

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

2 Kinematics in one dimension

Exercise C, Question 12

Question:

One stone is thrown vertically upwards with a speed of 2 m s^{-1} and another is thrown vertically downwards with a speed of 2 m s^{-1} . Both are thrown at the same time from a window 5 m above ground level.

- Which stone hits the ground first?
- Which stone is travelling fastest when it hits the ground?
- What is the total distance travelled by each stone?

Solution:

(a) The one thrown downwards.

(b) They both hit the ground at the same speed (10.1 m s^{-1}), since using the equation $v^2 = u^2 + 2as$ is used: u^2 is the same for both initial velocities.

(c) The stone thrown downwards travels only the 5 metres downwards. For the stone thrown upwards, $v^2 = u^2 + 2as$ to the highest point gives

$$0^2 = 2^2 + 2(-9.8)(h_1)$$

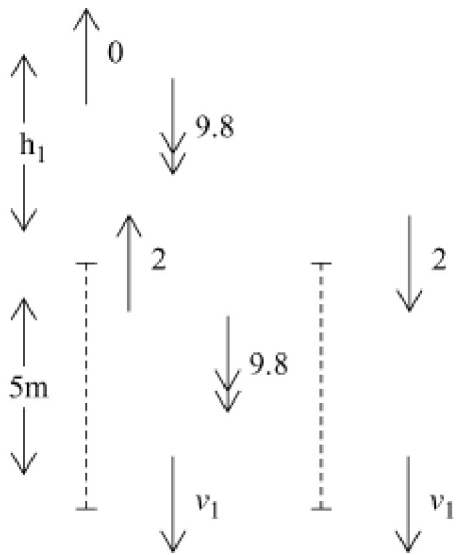
$$19.6h_1 = 4$$

$$\therefore h_1 = \frac{4}{19.6} = 0.20408... \text{ m}$$

\therefore The total distance travelled by the stone thrown upwards is

$$\begin{aligned} h_1 + h_1 + 5 &= 0.20408... + 0.20408... + 5 \\ &= 5.4081... \end{aligned}$$

i.e. total distance = 5.41 m (3 s.f.)



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