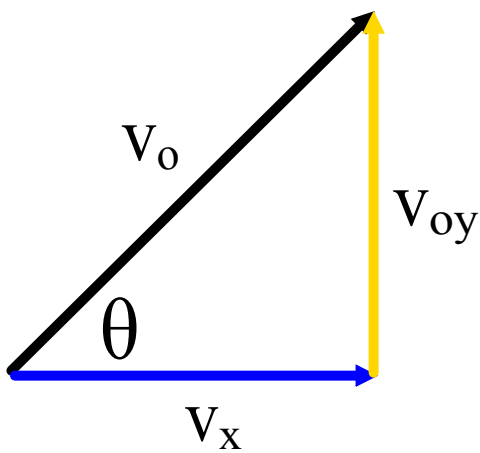
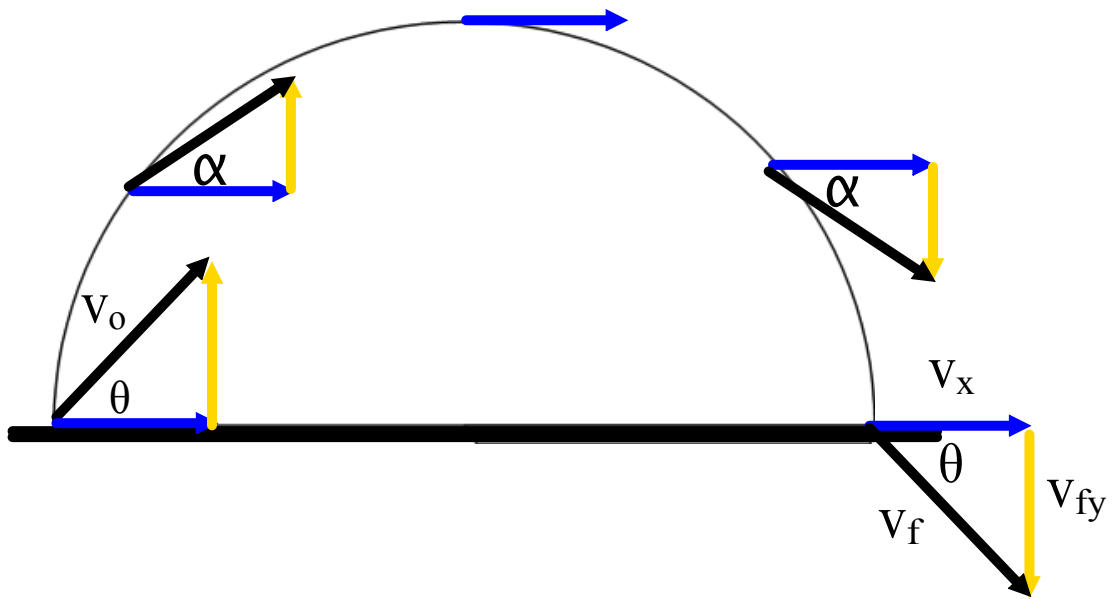


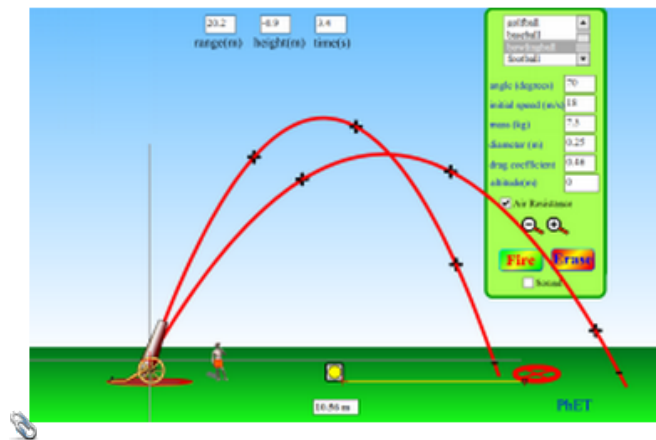
Projectiles Fired At An Angle

horizontal velocity: **constant**
 vertical velocity: **changes**

Trajectory



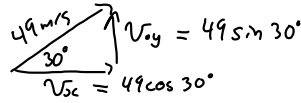
Projectile Motion



Example:

An arrow is shot at an angle of 30.0° with the ground. It has a speed of 49 m/s.

- a) How high will the arrow go? (31 m)
- b) Assuming the arrow lands on the ground, what is its range? (2.1×10^2 m)



x-direction	y-direction
$d_{0x} = 0$ $v_x = 49 \cos 30 = 42.4 \text{ m/s}$	$a = -9.81 \text{ m/s}^2$ $v_{0y} = 49 \sin 30 = 24.5 \text{ m/s}$ $d_{0y} = 0$ $v_{fy} = 0 \text{ m/s}$ $d_{fy} = ? \leftarrow \text{max height}$

$$v_{fy}^2 = v_{0y}^2 + 2a(d_{fy} - d_{0y})$$

$$0 = (24.5)^2 + 2(-9.81)(d_{fy} - 0)$$

$$0 = 600 - 19.62 d_{fy}$$

$$\frac{-600}{-19.62} = d_{fy}$$

$31 \text{ m} = d_{fy}$

b) range = ?

x-dir	y-dir
$d_{0x} = 0$ $v_x = 42.5 \text{ m/s}$ $d_{fx} = ?$ $t = ? \leftarrow \text{find time first!}$	$d_{0y} = 0$ $d_{fy} = 0$ $a = -9.81 \text{ m/s}^2$ $v_{0y} = 24.5 \text{ m/s}$ $t = ?$

$$d_{fy} = d_{0y} + v_{0y}t + \frac{1}{2}at^2$$

$$0 = 0 + 24.5t - 4.9t^2$$

$$0 = t(24.5 - 4.9t)$$

$$t = 0 \text{ s}$$

$$24.5 - 4.9t = 0$$

$$-4.9t = -24.5$$

$$t = \frac{-24.5}{-4.9}$$

$$t = 5.0 \text{ s}$$

$$d_{fx} = ? \quad v_x = \frac{d_{fx} - d_{0x}}{t}$$

$$42.5 = \frac{d_{fx} - 0}{5}$$

$212 \text{ m} = d_{fx}$

Attachments

projectile-motion_en.jar