

“free fall problem”

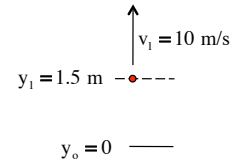
A mass located at 1.5 meters above the ground is thrown upward with velocity 10 m/s.

- Where will the body be at $t = .2$ seconds?
- At what time will the mass be at $y = 4.0$ meters?
- What will the mass's velocity be after .15 seconds?
- What will the mass's velocity be when at $y = 1.25$ meters?
- How high maximum (relative to the ground) will the mass go?

1.)

A mass located at 1.5 meters above the ground is thrown upward with velocity 10 m/s.

- Where will the body be at $t = .2$ seconds?



- At what time will the mass be at $y = 4.0$ meters?

2.)

A mass located at 1.5 meters above the ground is thrown upward with velocity 10 m/s.

- Where will the body be at $t = .2$ seconds?

$$y_2 = y_1 + v_{1,y} (\Delta t) + \frac{1}{2} a_y (\Delta t)^2$$

$$= (1.50 \text{ m}) + (10.0 \text{ m/s})(.200 \text{ s}) + \frac{1}{2}(-9.80 \text{ m/s}^2)(.200 \text{ s})^2$$

$$= 3.30 \text{ m}$$

- At what time will the mass be at $y = 4.0$ meters?

$$y_3 = y_1 + v_{1,y} (\Delta t) + \frac{1}{2} a_y (\Delta t)^2$$

$$\Rightarrow (4.00 \text{ m}) = (1.50 \text{ m}) + (10.0 \text{ m/s})(\Delta t) + \frac{1}{2}(-9.80 \text{ m/s}^2)(\Delta t)^2$$

$$\Rightarrow 0 = (-2.50 \text{ m}) + (10.0 \text{ m/s})(\Delta t) - (4.9 \text{ m/s}^2)(\Delta t)^2$$

$$(\Delta t) = .292 \text{ s or } 1.75 \text{ s}$$

2.)

A mass located at 1.5 meters above the ground is thrown upward with velocity 10 m/s.

- What will the mass's velocity be after .15 seconds?

$$v_{2,y} = v_{1,y} + a_y (\Delta t)$$

$$= (10.0 \text{ m/s}) + (-9.80 \text{ m/s}^2)(.150 \text{ s})$$

$$= 8.53 \text{ m/s}$$

- What will the mass's velocity be when at $y = 1.25$ meters?

$$(v_{y,2})^2 = (v_{y,1})^2 + 2a_y (y_2 - y_1)$$

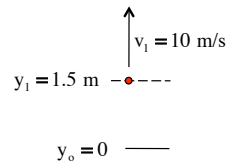
$$= (10.0 \text{ m/s})^2 + 2(-9.80 \text{ m/s}^2)((1.25 \text{ m}) - (1.50 \text{ m}))$$

$$\Rightarrow |v_{y,2}| = [(10.0 \text{ m/s})^2 + 2(-9.80 \text{ m/s}^2)(-.25 \text{ m})]^{1/2}$$

$$= 10.24 \text{ m/s}$$

3.)

A mass located at 1.5 meters above the ground is thrown upward with velocity 10 m/s.



e.) How high maximum (relative to the ground) will the mass go?

$$(v_{\text{top},y})^2 = (v_{1,y})^2 + 2a_y \Delta y$$

$$\Rightarrow 0 = (10.0 \text{ m/s})^2 + 2(-9.80 \text{ m/s}^2)(y_{\text{max}} - (1.50 \text{ m}))$$

$$\Rightarrow y_{\text{max}} = 6.60 \text{ m}$$