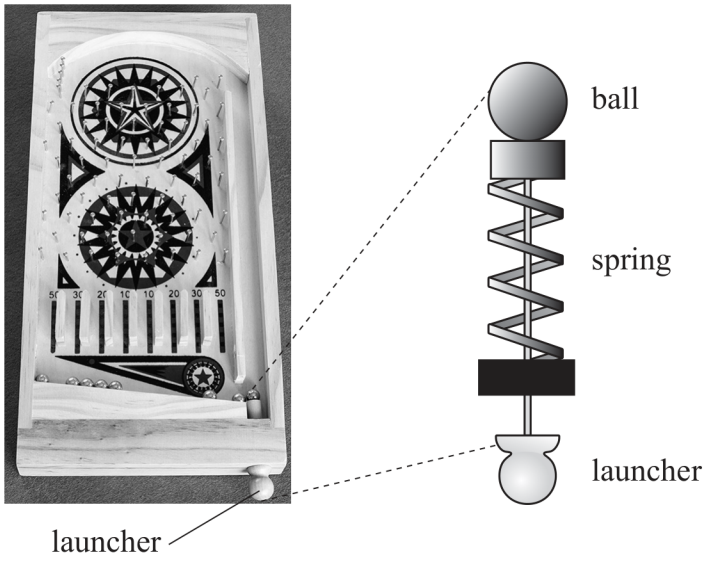
16 The photograph shows a toy pinball machine. The launcher is pulled back, compressing a spring. The spring obeys Hooke's law. When the launcher is released, the spring returns to its original length and a small ball is launched horizontally into the machine.



(Source: © Valery Voennyy/Alamy Stock Photo)

When the launcher is pulled back, the spring is compressed by 5.0 cm. When the spring is released, the ball is launched at a speed of 8.0 cm s^{-1}.

(a) Show that the kinetic energy of the ball just after launching is about 4×10^{-5} J.

mass of ball = 12 g

(2)

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.....

.....

.....

(b) Determine the force on the ball when the spring is released.

(2)

.....

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.....

.....

Force = ...

(c) Determine the stiffness of the spring.

(2)

.....

.....

.....

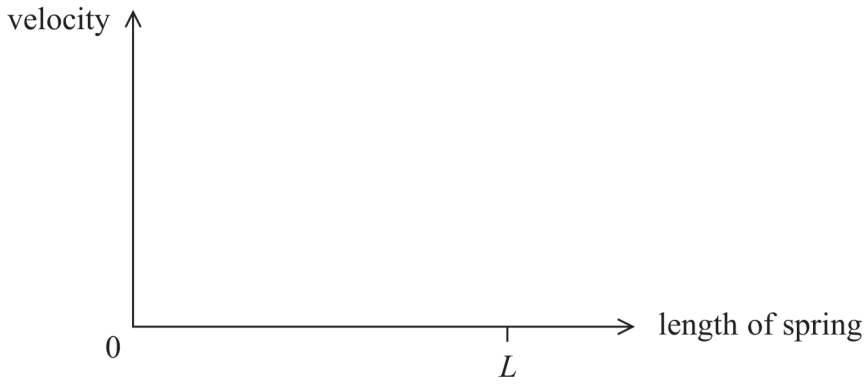
.....

Stiffness = ...

(d) The spring returns to its original length L.

Sketch a graph, on the axes below, to show how the velocity of the ball varies with the length of the spring.

(4)



(Total for Question 16 = 10 marks)