Formatting: (5pts)

- Names (1pt)
- Date (1pt)
- Lab # (1pt)
- The report is easy to navigate (everything has labels which follow numerical order). (1pt)
- The report is easy to read (example of poor formatting: a graph/table on two pages). (1pt)

Abstract (Remember it is a summary. No bullet points.)**:** **(15pts)**

- Start with the statement on the goal of the lab. **Hint:** *we manipulated the angle at which a projectile is launched and measured the respective range the projectile travels horizontally*. **(5pts)**
- Proceed to the brief description of what was done to achieve the goal of the experiment (see the hint above). Without plagiarizing the instructions and avoiding minute details, briefly explain the setup of the experiment followed by the measurements made in the experiment and calculations that used these measurements. **Example:** *A ball was launched from a spring gun at a set of angles varying from zero to 80 degrees in increments of 10. At each angle, the projectile was fired 3 times from the heigh ____m above the landing surface and the ranges for each of these launches were measured and averaged.* Add how the distance was measured, with what tool, how the landing point was marked. Continue with the explanation on the plotting the collected data as a graph _____ vs. _______ while describing the shape of the graph with special attention to the angle when the range peaked. **(5pts)**
- Conclude the abstract with the statement on the result: was the objective achieved? Make sure to base this statement on the numerical values produced by the experiment. **(5pts)**

Introduction (5pts): Define a projectile and specify physics quantities influencing the motion of a projectile while shaping its trajectory. Emphasize the 2-dimentional nature of the motion resulting in each vector quantity having a horizontal and vertical component.

Procedure (10pts): Describe the experimental set up such that a person unfamiliar with the experiment can reproduce it. Focus on essential parts of the experiment that cannot be omitted:

- What object was used as a projectile and why it can be considered a projectile. (1pt)
- What was used as a launcher and how the consistency in all the launch parameters, but angle was achieved. (2pt)
- How the landing spot was marked, and horizontal displacement of the projectile was measured. (2pt)
- What was done to assure the accuracy of the measurements. (1pt)
- How collected data was analyzed including the calculation of the initial speed of the projectile and plotting two series, experimental and predicted (include the formula use in the prediction). (4pt)

Example: *The average range for the horizontal launch was computed and employed as the horizontal displacement of the projectile. The airborne time of the projectile launched horizontally was calculated by the equation* $t = \sqrt{\frac{2h}{g}}$*. The formula* $\Delta x = V_{ox} * t$*, was re-arranged to solve for* V_{0x}*, where* V_{0x} *of horizontal launch equals to the initial velocity,* V_0*, of the launch.*

Discussion and Conclusion (20pts): Use the numerical values from the Tables and Graph to describe and interpret the experimental results.

1. Describe the outcome of the graphing **(14pts):**
   - What shape predicted and experimental curves display? What trendline?
   - Was the experimental curve closely tracing the predicted curve?
   - If not, were calculated ranges larger or smaller than predicted ranges? Why? Briefly state the uncertainties responsible for this disparity.
   - As the values of the angle increase, what do you observe about the values of the range?
   - Which angle had the greatest range for calculated and for predicted?
   - Which angle had the smallest range for calculated and for predicted?
     Example: *The predicted range had the largest value at the angle ____ while the experimental range crested at the angle of ___. For both experimental and predicted ranges, the optimal angle was ____ . The angle ____had the smallest experimental range, and the angle ___had the smallest predicted range.*
     ______ranges were larger than ______ ranges due to these uncertainties/errors:______, , and _______.

2. Summarize the result of the investigation referring to the purpose of the lab **(6pts):**
   - What did you find about the effect of the angle on the range of the projectile?
   - How reliable your findings are?
   - If you repeat the experiment, what can be done to improve the reliability of the data.

Results: (45pts):

- ✓ Table 1-labled and captioned with appropriate units and significant figures **(10pts):**
- ✓ Table 2- labeled and captioned with appropriate units and significant figures **(15pts):**
- ✓ Graph 1- labeled and captioned with appropriate units (both the experimental range and the predicted range should appear on the same graph) **(20pts):**