

- 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.

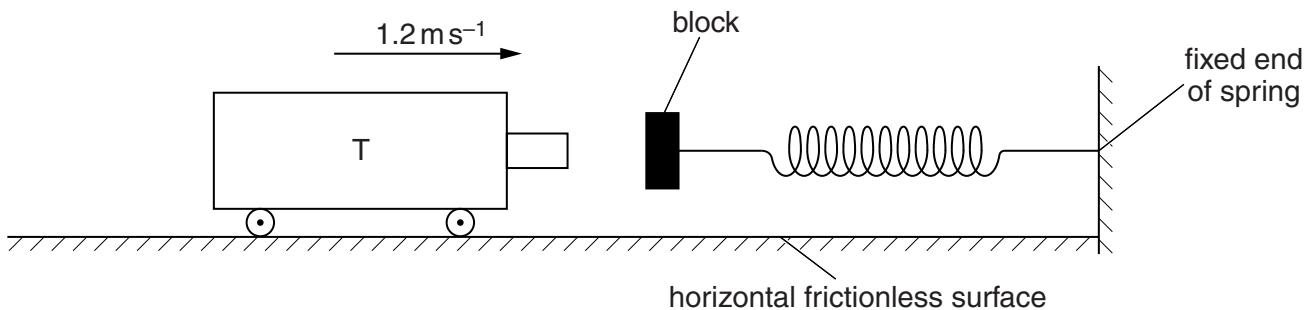


Fig. 3.1

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.

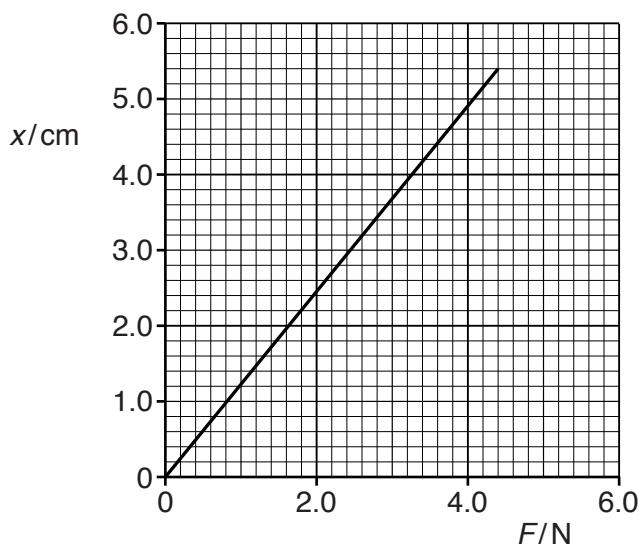


Fig. 3.2

- (a) Use Fig. 3.2 to determine

- (i) the spring constant of the spring,

$$\text{spring constant} = \dots \text{ N m}^{-1} [2]$$

- (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 ms^{-1} .

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

- (i) describe the energy changes,

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.....
.....

[2]

- (ii) determine the change in momentum of T.

change in momentum = Ns [2]