

- 4 (a) The defining equation of simple harmonic motion is

$$a = -\omega^2 x.$$

State the significance of the minus (-) sign in the equation.

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..... [1]

- (b) A trolley rests on a bench. Two identical stretched springs are attached to the trolley as shown in Fig. 4.1. The other end of each spring is attached to a fixed support.

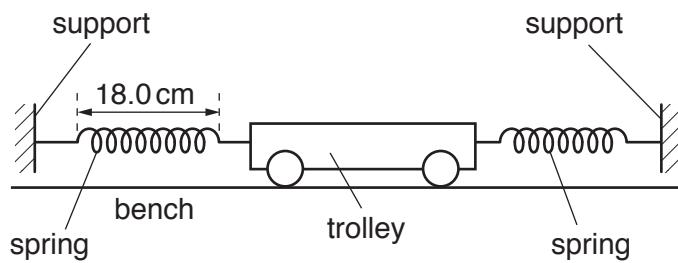


Fig. 4.1

The unstretched length of each spring is 12.0 cm. The spring constant of each spring is  $8.0 \text{ N m}^{-1}$ . When the trolley is in equilibrium the length of each spring is 18.0 cm.

The trolley is displaced 4.8 cm to one side and then released. Assume that resistive forces on the trolley are negligible.

- (i) Show that the resultant force on the trolley at the moment of release is 0.77 N.

[2]

- (ii) The mass of the trolley is 250 g.

Calculate the maximum acceleration  $a$  of the trolley.

$$a = \dots \text{ ms}^{-2} [1]$$

- (iii) Use your answer in (ii) to determine the period  $T$  of the subsequent oscillation.

$$T = \dots \text{ s} [3]$$

- (iv) The experiment is repeated with an initial displacement of the trolley of 2.4 cm.

State and explain the effect, if any, this change has on the period of the oscillation of the trolley.

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[2]