PHY111

Lab Assignment: 02

Projectile Motion in 2D Plane

PART A: Online Lab Resources

Simulation Resource

We will be doing the simulation using the PhET interactive simulation project. Follow the link below for projectile simulation:

https://phet.colorado.edu/en/simulation/projectile-motion

Graph Plotting Resource

You may plot graph using any of the two software, Desmos(Online) and Graph(Offline), the link for these two graph-plotting software are given below:

Desmos

Desmos is an online suite of math software tools, including the renowned Desmos Graphing Calculator and Scientific Calculator. You will be using the Graphing Calculator resource of Desmos. It is accessible from the following link: https://www.desmos.com/calculator

You may follow the given link as a tutorial for plotting in ***Desmos*** :

https://www.youtube.com/watch?v=-lIUNWVKnUY

Graph

Graph is an offline open source application used to draw mathematical graphs in a coordinate system. This application needs to be downloaded and installed in your PC, then you may use it offline at any time. You may download the application from the following link:
https://www.padowan.dk/download/

You may follow the given tutorial links for using the ***Graph*** software:

How to install graph software: https://youtu.be/e19JqLJMx3A

How to draw a curve using graph software: https://youtu.be/QBkdzU_8vVo

How to calculate the slope of a line using graph software: https://youtu.be/z4cMiUFu5j8

Lab Tutorial

The detailed instruction for the lab is written below. However, you may see this tutorial video for this experiment: **https://youtu.be/5WkdwRPQ-YU**

PART B: Purpose and Procedure

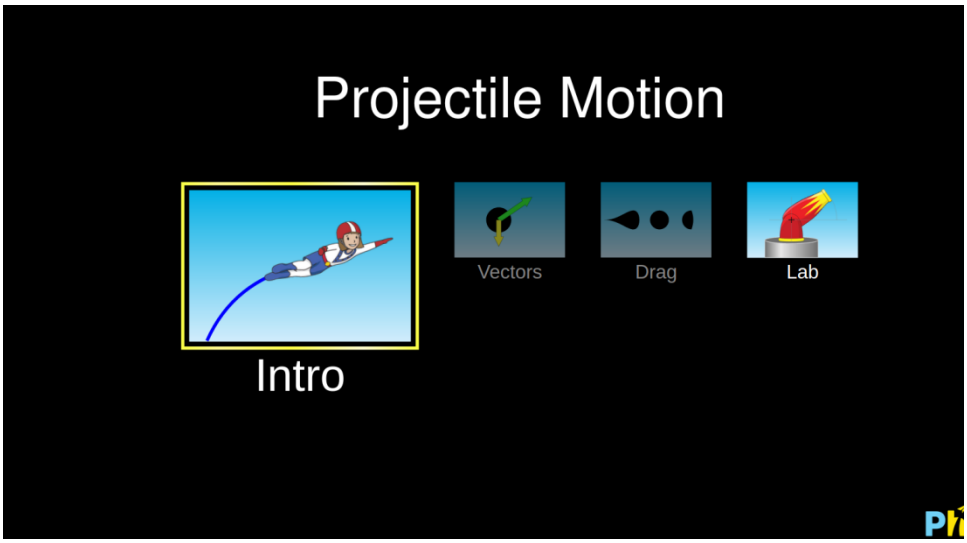
Purpose

The purpose of this experiment is to accustom you to projectile motion and its variables which includes

- drawing motion diagrams for a projectile
- investigating how range, maximum height and flight time of a projectile changes with the launch angle

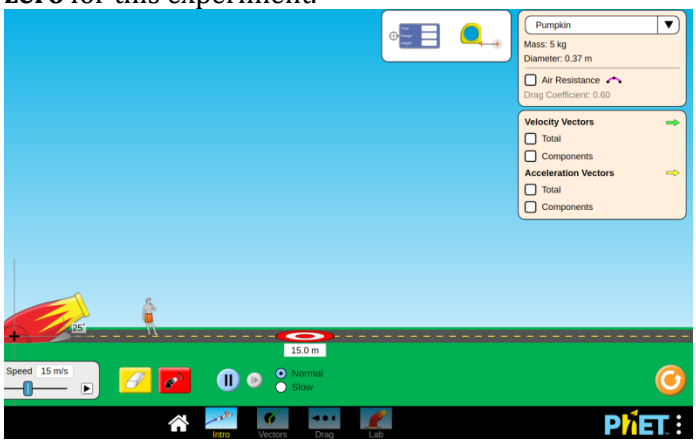
Procedure

1. Go to the ***Phet simulation*** site using the following link: https://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_en.html



2. Use the **Intro** screen for this experiment. We are going to test how launching angle affects the landing location of a projectile.

3. By default, the height of the launching pad is 10 m**. Set this height to zero.** Air resistance will remain **zero** for this experiment.



4. Set **initial speed** to **15 m/s**.
5. For constant values of initial speed (15 m/s), fire the projectile for **8 different** angles (**25, 35, 45, 55, 65, 75, 85, 90** degrees).
6. Using the **Time, Height and Range** tool, collect data in the data **Table-1**.

Launch Speed v_x(m/s)	Launch Angle θ (degrees)	Range R (m)	Flight Time T_f(s)	Max. Height H (m)	Time taken to reach Max. Height T_h(s)
15	25				
15	35				
15	45				
15	55				
15	65				
15	75				
15	85				
15	90				

You may download and fill out the **Data Table_Lab2** file or draw an exact neat table in your copy, write down the values there and take an image
Take screenshot or picture of your table name it as ID_Table_Lab2 (21115002_Table_Lab2)

7. Based on your data from **Table-1:** plot R vs θ graph using any software you like (specified softwares are recommended).
Take screenshot of your graph, name it as ID_Graph_Lab2 (21115002_Graph_Lab2)

PART C: Question and Answer

Answer the following questions using a single sentence:

1. For which angle is the height H of the projectile maximum?

2. Determine maximum Range from R vs θ graph (Insert the graph here). For which angle is the range R of the projectile greatest? (Well, this one cannot be answered in a single sentence in case you're wondering)

3. For which angle is the flight time T_f of the projectile greatest?

4. Will the angle at which the projectile has the maximum height change with velocity? (Play with the simulation and find the answer if you cannot answer it theoretically)

5. Will the mass of the projectile have any effect on the maximum height reached, provided the initial velocity remains constant?