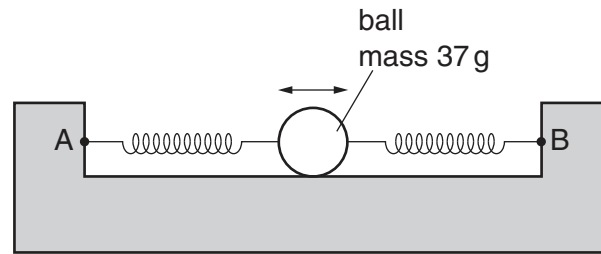


- 2 A ball of mass 37 g is held between two fixed points A and B by two stretched helical springs, as shown in Fig. 2.1.



**Fig. 2.1**

The ball oscillates along the line AB with simple harmonic motion of frequency 3.5 Hz and amplitude 2.8 cm.

- (a) Show that the total energy of the oscillations is 7.0 mJ.

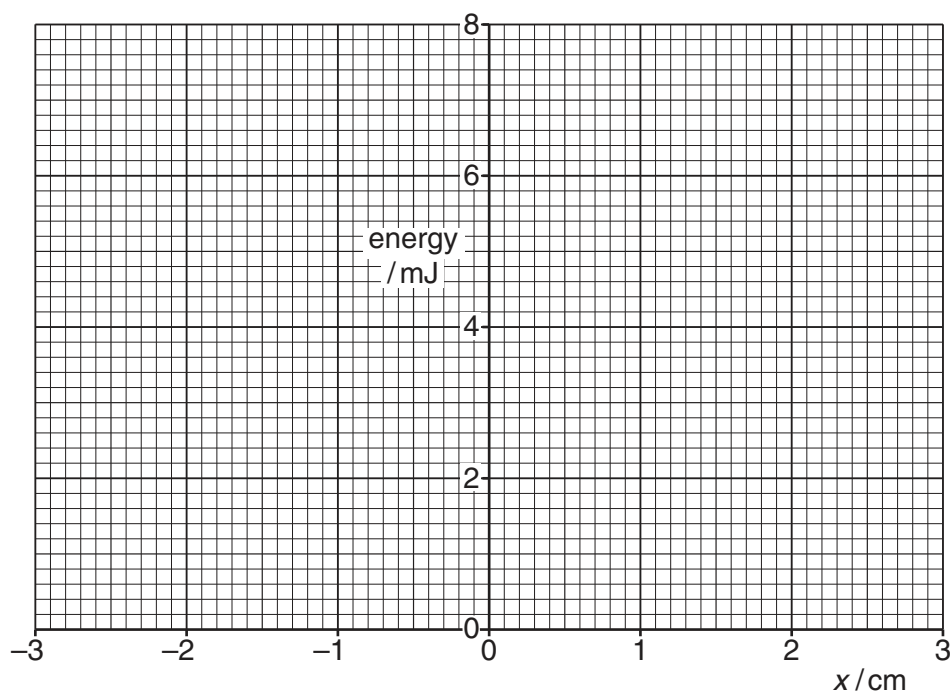
[2]

- (b) At two points in the oscillation of the ball, its kinetic energy is equal to the potential energy stored in the springs.  
Calculate the magnitude of the displacement at which this occurs.

displacement = ..... cm [3]

(c) On the axes of Fig. 2.2 and using your answers in (a) and (b), 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. 2.2**

(d) The arrangement in Fig. 2.1 is now rotated through  $90^\circ$  so that the line AB is vertical and the ball oscillates in a vertical plane.

Suggest one form of energy, other than those in (c), that must be taken into consideration when plotting new graphs to show energy changes with displacement.

..... [1]

