



- 3 (a) An object is placed upon a platform that can oscillate up and down, as shown in Fig. 3.1.

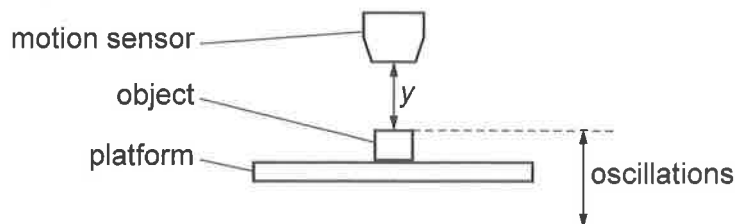


Fig. 3.1 (not to scale)

The object and the platform oscillate vertically with simple harmonic motion. A motion sensor is used to record the motion of the object. The vertical displacement of the object below the sensor is y . Fig. 3.2 shows the variation of y with time t .

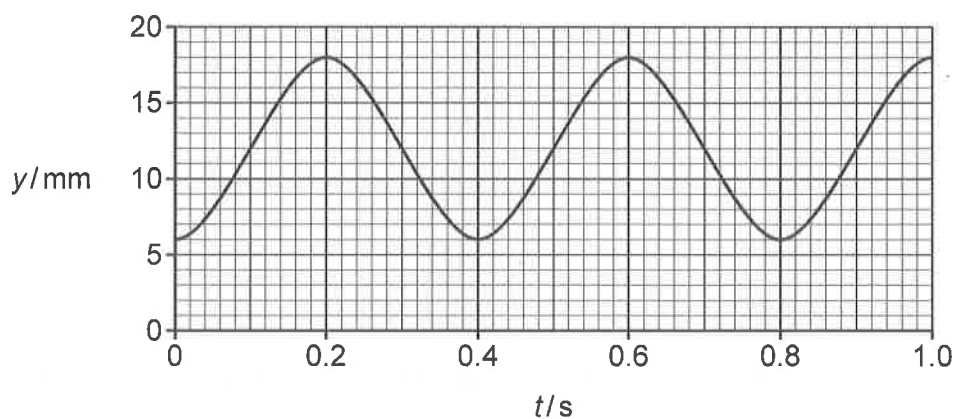


Fig. 3.2

- (i) Show that the angular frequency ω of the oscillations of the object is 16 rad s^{-1} .

[1]

- (ii) Determine the magnitude of the maximum acceleration of the object.

maximum acceleration = ms^{-2} [2]

- (iii) Determine the magnitude of the maximum velocity of the object.

maximum velocity = ms^{-1} [1]



- (iv) On Fig. 3.3, sketch a line to show the variation of the velocity v of the object with y .

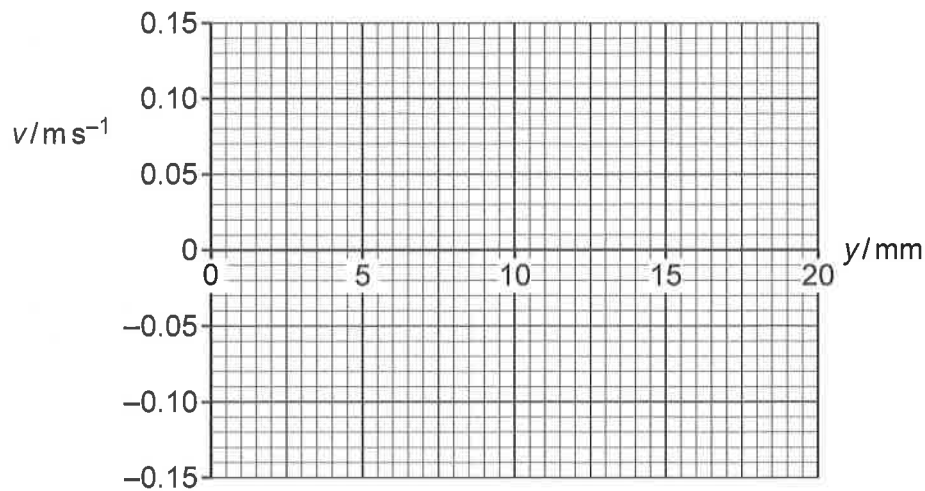


Fig. 3.3

[3]

- (v) The angular frequency of the oscillations is kept constant. The amplitude of the oscillations is gradually increased. At an amplitude of A_0 , the object just loses contact with the platform.

Determine A_0 .

$$A_0 = \dots\dots\dots \text{m} \quad [2]$$

- (b) (i) State what is meant by critical damping.

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 [1]

- (ii) Explain, with reference to energy, why critical damping is important in car suspension systems.

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 [1]

[Total: 11]

