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Class: Physics 1
Period: 2
Group #:
Lab # and Title: # – Projectile Motion

AP PHYSICS I

Lab: Parabolic Motion – Can You Hit the Target?

Purpose

The purpose of this lab is to bridge a relationship between an angle of elevation/depression to an effective launch distance of a projectile.

Procedure

Adjust the angle of the marble launcher and record the horizontal displacement in which the marble travels.

Data

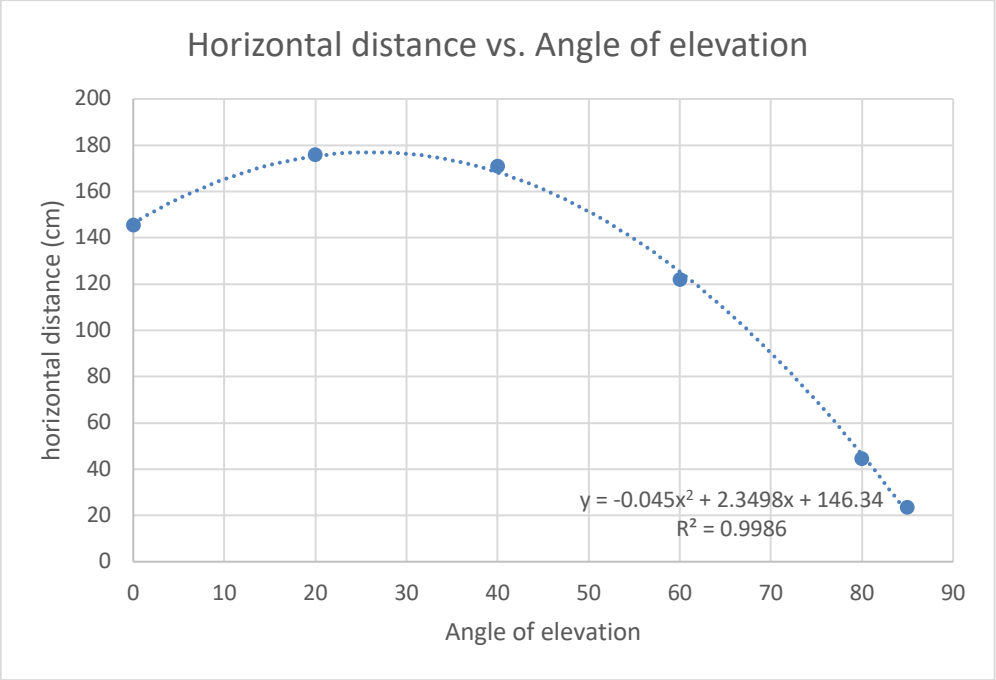
Launching Height: 97cm

		Trials		
Runs	**Angle**	**Range**		**Average Range**
1	**0°**	**135cm**	**156cm**	**145.5 cm**
2	**20°**	**172 cm**	**180 cm**	**176cm**
3	**40°**	**170 cm**	**172cm**	**171cm**
4	**60°**	**126cm**	**118cm**	**122cm**
5	**80°**	**44cm**	**45cm**	**44.5cm**
6	**85°**	**27cm**	**20cm**	**23.5cm**

Only use positive angles of elevation.

Analysis

Enter your average data values into the graph below. Label the axes to the appropriate variables with the approximate units (y-axis = Horizontal Distance, x-axis = angle of elevation/depression). Record the appropriate equation below to make later predictions.

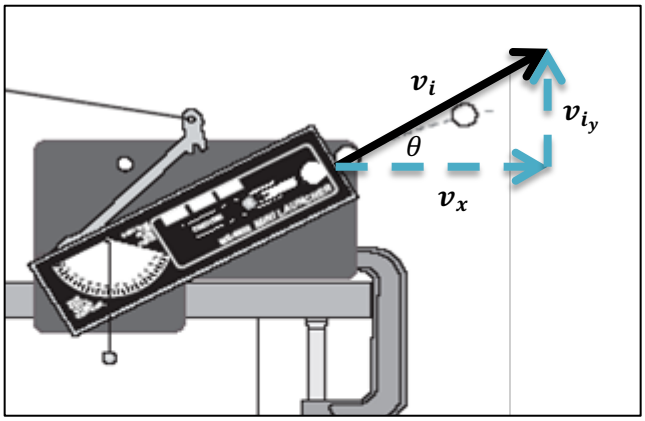


Conclusion

What did you discover? What happens with the horizontal displacement reached as the angle is changed?

Generally, as the angle of the launcher increased, the horizontal displacement decreased as the metal ball started to resemble a free fall rather than a projectile motion.

Putting your data to the test!



Note: The x-directional motion is reliant on constant velocity ideas and the y-directional motion is reliant on free fall acceleration ideas.

$$\theta = launch\ angle$$
$$v_x = v_i \cos\theta$$
$$v_{i_y} = v_i \sin\theta$$

Therefore,

$$\Delta x = v_x t \quad \rightarrow \quad v_i \cos\theta \cdot t$$
$$\Delta y = v_{i_y} t + \frac{1}{2} g t^2 \quad \rightarrow \quad \Delta y = v_i \sin\theta \cdot t + \frac{1}{2} g t^2$$

Leave v

1. Using the equations above and your data, what is the calculated time spent of the marble in the air at a launch angle of $\theta = 0°$?

2. Using the equations above and the time calculated in #1, what is the initial velocity v_i of the marble as it is launched?

3. What angle did your launcher reach a maximum horizontal displacement?

4. Mr. Shah is going to place a target which is _____ meters away from your launcher. Using your created equation from the Analysis portion, Make an interpolation/extrapolation as to what angle you should launch the marble with to achieve this distance.