Name: _____
Number: _____
Date: ____/____/____

<u>Unit 2: Newtonian Mechanics – Kinematics in Two Dimensions</u>
LAB: Horizontal Range Analysis of Upwardly-Launched Projectiles

Objective: Generate and test a hypothesis predicting the relationship between launch angle and horizontal range for an upwardly-launched projectile. Pro-tip: It is always advisable to do complete the background section before writing your hypothesis.

- State your hypothesis: At a launch height of _____ m the launch angle that should give the maximum horizontal range is _____ m, and the launch angle that should give the maximum vertical range is _____ m.

Background:

When an object travels in a projectile, it has two aspects, or components, to its motion: _____ and _____. These two components are _____ of each other. That is because different physics governs each component.

The gravitational field acts on the _____ component and causes it to _____ at a rate of _____. Therefore the _____ velocity component will _____ on the way up, be _____ at the peak, and _____ on the way down. Hence the displacement vertically _____ each second on the way up and _____ each second on the way down.

There is no field that acts on the _____ component of the projectile's motion. Therefore the _____ velocity component will _____, and the displacement each second will _____.

The result of this physics is that the path a projectile takes, in the absence of significant air resistance, is a _____, and kinematic calculations of the motion of a projectile must use _____ accelerations when analyzing the vertical and horizontal components. However, the net landing velocity can be found by combining the _____ and _____ components using a mathematical process called _____.

Equipment:

- PASCO projectile launcher with photogates
- Meterstick or measuring tape
- Video taken on your phone or the teacher iPad if desired

Procedure: List <u>in logical order</u> the measurements and calculations you must do to predict the horizontal range for any single launch at a generic angle, theta (θ).

Show your work predicting the angle that will give the maximum horizontal range for your projectile setup. Then show the same work for an angle five degrees smaller and the same work for an angle five degrees larger proving that those angles should give a smaller horizontal range. THEN you can fill in your hypothesis statement on page one.

Procedure: State the steps in your procedure.

- Note: Do multiple trials (at least five) for each launch angle. Use the median value for each when reporting your data.

Data:

- Note: Remember to identify the uncertainty of the measurements.

Angle	Predicted Launch Range (m)	Actual Launch Range (m)	Uncertainty of Measurement

Graphical Representation of Data: Create a graph of the data using Excel or Google Sheets and staple it to this lab report.

Conclusion: Answer each of the questions with NO MORE THAN ONE SENTENCE.

- Claim: The hypothesis was _____.
- Evidence:

- Reason that the evidence you cited supports the claim you made:

- Identify sources of possible experimental error.