PQ 6 d

Questions and Answers

Q1

A window is 1.50 m high. A stone falling from above passes the top of the window with a speed of 3.00 m s^{-1}. When will it pass the bottom of the window? (Take the acceleration due to gravity to be 10.0 m s^{-2}.)

Use $s = ut + \frac{1}{2}at^2$ to get $-1.5 = -3t + \frac{1}{2} \times (-10) \times t^2 \Rightarrow t = 0.324$ s.

Q2

A ball is dropped from rest from a height of 20.0 m. One second later a second ball is thrown vertically downwards. If the two balls arrive on the ground at the same time, what must have been the initial velocity of the second ball?

$s_1 = -\frac{1}{2} \times 10t^2 = -5t^2$ and $s_2 = u(t-1) - \frac{1}{2} \times 10(t-1)^2$. When $s_1 = -20$ m,

$5t^2 = 20 \Rightarrow t = 2.0$ s. Hence, $-20 = u(2-1) - \frac{1}{2} \times 10(2-1)^2 \Rightarrow u = -15$ m s^{-1}.

Q3

Two balls are dropped from rest from the same height. One of the balls is dropped 1.00 s after the other. What distance separates the two balls 2.00 s after the second ball is dropped?

$s_1 = -\frac{1}{2} \times 10t^2 = -5t^2$ and $s_2 = -\frac{1}{2} \times 10(t-1)^2$. Two seconds after the second ball was dropped means that $t = 3.0$ s. Then, $s_1 = -45$ m and $s_2 = -20$ m. The separation is thus 25 m.