∴ An arrow is shot at an angle of 30.0° with the ground.
It has a speed of 49 m/s. ~~Assuming the arrow is shot from ground level and it lands on the ground, answer the following questions~~.

a) How high will the arrow go? (31 m)
b) Assuming the arrow lands on the ground, what is its range? (2.1 x 10² m)

a) $d_{fy} = ?$ $g = -9.81 \, \text{m/s}^2$ $\overset{49\sin 30}{\underset{\downarrow}{}}$

$V_{oy} = 49\sin 30$ $d_o = 0 \, m$ $V_{oy} = 24.5 \, \text{m/s}$

$V_f = 0 \, \text{m/s}$

$$V_f^2 = V_o^2 + 2g(d_f - d_o)$$

$$0 = (24.5)^2 + 2(-9.81)(d_f - 0)$$

$$0 = 600.25 - 19.62 d_f$$

$$\frac{-600.25}{-19.62} = d_f$$

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

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b) $d_{fx} = ?$ when it hits ground

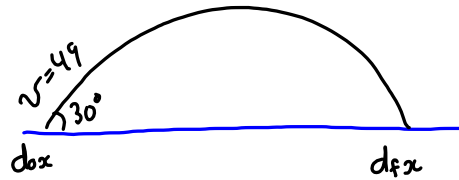$$\vec{V_x} = \frac{\vec{d}}{t} = \frac{d_{fx} - d_{ox}}{t}$$

$V_x = 49 \cos 30°$

$V_x = 42.4 \, m/s$

$d_{ox} = 0_m$

$d_{fx} = ?$

$t = ?$

d_{ox} d_{fx}

* Find the time in the air. Use y-direction

$d_{oy} = 0_m$ $g = -9.81$ $t = ?$

$d_{fy} = 0_m$ $V_{oy} = 24.5 \, m/s$

$V_{fy} = -24.5 \, m/s$ *** because it lands at the same height it was launched.**

$$a = \frac{V_f - V_o}{t}$$

$$d_f = d_o + V_o t + \tfrac{1}{2} a t^2$$

$$0 = 0 + 24.5t + \tfrac{1}{2}(-9.81)t^2$$

$$0 = 24.5t - 4.9t^2 \quad \text{*factor out } t$$

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

Two equations $0 = t$ ← not looking for this.

$$0 = 24.5 - 4.9t$$

$$\frac{-24.5}{-4.9} = t \qquad \underline{\underline{5s = t}}$$

Find d_{fx} $V_x = \dfrac{d_{fx} - d_{ox}}{t}$

$$42.4 = \frac{d_{fx} - 0}{5}$$

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

Attachments

projectile-motion_en.jar