PROJECT REPORT

TREBUCHET

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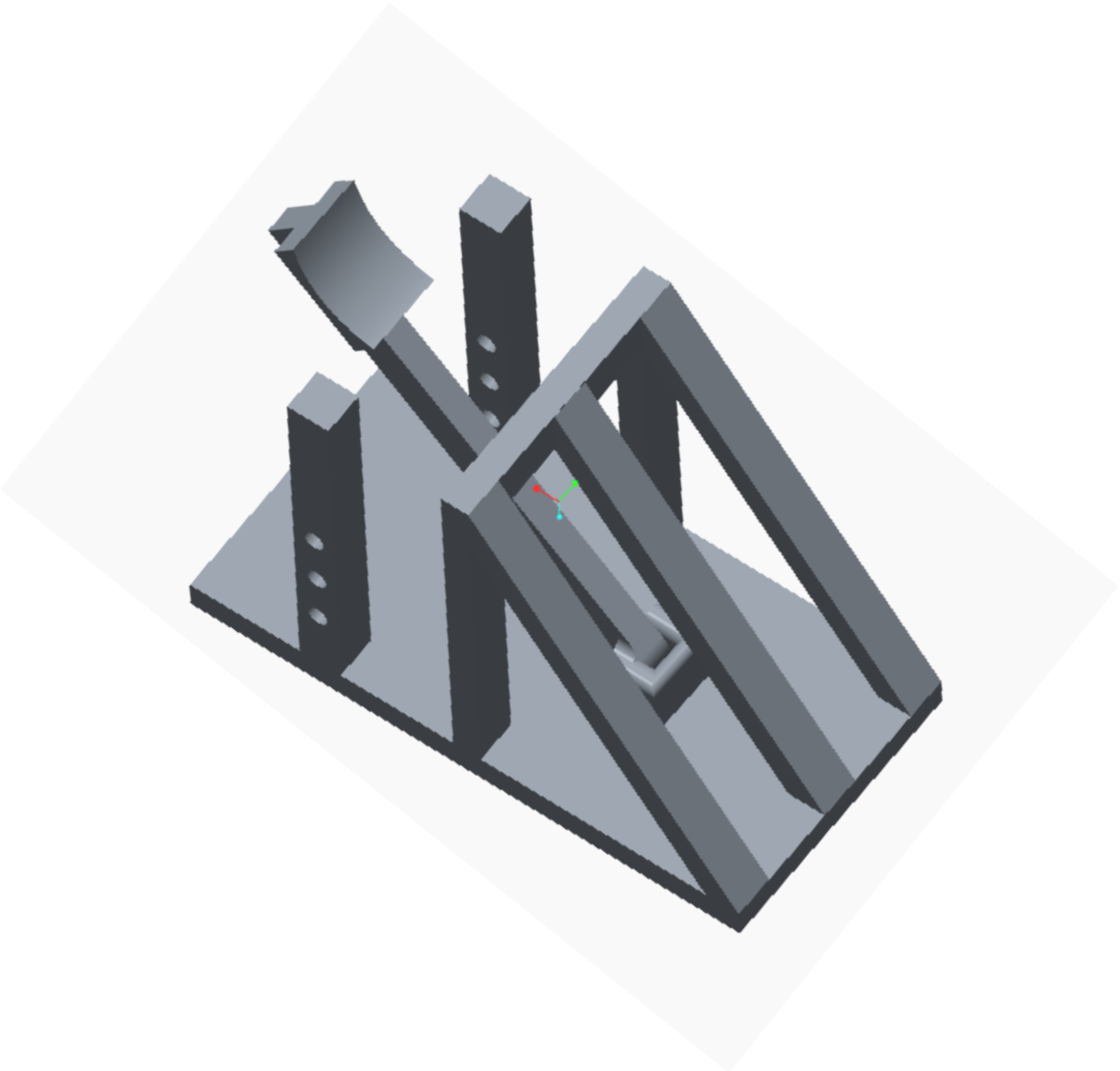
Trebuchet

Description:

The mechanism works in such a way that it uses a spring that throws an object mounted on an arm, at some distance. The arm is fixed at one end and is given only one degree of freedom. It is locked at a three specific points with three different levels of compression of the spring that in return give us three different trajectories. Our purpose is to calculate and measure those trajectories.

Diagram:



Calculations and Formulae:

Spring constant “k”?

Initial velocity “Vi”?

Final velocity “Vf”?

Height “h”?

Range “R”?

Time of flight “t”?

Angle theta? I.e. angle of projection.

$$\text{Horizontal distance, } x = V_x t$$

$$\text{Horizontal Velocity, } V_x = V_{xo}$$

$$\text{Vertical distance, } y = V_{yo} t - \frac{1}{2} g t^2$$

$$\text{Vertical Velocity, } V_y = V_{yo} - gt$$

Where:

Vx is velocity along x-axis i.e. VoCosϴ.

Vxo is the initial velocity along x-axis.

Vyo is the initial velocity along y-axis.

Vy is the velocity along y-axis i.e. VoSinϴ.

g is the acceleration due to gravity.

*Simple 1st and 2nd equation of motion are reshaped.

$$\text{Time of flight, } t = \frac{2v_0 \sin\theta}{g}$$

$$\text{Maximum height reached, } H = \frac{v_0^2 \sin^2\theta}{2g}$$

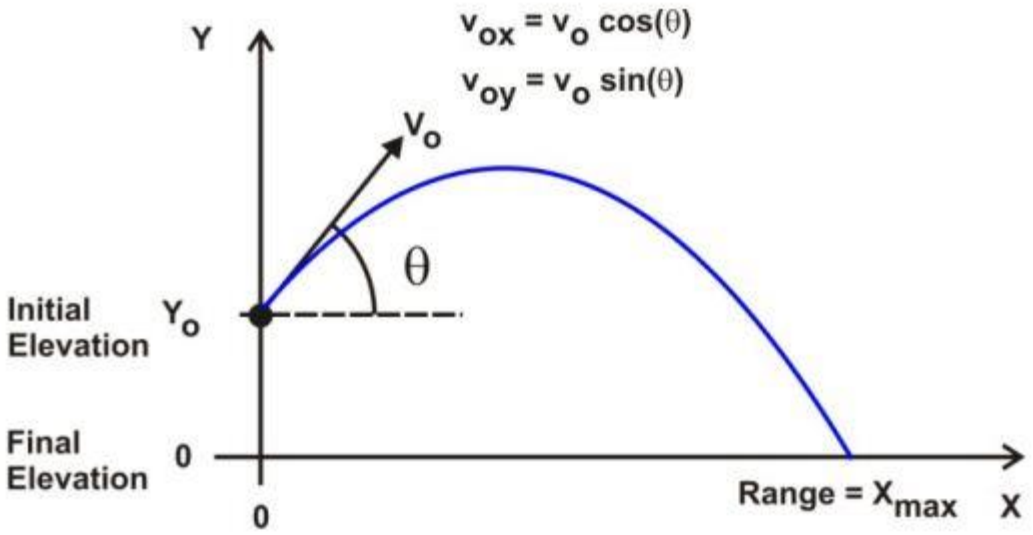
$$\text{Horizontal range, } R = \frac{v_0^2 \sin 2\theta}{g}$$

Vo is the initial velocity.

Sinϴ is component along y-axis.

Cosϴ is the component along x-axis.

Our mechanism will have a graphical representation like this where we have a certain initial elevation and the object falls to the ground i.e. lower than the initial height.



As we have an elevation at the start so the equation for distance along y-axis changes. The initial height Yo is added to it.

Observations:

S.No	1	2	3
Initial velocity			
Final velocity			
Initial height			
Time of flight			
Range			
Height of flight			
Angle (Θ)			