Physics 1P Traeger

Tennis Ball Launch: A Good Review of the Principles of Projectile Motion

Name: ______________________________ Period: ______ Date: _______________________

Purpose: To review the concepts of projectile motion in a real-world scenario.

Materials: Water Balloon Launcher, Protractor with string and paperclip plumb bob, Tennis Balls, 30 Meter tape, Safety Glasses, Timer

Procedure:

1. Get in to groups of 6-7. Go outside to the football field, baseball field, or softball field with your tennis balls, water balloon launcher, protractor, 30 meter tape, stop watch, and a pencil. Make sure to select an area for your launch where no one downrange is going to be hit by the launched balls. Also make sure to wear your safety glasses at **all** times.
2. Launch your tennis balls with the same amount of pull back on the launcher each time. You might want to do some initial tests to make sure that your balls do not fly too far. If they do, back off on your pull back. Once you have noted the correct amount of pull back, you will use this same amount for each trial.
3. Launch your tennis balls at 15°, 30°, 45°, 60°, and 75° angles, doing 3 trials for each angle. Record your data in the table below.

Trial	Distance traveled in X direction (meters)	Hang Time (seconds)	Velocity in X Direction (meters/second) Calculate for Average Only
15° Launch 1			-------------------------------
15° Launch 2			-------------------------------
15° Launch 3			-------------------------------
15° Launch Average			
30° Launch 1			-------------------------------
30° Launch 2			-------------------------------
30° Launch 3			-------------------------------
30° Launch Average			
45° Launch 1			-------------------------------
45° Launch 2			-------------------------------
45° Launch 3			-------------------------------
45° Launch Average			
60° Launch 1			-------------------------------
60° Launch 2			-------------------------------
60° Launch 3			-------------------------------
60° Launch Average			
75° Launch 1			-------------------------------
75° Launch 2			-------------------------------
75° Launch 3			-------------------------------
75° Launch Average			

4. Analyze your data. Which launch angle produced the greatest distance? Why is this if you think about vector components in the x and y directions?

5. Analyze your data. Which launch angle produced the greatest hang time? Use your physics equations $x = v_x * t$, $y_f = y_o + v_{oy}*t + ½ * g * t^2$, or $v_{fy} = v_{oy} + g * t$ to find out how **high** the ball went vertically at its greatest launch angle. Show work. Hint: You will need to use some trigonometry to find out the initial velocity in the y direction. The y velocity and the time are needed to calculate the height.

6. Now that you know the magnitude of the y velocity and the magnitude of the x velocity, you can find the velocity that the tennis ball left the launcher at. Show work and calculate the overall velocity of the tennis ball at the greatest launch angle.

7. Provided that you pulled the launcher back equally each time, what was the overall velocity of the tennis ball at each launch angle.

8. Analyze your data to determine a relationship between launch angle and distance. Which angles produced the same horizontal distance of travel? Why is this?

9. Make a drawing below showing the flight of the tennis ball at the greatest launch angle. You should pick 5 positions along the flight to draw a scaled vector diagram showing the x and y components and the resultant vectors of velocity for the flight.

10. How do you think air resistance affected your data? What would the trajectory with air resistance and without air resistance look like? Draw this below.

Conclusion: What did you learn from this lab? What are some possible sources of error in this lab?