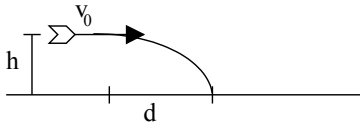


Chapter 3 Problem 41 †



Given

$$d = 23 \text{ m}$$

$$\vec{v}_0 = 41 \hat{i} \text{ m/s}$$

$$\vec{a} = -9.8 \hat{j} \text{ m/s}^2$$

Solution

Find the height, h , from which the arrow was fired.

The position vector is given by

$$\vec{r} = \vec{r}_0 + \vec{v}_0 t + \frac{1}{2} \vec{a} t^2$$

$$\vec{r} = h \hat{j} + \left\{ 41 \text{ m/s } \hat{i} \right\} t + \frac{1}{2} \left\{ -9.8 \text{ m/s}^2 \hat{j} \right\} t^2$$

Regrouping gives

$$\vec{r} = \left\{ (41 \text{ m/s}) t \hat{i} + (h - (4.9 \text{ m/s}^2) t^2) \hat{j} \right\}$$

Using the x-component and setting it equal to 23 m, the time becomes

$$(41 \text{ m/s}) t = 23 \text{ m}$$

$$t = 0.561 \text{ s}$$

At this time, the final height is zero. Setting the y-component equal to zero and substituting in for time gives

$$h - (4.9 \text{ m/s}^2) t^2 = 0$$

$$h = (4.9 \text{ m/s}^2) (0.561 \text{ s})^2 = 1.54 \text{ m}$$

†Problem from Essential University Physics, Wolfson