01-09P Projectile Motion Lab *Name: _____*

Objectives

- Accurately predict where a projectile will land.

Materials

- Safety Glasses
- Mini launcher and marble
- Photogate mounting bracket
- Smart Photogate
- iPad with SPARKvue
- Meterstick

Procedure

1. **SAFETY GLASSES MUST BE WORN THE ENTIRE CLASS PERIOD!!**
2. Set up the photogate and projectile launcher as shown in the picture. Make sure the photogate laser beam is not blocked by the launcher.
    a. Mount the launcher to hole 1 so that hole 3 is in the launcher rail.
    b. Slide the rod stand through the launcher base so that it is secured to the top of the rod stand.
    c. Use one of the thin mounting screws to mount the photogate to the middle hole of the photogate mounting bracket. (You may need to remove a small bracket from the photogate first.)
    d. Attach the photogate mounting bracket to the launcher by sliding the nut end of the bracket down the rail below the barrel end of the launcher. Adjust it so that the photogate is at the end of the barrel.
3. Adjust the launcher until it is between 25° and 30°. Record the angle. θ = _____
4. Aim the launcher away from everyone, but at an open area of floor.
5. Open the SPARKvue app on the iPad and select **Build New Experiment** from the main screen.
    a. Select the top **1 window layout** from the right.
    b. Select the **1.23** to get a display.
    c. Turn on your smartgate and tap the Bluetooth icon in the SPARKvue app. Connect to your smartgate.
    d. Select **Smart Gate Only**.
    e. Select **Smart Gate Timer** from the drop-down menu and tap **OK**. Then tap **Done**.
    f. You should now be back at your screen reading 0.00. In the top right, tap **Select Measurement** and tap **Speed Between Gates**.
6. Load the marble into the launcher pushing it down **1** click.
7. Press Start and fire the marble. Record the speed. This is the initial velocity. Repeat three times and take the average. $v_0 1$= _____, $v_0 2$= _____, $v_0 3$ = _____ v_0AVE = _____
8. Measure the initial height of the marble as it leaves the launcher. h_0 = _____
9. Calculate where the marble should land on the floor when it is fired. x_{theory} = _____
10. Load the marble into the launcher pushing it down **1** click.
11. Fire the marble noting exactly where the marble first lands. Measure this distance. x_{exp} = _____
12. Calculate the percent difference. $\%\ diff = \frac{theoretical - experimental}{theoretical} \times 100\%$ = _____
13. If you pushed the marble 3 clicks into the launcher so that it had a larger initial velocity, would it go *farther*, *not as far*, or the *same distance*? _____
14. What would happen if the angle was smaller? would it go *farther*, *not as far*, or the *same distance*? _____
15. Loosen the mounting screws holding the launcher to its base. Adjust it so that the angle is 15°. Repeat steps 6-12.
    a. v_0 = _____
    b. h_0 = _____
    c. x_{theory} = _____
    d. x_{exp} = _____
    e. % difference = _____
16. Return the equipment to the same condition it was given to you.