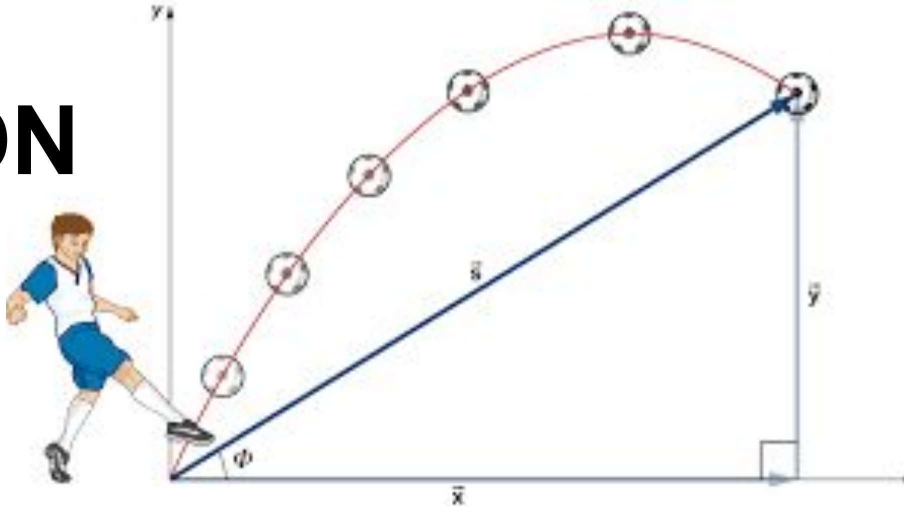
Physics

April 6th, 2020

PROJECTILE MOTION

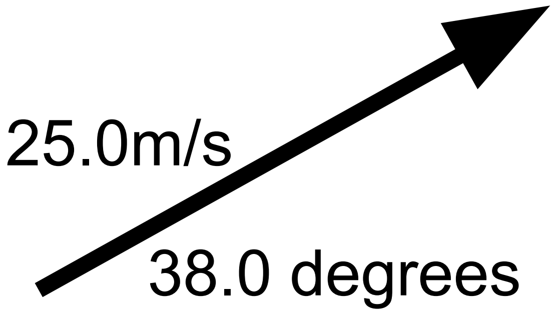


LESSON GOALS

Students will examine objects that are moving in two dimensions, and use kinematic equations to solve basic 2-d problems.

QUICK REVIEW

What are the vertical and horizontal components of the 25.0m/s vector below if it makes a 38.0 degree angle with the horizontal?

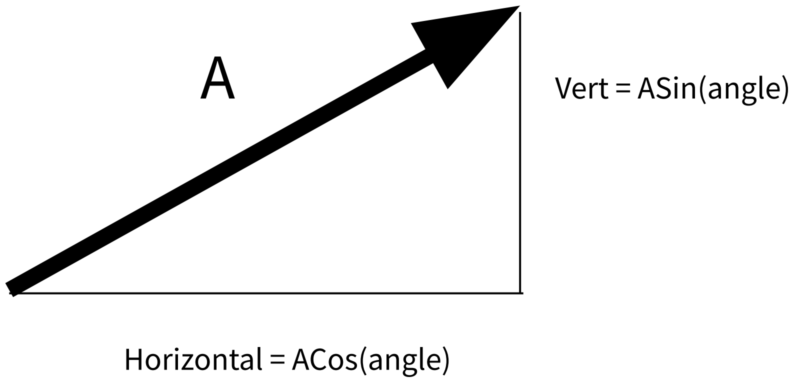


QUICK REVIEW

Solution:

Horizontal = 25.0m/s * Cos38.0 = 19.7m/s

Vertical = 25.0m/s * Sin38.0 = 15.4m/s



Projectile Motion

Link: Projectile Motion

Directions:

- Read through the section on Projectile motion.
- Work through the examples on a separate piece of paper before you scroll down to the solution.
- On a separate piece of paper complete the practice problems on the following slide
- Check your answers.
- For additional practice check out the conceptual questions and the problems and exercises in the table of contents for the online text linked above.

Practice Problems

1) A lacrosse player slings the ball at an angle of 30 degrees above the horizontal with a speed of 20 m/s. How far away should a teammate position herself to catch the ball?
2)
3) Frustrated with HISTORY, (you never get frustrated in physics) you open the second story classroom window and (to the horror of your teacher but to the secret delight of your classmates) violently hurl your history book out the window with a velocity of 18 m/s at an angle of 35 degrees above the horizontal. If the launch point is 6 meters above the ground, how far from the building will the book hit the ground?

Practice Problems Solutions

1)

$\Delta y = 0\text{m}$

$v_{yi} = 10\frac{m}{s}$

$v_x = 17.3\frac{m}{s}$

$a = g = -10\frac{m}{s^2}$

$\Delta t = ?$

$\Delta x = ?$

$$v_x = \cos 30°(20\tfrac{m}{s}) = 17.3\tfrac{m}{s}$$

$$v_{yi} = \sin 30°(20\tfrac{m}{s}) = 10\tfrac{m}{s}$$

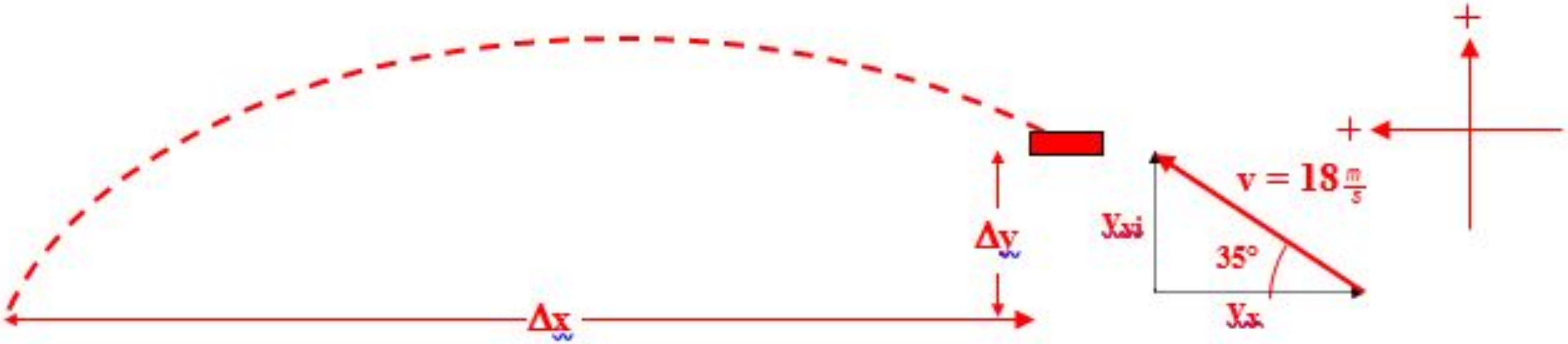
$$\Delta y = v_{yi}\Delta t + \tfrac{1}{2}a\Delta t^2 \Rightarrow 0 = (10\tfrac{m}{s})\Delta t + \tfrac{1}{2}(-10\tfrac{m}{s^2})\Delta t^2$$

$$(5\tfrac{m}{s^2})\Delta t = 10\tfrac{m}{s} \Rightarrow \Delta t = 2.0s$$

$$\Delta x = v_x\Delta t = (17.3\tfrac{m}{s})2.0s = 35\,m$$

Practice Problems Solutions

2)



$\Delta y = -6.0\ \text{m}$

$v_{yi} = 10.3\ \frac{m}{s}$

$v_x = 14.7\ \frac{m}{s}$

$a = g = -10\ \frac{m}{s^2}$

$\Delta t = ?$

$\Delta x = ?$

$$v_x = \cos 35^\circ (18\tfrac{m}{s}) = 14.7\tfrac{m}{s}$$

$$v_{yi} = \sin 35^\circ (18\tfrac{m}{s}) = 10.3\tfrac{m}{s}$$

$$\Delta y = v_{yi}t + \tfrac{1}{2}a\Delta t^2 \Rightarrow -6.0\text{m} = (10.3\tfrac{m}{s})t + \tfrac{1}{2}(-10\tfrac{m}{s^2})t^2$$

$$(-5\tfrac{m}{s^2})t^2 + (10.3\tfrac{m}{s})t + 6.0\text{m} = 0 \text{ (use solver or quadratic) } t = 2.53s$$

$$\Delta x = v_x \Delta t \Rightarrow \Delta x = 14.7\tfrac{m}{s}(2.53s) = 37m$$

Additional Practice

For additional practice check out the conceptual questions and the problems and exercises in the table of contents from the online text linked above.