4 **(a)** State what is meant by *simple harmonic motion*.

.....

.....

..... [2]

(b) A trolley is attached to two extended springs, as shown in Fig. 4.1.

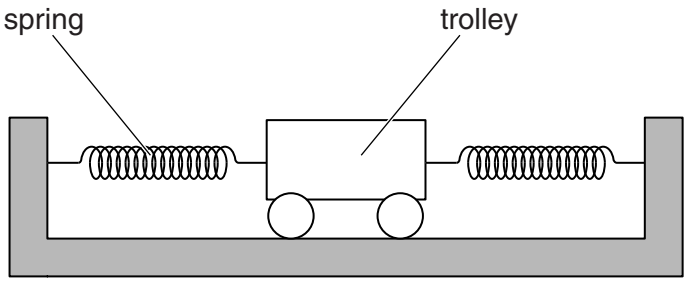

Fig. 4.1

The trolley is displaced along the line joining the two springs and is then released. At one point in the motion, a stopwatch is started. The variation with time t of the velocity v of the trolley is shown in Fig. 4.2.

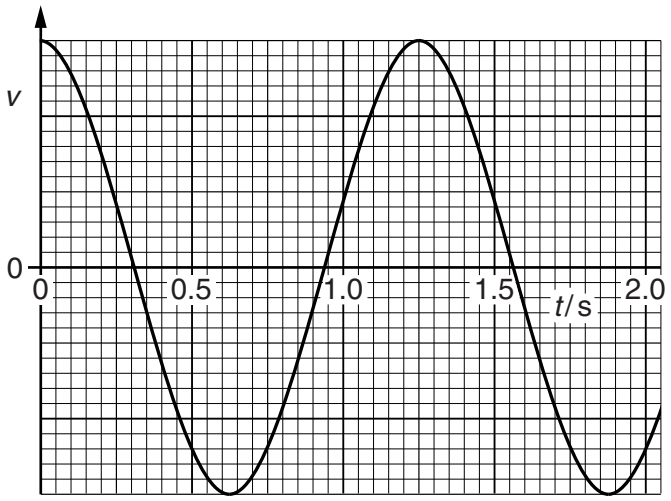

Fig. 4.2

The motion of the trolley is simple harmonic.

(i) State one time at which the trolley is moving through the equilibrium position and also state the next time that it moves through this position.

.....s and .....s [1]

(ii) The amplitude of vibration of the trolley is 3.2 cm.

Determine

1. the maximum speed v_0 of the trolley,

v_0 = ... $cm\,s^{-1}$ [3]

2. the displacement of the trolley for a speed of $\frac{1}{2}v_0$.

displacement = ... cm [2]

(c) Use your answers in **(b)** to sketch, on the axes of Fig. 4.3, a graph to show the variation with displacement x of the velocity v of the trolley.

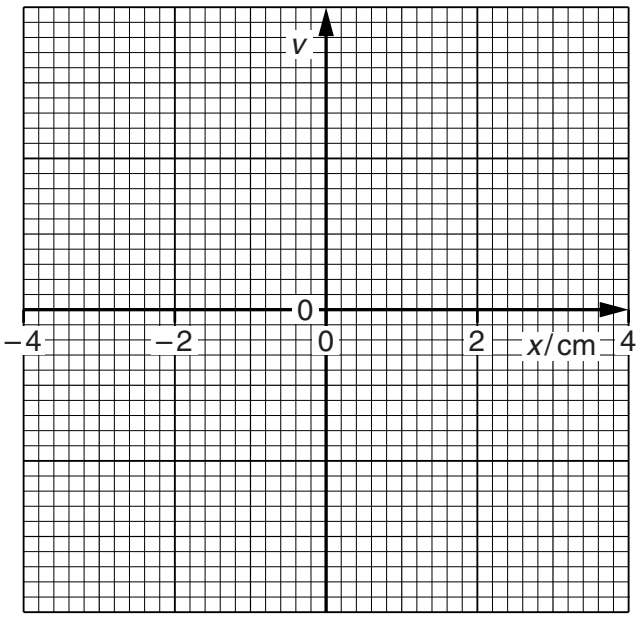

Fig. 4.3

[2]