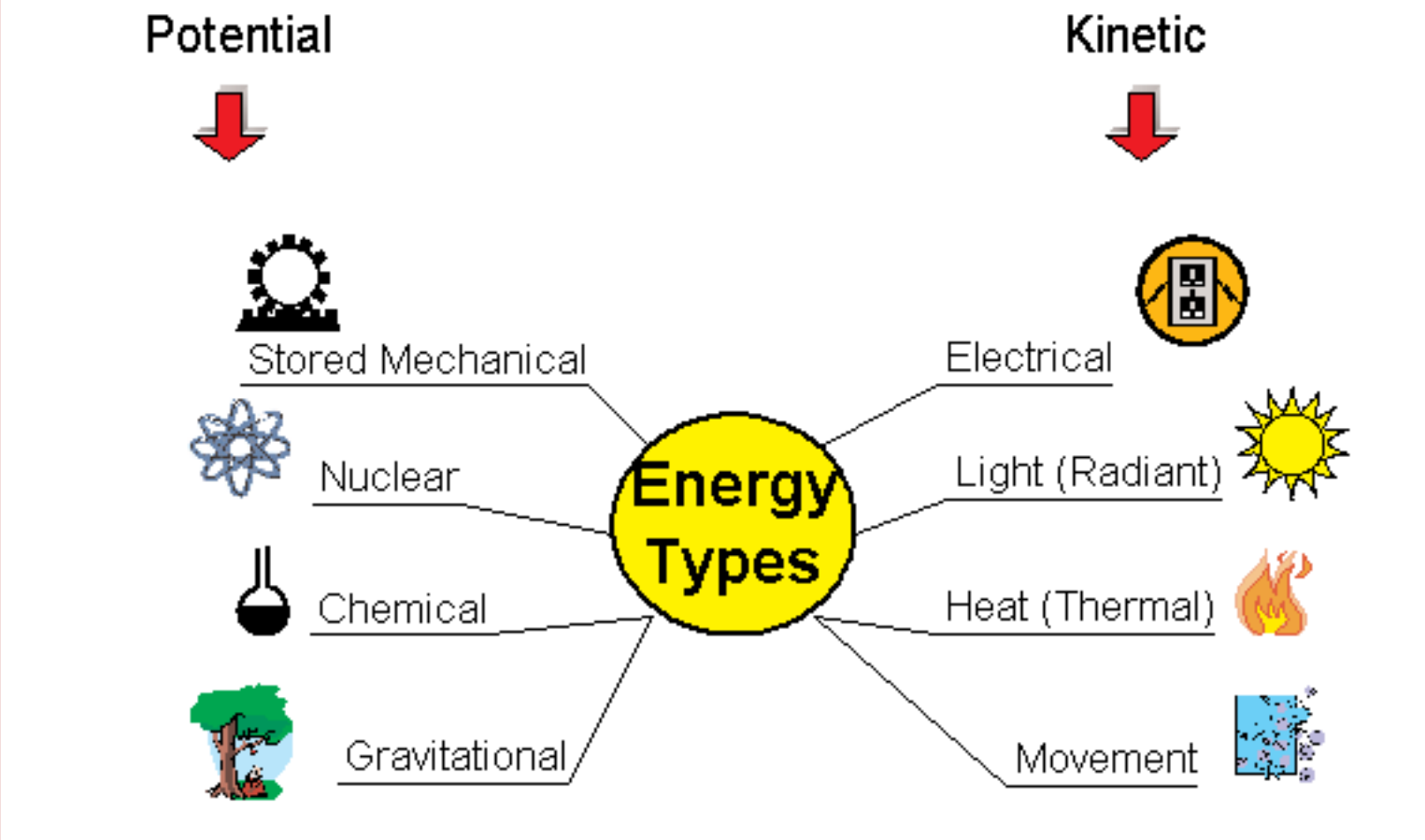
Forms of Energy

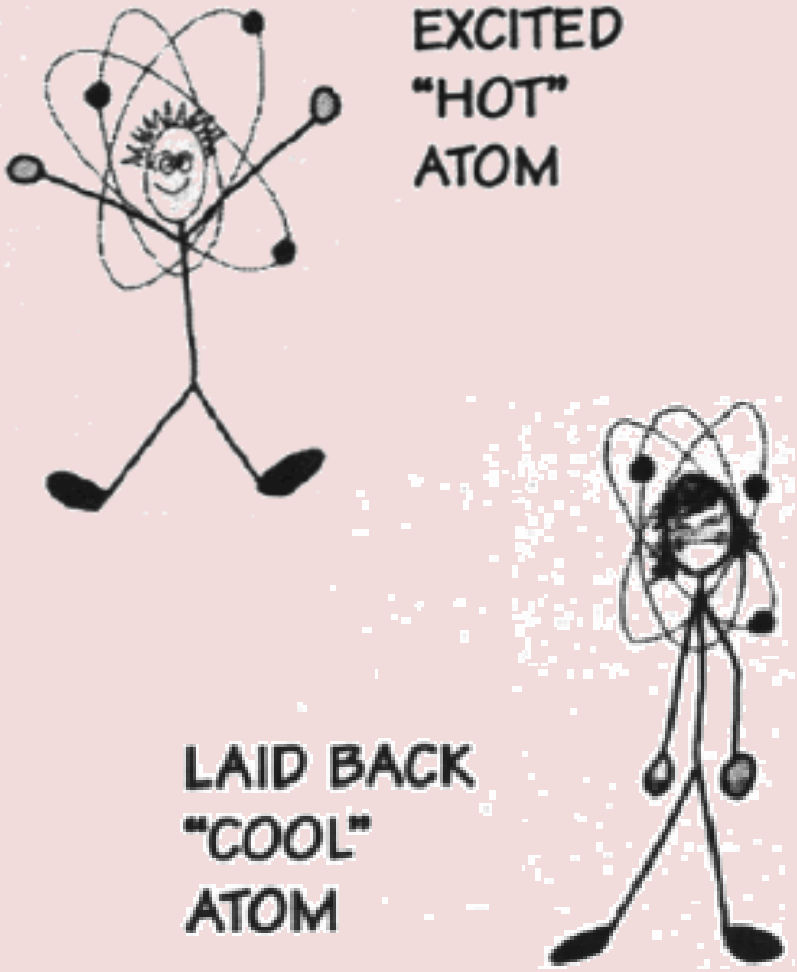


http://www.brainpop.com/science/energy/formsofenergy/

- All energy involves either motion or position.
- Energy takes different forms.
  - Examples:
    - Thermal
    - Chemical
    - Electrical
    - Sound
    - Light
    - Nuclear

Thermal Energy (Heat Energy)

i. All matter is made up of particles that are constantly moving; therefore all matter has kinetic energy.
   1. At higher temperatures, particles move faster, thus having more kinetic energy and greater thermal energy.
   2. Particles that are further apart have more energy than particles that are closer together.
   3. Thermal energy also depends on the number of particles.
   4. Ex: Steam has more energy than an ice cube and the ocean; but the ocean has the most thermal energy because it contains the most particles.



Chemical Energy

i. The energy of a compound that changes as its atoms are arranged to form new compounds

ii. Molecules that have a lot of bonds between atoms tend to have a lot of chemical energy- gasoline.

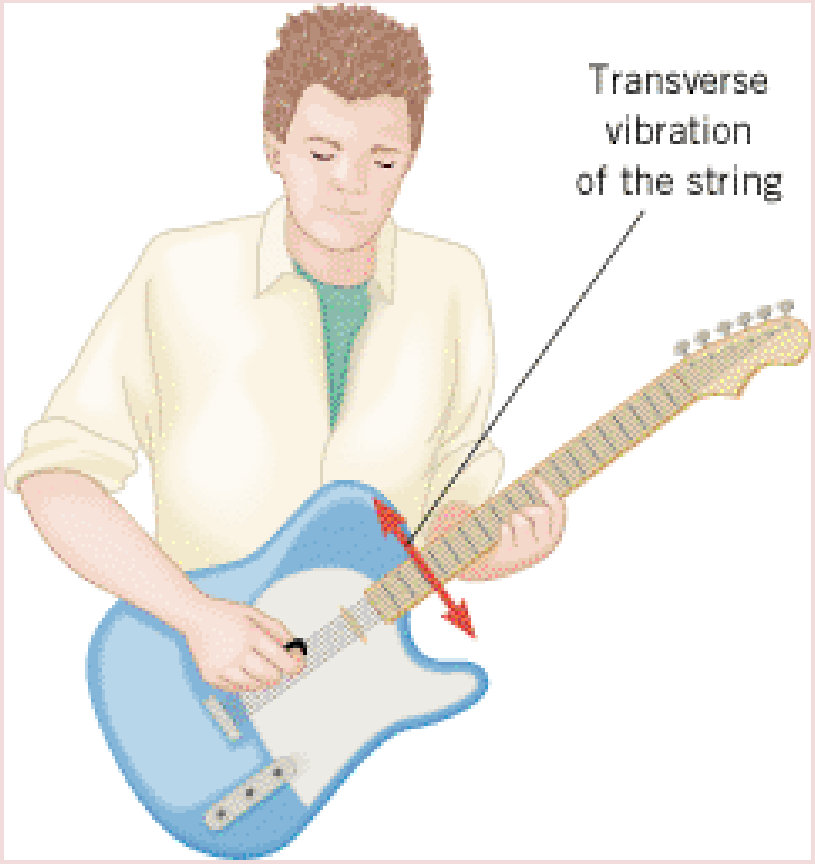
iii. Ex:

1. When wood burns, the chemical energy stored in the wood is used to heat the house.
2. When you eat a marshmallow, chemical energy stored in the sugar molecules becomes available for you to use.

Electrical Energy

i. The energy of moving electrons
ii. The electrical energy produced by electrons moving (120 times per second) is used to do work.
iii. Generators rotate magnets within coils of wire to produce electrical energy.
iv. Electrical energy can be considered both potential energy (because the magnet is changing position) and kinetic energy (because the electrons are moving).

Sound Energy



i. Caused by an object's vibration

ii. A form of potential and kinetic energy

1. To make an object vibrate, work must be done to change its position.

   a. Ex: When you pluck and release a guitar string; when the guitar string moves back to its original position, it has kinetic energy.

Light Energy

i. Produced by the vibrations of electrically charged particles

ii. Can be transmitted through a vacuum (a space without matter)

1. The energy used to cook food in the microwave

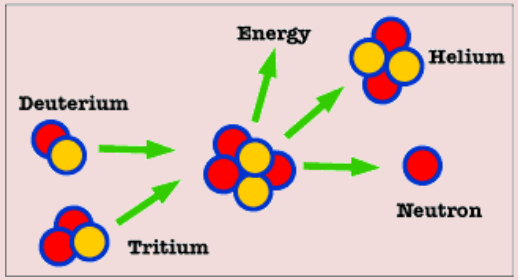
Nuclear Energy (Atomic Energy)

i. The energy associated with changes in the nucleus of an atom

ii. Produced 2 ways:

1. When 2 or more nuclei join together

2. When the nucleus of an atom split apart

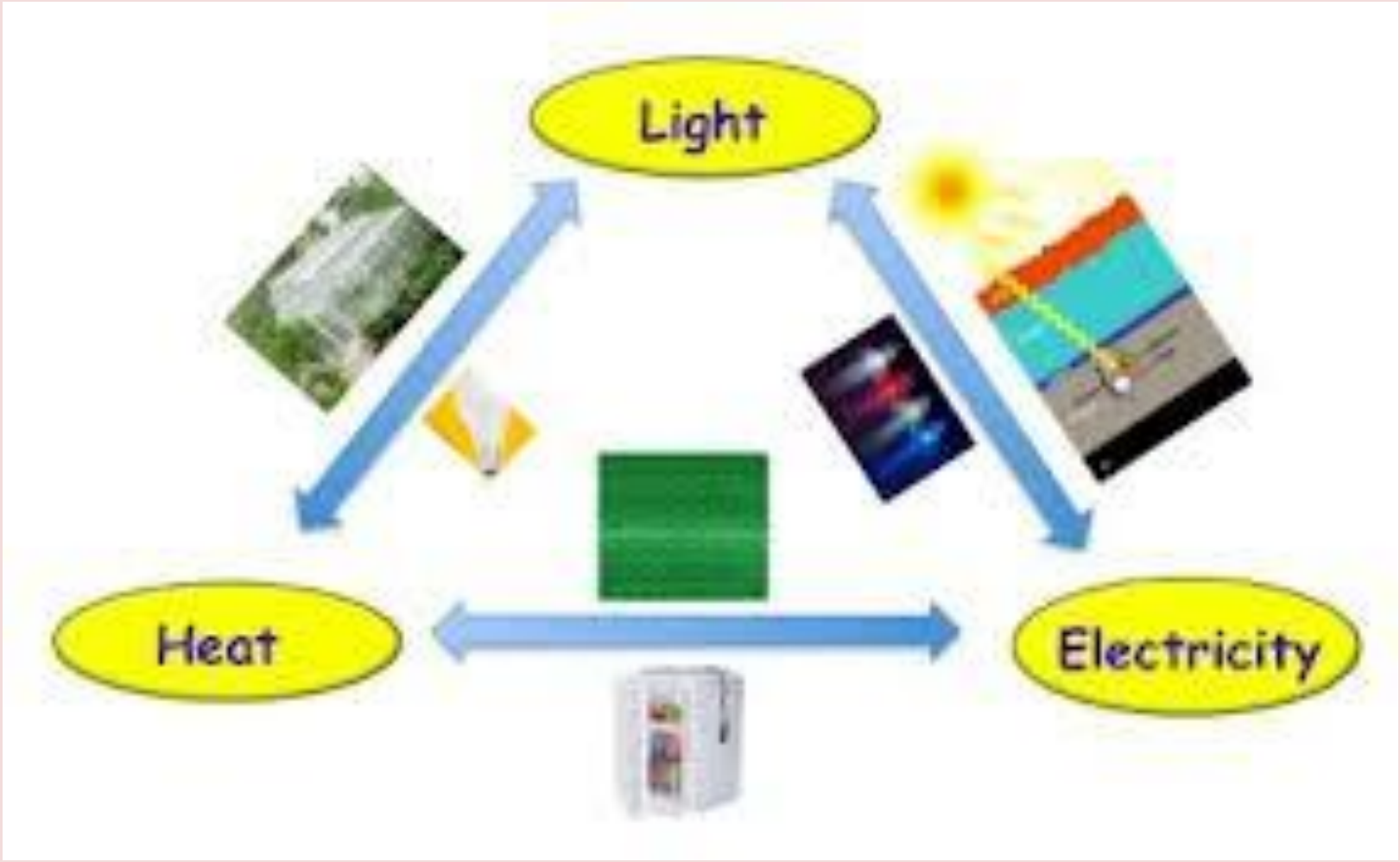


iii. In the sun, hydrogen nuclei join together to make a larger helium nucleus. This reaction releases a huge amount of energy, which allows the sun to light and heat the Earth.

iv. The nuclei of some atoms, such as Uranium, store a lot of potential energy. When work is done to split these nuclei apart, energy is released. This nuclear energy is used to generate electrical energy, which will run nuclear power plants.

Brainpop: "Forms of Energy"

Energy Conversions

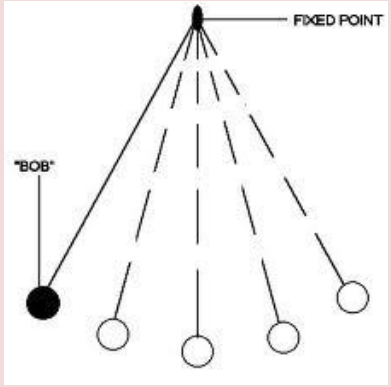


Energy Conversion-

- A change from one form of energy into another
  - Any form of energy can be converted into any other form of energy.
- In every conversion, some energy is always converted into thermal energy.

Pendulum

- A mass hung from a fixed point so that it can swing freely
- When you lift the pendulum to one side, you do work on it, and the energy used to do that work is stored by the pendulum as potential energy. As soon as you let it go, it swings back because the Earth exerts a force on it.
  - As a pendulum swings downward, its work converts potential energy into kinetic energy.

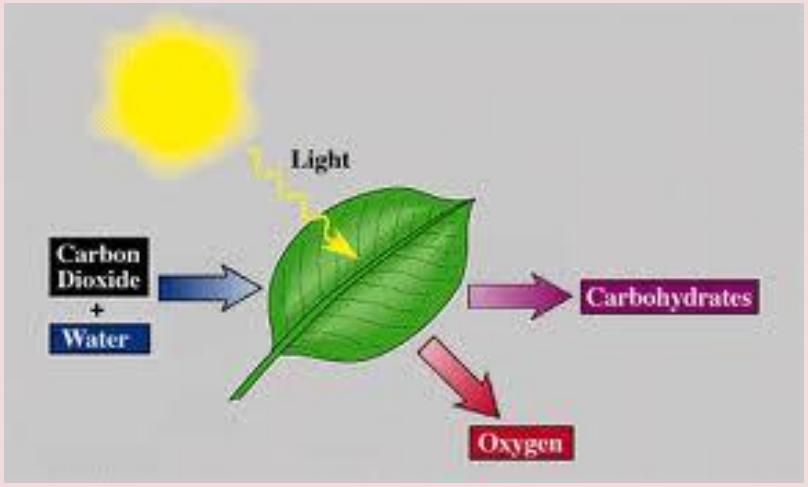


Conversions Involving Chemical Energy

- Chemical to thermal energy examples:
  - Food is digested and used to regulate body temperature
  - Charcoal is burned in a barbecue pit
  - Coal is burned to boil water
  - The chemical energy in the sugars and starches of food fuels all your body functions and movements and provides the thermal energy that keeps your body temperature constant.

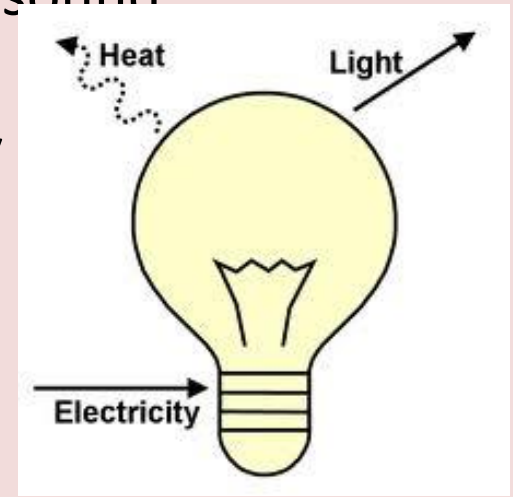
Conversions Involving Chemical Energy (cont'd)

– The chemical energy of the food we eat is a result of a conversion of light energy to chemical energy.
  - During photosynthesis, plants use light energy to produce new substances with chemical energy.



Conversions Involving Electrical Energy

- Can be easily converted into other forms of energy
  - When you turn on a light bulb, you convert electrical energy into light energy and thermal energy.
  - Microphone: sound energy → electrical energy
  - Alarm clock: electrical energy → light and sound energy
  - Battery: chemical energy → electrical energy
  - Blender: electrical energy → kinetic and sound energy
  - Iron: electrical energy → thermal energy



Energy and Machines

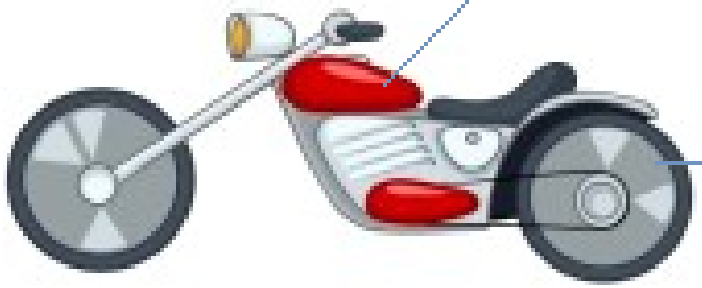
- Machines can transfer and convert energy.
- Can make work easier by changing the size or direction (or both) of the force required to do the work
  - Transferring ex: Cracking open a walnut; Using a nutcracker would be much easier than your fingers.
    - Transfers your energy to the nutcracker, and it transfers energy to the nut, therefore, breaking it open
- Some machines that convert energy:
  - electric motor, windmill, doorbell, gas heater, telephone, microphone, toaster, dishwasher, lawn mower, clock

Why Energy Conversions Are Important/ Making Conversions Efficient

- Everything we do is related to energy conversions.
- Can think of energy conversions as a way of getting energy in the form that you need
- ***Energy efficiency***- a comparison of the amount of energy before a conversion with the amount of useful energy after a conversion.
  - Ex: a comparison of the electrical energy going into a light bulb with the light energy coming out of it
    - The less electrical energy that is converted into thermal energy instead of into light energy, the more efficient the bulb. (More efficient light bulbs produce more light energy.)

Fuel (Potential Energy)

('converted into')

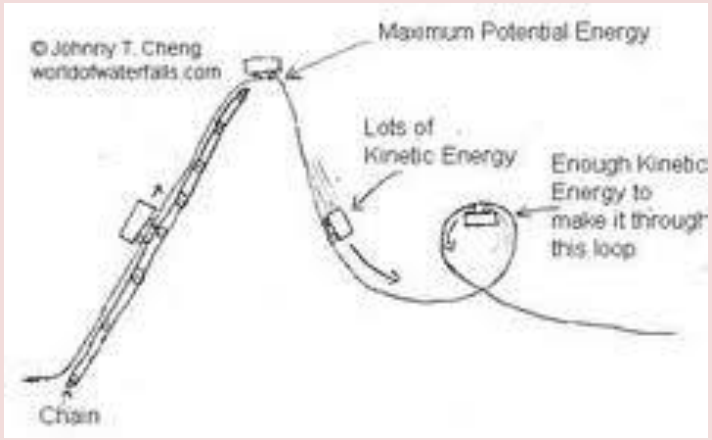


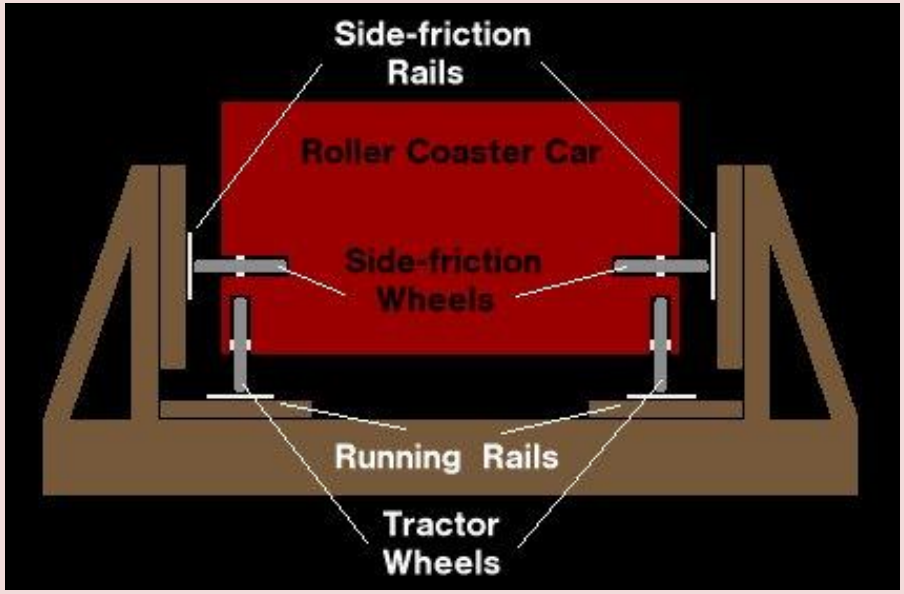
Rotation (Kinetic Energy)

Conservation of Energy

Friction-

- A force that opposes motion between two surfaces that are touching
  - Ex: Due to friction, not all of the cars' potential energy on a roller coaster is converted into kinetic energy as the cars go down the first hill. It is also converted to thermal and sound energy! In addition, not all of the cars' kinetic energy is converted into potential energy as the cars go up the second hill.





Law of Conservation of Energy-

- Energy can neither be created nor destroyed.
  - Energy can be changed from one form to another, but all the different forms of energy in a system always add up to the same total amount of energy, no matter how many energy conversions occur.