Name: _____

Period: _____

Projectile Motion Concepts with Diagrams

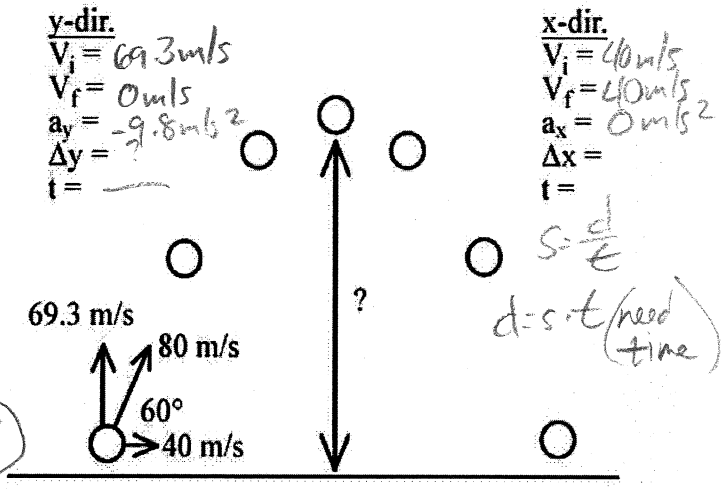
2.6

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.



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

$0m/s = (69.3m/s)^2 + (2 \cdot -9m/s^2 \cdot \Delta y)$

$-4802.49 = -19.6\Delta y$ $\quad \Delta y = 245m$

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? 0m/s

   B. What is its initial x-direction velocity? 8m/s

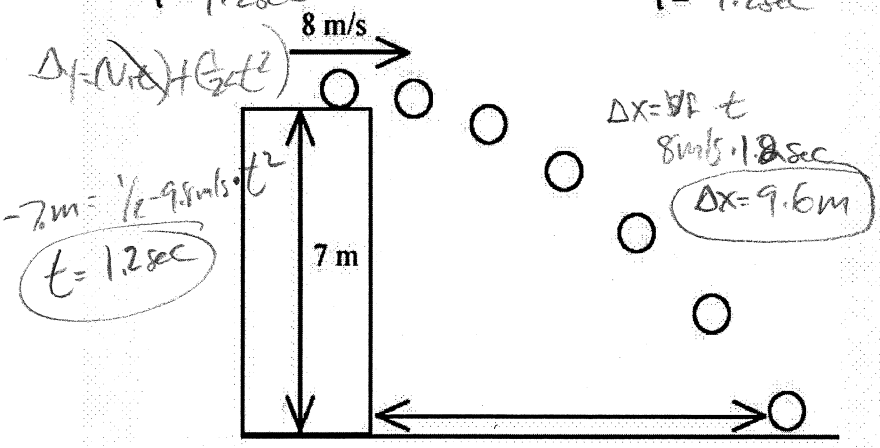
   C. Again, in the y-direction projectiles are just freefall, fill in the y-direction variables.

   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? $v = d/t$ or $d = s \cdot t$

   H. Calculate how far away it landed in the x-direction, using the time you just found. 9.6m



$\Delta y = (V_i t) + (\frac{1}{2} a t^2)$

$-7m = \frac{1}{2} \cdot -9.8m/s \cdot t^2$ $\quad t = 1.25sec$

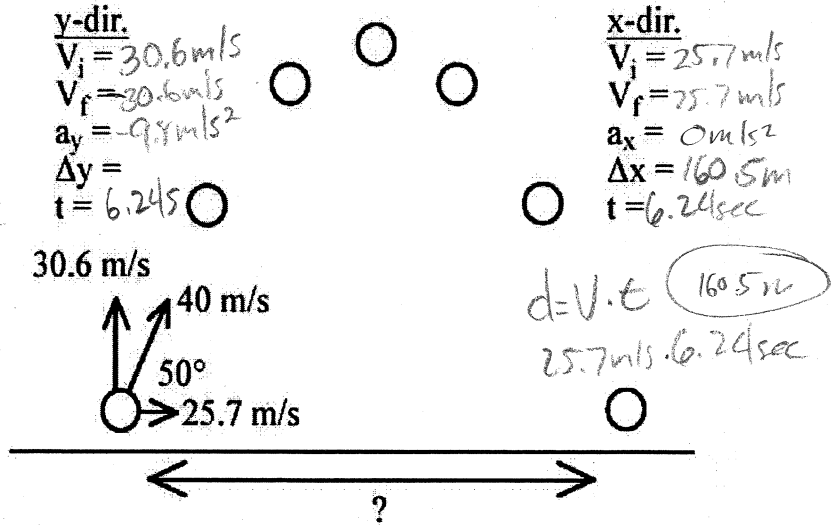
$\Delta x = v \cdot t$

$8m/s \cdot 1.25sec$ $\quad \Delta x = 9.6m$

3. An object is shot 40 m/s at an angle of 50° 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.



$V_f = V_i + (at)$

$-30.6m/s = 30.6m/s + (-9.8m/s^2 \cdot t)$

$-61.2 = -9.8t$ $\quad t = 6.24sec$

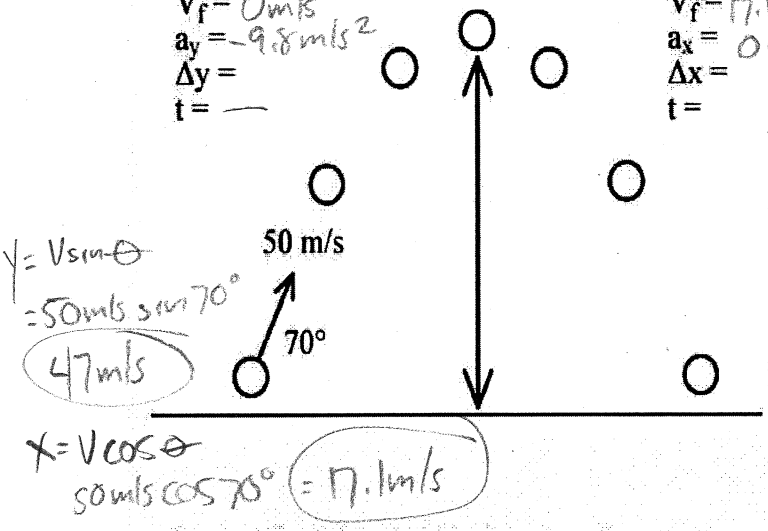
   C. In the x-direction (at constant speed), use the time you just calculated to find how far away it landed.

$d = vt$

$25.7m/s \cdot 6.24sec = 160m$

y-dir.
$V_i = 47 m/s$
$V_f = 0 m/s$
$a_y = -9.8 m/s^2$
$\Delta y =$
$t =$ —

x-dir.
$V_i = 17.1 m/s$
$V_f = 17.1 m/s$
$a_x = 0 m/s^2$
$\Delta x =$
$t =$



$y = V \sin\theta$
$= 50 m/s \sin 70°$
$47 m/s$

$x = V \cos\theta$
$50 m/s \cos 70° = 17.1 m/s$

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.

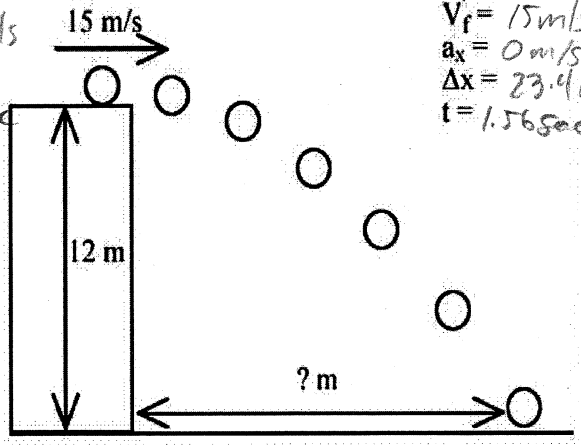
$V_F^2 = V_i^2 + 2a\Delta y$
$(0 m/s)^2 = (47 m/s)^2 + 2(-9.8 m/s^2)\Delta y$
$-2209 = -19.6 \Delta y$
$\Delta y = 112.7 m$

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

A. Fill in the variables for the object.

y-dir.
$V_i = 0 m/s$
$V_f =$
$a_y = -9.8 m/s$
$\Delta y = 12 m$
$t = 1.56 sec$

x-dir.
$V_i = 15 m/s$
$V_f = 15 m/s$
$a_x = 0 m/s^2$
$\Delta x = 23.4 m$
$t = 1.56 sec$



B. Solve for time in the y-direction.

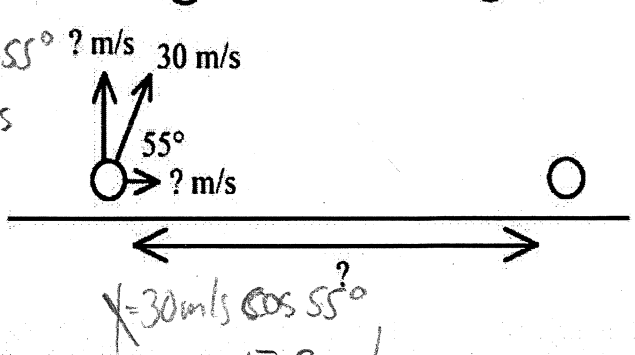
$\Delta y = V_i t + \frac{1}{2} a t^2$
$-12 m = \frac{1}{2}(-9.8 m/s^2) t^2$
$t = 1.56 sec$

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

$\Delta x = S \cdot t = 15 m/s \cdot 1.56 sec = 23.4 m$

y-dir.
$V_i = 24.6 m/s$
$V_f = 0 m/s$
$a_y =$
$\Delta y =$
$t =$

x-dir.
$V_i = 17.2 m/s$
$V_f = 17.2 m/s$
$a_x = 0 m/s$
$\Delta x =$
$t =$



$y = 30 m/s \sin 55°$
$24.6 m/s$

$x = 30 m/s \cos 55°$
$x = 17.2 m/s$

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.

$t_{total} = \left| 2 \frac{V_{iy}}{g} \right| = \left| 2 \frac{24.6 m/s}{-9.8 m/s^2} \right|$ $t = 5 sec$

D. Calculate Δx.

$S = \frac{d}{t}$
$d = S \cdot t$ $17.2 m/s \cdot 5 sec = 86.4 m$