5 A pinball machine uses a spring to launch a small metal ball of mass 4.5×10^{-2} kg up a ramp. The spring is compressed by 8.0×10^{-2} m and held in equilibrium, as shown in Fig. 5.1.

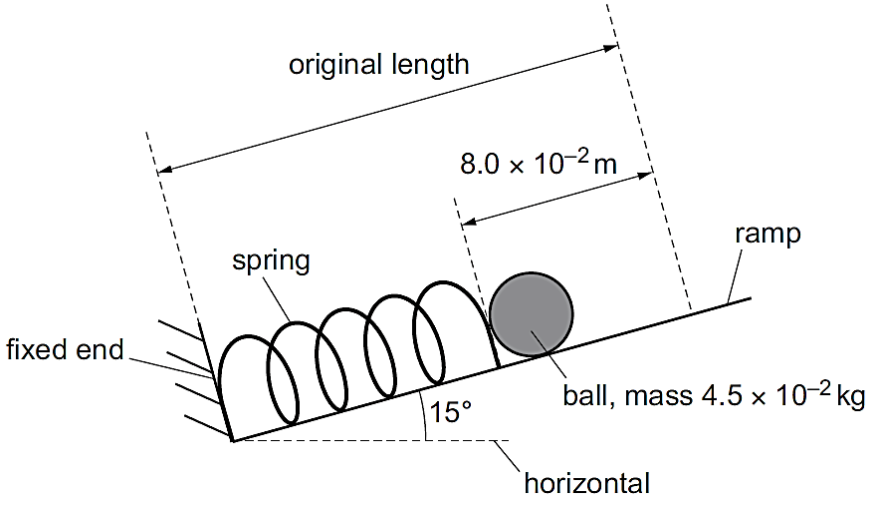

Fig. 5.1 (not to scale)

The ramp is at an angle of 15° to the horizontal.

(a) The spring obeys Hooke's law and has a spring constant of 29 N m^{-1}.

Calculate the elastic potential energy in the compressed spring.

elastic potential energy = ……J [2]

(b) The spring is released and expands quickly back to its original length.

The ball leaves the spring when the spring reaches its original length. Assume that all the elastic potential energy of the spring is transferred to the ball.

Calculate the speed of the ball as it leaves the spring.

speed = ……m s^{-1} [3]

(c) State and explain the effect on the speed in **(b)** when the mass of the spring cannot be neglected.

……..

…….....[1]

[Total: 6]