

## The Plan

Today - Falling For Physics

Tomorrow - Review

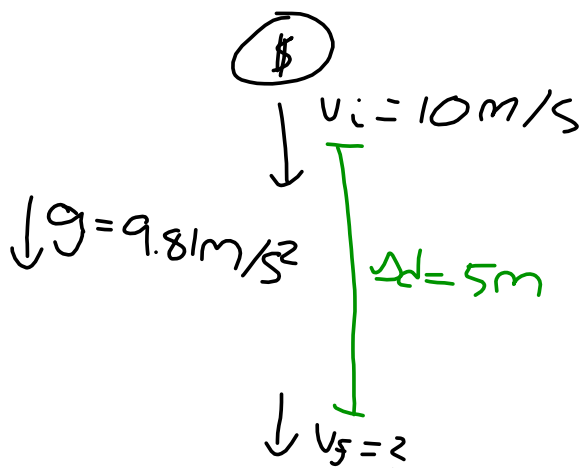
Friday - Test

Acceleration Lab Due Monday

## Free fall

When released, all objects accelerate downwards towards the earth at  $9.81 \text{ m/s}^2$ .

1. A coin gets tossed from a balcony with an initial velocity of 10 m/s downwards. The coin falls a distance of 5 m. What is the
  1. Final velocity for the coin?
  2. Time of flight for the coin?



$$v_f^2 = v_i^2 + 2a\Delta d$$

$$= (10 \text{ m/s})^2 + 2(9.81 \text{ m/s}^2)(5 \text{ m})$$

$$v_f^2 = 198.1 \text{ m}^2/\text{s}^2$$

$$v_f = 14.1 \text{ m/s}$$

$$b) \quad v_f = v_i + a\Delta t$$

$$14.1 \text{ m/s} = 10 \text{ m/s} + (9.81 \text{ m/s}^2)\Delta t$$

$$\Delta t = 0.42 \text{ s}$$

1. You drop a stone  $v_i = 0$  down a well and you hear a splash  $a = g = 9.81 \text{ m/s}^2$   $\Delta t$  2 seconds later.
1. How deep is the well?
  2. How fast was the stone travelling just before it hit the water at the bottom of the well?

$$\begin{aligned}
 1) \quad \Delta d &= \frac{1}{2} a \Delta t^2 \\
 &= \frac{1}{2} (9.81 \text{ m/s}^2) (2 \text{ s})^2 \\
 &= 19.62 \text{ m}
 \end{aligned}$$

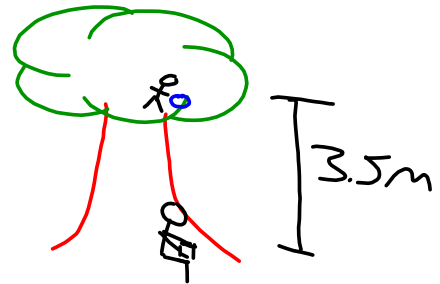
$$\begin{aligned}
 2) \quad v_f &= v_i + a \Delta t \\
 &= 0 + (9.81 \text{ m/s}^2) (2 \text{ s}) \\
 &= 19.62 \text{ m/s}
 \end{aligned}$$

1. Your friend is sitting under a tree unaware that you are in the tree above with a water balloon. You drop the balloon. If you are 3.5 m above your friend, how long does he have to get out of the way?

$$\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$$

$$\frac{2 \Delta d}{a} = \frac{a \Delta t^2}{a}$$

$$\sqrt{\frac{2 \Delta d}{a}} = \sqrt{\Delta t^2} = \Delta t$$



$$3.5 \text{ m} = \frac{1}{2} (9.8 \frac{\text{m}}{\text{s}^2}) \Delta t^2$$

$$\frac{3.5 \text{ m}}{4.905 \frac{\text{m}}{\text{s}^2}} = \frac{4.905 \text{ m}}{4.905 \frac{\text{m}}{\text{s}^2}} \Delta t^2$$

$$\Delta t^2 = 0.71 \text{ s}^2$$

$$\Delta t = 0.85 \text{ s}$$

1. You are standing on a roof and drop a stone off the edge. A 2 m tall window is 3 m below where you dropped the stone.
  1. How fast is the stone travelling at the top of the window?
  2. How long does the rock take to pass by the window?

