June 13, 2016

Warm up: List as many combinations of units as you can for speed

$\frac{m}{s}$ $\frac{m}{s}$ $\frac{mi}{h}$ $\frac{cm}{s}$ $\frac{ft}{s}$ $\frac{km}{s}$

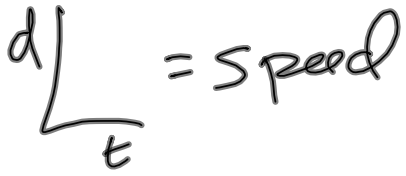
$\frac{\text{length}}{s}$ $\left(\frac{m}{s}\cdot\frac{1}{s}\right)s$

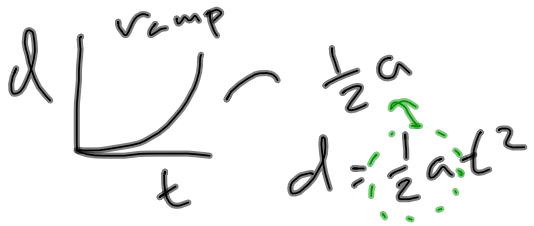
Unit Analysis

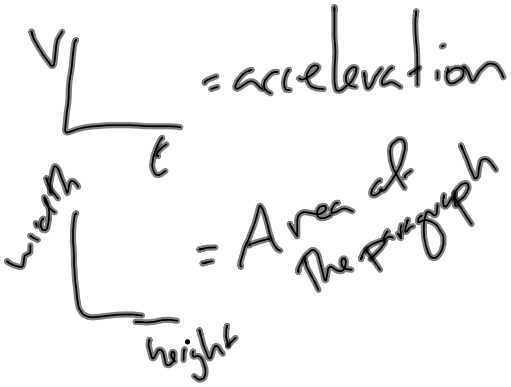
$\frac{s}{kg}\cdot N = \frac{kg\,m}{s^2}\cdot\frac{s}{kg}$

$\frac{N\cdot s}{kg} = \frac{m}{s}$

What have Slopes represented so far?







Energy:

Movement or the potential for movement

$N = \frac{kg\,m}{s^2}$ Units: Joules [J]

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

(mass · acceleration · displacement)

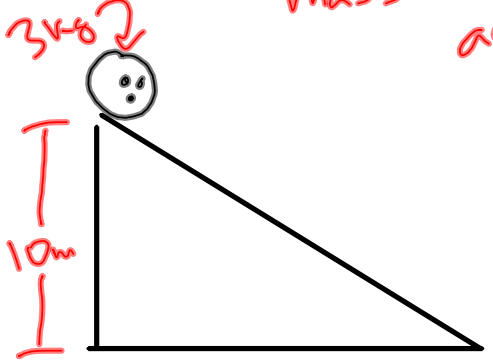
$\frac{kg\,m^2}{s^2}\left(\frac{1}{m}\right) = \frac{kg\,m}{s^2} = N$

Gravitational Potential Energy

$E_g = m \cdot g \cdot h$ → height off ground

m → mass

g → acceleration due to gravity $9.8\ m/s^2$



$E_g = m \cdot g \cdot h$

$= (3kg)(9.8\ m/s^2)(10m)$

$= 294\ J$

Describe an energy Transform

Types of Energy

E_g = Gravitational $E_g = mgh$

E_k = Kinetic Energy - movement → Velocity

E_{sound} = Sound

$E_{Thermal}$ = Heat

$E_{elastic}$ = spring

$E_{chemical}$ = food

Work

Energy transferred by a force over a distance.

When you apply a force to an object, and the object moves, you are changing its energy = work

work

$$W = F \cdot d$$

F = force

d = displacement

Units: $N \cdot m = J$

$$W = \Delta E$$

Δ = change in

Forces can add energy to an object and they can take energy away from an object

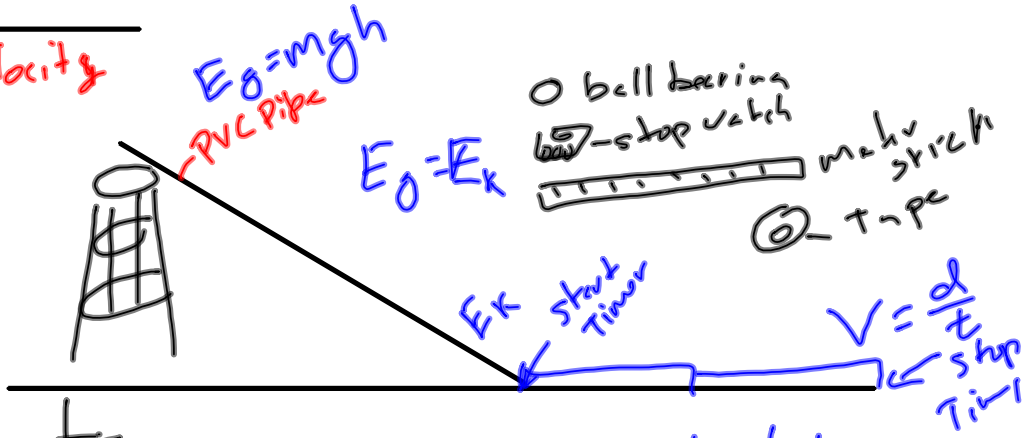
Research Question: What is the relationship between kinetic energy E_k and velocity?

Hypothesis:

As the velocity increases, the kinetic energy will _____

in a _____ relationship.

Procedure:



Measurements

- height of release
- mass of ball – control
- Time on ground
- distance on ground – control
- $g = 9.8 m/s$ – control

Calculate

$E_k = E_g = mgh$

$V = \frac{d}{t}$

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mass of ball: (kg)

distance rolled on ground: (m)

Height (m) ±	Time (s)			Average Time (s)	Uncertainty Time (s)	Velocity $V=\frac{d}{t}$ $(\frac{m}{s})$	$E_k = E_g$ $E_k = mgh$ (J)
	T_1	T_2	T_3	$\frac{T_1+T_2+T_3}{3}$	$\frac{\text{Max-min}}{2}$		