

The image features the word "ENERGY" in a bold, sans-serif font. The letters are rendered in a vibrant blue, glowing neon style with a textured, wireframe-like appearance. The text is centered horizontally and slightly above the vertical middle. The background is solid black, which makes the blue elements stand out. Numerous jagged, branching blue lightning bolts are scattered across the scene, with a particularly dense cluster in the upper left and another in the lower right. The overall aesthetic is high-tech and energetic.

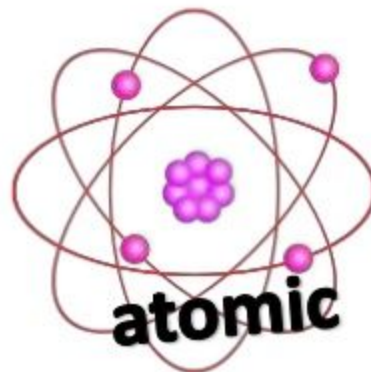
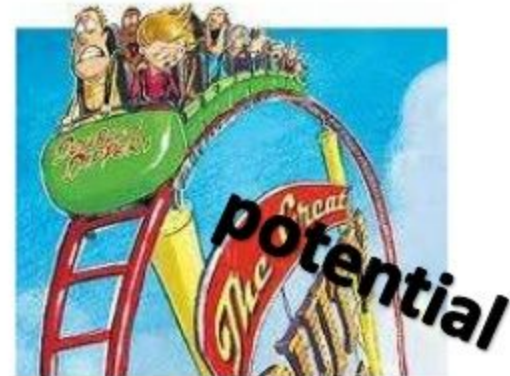
ENERGY

What is Energy?

“Energy makes things go”

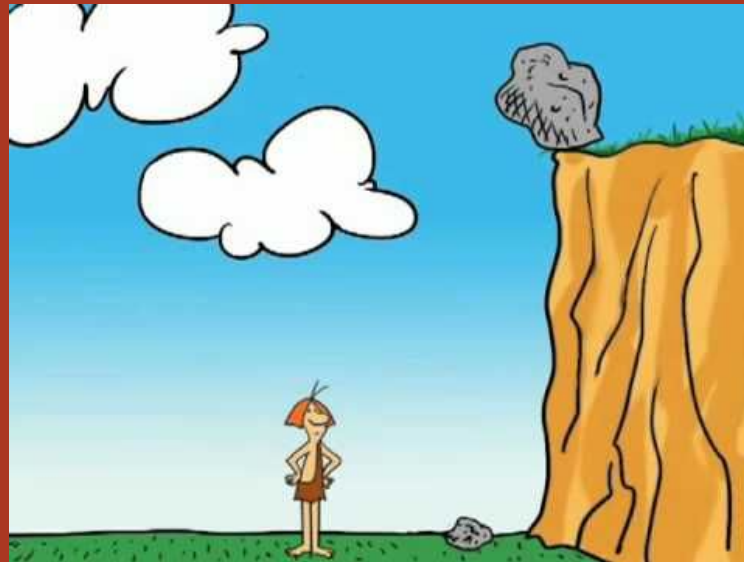
(Ability to do work)

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.



PE Equation

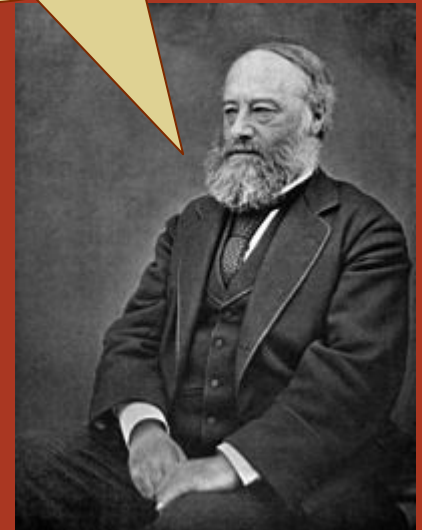
$m = \text{mass (kg)}$

$g = 9.8 \text{ m/s/s/}$

$h = \text{height (m)}$

$$PE = mgh$$

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



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?

$$\begin{aligned} PE &= mgh \\ &= (2.0)(9.8)(4200) \\ &= 82320 \text{ J} \end{aligned}$$



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?

$$\begin{aligned} \text{PE} &= mg\Delta h \\ &= (78)(9.8)(22) \\ &= 16819 \text{ J} \end{aligned}$$



Kinetic Energy

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

**m = mass
v = velocity**

$$\mathbf{KE = \frac{1}{2}mv^2}$$

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

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?



$$\begin{aligned} \text{KE} &= \frac{1}{2}mv^2 \\ &= \frac{1}{2}(.004)(3^2) \\ &= 0.018 \text{ J} \end{aligned}$$

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?

$$\Delta KE = KE_1 - KE_2$$

$$= \frac{1}{2}mv_1^2 - \frac{1}{2}mv_2^2$$

$$=$$

$$\frac{1}{2}(75)(1132^2) - \frac{1}{2}(75)(4.5^2)$$

$$= 48052641 \text{ J}$$





STOP

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

Work-Energy Theorem

$$W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_o^2$$

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

$$W = K_f - K_o$$

$$W = \Delta K$$

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?

$$W = \Delta K$$

$$F \cdot \Delta x = \frac{1}{2} m (v_f^2 - v_o^2)$$

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

$$487.5 = 55v_f^2$$

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

$$v_f = 2.98 \text{ m/s}$$

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?

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

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

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

$$4.50 \Delta x = 0.6694$$

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