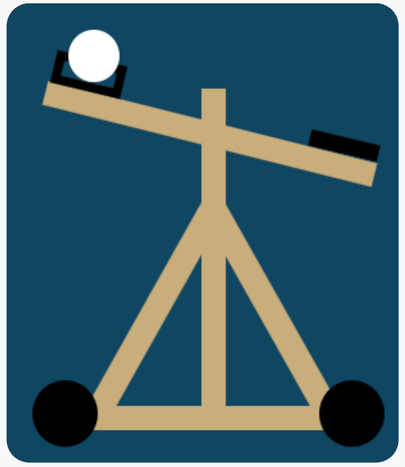
Simple Trebuchet



Equation for Total Inertia of The System

$$I_{total} = \left(\frac{1}{3}m_{arm} + m_{mass} + m_{projectile}\right)r^2$$

Equations utilized in Conservation of Energy

$$E_i = mg\Delta h$$

$$E_f = \frac{1}{2}I_{total}\left(\frac{v}{r}\right)^2$$

Relevant Equations

Equation for V (Velocity of ball)

$$v = \sqrt{\frac{\left(2mg\left(\sin\left(\theta_1\right)\right) + \left(\sin\left(\theta_2\right)\right)r\right)}{\frac{1}{12}m_2(2r)^2 + m(r)^2 + m_b(r)^2}}$$

Equation for X (Distance covered by ball)

$$x = \left(\cos\left(\theta_3\right)v\right)\left(\frac{\sin\left(\theta_3\right)v}{g} + \sqrt{\frac{2H_ig + 2\left(\sin\left(\theta_3\right)vg\right) - \left(v\sin\left(\theta_3\right)\right)^2}{g^2}}\right)$$

How equations were derived:

Through the use of principles such as Conservation of Energy, Inertia and Torque , and Energy of Rotating Systems, these equations calculating distance, velocity, and much more were able to be derived