

Potential and Kinetic Energy

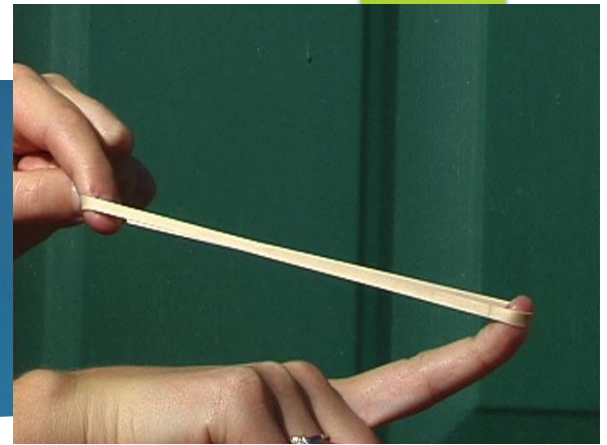
- ▶ <https://www.youtube.com/watch?v=Ehx1P4adv6I>

What is Energy???

- ▶ Energy is the ability to do **WORK**... remember... **Work = Force x Distance**.
- ▶ So... **Energy** provides the ability for some **FORCE** to move an object some **DISTANCE**.



Potential Energy



- ▶ Potential Energy is energy an **object** has because of its **position** (where it is) or **composition** (how it is made).
- ▶ We say Potential Energy is “**stored**” energy because it is not being used...but it has the “**potential**” to do work in the **future**.

Potential Energy



- ▶ Examples of Potential Energy due to an object's position:
 - ▶ Rock on the edge of a cliff.
 - ▶ Book hanging half-way off a shelf.
 - ▶ Snowboarder at the top of the hill.
 - ▶ Notice...all of the above deal with **GRAVITY!**

Potential Energy

- ▶ In situations where Potential Energy is present because of the object's position...we have a formula:
 - ▶ $GPE \text{ (gravitational potential energy)} = m \times g \times h$
 - ▶ **m** = mass in kilograms
 - ▶ **g** = acceleration due to gravity (always 9.8 m/s^2)
 - ▶ **h** = height in meters.

Potential Energy



▶ A rock at the edge of a cliff has a mass of 10 kg, and its height above the ground below is 100 m. What is the GPE?

▶ $GPE = m \times g \times h$

▶ $GPE = 10 \text{ kg} \times 9.8 \text{ m/s}^2 \times 100 \text{ m}$

▶ $GPE = 9800 \text{ J}$

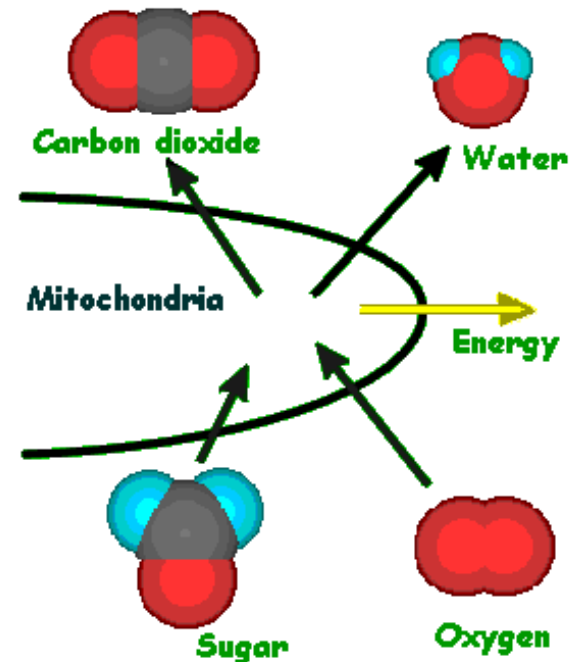
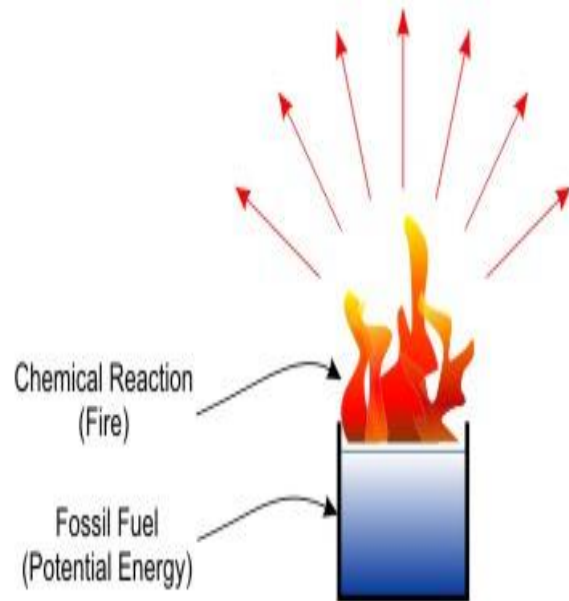
▶ The rock's gravitational energy is 9800 Joules

video

<https://www.brainpop.com/science/energy/potentialenergy/>

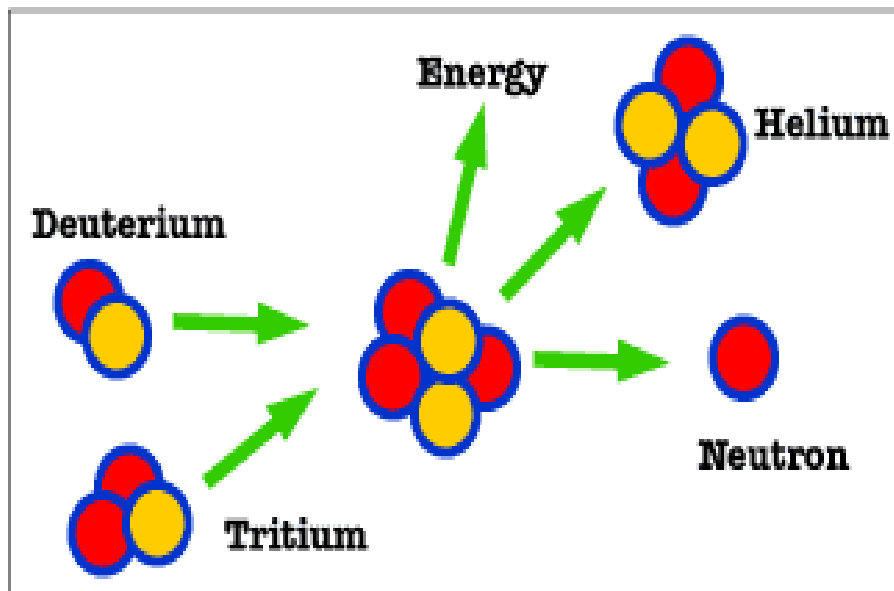
Forms of Potential (Stored) Energy

- **Chemical Energy:** Energy stored in the bonds that hold atoms together (food, fuels)



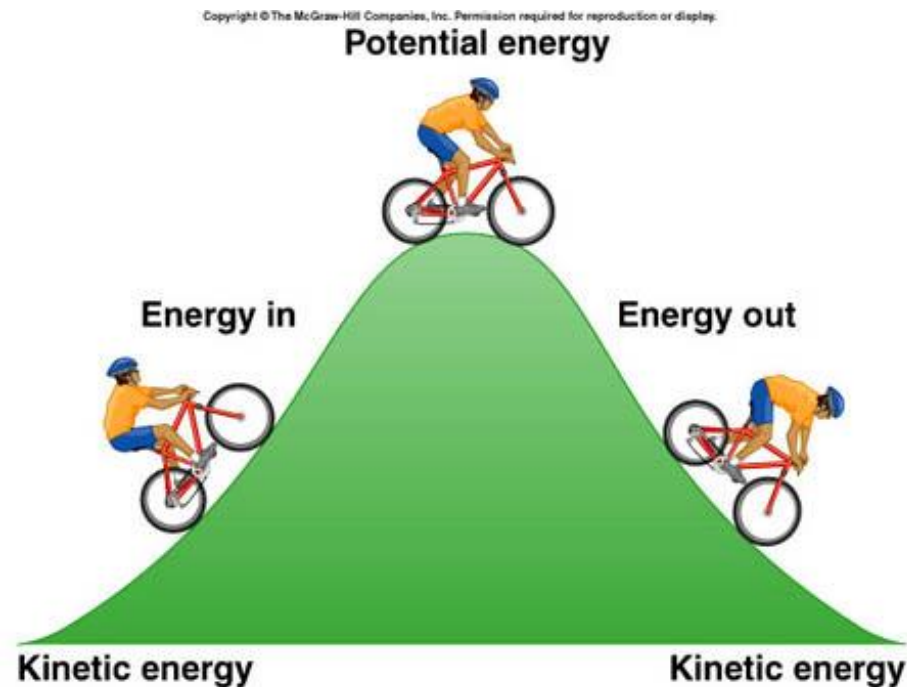
Forms of Potential (Stored) Energy

- **Nuclear Energy:** Energy stored in the nuclei of atoms; released when nuclei join together or split apart (nuclear power plants, fusion in stars).



Forms of Potential (Stored) Energy

- **Gravitational Energy: Energy of position (examples, biker at top of a hill, pendulum)**



Forms of Potential (Stored) Energy

Stored mechanical energy: Energy stored in an object because a force was applied to it (examples: compressed spring, stretched rubber band).



Kinetic Energy

- ▶ Kinetic Energy is the energy of **MOTION**.
- ▶ The amount of Kinetic Energy an object has depends on two factors: its **MASS** and **VELOCITY**.

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

Based on the above formula...which has a greater impact on KE...mass or velocity?

Kinetic Energy

- ▶ How much KE does a 10 kg rock have if it is rolling with a velocity of 20 m/s² North?

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

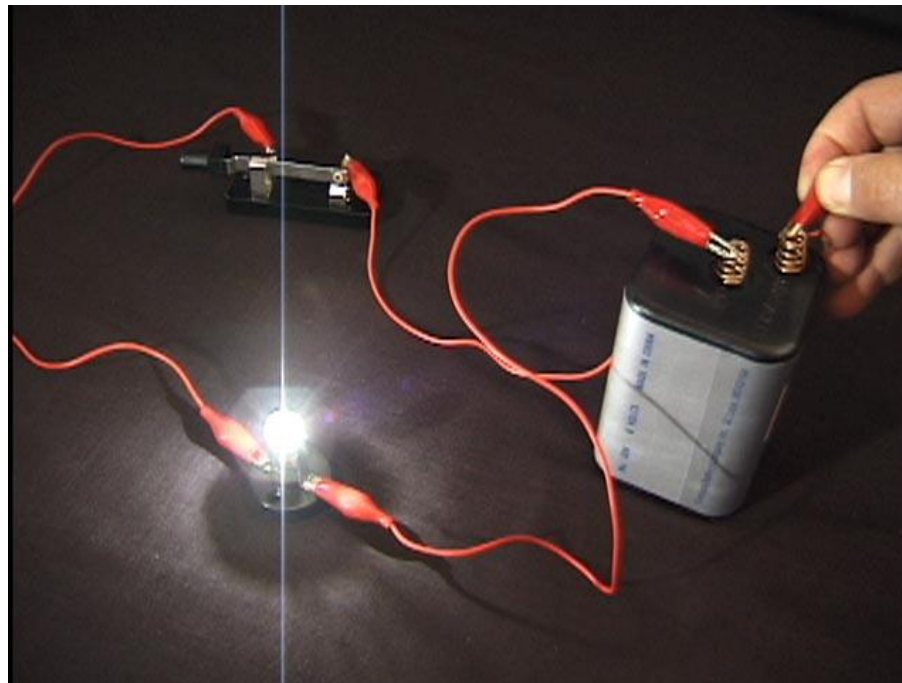
- ▶ Energy (Kinetic) = .5 x 10kg x 20x20 (v squared) m/s²
- ▶ Energy (Kinetic) = 2000 Joules

video

- ▶ <https://www.brainpop.com/science/energy/kineticenergy/>

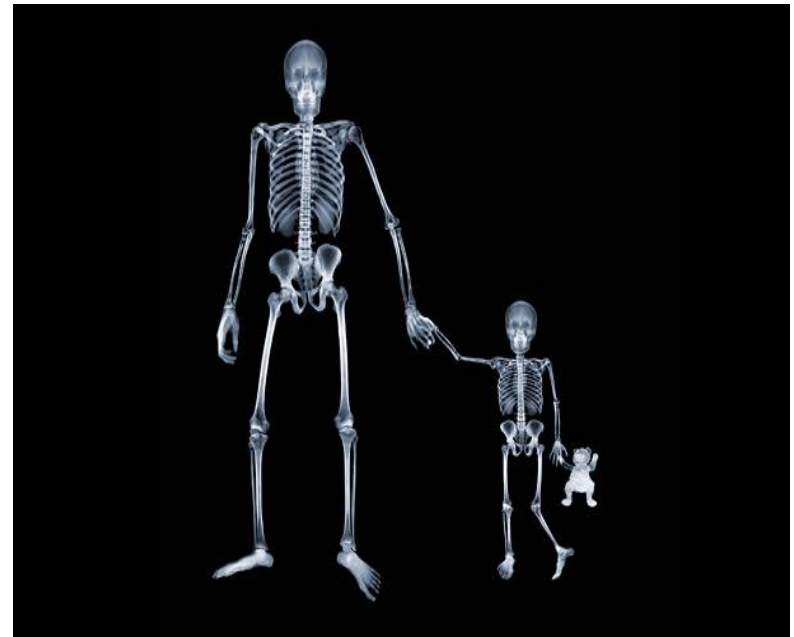
Forms of Kinetic Energy

- ▶ Electrical Energy: Energy of moving electric charges (examples: lightning, charged particles in a circuit)



Forms of Kinetic Energy

Radiant Energy: Energy that travels as electromagnetic waves (examples: visible light, microwaves, x-rays, infrared rays).



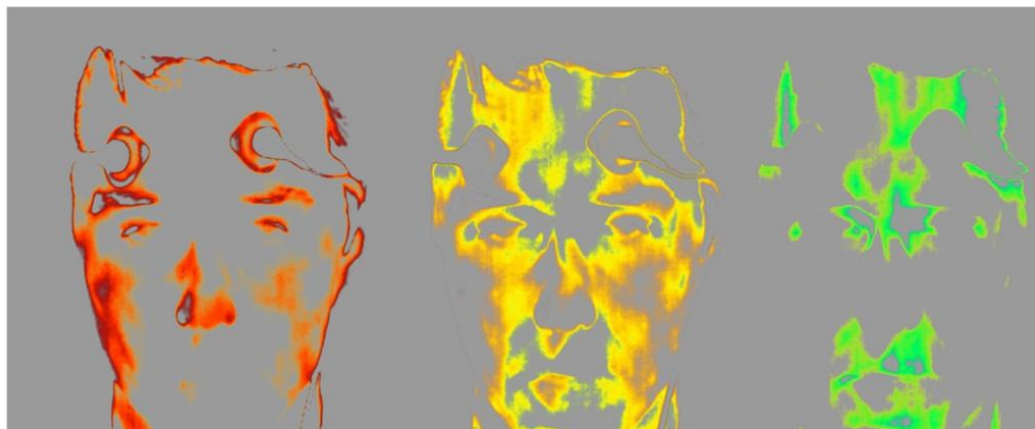
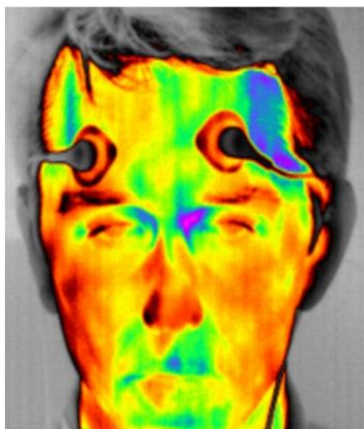
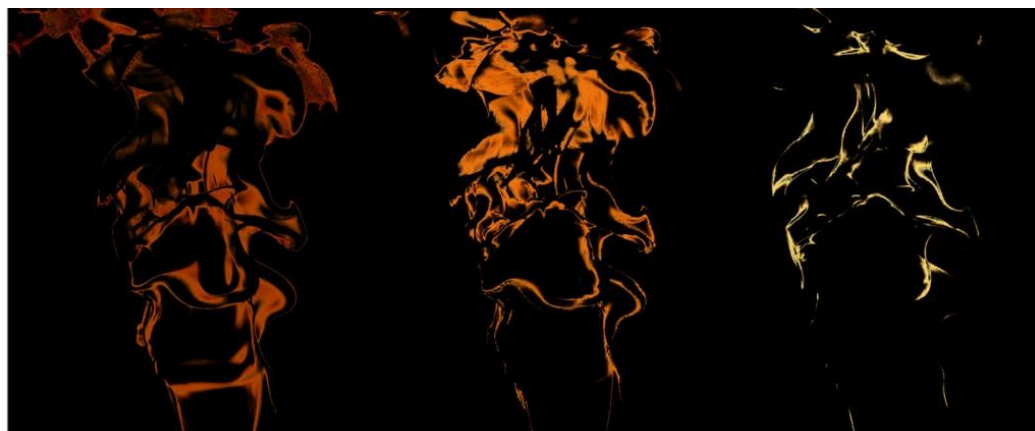
Sound Energy: Energy given off by vibrating objects; energy we can hear (examples: voices, music).



Mechanical Energy: Energy of motion used to do work (examples: flowing water, wind, machines, your body when moving).



Thermal Energy: Energy of the moving particles that make up matter (examples: energy that maintains your body's temperature).

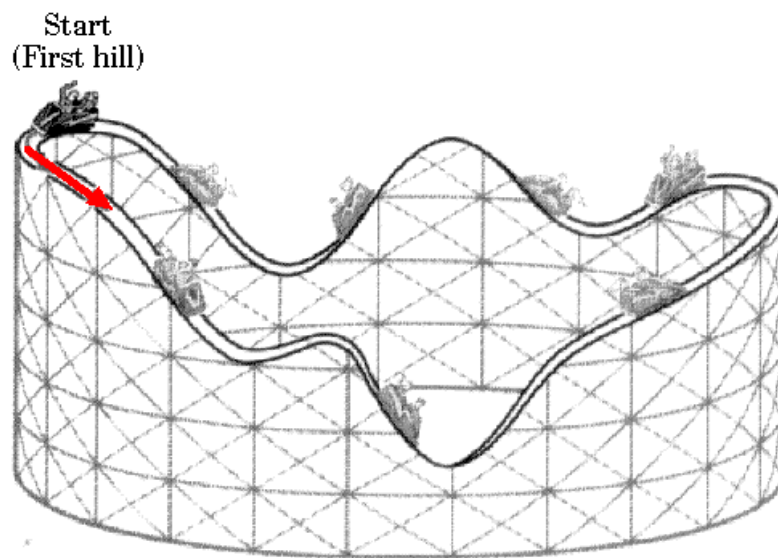


<https://www.youtube.com/watch?v=vl4g7T5gw1M>

<https://www.youtube.com/watch?v=lqV5L66EP2E>

Energy Transformations

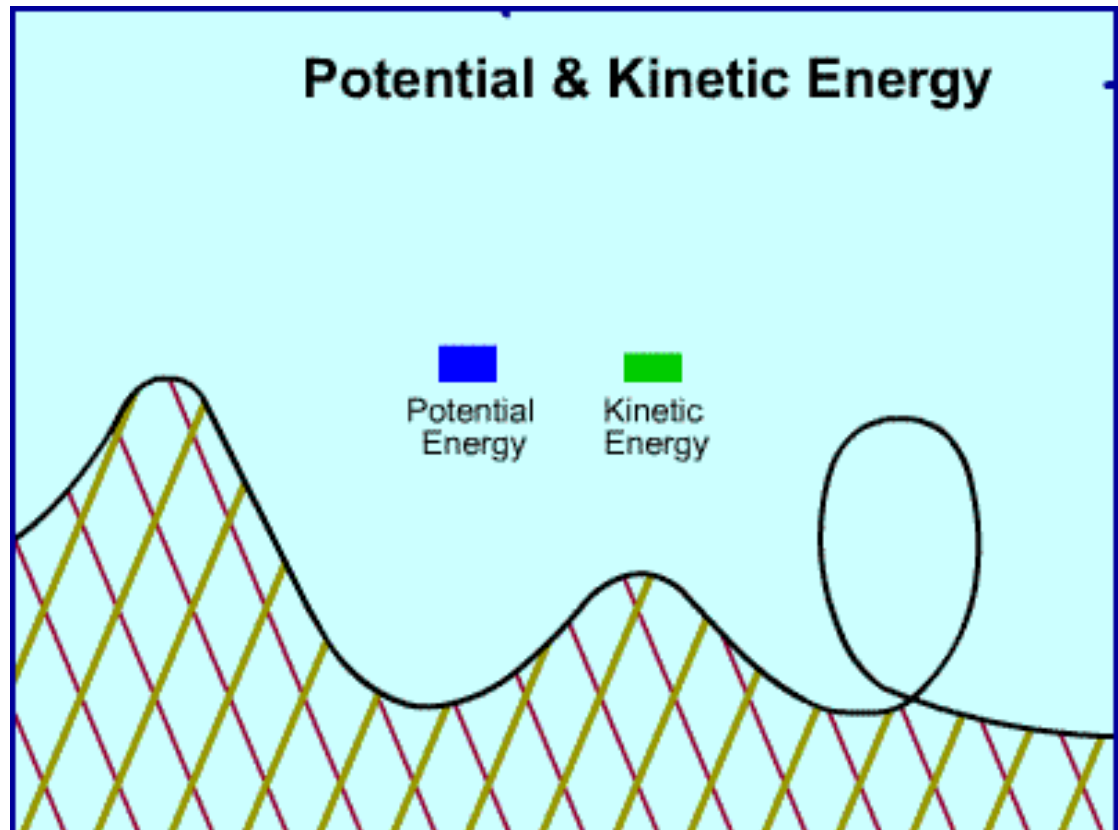
- ▶ Energy can be transformed, or changed, from one form to another.
- ▶ These energy transformations happen all around you and inside you.
- ▶ YOUR JOB is to be able to identify when this change is taking place and the type of change...enjoy!



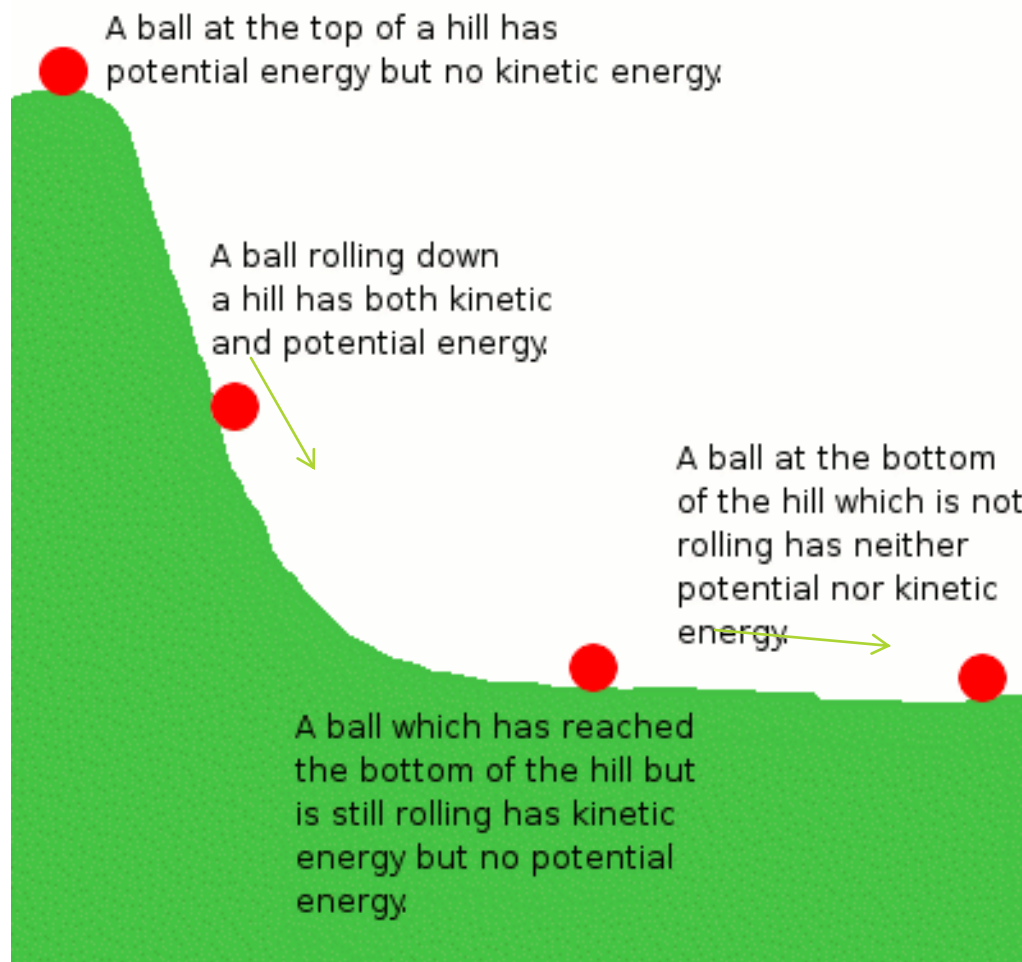
- ▶ https://www.youtube.com/watch?v=i6e-KrNCe_E

Potential to Kinetic Energy

- Potential Energy can change to Kinetic Energy and vice versa. Notice how the roller coasters location and speed determines where it has the most potential or kinetic energy.

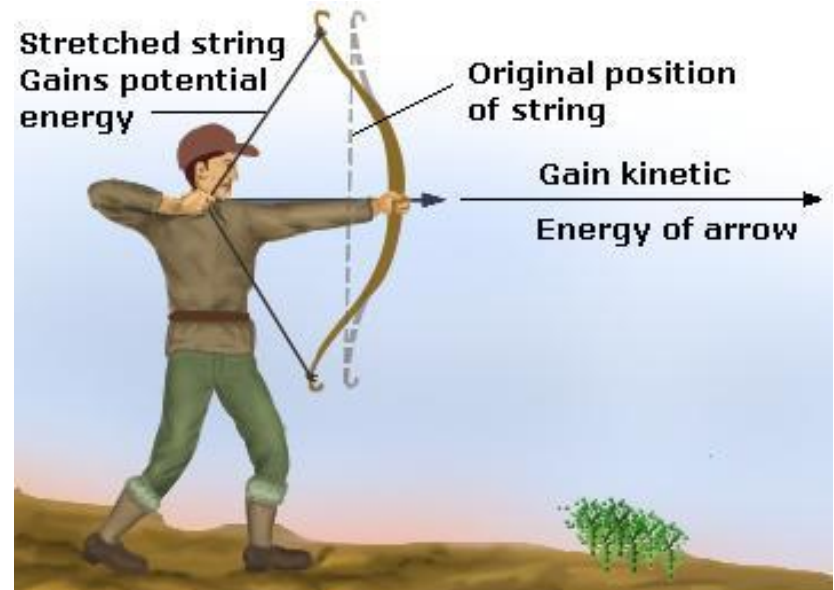


Potential and Kinetic Energy



Transformation of Potential Energy into Mechanical Energy

- ▶ When an archer pulls back on the string of a bow...mechanical **STORED** energy is put into the string. When the archer lets go...the mechanical stored energy in the string transfers its energy into the arrow...causing it to fly.



Transformations of Chemical Energy

Example 1: Chemical energy from the food you eat is changed into mechanical energy so you can run.



Example 2: Chemical energy in gasoline is changed into mechanical energy so your car can run.



Other Examples of Energy Transformations

- ▶ Green plants take radiant energy from the sun and change it into chemical energy.



- ▶ A hot plate changes electrical energy to thermal energy.



- ▶ A fan changes electrical energy into mechanical energy.



Energy Transformation into Heat

- ▶ In all energy transformations...some energy changes into heat...this is called “waste heat.”
- ▶ For example, the chemical energy in your food changes into mechanical energy that allows you to rub your hands together. Some of the energy from the rubbing converts to heat...which you can feel after only a few seconds of rubbing.

