Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_

Lab Projectile Intro

**Goal**: Discover facts about 2D projectile motion

● Optimal angle ●velocity component vectors of projectiles

● acceleration vectors of projectiles

**Simulator:** [PhET, Projectile Motion](file:///C%3A%5CUsers%5CBOSTOS42%5CDownloads%5Cprojectile-motion_en.html)

**Vocabulary**:

* Projectile: An object only interacting with air and gravity. A projectile is experiencing freefall.
* Trajectory: The pathway of a projectile. This will look like a parabola.

Figure 1: Vectors tab

* Range: Maximum horizontal distance of the projectile.

**Directions:**

 **Play**Open up the simulator and play around with ALL the stuff. Take a couple minutes to check out the capabilities of the simulator. Specifically, explore the projectile measuring tool (see figure 2) and how to use it with the pause/play buttons. This allows you to take data at any point along the trajectory. **Vector components**

Figure 2: Measuring tool.

Figure 3: Cannon setup.

1. Go to the “Vectors” tab (see figure 1).
2. Cannon setup: Set up the cannon at ground level (0 m mark) and at a 40o angle as shown in figure 3.
3. Display options: Set the vector display options to **show** components, velocity vectors, and acceleration vectors; turn **off** force vectors and air friction (see figure 4).

Figure 4: Vectors display options.

1. Observe: Fire the cannon (at an initial speed of 16 m/s) and record your **observations** of the vectors. Re-fire the cannon at this position as many times as you need to make your observations. Maybe try using the slow motion setting. Try using the pause/play button too.
	1. How does the **acceleration** vector change throughout the cannonball’s trajectory (use complete sentence)?
		1. Draw the **acceleration** vectors at every dot along the trajectory.
	2. How do the **velocity** vectors change throughout the cannonball’s trajectory?
		1. Describe **horizontal velocity** vectors (vx) (use complete sentence)?:
		2. Draw the vx vectors at every third dot along the trajectory.
		3. Describe **vertical velocity** vectors (vy) (use complete sentence)?:
		4. Draw the vy vectors at every third dot along the trajectory. **Include vector at the top.**

**Data comparing angled launches:**

* Discover how changing the angle changes the trajectory of the projectile.
* For each angle, shoot the cannon (from ground level and with an initial velocity of 16 m/s) and record your data and observations.
* Use the projectile measuring tool to record information about the trajectories.

|  |  |  |  |
| --- | --- | --- | --- |
| Angle (o) | Range (m) | Max height (m) | Time in air (s) |
| 30 |  |  |  |
| 40 |  |  |  |
| 45 |  |  |  |
| 50 |  |  |  |
| 60 |  |  |  |
| 90 |  |  |  |

* Draw the trajectories for each angled cannon shot (don’t include 40o and 50o).



**Summarize**: Formulate 4 big ideas about projectiles based upon this exercise:

1) 3)

2) 4)

**Created by Sean Boston ©**