Conservation of energy

mass · gravity · height

Potential energy (PE) = MGH

Kinetic energy (KE) = $\frac{1}{2}m(V^2)$ → $\frac{1}{2}$ mass (velocity^2)

Mechanical energy (E) = $KE + PE$

Momentum $(\vec{P})$ = $M \times \vec{V}$ mass · velocity

Law of conservation = PTotal BEFOR collision = PTotal AFTER collision

$$\%difference = \frac{p_{before} - p_{after}}{p_{before}} x100\%$$

Conservation of momentum

Measurements and errors

Radius (r) = $\frac{d}{2}$ ← diameter (you get it from the Vernier)

Density (d) = $\frac{\text{Mass}}{\text{Volume}}$

Volume of rectangle = length x width x height

Volume of sphere = $\frac{4}{3}\pi r^3$ Volume of a cylinder = $\pi r^2 h$

The weird "u" is coefficient of friction

$$\mu_s = \frac{f_s}{N} \qquad \mu_k = \frac{f_k}{N}$$

Static Kinetic

Frictional forces

Newtons Law

Use Pasco program to find the slope

$\Sigma\vec{F} = m\vec{a}$ → Reformat to find $\vec{a}$: $\vec{a} = \frac{\Sigma\vec{F}}{m}$

$\Sigma\vec{F}$ ↓ force; m ↓ mass · $\vec{a}$ ↓ acceleration

Projectiles

$V_i = d / t_{gates}$ (m/s)

d ↓ distance between the 2 Photo gates (middle to middle)

t gates is the time(s)

R measured is the distance between the launcher and where the ball hit

h is projectile launchers height

Graph R measured and R calculated

$t_{flight} = \sqrt{\frac{2h}{g}}$ (sec)

$R_{calculated} = V_i\sqrt{\frac{2h}{g}}$ (m) ← FOR ZERO LAUNCH

$\frac{V_i}{g}\sin(2\theta)$ ← FOR GENERAL LAUNCH

Free fall

$Y_i = h$ $Y_f = 0$

$g = \frac{2}{slope}$

$\Delta Y = V_i t - \frac{1}{2}gt^2$ note $V_i = 0$

To calculate the slope graph it first and pick 2 random points

Thermal expansion

Projectiles

because $V_{iy} = 0$

$$\Delta y = V_{iy} \cdot t + \frac{1}{2}(gt^2) \longrightarrow \frac{1}{2}(g \cdot t^2)$$

$$Y_f = Y_i + V_{iy} t + \frac{1}{2}(gt^2)$$

note $V_{iy} = 0$

→ 0 because it will touch the floor

$\Delta y = yf - yi = 0 - h$

↳ height

acceleration $\begin{cases} ay = -g \\ ax = 0 \end{cases}$

$$\text{time } (t) = \sqrt{2\frac{h}{g}}$$