<u>**Lab Instructions**</u>

Module Four Lab Activity

Projectile Motion - A Virtual PhET Lab

Objectives

After completing this lab activity, the students should be able to:

- **Conduct the projectile motion lab**
- **Calculate the range and the height of a projectile, released at various angles**
- **Write a lab report**

Lab Report

The lab report must include the following:

- **Title**
- **Introduction**
- **Experimental Details or Theoretical Analysis**
- **Results**
- **Discussion**
- **Conclusions and Summary**
- **References**

Please visit the following website to learn more about lab reports:

http://course1.winona.edu/mengen/Chemistry%20320/Lab/ACS%20Report%20Format.htm

An example of a lab report is given on the following website:

http://www.professorkshow.com/sample.html

Lab Activity

Please follow the steps given below to conduct the experiment:

- This lab requires you to produce a lab report to **'Determine the height and the range of a projectile."** This is the **"Title"** of your lab report.
- Read the relevant chapter on projectile motions and add an **"Introduction."**

You conduct this lab by connecting to the PhET website by clicking on the link given below (or where applicable through the embedded simulation on the lab page):

Projectile Motion (colorado.edu)

Attribution:

PhET Interactive Simulations
University of Colorado Boulder
https://phet.colorado.edu

(If you cannot use the above simulation or cannot get to the website by clicking on the link, please copy and paste the link into your browser. If the simulation is not running, please check if you have the latest Java, Adobe Flash, or HTML5 software [depending on the simulated lab]. If you download the relevant software and attempt to run the simulation and it is still not working, please call the IT helpdesk. It also could be that your computer does not have sufficient space to run the simulation. Please check all the possibilities).

- After you open the simulation site, select, “lab” part of the simulation. Then, once you open the simulation site, move the “Cannon” to the desired angle as per the given values in the lab scenario section. Then select the “initial speed” to the desired value as per the given values as well. You will notice that these values are shown on the top right side of the simulation.
- Now select “Cannonball” as the projectile from the dropdown menu at the top right (below initial value). Select the “Mass” as 20kg, “Diameter” as 0.50 m, and “Gravity” s 9.81 m/s^2. Do not select “Air Resistance.” We will conduct the experiment without any air resistance.
- Now, click on the red button at the bottom that will release the projectile. Measure the range reached and the height of the parabolic pathway of the projectile using the “measuring tape” at the top right side of the simulation page.
- This information constitutes the **“Experimental Details”** section of the lab report. You must keep a record of the all the values as **experimental values** for the scenarios given below. These values form part of the **“Results”** section of the lab report. Now, complete the theoretical calculations of necessary values for each scenario using relevant equations. These calculated values also form the **“Results”** section of the lab report.
- Please watch the following YouTube videos for more information:

Introduction to Projectile Motion - Formulas and Equations - YouTube

- Now, you can complete the **“Discussion”** section of your lab report by comparing the values and discussing any differences in the theoretical and experimental values and any other information relevant to the experiment.
- Complete the lab report by adding a summary to the “**Conclusion**” section of your lab report.
- Submit the lab report to the relevant Canvas Dropbox

Lab Scenarios

1. The angle of the projectile - 45^0. The initial speed 20m/s.
2. The angle of the projectile - 60^0. The initial speed 20 m/s.
3. The angle of the projectile – 30^0. The initial speed 20 m/s.

Compare the “range” values for experimental scenario 2 and 3. How would you explain these values with your theoretical knowledge.