

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

2 Kinematics in one dimension

Exercise C, Question 16

Question:

A tennis ball is hit so that it moves vertically downwards from a height of 1 m with an initial speed of 5 m s^{-1} . When it hits the ground it rebounds vertically with half the speed it had when it hit the ground.

(a) Find the height to which it rebounds.

(b) State whether this is likely to be an under-estimate or an over-estimate, giving reasons to support your answer. [A]

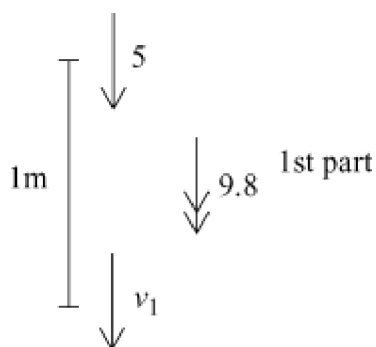
Solution:

$$\begin{aligned} \text{1st part, } v^2 &= u^2 + 2as, \downarrow \\ v_1^2 &= 5^2 + 2(9.8)(1) \end{aligned}$$

$$\text{(a) } v_1^2 = 44.6$$

$$\text{i.e. } v_1 = \sqrt{44.6}$$

$$\text{i.e. } v_1 = 6.6783... \text{ m s}^{-1}$$

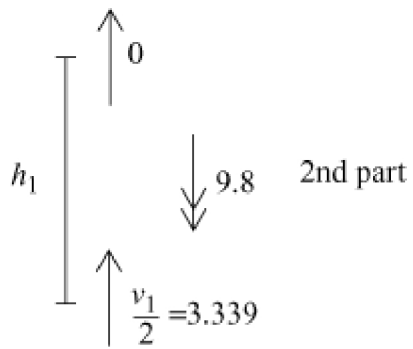


$$\begin{aligned} \text{2nd part, } v^2 &= u^2 + 2as, \uparrow \\ 0^2 &= 3.339^2 + 2(-9.8)(h_1) \end{aligned}$$

$$\therefore 19.6h_1 = 3.339^2$$

$$h_1 = \frac{3.339^2}{19.6} = 0.568877...$$

$$\text{i.e. } h_1 = 0.569 \text{ m (3 s.f.)}$$



(b) This is likely to be an overestimate since air resistance hasn't been taken into account: this would slow the ball down.

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