Lab Assignment: 02

Projectile Motion In 2D Plane

Resources:

Link for online lab:

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

List and link for the graph-plotting softwares:

- Desmos (Online): **Link for the "Desmos" software**
- Graph (Offline): **Link for the "Graph" software**

Tutorials:

- Tutorial link for plotting in ***Desmos*** :

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

- Tutorials link for the ***Graph*** :

  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

Video-link (Experiment #1):

https://www.youtube.com/watch?v=EzgBILY_oMc

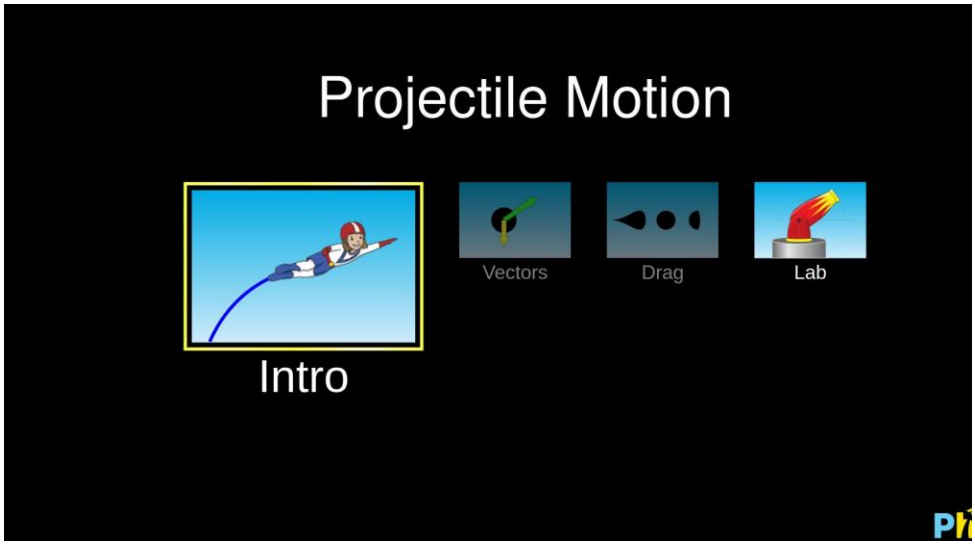
Purpose:

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

Procedure:

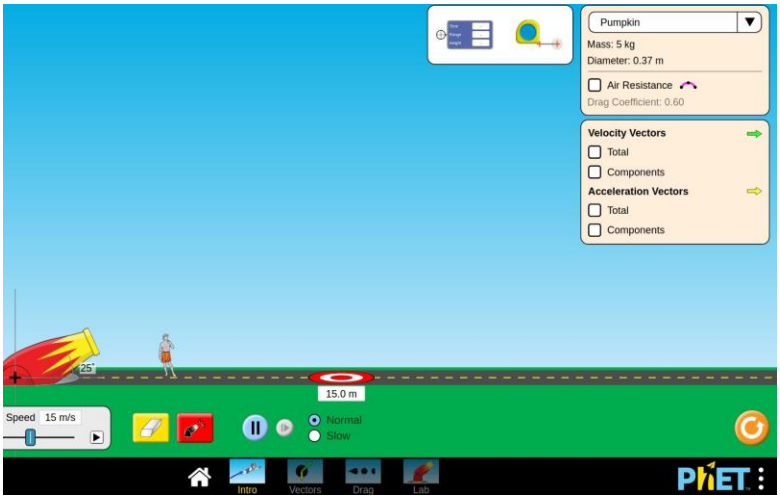
1. Go to the ***Phet simulation*** site using the following link.

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**.

7. Based on your data from **Table-1:** plot R vs θ graph using any software you like (specified softwares is recommended). **You must write your ID in each of your graphs.**

8. Submit your lab report using the following submission form.

Submission Form

Fill up the following slots with appropriate content. You must submit the content of this document from this page only.

- Your Name : Papon Sarkar
- Your ID: 22101760
- Your Section : 16
- Experiment No: 2
- Experiment Title: Projectile Motion in 2D Plane

Table-1 :

Measure the following quantities:

R - Range (at the location where projectile hits the ground)

$\mathbf{T_f}$ - Flight Time (at the location where projectile hits the ground)

H - Maximum Height (at the peak of the projectile)

$\mathbf{T_h}$- Time at Max Height (at the peak of the projectile)

Launch Speed v_x (m/s)	LaunchAngle θ (degrees)	Range R (m)	Flight Time T_f (s)	Max. Height H (m)	Time taken to reach Max. Height T_h (s)	sin θ	$\sin^2\theta$	sin 2θ
15	25	17.57	1.29	2.05	0.65	0.42	0.18	0.77
15	35	21.55	1.75	3.77	0.88	0.57	0.33	0.94
15	45	22.94	2.16	5.73	1.08	0.71	0.5	1.0
15	55	21.55	2.51	7.69	1.25	0.82	0.67	0.94
15	65	17.57	2.77	9.42	1.39	0.91	0.82	0.77
15	75	11.47	2.95	10.7	1.49	0.97	0.93	0.5
15	85	3.98	3.05	11.38	1.52	0.99	0.99	0.17
15	90	0.00	3.06	11.47	1.53	1.0	1.0	0.00

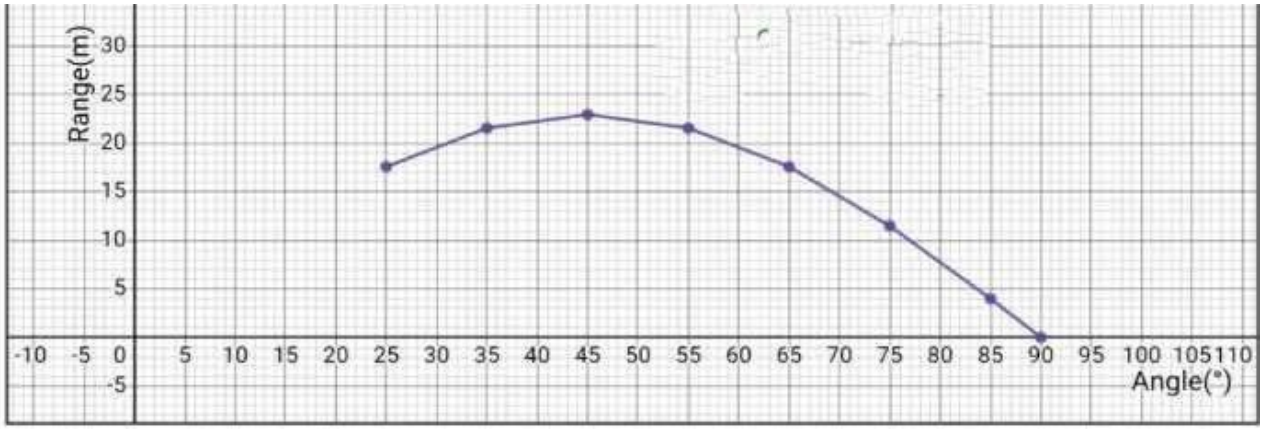
Answer the following questions using ONE sentence:

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

Answer: For the angle 90°, the height H of the projectile is 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)

Answer: From the graph, the maximum range is 23 m. For the angle 45°, the range R of the projectile is greatest.



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

Answer: For the angle 90°, the flight time Tf of the projectile is greatest.

4. Will the angle at which the projectile has the maximum height change with velocity?

Answer: No, the angle at which the projectile has the maximum height which is 90°, will not change with velocity

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

Answer: No, as the maximum height doesn't depend on the mass of the projectile, it won't have any effect on the maximum height reached, provided the initial velocity remains constant.