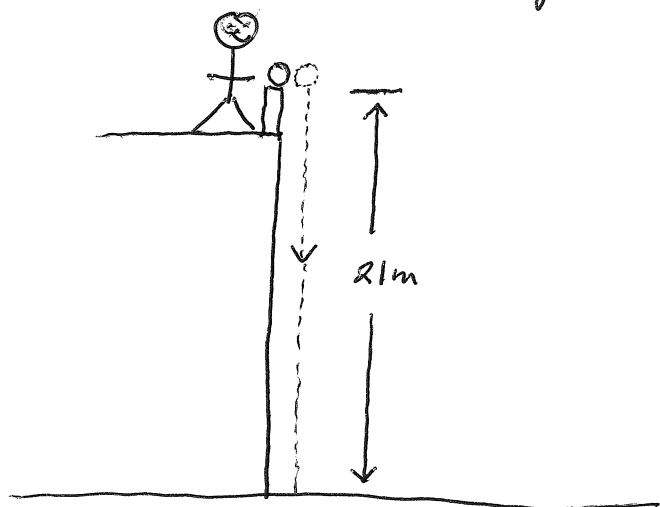


(1)

## Example - Free-Fall



A water balloon is pushed gently over the edge of a building top as shown.

- 1) How long does it take for the balloon to reach the ground?
- 2) How fast is the balloon traveling when it strikes the ground?

1) How long?

$$t = ?$$

$$x_0 = 21\text{m}$$

$$x = 0\text{m} \quad \text{-(Ground is origin)}$$

$$v_0 = 0\text{m/s} \quad \text{-(object is not thrown down)}$$

$$a = -9.80\text{m/s}^2 \quad \text{-(acceleration provided by gravity)}$$

$$x = x_0 + \cancel{v_0 \Delta t} + \frac{1}{2} a \Delta t^2$$

$$0\text{m} = 21\text{m} + \frac{1}{2} (-9.80\text{m/s}^2) \Delta t^2$$

$$\sqrt{\frac{-21\text{m}}{\frac{1}{2}(-9.80\text{m/s}^2)}} = \Delta t =$$

2) How fast?

$v = ?$

$v_0 = 0\text{m/s}$

$a = -9.80\text{m/s}^2$

$\Delta t = ?$  or

- (don't have to use this)

$x_0 = 21\text{m}$

$x = 0\text{m}$

$$v^2 = v_0^2 + 2a\Delta x$$

$$v = \sqrt{2a\Delta x} = \sqrt{2(-9.80\text{m/s}^2)(0\text{m} - 21\text{m})}$$

$$= 20.3\text{m/s}$$

$$\boxed{-20\frac{\text{m}}{\text{s}}}$$

choose the - answer to indicate falling