Summative Assessment: Piggie Poppers

Purpose: To determine the launch velocity of ball launched by air pressure using two or more different methods and to compare these velocities to determine the accuracy of your methods.

Standard: Systems and System Models

Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales.

Supporting Standards:

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Using Mathematics and Computational Thinking: Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to describe explanations.

Materials

Piggie popper and balls	Wooden wedges (to control launch angle, optional)
Stopwatch	Altitude finder
Measuring wheel	Protractor

1. Collect your data using your plan from the prelab (need to calculate the velocity by at least 2 ways to meet the standard and more than 2 ways to exceed the standard.) Do multiple trials! Must include at least one way with data from ball launched vertically and one from an angle
2. Construct a data sheet. Data should be in a neat, labelled table with correct units and significant figures.
3. Use your data to calculate the vertical and horizontal (where appropriate) components of the velocity of the ball. CLEARLY divide your work into horizontal and vertical components. Label all numbers with the correct variables (i.e. Δx, a, t). Show all equations used.
4. Find the total velocity of the ball. Show all work.

5. Write a conclusion. In words, explain your methods for finding the velocity of the ball. Compare the velocities you got by different methods. Discuss the accuracy of your results including areas of experimental error. Discuss specific ways that the experiment could be improved if done another time.
6. Check your report using the rubric!!!!!!!!!!

Ball Launch	**4 (exceeds)**	**3 (meets)**	**2 (partially meets)**	**1 (does not meet)**
Data	____ Data has correct units and significant figures and is in a neat, labeled table. Labels describe what is being measured. ____Sufficient data (multiple trials and three or more methods) is taken on which to base a conclusion.	____ Data has correct units and is in a neat, labeled table. ____Sufficient data (multiple trials and two methods) is taken on which to base a conclusion.	____ Data is labeled. ____ Enough data is taken to find the velocity of a ball by at least one method.	____ Data is not labeled. ____ Insufficient data is taken to find the velocity of a ball by at least one method.
Analysis	___ Problem is clearly broken into horizontal and vertical components with correct, labeled givens and equations listed for each. ____Total velocity of ball is correctly calculated by more than two methods.	____ Problem is broken into horizontal and vertical components. Givens and equations are shown. ____Total velocity of ball is correctly calculated by two methods (vertically & angle)	____ An attempt is made to divide the problem into horizontal and vertical components. ____ Calculations are partially correct	____ Givens are either not listed or not separated into the horizontal and vertical parts of the problem ____ Calculations are incorrect
Conclusions	____ Gives an insightful written explanation of why the motion of the ball can be analyzed separately by horizontal and vertical components and how the total velocity of the ball was determined. ____ Values of the total velocity are compared and the accuracy of the methods is discussed including areas of experimental error and how the experiment could be improved next time.	____ Gives a correct written explanation of why the motion of the ball can be analyzed separately by horizontal and vertical components. ____ The accuracy of the methods is discussed including areas of experimental error.	____ Gives a partially correct written explanation of the types of motion in the horizontal/vertical directions and/or how the velocity of the ball was determined. ____ Accuracy of the results OR experimental error is discussed.	____ Written explanation of how the velocity of the ball was determined is missing or incorrect. ____ Accuracy and experimental error are not discussed.