3 A trolley T moves at speed $1.2\,m\,s^{-1}$ along a horizontal frictionless surface. The trolley collides with a stationary block on the end of a fixed spring, as shown in Fig. 3.1.

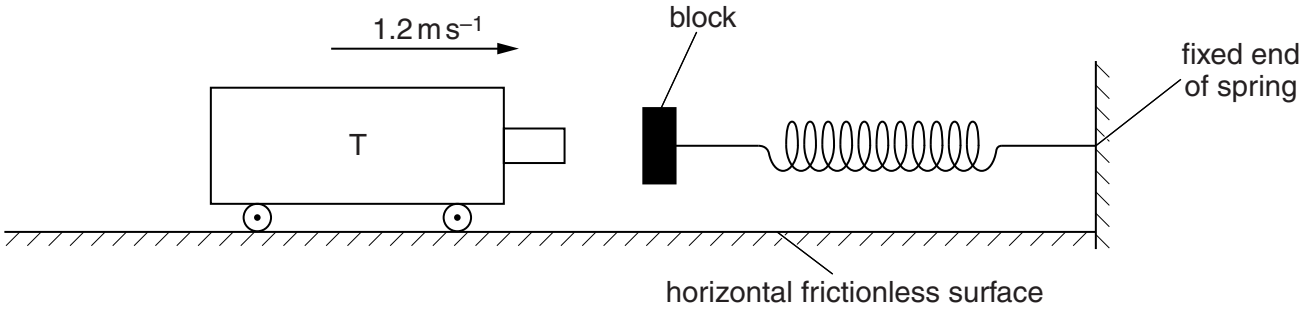

Fig. 3.1

The mass of T is 250 g. T compresses the spring by 5.4 cm as it comes to rest.
The relationship between the force F applied to the block and the compression x of the spring is shown in Fig. 3.2.

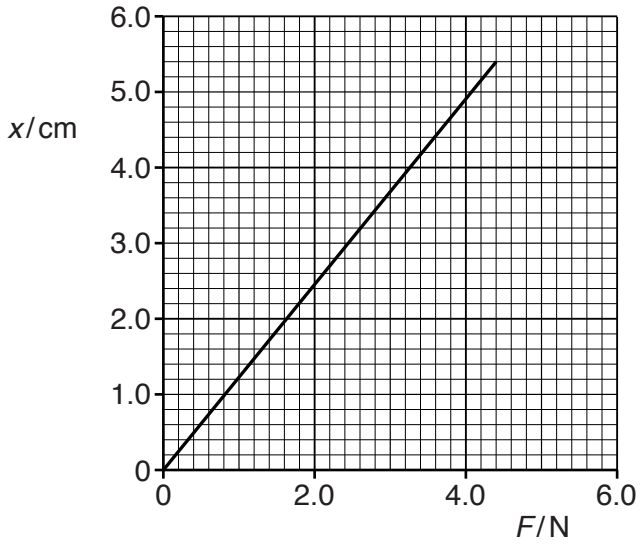

Fig. 3.2

(a) Fig. 3.2 to determine

(i) the spring constant of the spring,

spring constant = ... $N\,m^{-1}$ [2]

(ii) the work done by T compressing the spring by 5.4 cm.

work done = ... J [2]

(b) The spring then expands and causes T to move in a direction opposite to its initial direction. At the time that T loses contact with the block, it is moving at a speed of 0.75 m s^{-1}.

From the time that T is in contact with the block,

(i) describe the energy changes,

.....

.....

.....

.....[2]

(ii) determine the change in momentum of T.

change in momentum = ... N s [2]