the vertical height of P above the ground is twice that of Q. A particle is projected downward with a speed of 9.8m per second from P and simultaneously another particle is projected with same velocity from Q. both particle reach the ground simultaneously. the time taken to reach the ground is-

Solution:

$V_Q = V_P = V = 9.8\frac{m}{s} - \text{speed of the particles}$

$t_Q = t_P = t - \text{time taken to reach the ground}$

Equation of the motion for particle at the height P above the ground on Y-axis:

$$P = Vt + \frac{gt^2}{2} \qquad (1)$$

Equation of the motion for particle at the height Q above the ground on Y-axis (velocity is directed upwards):

$$Q = -Vt + \frac{gt^2}{2} \qquad (2)$$

$$P = 2 \cdot Q \qquad (3)$$

$(1)\text{and}(2)\text{in}(3)$:

$$2\left(-Vt + \frac{gt^2}{2}\right) = Vt + \frac{gt^2}{2}$$

$$-2Vt + gt^2 = Vt + \frac{gt^2}{2}$$

$$3V = \frac{gt}{2}$$

$$t = \frac{6V}{g} = \frac{6 \cdot 9.8\frac{m}{s}}{9.8\frac{m}{s^2}} = 6s$$

Answer: time taken to reach the ground is 6s.