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?**

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

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)

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?

(Continued on next page)

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 at they reach the ground
(3) initial horizontal velocity
(4) initial vertical velocity

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?

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

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

II. Vector Components

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 was kicked at and initial speed.

(Continued on next page)

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.

4. A pumpkin is launched at an angle of 80 degrees from a cannon. If the vertical component of its initial velocity is 130 m/s, calculate the cannon's initial speed.

5. A projectile is fired with an initial velocity of 120 m/s, at an angle theta above the horizontal. What is the angle theta if the projectile's initial horizontal speed is 55 m/s?

III. Projectiles at an Angle

1. A machine launches a tennis ball at an angle of 45 degrees above the horizontal. The ball has an initial vertical velocity of 9 m/s and an initial horizontal velocity of 9 m/s. The ball reaches its maximum height 0.92 s after its launch. (Neglect air resistance and assume the ball lands at the same height form which it was launched.)

A. Determine the speed of the ball as it leaves the launcher.

B. Determine the horizontal distance traveled by the ball during the ENTIRE time it is in the air.

(Continued on next page)

C. Determine the maximum height of the projectile.

D. Compared to the vertical acceleration of the ball at the time of launch, the vertical acceleration of the ball at elapsed time 0.92 s is (A) less, (B) greater, (C) same

---

2. A small missile is fired with a velocity of 300 m/s at an angle of 30 degrees from the ground. The missile returns to the level ground. (Neglect air resistance).

A) Determine the initial horizontal and initial vertical components of the velocity.

B) Determine the maximum height of the missile above the ground.

C) Determine the horizontal range of the missile.

3. Donia Ryan throws a football with a velocity of 60 m/s at 25 degrees.
   A. Find the horizontal and vertical components of the ball's speed.

   B. Calculate the time it takes to reach the maximum height.

   C. How long is the ball in the air for? (total time in the air).

   D. Calculate the horizontal distance (range) it traveled during the entire flight.

   E. Calculate the maximum height of the football.

   F. Sketch the path of the football as it travels in the air.

   G. What would happen to the following if he threw it at an angle of 70^{o}: (increase, decrease, or remain the same)

   A) initial horizontal speed:

   B) initial vertical speed:

   C) maximum height:

   D) total flight time: