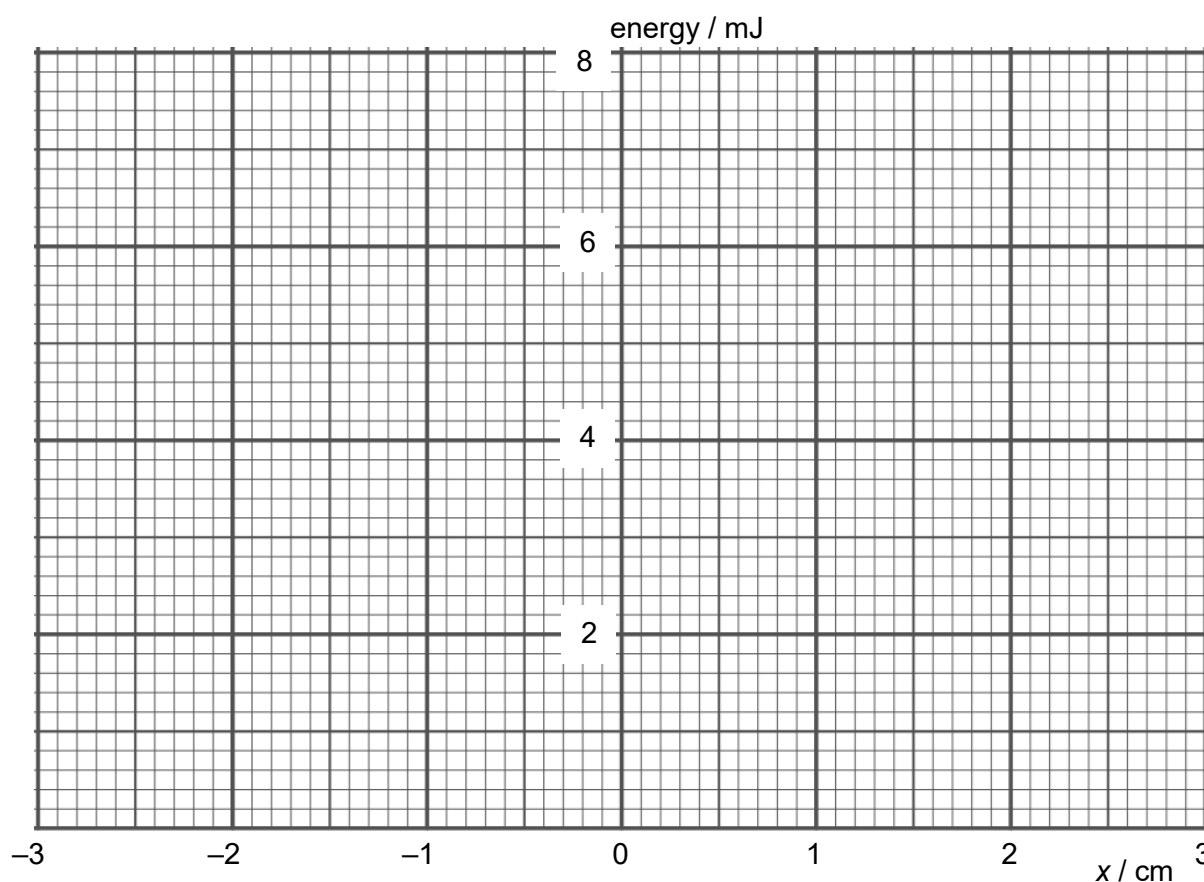
[2]

(b) On the axes of Fig. 4.2 and using your answers to (a), sketch a graph to show the variation with displacement  $x$  of

(i) the total energy of the system (label this line T), [1]

(ii) the kinetic energy of the ball (label this line K), [2]

(iii) the potential energy stored in the springs (label this line P). [2]



**Fig. 4.2**

(c) The ball in Fig. 4.1 is replaced with a heavier ball of the same size. State and explain the change, if any, to the maximum speed of the ball during the oscillation, if the amplitude remains unchanged.

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