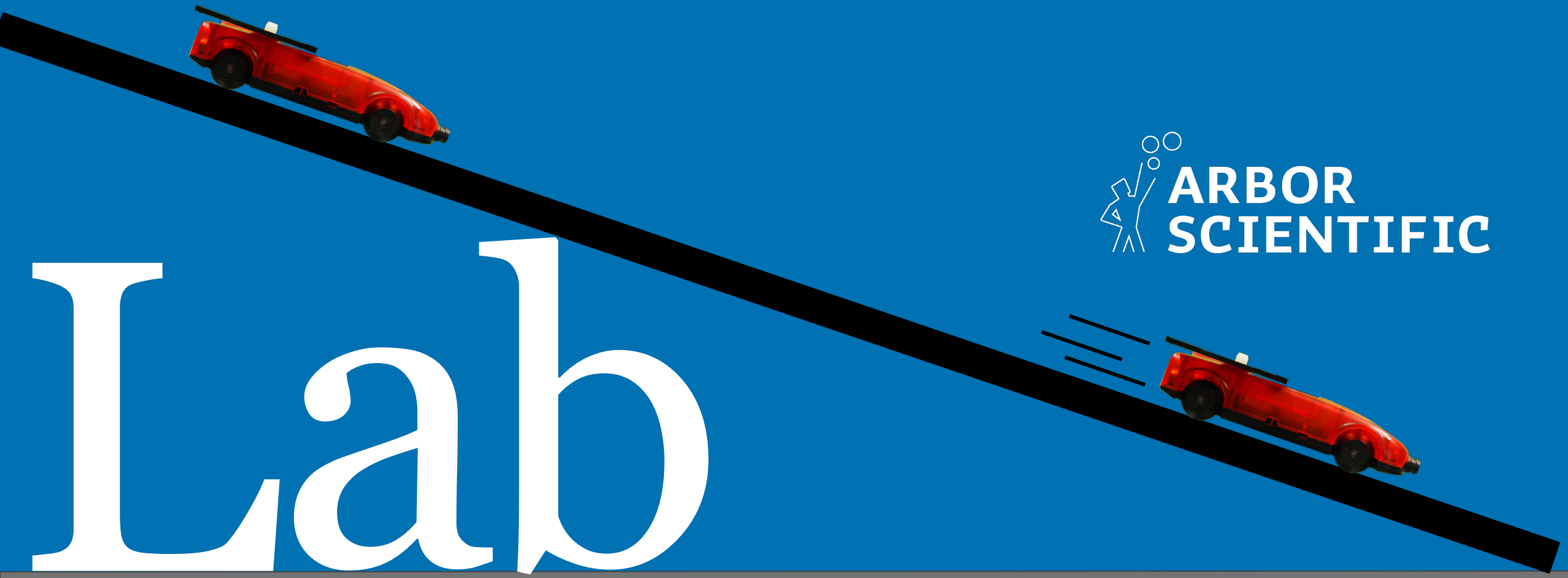
Kinetic Energy Lab



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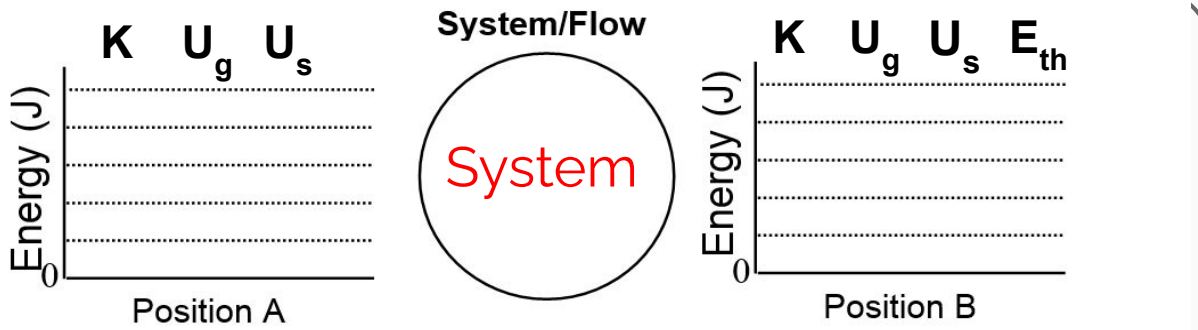
Tools to Solve Quantitative



Energy Conservation Equation

$$\Delta U_g = mg\Delta y$$

$$U_s = \tfrac{1}{2}k(\Delta x)^2$$

$$\Delta E = W = F_{\parallel} d = Fd\cos\theta$$

Energy Problems

$$K = ?$$

Title: Kinetic Energy Lab

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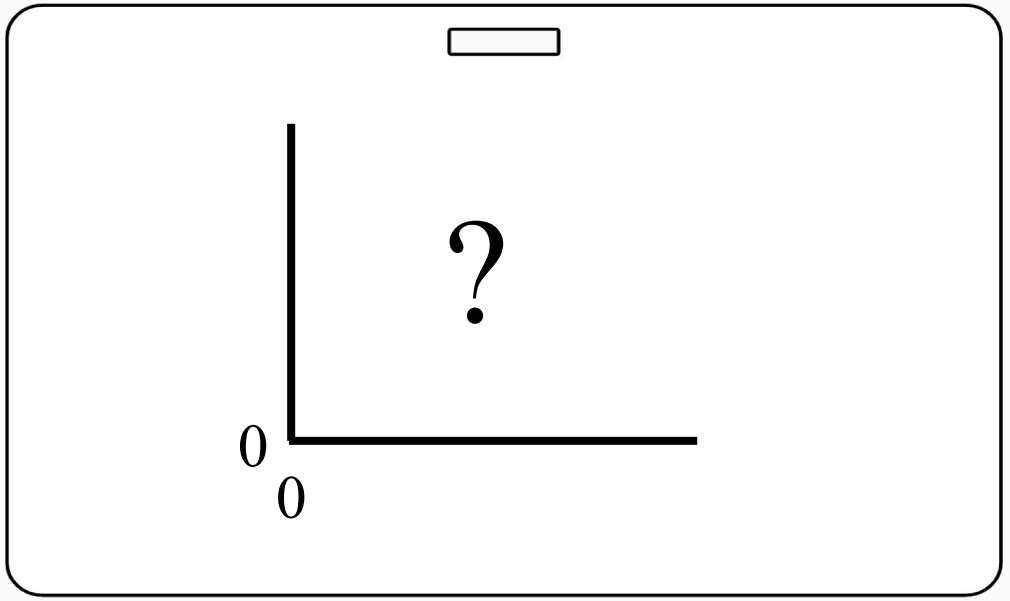
Purpose: To determine the relationship between the...

Data:

...	...



Title: Kinetic Energy Lab

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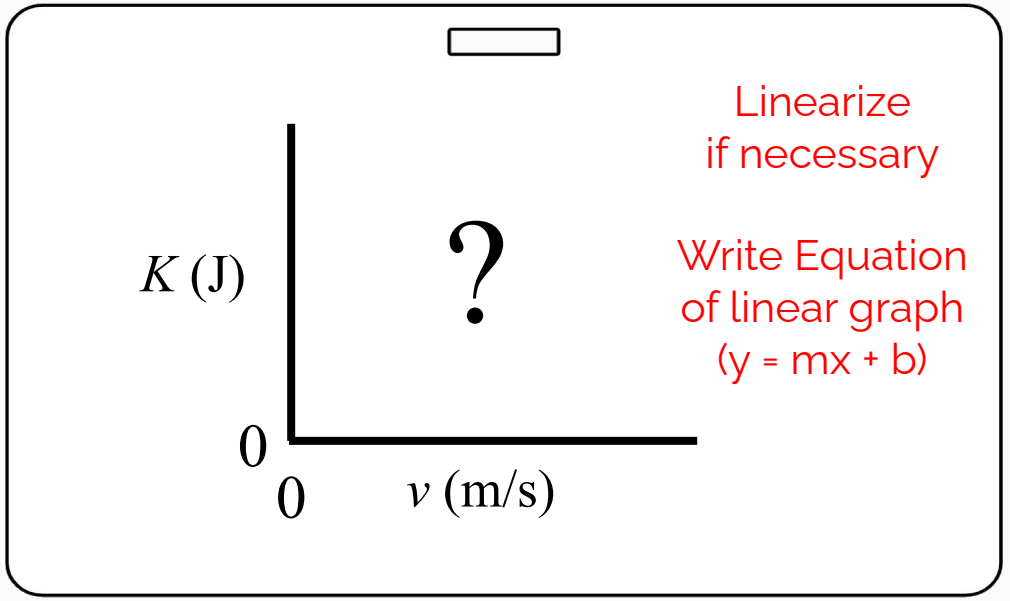
Purpose: To determine the relationship between the kinetic energy of a moving object and the object's velocity.

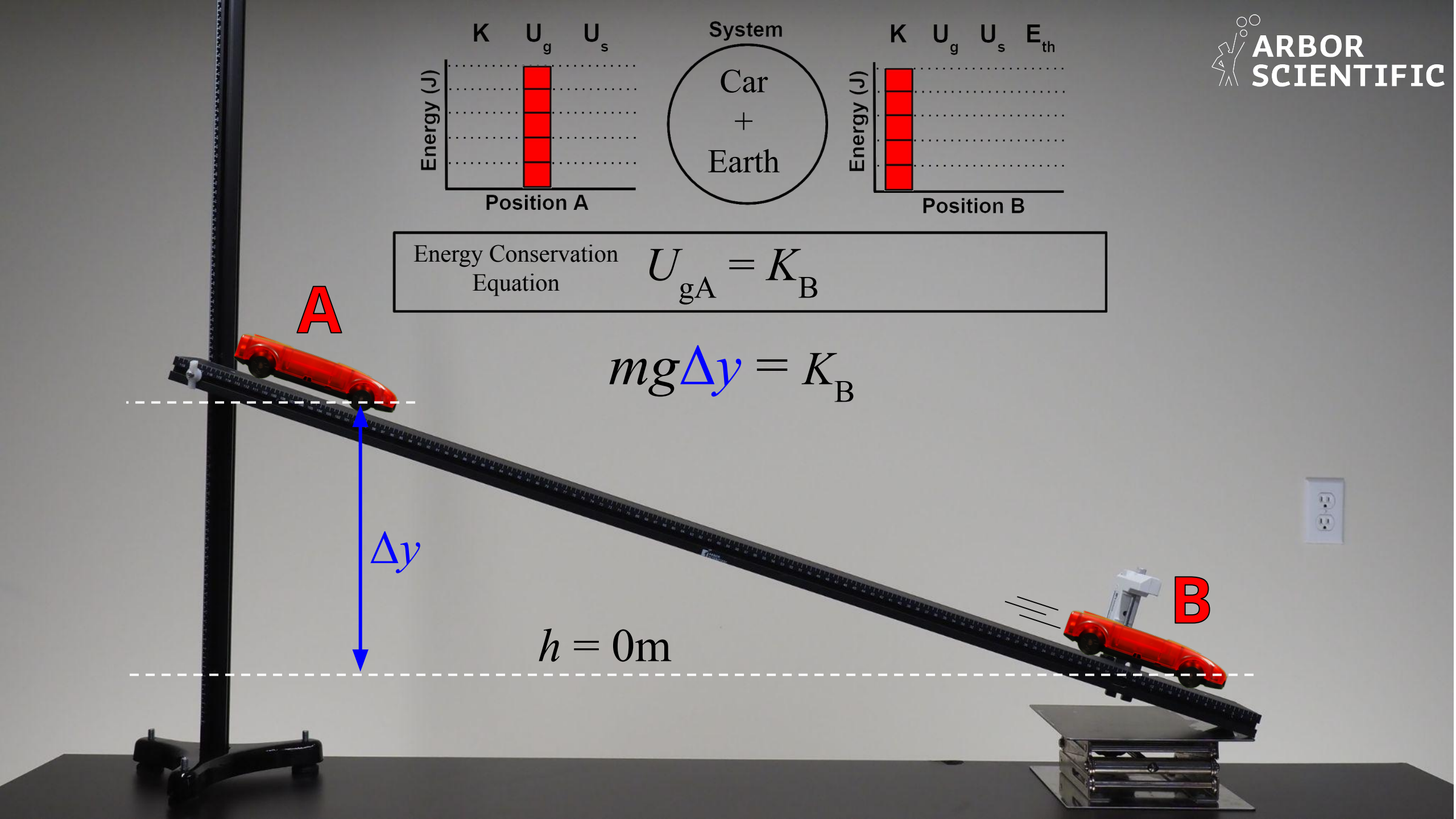
Data:

Dependent Variable

Independent Variable

v (m/s)	K (J)
...	...




K U_g U_s
Energy (J)
Position A
System
Car
+
Earth
K U_g U_s E_th
Energy (J)
Position B
Energy Conservation Equation
$U_{gA} = K_B$
A
$mg\Delta y = K_B$
Δy
$h = 0\text{m}$
B
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Expanded Data Table

$$v = \frac{\Delta x}{\Delta t}$$

From the photogate

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Δh or Δy(m)	$U_{g\,A}$(J)	K_B(J)	v(m/s)

$$U_{g\,A} = mg\Delta y = K_{\mathrm{B}}$$

Whiteboard Results

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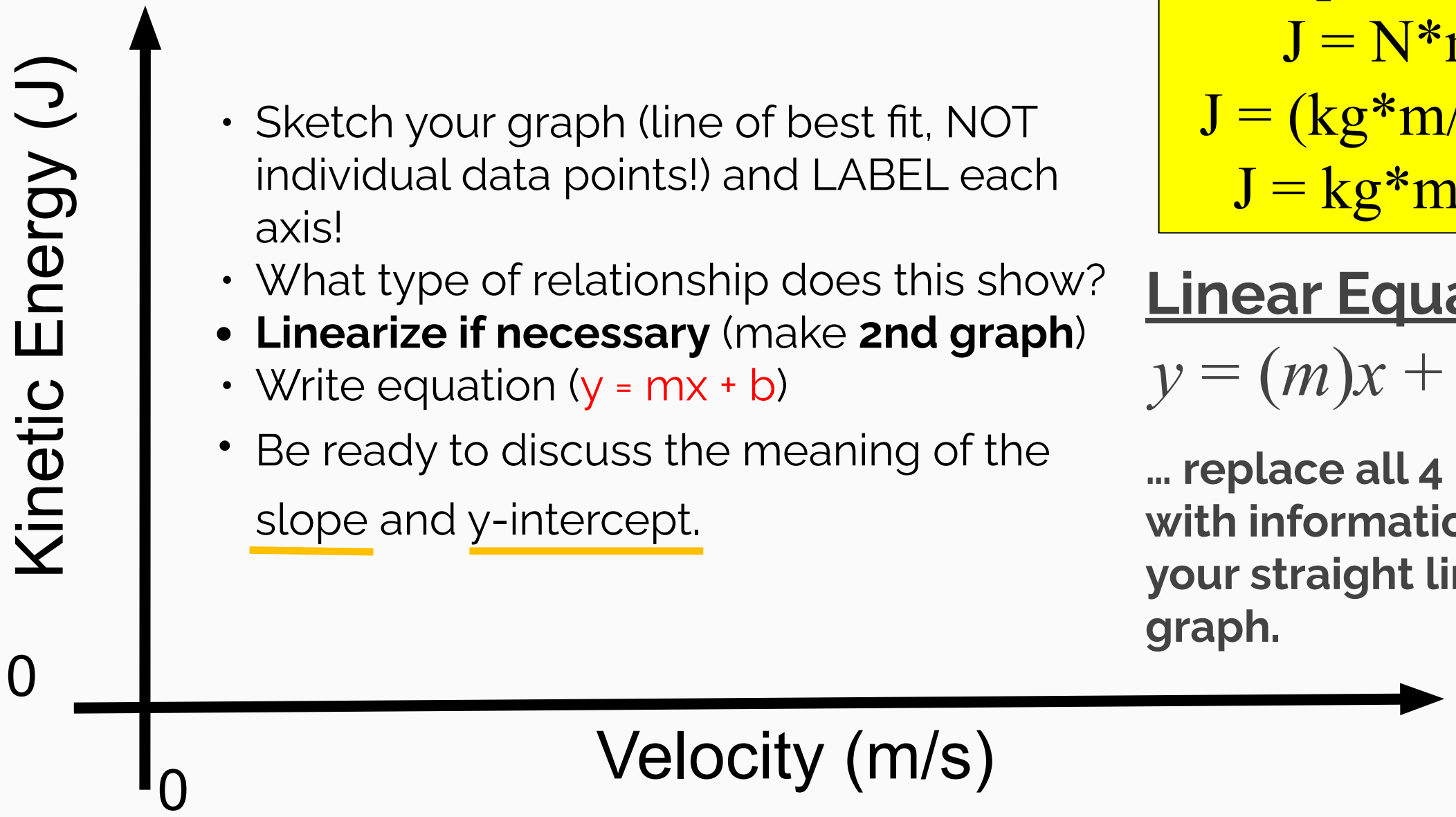

- Sketch your graph (line of best fit, NOT individual data points!) and LABEL each axis!
- What type of relationship does this show?
- **Linearize if necessary** (make **2nd graph**)
- Write equation (y = mx + b)
- Be ready to discuss the meaning of the slope and y-intercept.

Slope Units:

$J = N*m$

$J = (kg*m/s^2)m$

$J = kg*m^2/s^2$

Linear Equation:

$y = (m)x + b \rightarrow ?$

… replace all 4 letters with information from your straight line graph.

Patterns in Nature

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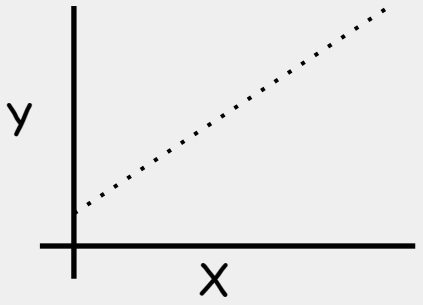
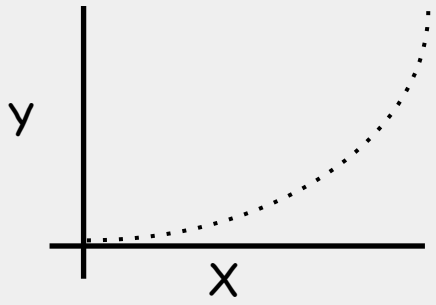
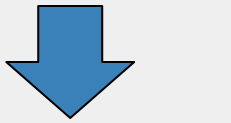
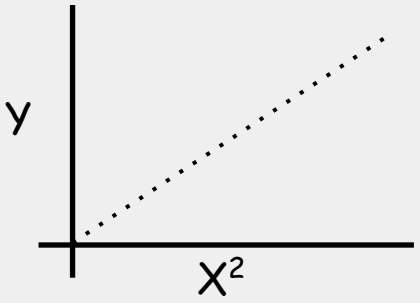
Linear Relationship



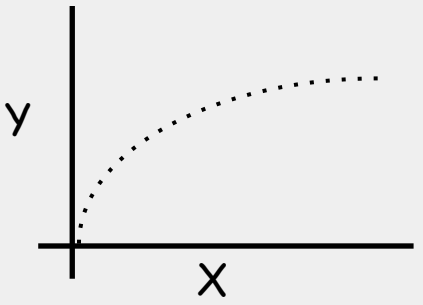
Top-opening Parabola

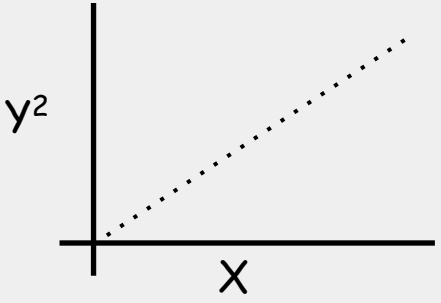




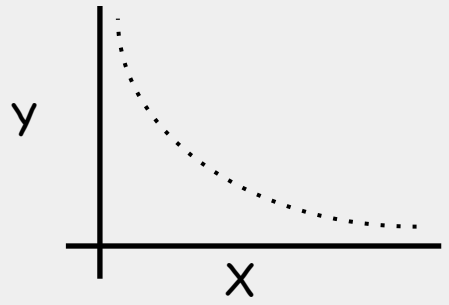


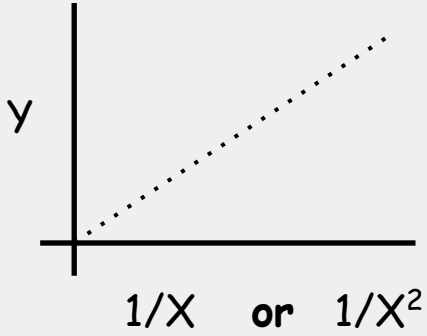
Side-opening Parabola





Hyperbolic Relationship





To "Linearize" or "Re-express"

Algebraic Representation of Relationship

$y=mx+b$	$y=mx^2+b$	$y^2=mx+b$	$y=m(1/x)+b$ $y=m(1/x^2)+b$

Simplifying the SLOPE Units

$$\frac{J}{m^2/s^2} = \frac{N \cdot m}{m^2/s^2} = \frac{\left(kg \cdot m/s^2\right) \cdot m}{m^2/s^2} = kg$$

Y-Intercept Rules:

5% Rule: If the y-intercept is less than 5% of the maximum y-value, then you can say that it is insignificant or zero.

Logic: If you can reason that the y-intercept should be zero. You can say its is zero.

$$K = (0.128\text{kg})v^2 + 0$$

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$$K = (0.128\text{kg})v^2 + 0$$

Insignificant

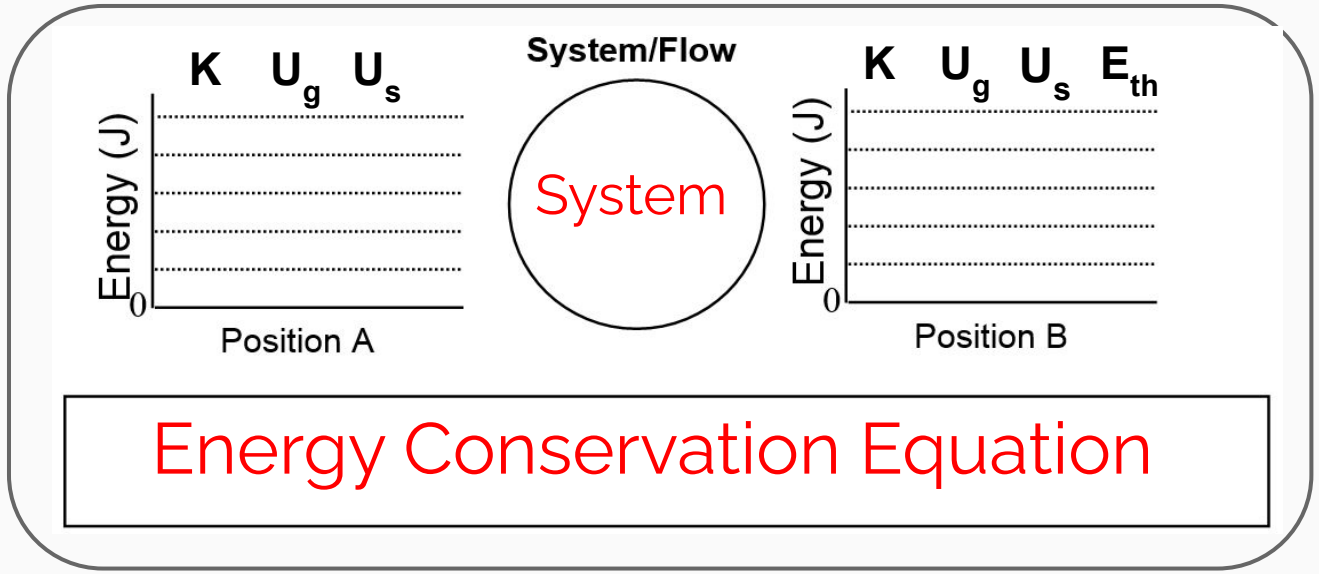
Slope = ½ of the moving object's mass

Symbol: $\frac{1}{2}m$ **Units:** kg

General Equation

$$K = \frac{1}{2}mv^2$$

Tools to Solve Quantitative



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