Projectile Motion Concepts with Diagrams

1. An object is thrown into the air going 80 m/s at an angle of 60°. How high does it go?

   A. Realizing that in the y-direction projectiles are just freefall , fill in the y-direction variables.

   B. Realizing that in the x-direction, projectiles are at constant speed, fill in the x-direction variables.

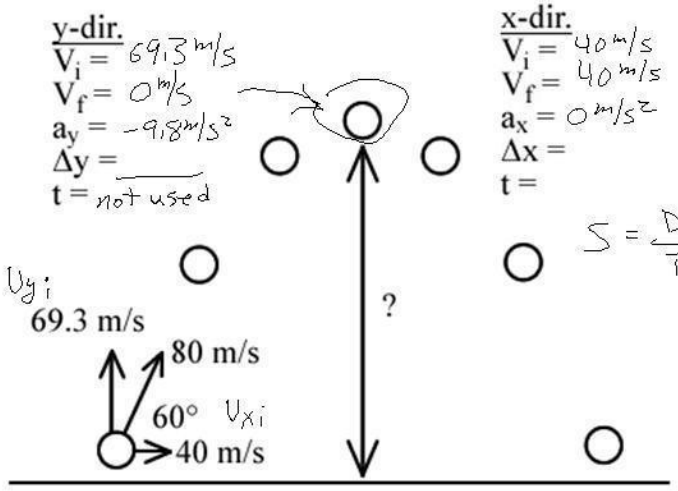
   C. In the y-direction, calculate how high the object goes.

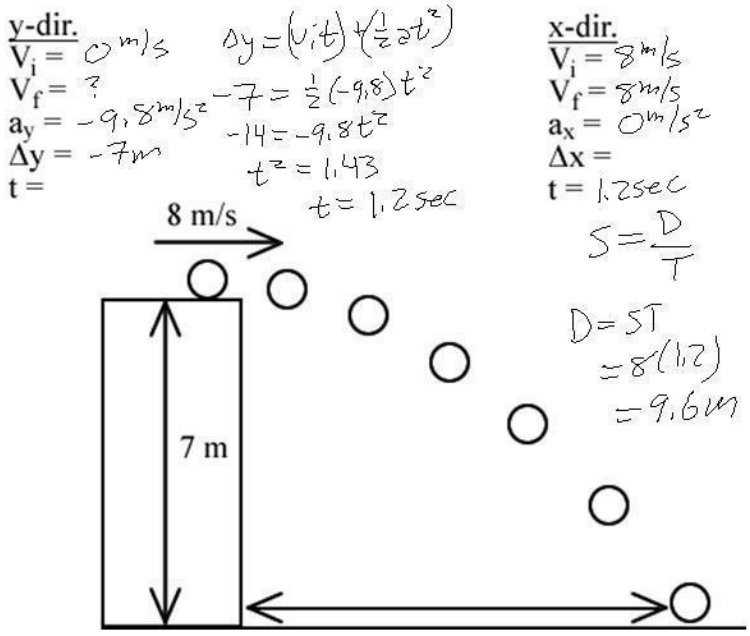
$V_f^2 = V_i^2 + (2a\Delta y)$

$0 = 69.3^2 + (-19.6\Delta y)$ $\quad \Delta y = 245m$

$0 = 4802 - 19.6\Delta y$

$-4802 = -19.6\Delta y$





2. An object is launched horizontally with a speed of 8 m/s.

   A. Since it is launched horizontally, what is the initial y-direction velocity?

   B. What is its initial x-direction velocity?

   C. Again, in the y-direction projectiles are just freefall, fill in the y-direction variables.

   D. In the x-direction, projectiles are at constant speed, fill in the x-direction variables.

   F. In the y-direction, calculate how much time it is in the air before it hits the ground.

   G. In the x-direction (at constant speed), what equation will you use?

   H. Calculate how far away it landed in the x-direction, using the time you just found.

3. An object is shot 80 m/s at an angle of 60° from the ground. How far away does it land?

   A. Fill in the x and y variables for the object.

   B. Calculate how long it was in the air, in the y-direction.

$V_f = V_i + (at)$

$-69.3 = 69.3 - 9.8t$

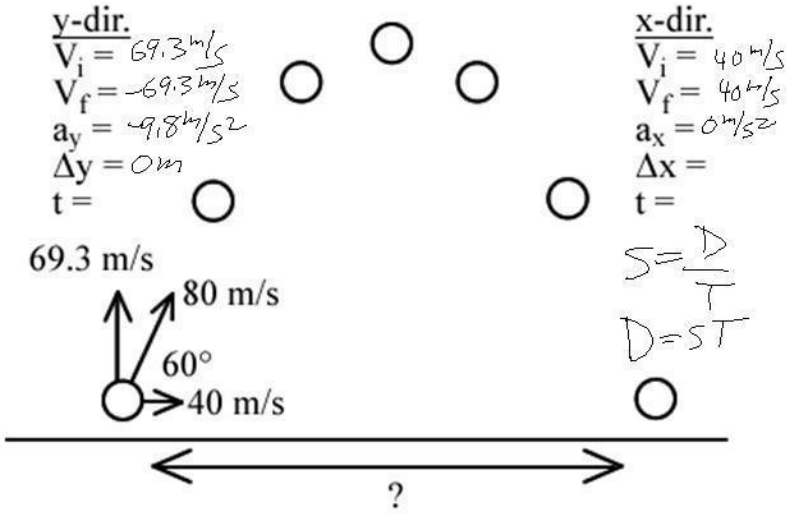
$-138.6 = -9.8t$

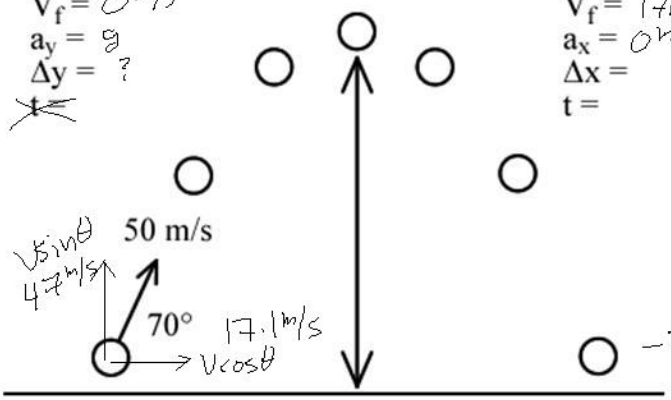
$t = 14.14sec$

   C. In the x-direction (at constant speed), use the time you just calculated to find how far away it landed.

$D = 40(14.14)$

$= 565.6m$





4. An object is shot 50 m/s at an angle of 70°. How high does it go?

A. Use trigonometry to calculate the initial x and y velocities of the object.

B. Fill in the x and y variables.

C. Calculate how high the object rises.

$V_f^2 = V_i^2 + 2a\Delta y$

$0 = 47^2 - 19.6\Delta y$

$-2209 = -19.6\Delta y$

112.7 m

5. An object is launched 15 m/s horizontally.

A. Fill in the variables for the object.

B. Solve for time in the y-direction.

$\Delta y = v_i t + \frac{1}{2}at^2$

$-12 = -4.9t^2$

$2.448979592 = t^2$

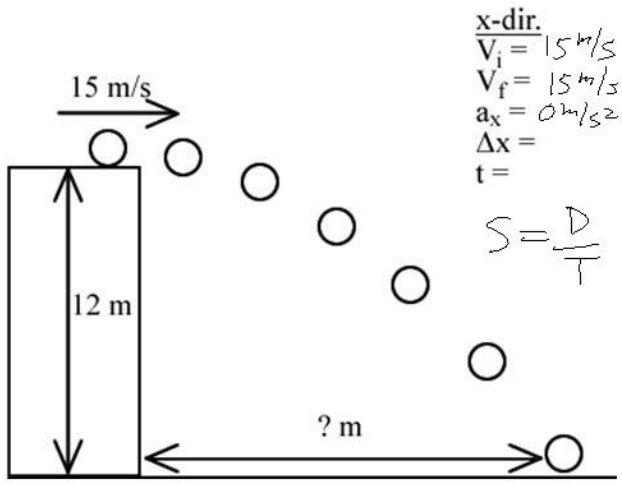
$t = 1.56\text{ sec}$

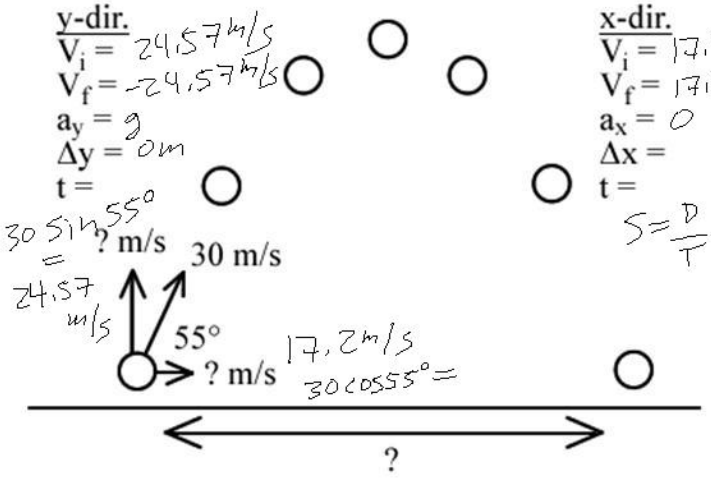
C. Since the x-direction is constant speed, solve for Δx.

$S = \frac{D}{T}$

$D = ST$

$15(1.56) = 23.5\text{ m}$





6. An object is launched from the ground at a speed of 30 m/s at an angle of 55°. If it lands back on the ground, calculate how far it went horizontally.

A. Find the initial x and y velocities from the given speed and direction.

B. Fill in the variables.

C. Calculate time in the y-direction.

$V_f = V_i + at$

$-24.57 = 24.57 - 9.8t$

$-24.57 \quad -24.57$

$\frac{-49.14}{-9.8} = \frac{-9.8t}{-9.8}$

$t = 5\text{ sec}$

D. Calculate Δx.

$S = \frac{D}{T} \quad D = ST$

$D = 5(17.2) = 86.4\text{ m}$