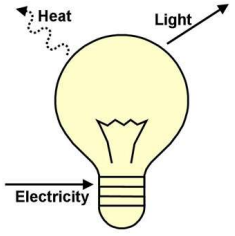
CHAPTER 13.3 & 13.4



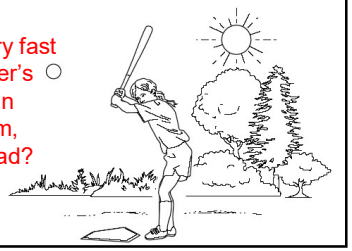
ENERGY TRANSFORMATION

What is Energy?

- Energy is anything that can cause matter to **change**.
  - Energy is the ability to do work
  - Both work and energy are typically measured in **joules (J)**.

After the girl hits the ball, the ball moves very fast and has energy. When the ball hits the fielder's glove, it stops moving. Given that energy can never be destroyed but merely changes form, what happens to the energy the ball once had?

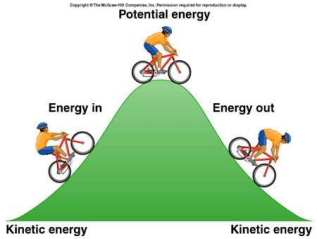
Energy changes to another form of energy. Ex. Heat from friction



Gravitational Potential Energy

Video Clip

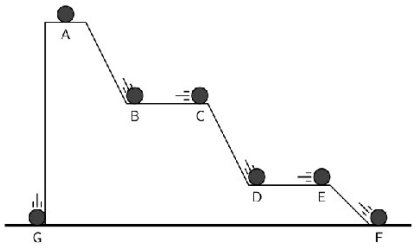
- Gravitational potential energy – any time gravity supplies the force
- Most often because it is raised off the ground.
- Dependent on its mass, its height, and the acceleration due to gravity.



Gravitational Potential Energy

- The greater the height the more gravitational potential energy an object has.

In the image below, where is the greatest GPE found?



What Forms of Energy Are There?

Potential Energy

- Chemical Energy
- Nuclear Energy
- Gravitational Energy

Kinetic Energy

- Radiant Energy
- Electrical Energy
- Sound
- Thermal Energy
- Mechanical

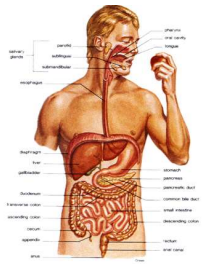
How will we ever remember these?
Just remember the sentence:
Cam Newton got really excited making stinky tacos.

Cam= **Chemical**
Newton= **Nuclear**
Got= **Gravitational**
Really= **Radiant**
Excited= **Electrical**
Making= **Mechanical**
Stinky= **Sound**
Tacos= **Thermal**

1. Chemical = Cam

- Energy stored in the bonds of atoms and molecules.

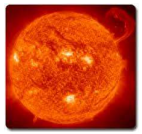
Example: Matches, Digestion, batteries



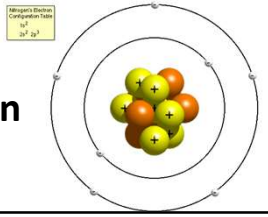
Plants convert sunlight into food.

2. Nuclear =Newton

- Energy stored in the nucleus of an atom. The energy that holds the nucleus together.
- The sun's energy comes from fusion – putting two hydrogen atoms to make helium atoms



Example: Breaking down Uranium



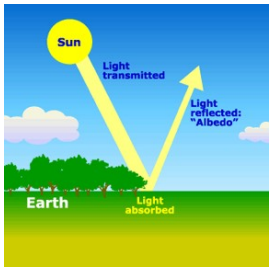
3. Gravitational = Got

- Energy of place or position.
- Higher = more gravitational energy.

Example: two plants at different heights

4. Radiant = Really

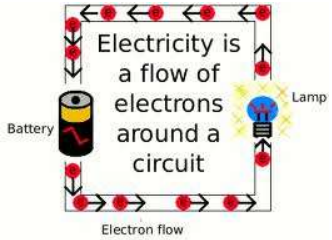
- Electromagnetic energy that travels in waves like light.



Example: Visible Light

5. Electrical = Excited

- Movement of <u>electrons</u>.



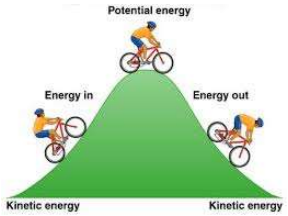
Example: lamp, computer, lightning

6. Mechanical = Making

- The movement of a substance from one place to another.
  - The sum of the potential and kinetic energy an object uses to do work.
  - An object in motion.

Example: Riding a bike

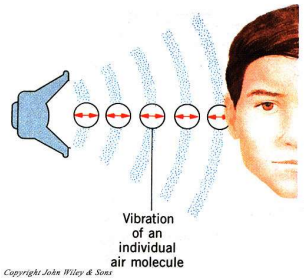
Mechanical Energy



7. Sound = Stinky

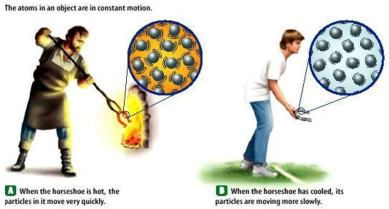
- Movement of energy through substances in waves.

Example: bell



8. Thermal =Tacos

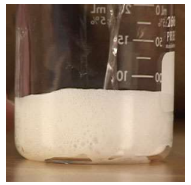
- The vibration or movement of atoms and molecules.
- Ex: Heat



Example: stove boiling water

What form of Energy?

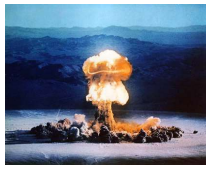
Sound



Chemical

Thermal

Electrical



Nuclear

Mechanical

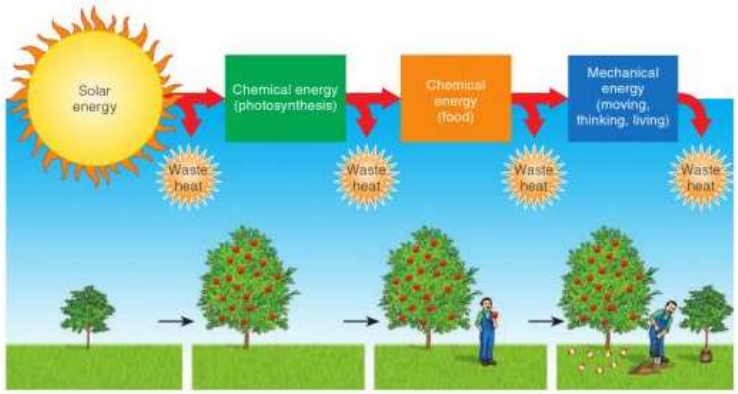
Energy Transformation

The process of changing energy from one form to another is **energy conversion.**

- **Ex:** The striking of a match

•Muscles use chemical energy to move the match.
•Chemical energy is converted into thermal energy (heat) and electromagnetic energy (light) in the flame.

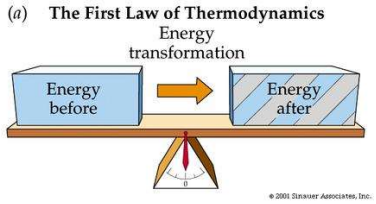
Law of Conservation of Energy



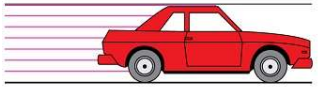
Law of Conservation of Energy

- First law of Thermodynamics:
  - For any system, the net change in energy equals the energy transferred as work and as heat.
  - A version of the law of conservation of energy
    - Energy can change forms, but cannot be created or destroyed

Whenever the total energy in a system increases, it must be due to energy that enters the system from an external source.



For the following images, identify how energy has been transformed.

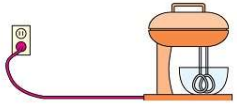


An automobile engine changes chemical energy to mechanical and heat energy.

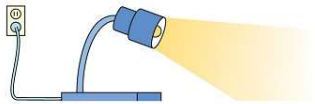
A tree changes radiant energy to chemical energy.

Hammering a nail changes mechanical energy to deformation and heat energy.

A thermonuclear reaction changes nuclear energy to radiant and heat energy.



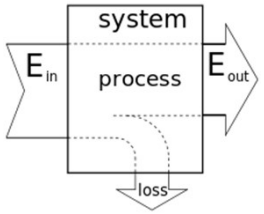
An electric mixer changes electrical energy to mechanical and heat energy.



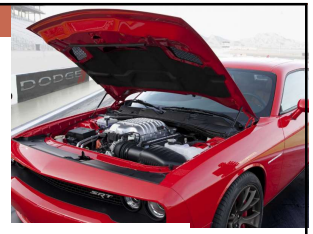
A lamp changes electrical energy to radiant and heat energy.

Efficiency of Machine

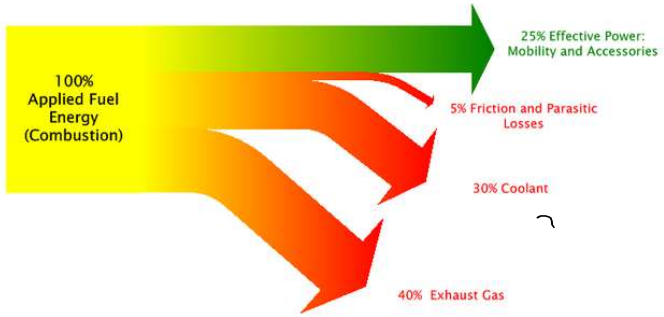
- Efficiency is the ratio of useful work out to work in done by a device. Ex. Refrigerator, TV, engines in cars
- Not all the work done is useful work
  - Some gets turned into other forms
    - Often heat (the least organized of all types of energy)
- Efficiency is ALWAYS less than 100% or 1.



Efficiency of Machine



Typical Energy Split in Gasoline Internal Combustion Engines



Examples of Conservation of Energy

For each of the following examples, how is the energy being conserved?

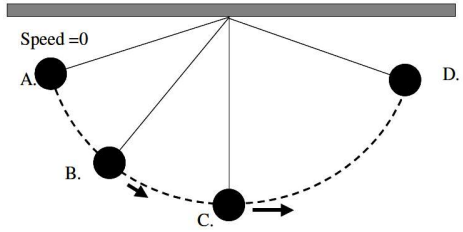
Example 1: Gas in a Car

Chemical energy → mechanical energy

Example 2: Radio

Electrical energy → sound

Potential and Kinetic Energy Transformation of a Pendulum



Describe the energy transformation from A. to B.

Describe the energy transformation from B. to C.

Describe the energy transformation from C. to D.

If not pushed, why does the pendulum not go as high when it swings back. Where does lost potential energy go?