Name _____ Regents Physics
Unit 3: Projectile Motion Mr. Mellon

Unit 3: Projectile Motion Work Packet

I. Horizontal Projectiles

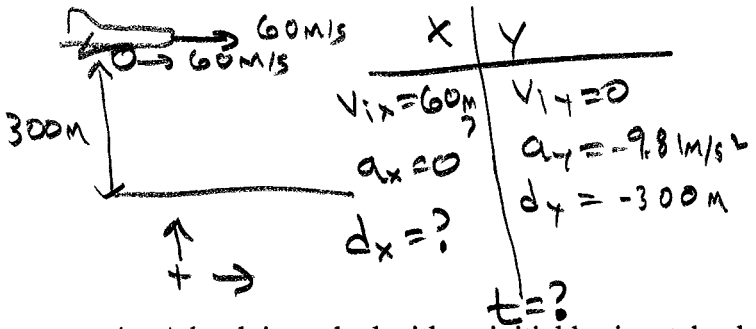
1. An object is dropped from a height of 100 m at the same time that a similar object is fired horizontally from the same height. Disregarding the effects of the atmosphere, do they hit at the same time? **WHY?**

YES, AS THEY BOTH FALL THEY ONLY EXPERIENCE ACCELERATION IN THE VERTICAL DIRECTION. THEREFORE, THEY FALL AT THE SAME RATE & HIT AT THE SAME TIME

2. Describe the horizontal and vertical **velocity** and **acceleration** components of a projectile fired horizontally from the top of a building.

(HORIZONTAL) X	Y (VERTICAL)
V_{ix} = CONSTANT	$V_{iy} = 0$ ← MAGNITUDE ↑ AS IT FALLS
$a_x = 0$	$a_y = -9.81 m/s^2$

3. Suppose that an airplane flying 60 m/s, at a height of 300m, dropped a sack of flour. How far from the point of release would the sack have traveled when it struck the ground? (Hint: Find the time it takes to hit the ground first)



X	Y
$V_{ix} = 60 m/s$	$V_{iy} = 0$
$a_x = 0$	$a_y = -9.8 m/s^2$
$d_x = ?$	$d_y = -300 m$
	$t = ?$

① $d_y = v_{iy}t + \frac{1}{2}a_y t^2$ ($v_{iy} = 0$)

$t = \sqrt{\frac{2d_y}{a_y}} = \sqrt{\frac{2(-300m)}{-9.81 m/s^2}}$

$t = 7.82 s$

② $d_x = v_{ix}t + \frac{1}{2}a_x t^2$ ($a_x = 0$)

$d_x = (60 m/s)(7.82 s) = 469 m$

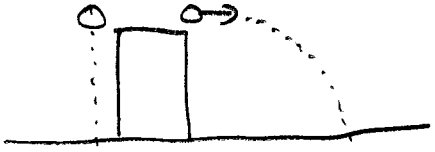
4. A book is pushed with an initial horizontal velocity of 5.0 m/s off the top of a desk. What is the initial **vertical** velocity of the book?

$V_{iy} = 0$

5. A ball is thrown horizontally from the top of a building with an initial velocity of 15 m/s. At the same instant, a second ball is dropped from the top of the building. The two balls have the same:

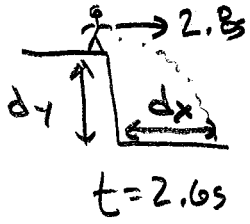
(1) ~~paths they fall~~
(2) final velocity as they reach the ground
(3) initial horizontal velocity
(4) initial vertical velocity

$V_{iy} = 0$



6. You take a running horizontal leap off a high-diving platform. You were running at 2.8 m/s and hit the water 2.6 s later.

A) How high was the platform?



$d_y = ?$ $\quad d_y = v_{iy}t + \frac{1}{2}a_y t^2$ ($v_{iy} = 0$)

$d_y = \frac{1}{2}(-9.81 m/s^2)(2.6s)^2$

$d_y = -33.2m \rightarrow$ **33.2m**

X	Y
$v_{ix} = 2.8 m/s$	$v_{iy} = 0$
$a_x = 0$	$a_y = -9.81 m/s^2$
	$t = 2.6s$

B) What is the vertical speed right before you hit the water?

$v_{fy} = ?$ $\quad v_{fy} = v_{iy} + a_y t$ ($v_{iy} = 0$)

$= (-9.81 m/s^2)(2.6s)$

$v_{fy} = -25.5 m/s$

C) How far away from the platform did you land?

$d_x = ?$ $\quad d_x = v_{ix}t + \frac{1}{2}a_x t^2$ ($a_x = 0$)

$d_x = (2.8 m/s)(2.6s) =$ **7.28 m**

II. Vector Components (Hint: Sketch a triangle and label the sides)

1. A projectile if fired with a velocity of 30 m/s at 60 degrees. Calculate the horizontal and vertical initial speeds.

2. A ball is kicked with a horizontal velocity of 8 m/s and vertical velocity of 4 m/s. Calculate the angle if it was kicked at and initial speed.

3. A cannon is fired at an angle of 35 degrees. If the horizontal component of its initial speed of 180 m/s, calculate the cannon's initial speed.