Matter and Energy

Potential versus Kinetic Energy

Other examples of potential and kinetic energy:

Potential:
- water behind a dam
- energy stored in food
- energy stored in a battery

Kinetic:
- water falling over dam
- wind
- a moving train

Matter and Energy

Thermodynamics (i.e. energy transfer)

Matter is constantly recycled

Energy is NOT recycled

Matter and Energy

1st and 2nd Law of Thermodynamics

First Law: energy is conserved; neither created nor destroyed

Second Law: with each successive energy transfer, less energy is available to do work

Entropy is the tendency for all systems to go toward disorder
**Energy from the Sun**

*The Solar Spectrum*

**Photosynthesis**

*Environmental Unity - every component of our existence affects every other component - and ultimately everything is powered by the sun*

Photosynthesis: production of green plants

\[6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{sunlight}} \text{C}_6\text{H}_12\text{O}_6 + 6\text{O}_2\]

Plants use glucose to build new plant material

**Photosynthesis and Food**

The green plants that store the sunlight are called *producers* - only plants capable of photosynthesis are producers - everything else is a consumer

We can arrange the producers and consumers so that they form a pyramid such that the producers are at the base

- 4th trophic level
- 3rd trophic level
- 2nd trophic level
- 1st trophic level
Although arranging producers and consumers into food pyramids and chains greatly oversimplifies the truth, it does help us visualize what’s going on.

1 ppm humans $1$
1000 ppb = 1 ppm fish $10$
100 ppb frogs $1 = 100$
10 ppb grasshoppers $10$
1 ppb grass $100$

More Food Chains and Webs

Figure 2.16

More Food Chains and Webs

Figure 2.17

More Food Chains and Webs
Biogeochemical Cycles

- Hydrologic cycle - fastest
- Carbon cycle
- Nitrogen cycle
- Phosphorus cycle - slowest
- Sulfur cycle