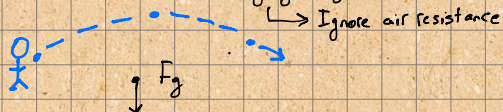


Warm-up:

1. Your friend drops a 2 kg water balloon out a window above you on the second floor [10m]. How fast is it moving when it hits your head [you are 1.6m tall]? How long do you have to move?

$m =$
 $d =$
 $a =$
 $v =$
 $t =$

• Projectile Motion: Only gravity acts on an object in midair



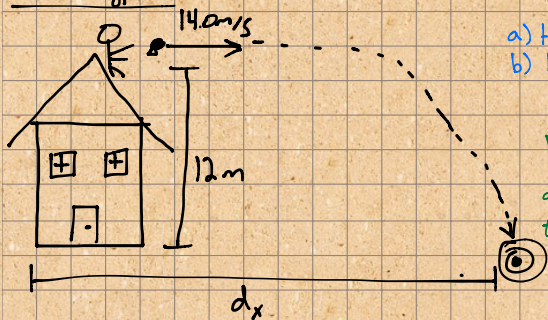
x-component: No horizontal forces = no acceleration

$$v = \frac{\text{distance}}{\text{time}}$$

y-component: acceleration = -9.8 m/s^2

What will ALWAYS be the same? TIME!

Problem Type 1:



a) How long will it be airborne?
 b) How far will it travel in the x-direction?

x	y
$v_x = 14.0 \text{ m/s}$	$v_{y0} = 0 \text{ m/s}$
$d_x = ?$	$v_{fy} = ?$
$t = ? = 1.57 \text{ s}$	$a = -9.8 \text{ m/s}^2$
	$d_y = -12 \text{ m}$
	$t = ? = 1.57 \text{ s}$

$$\begin{aligned} \text{a) } d &= v_0 t + \frac{1}{2} a \cdot t^2 \\ -12 &= \frac{1}{2} \cdot -9.8 \cdot t^2 \\ -4.9 &= -4.9 t^2 \\ 2.45 &= t^2 \\ \boxed{t = 1.57 \text{ s}} \end{aligned}$$

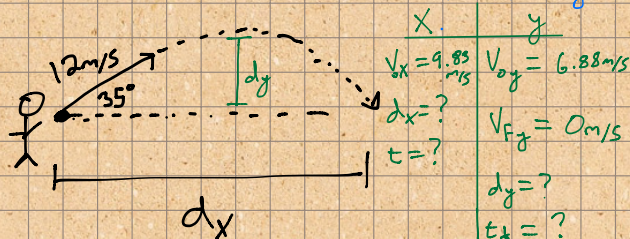
$$\text{b) } v = \frac{d}{t}$$

$$v \cdot t = d$$

$$14.0 \text{ m/s} \cdot 1.57 \text{ s} = d$$


$$\boxed{d = 21.98 \text{ m}}$$

Problem type 2:



a) What is d_x ? b) How high does the ball go?

x	y
$v_x = 9.83 \text{ m/s}$	$v_{y0} = 6.88 \text{ m/s}$
$d_x = ?$	$v_{fy} = 0 \text{ m/s}$
$t = ?$	$d_y = ?$
	$t_x = ?$



$V_y = 12 \cdot \sin(35) = 6.88 \text{ m/s}$

$V_x = 12 \cdot \cos(35) = 9.83 \text{ m/s}$