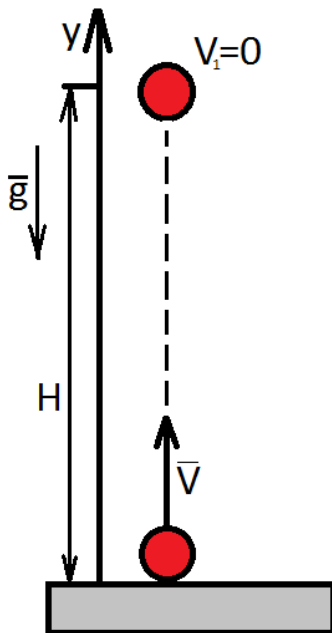


With what velocity must a ball be thrown vertically upward in order to rise a height of 50m? How long will it be in the air?

Solution:



The equation of motion for the ball:

$$H = Vt - \frac{gt^2}{2} \quad (1),$$

t – flight time to reach the height $H = 50\text{m}$

Rate equation for the ball, in the end of the flight speed of the ball is zero:

$$0 = V - gt$$

$$t = \frac{V}{g} \quad (2)$$

$$(2) \text{ in } (1): H = V \frac{V}{g} - \frac{g \left(\frac{V}{g}\right)^2}{2}$$

$$H = \frac{V^2}{2g}$$

$$V = \sqrt{2gH} = \sqrt{2 * 10 \frac{\text{m}}{\text{s}^2} * 50\text{m}} = 31.6 \frac{\text{m}}{\text{s}}$$

Residence time in the air: time of flight of the ball upward equals time of the fall:

$$T = t_{up} + t_{down} = 2t = \frac{2V}{g} = \frac{2 * 31.6 \frac{\text{m}}{\text{s}}}{10 \frac{\text{m}}{\text{s}^2}} = 6.32 \text{ s}$$

Answer: velocity: $V = 31.6 \frac{\text{m}}{\text{s}}$

Time in the air: $T = 6.32 \text{ s}$