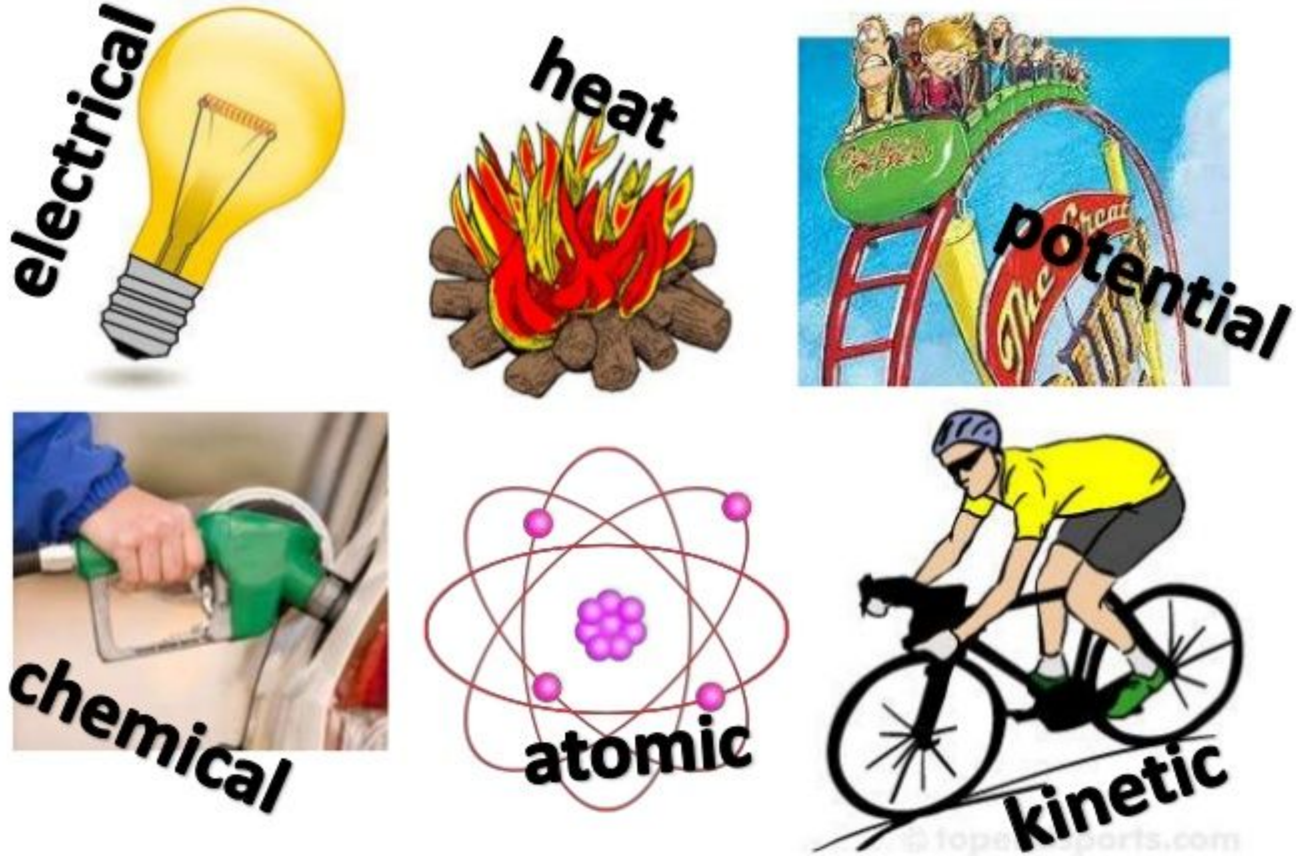

ENERGY

What is Energy?

“Energy makes things go”

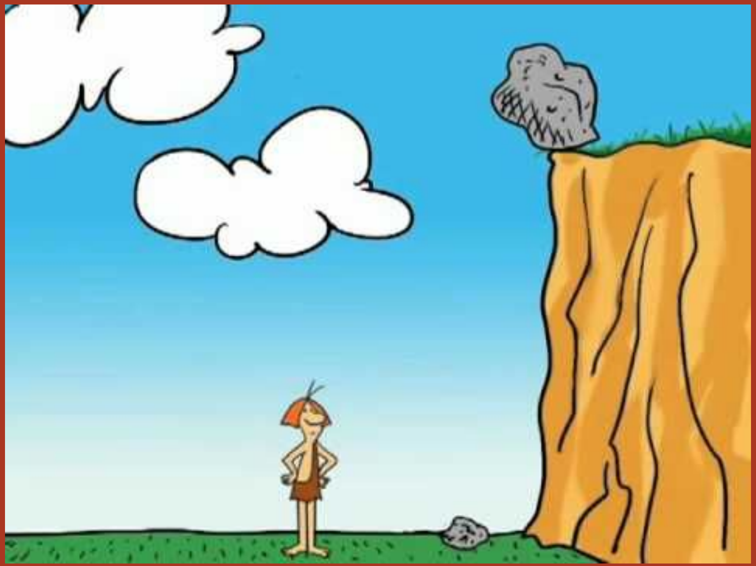
(Ability to do work)

Different forms (types) of energy



Gravitational Potential Energy (PE)

- Energy stored due to an object’s distance from the Earth (height)
- Gravitational Potential Energy is the ***Work*** that gravity ***can do*** or has the ***potential to do***.



End Slide

PE Equation

m = mass (kg)
g = 9.8 m/s/s/
h = height (m)

PE= mgh

The unit of energy is a *Joule (J)*, named after me:
James Prescott Joule.

End Slide

Example #1

Pierre the French-Canadian duck is about to go skydiving from 4200 m (14,000 ft). If Pierre has a mass of 2.0-kg, what is his Potential Energy?

$$PE = mgh$$
$$= (2.0)(9.8)(4200)$$
$$= 82320\ J$$

End Slide

Example #2

Sherlock Holmes is preparing to pull off a clever stunt from St. Bart's Hospital, which is 22 m tall. If Sherlock has a mass of 78 kg, how much PE does he have?

$$PE = mg\Delta h$$

$$= (78)(9.8)(22)$$

$$= 16819 \text{ J}$$

Kinetic Energy

Kinetic Energy is the energy stored in the motion of an object.

m = mass
v= velocity

$$KE = {}^{1}/_{2}mv^{2}$$

A change in *Kinetic Energy* will also mean a change in *speed*.

End Slide

Example #3

Gomer the hamster has a tiny mass of 4.0 grams. He rolls across Mr. McQueary's carpet at 3.0 m/s. How much Kinetic Energy does Gomer have?

$$KE = {}^{1}/_{2}mv^{2}$$
$$= {}^{1}/_{2}(.004)(3^{2})$$
$$= 0.018\ J$$

End Slide

Example #4

Barry Allen, the fastest man alive, travels 1132 m/s in a full sprint and then slows down to 4.5 m/s to blend into Central City. If Barry's mass is 75 kg, how much Kinetic Energy did he lose on his slowdown?

$$\Delta KE = KE_1 - KE_2$$

$$= {}^1/_2 m v_1^2 - {}^1/_2 m v_2^2$$

$$=$$

$${}_2(75)(1132^2) - {}^1/_2(75)(4.5^2)$$

$$= 48052641\ J$$


STOP

The total work done on an open system will produce a change in kinetic energy.

Work-Energy Theorem

$$W = {}^{1}\!/_{2}\, m{v_f}^2 - {}^{1}\!/_{2}\, m{v_o}^2$$

$$KE = {}^{1}\!/_{2}\, mv^2$$

$$W = K_f - K_o$$

$$W = \Delta K$$

A horizontal force of 3250 N is applied to a 110-kg mass initially at rest for a horizontal distance of 0.15 m. What is the final velocity of the mass?

$$W = \Delta K$$

$$F^*\Delta x = {}^{1}/_{2}m(v_f^2 - v_o^2)$$

$$(3250)(0.15) = {}^{1}/_{2}(110)\,(v_f^2 - 0^2)$$

$$487.5 = 55v_f^2$$

$$\sqrt{v_f^2} = \sqrt{8.86}$$

$$v_f = 2.98\ {}^{m}/_{s}$$

A 105-g hockey puck is sliding across the ice at 1.3 $^{m}/_{s}$. A player exerts a constant 4.50-N force to give the puck a velocity of 3.8 $^{m}/_{s}$. For what distance did the player apply the force to the puck?

$$W = \Delta K \Rightarrow F*\Delta x = {}^{1}/_{2}m(v_f^2 - v_o^2)$$

$$4.50\Delta x = {}^{1}/_{2}(0.105)(3.8^2 - 1.3^2)$$

$$4.50\Delta x = 0.0525*(12.75)$$

$$4.50\Delta x = 0.6694$$

$$\Delta x = 0.149 \text{ m}$$