

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

2 Kinematics in one dimension

Exercise C, Question 9

Question:

A ball is dropped from rest on to level ground from a height of 20 m.

- (a) Calculate the time taken to reach the ground.
The ball rebounds with half the speed it strikes the ground.
(b) Calculate the time taken to reach the ground a second time.

Solution:

$$s = ut + \frac{1}{2}at^2$$

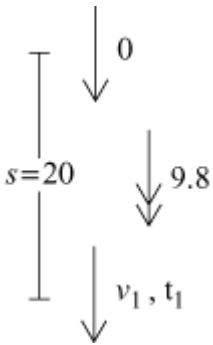
$$20 = 0 \times t_1 + \frac{1}{2} \times 9.8 \times t_1^2$$

$$(a) \frac{20}{4.9} = t_1^2,$$

$$\text{i.e. } t_1^2 = 4.0816\dots$$

$$\therefore t_1 = \sqrt{4.0816} = 2.0203\dots$$

$$\therefore t_1 = 2.02 \text{ s (3 s.f.)}$$



$$v^2 = u^2 + 2as$$

$$v_1^2 = 0^2 + 2(9.8)(20)$$

$$(b) v_1^2 = 392$$

$$\therefore v_1 = \sqrt{392} = 19.798\dots \text{ m s}^{-1}$$

$$s = ut + \frac{1}{2}at^2$$

$$0 = 9.8995T + \frac{1}{2} \left(-9.8 \right) T^2 \text{ i.e. } 0 = T \left(9.8995 - 4.9T \right)$$

$$\therefore T = 0 \text{ (at start) or } T = \frac{9.8995}{4.9} = 2.02 \text{ s (3 s.f.)}$$

$$\therefore T = 2.02 \text{ s}$$

$$\begin{array}{c} \downarrow 9.8 \\ s=0 \uparrow \frac{1}{2} \times 19.798 \\ t=T \quad = 9.8995 \end{array}$$

© Harcourt Education Ltd 2005