

- 4 (a) State two conditions necessary for a mass to be undergoing simple harmonic motion.

1.

.....

2.

.....

[2]

- (b) A trolley of mass 950 g is held on a horizontal surface by means of two springs attached to fixed points P and Q, as shown in Fig. 4.1.

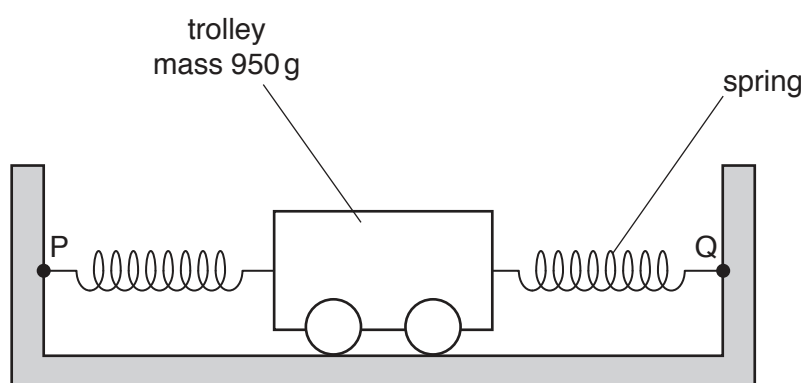


Fig. 4.1

The springs, each having a spring constant k of 230 N m^{-1} , are always extended.

The trolley is displaced along the line of the springs and then released.

The variation with time t of the displacement x of the trolley is shown in Fig. 4.2.

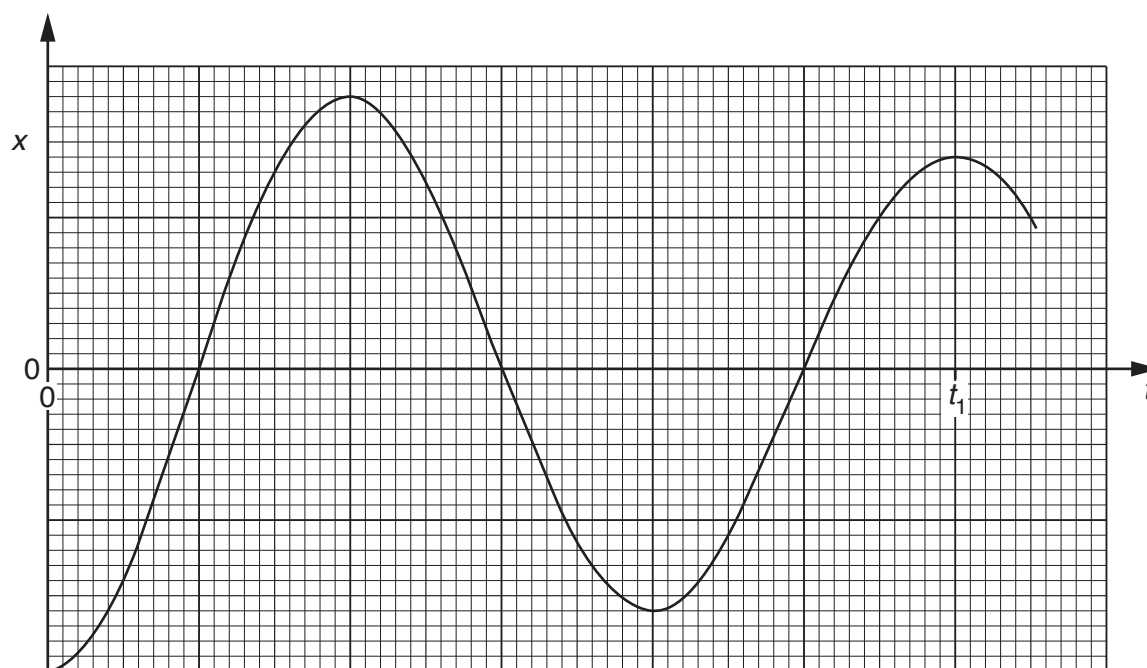


Fig. 4.2

- (i) 1. State and explain whether the oscillations of the trolley are heavily damped, critically damped or lightly damped.

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2. Suggest the cause of the damping.

.....

[3]

- (ii) The acceleration a of the trolley of mass m may be assumed to be given by the expression

$$a = -\left(\frac{2k}{m}\right)x.$$

1. Calculate the angular frequency ω of the oscillations of the trolley.

$$\omega = \dots\dots\dots \text{rad s}^{-1} \quad [3]$$

2. Determine the time t_1 shown on Fig. 4.2.

$$t_1 = \dots\dots\dots \text{s} \quad [2]$$

[Total: 10]