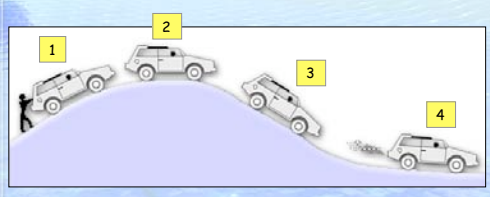
Matter and Energy

Potential versus Kinetic Energy

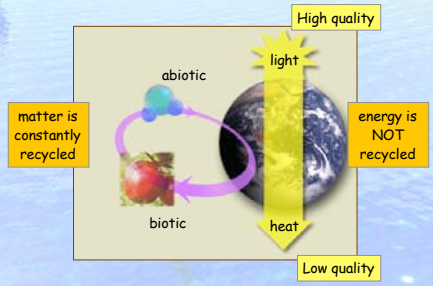


Other examples of potential and kinetic energy

Potential	Kinetic
• water behind a dam	• water falling over dam
• energy stored in food	• wind
• energy stored in a battery	• a moving train

Matter and Energy

Thermodynamics (i.e. energy transfer)



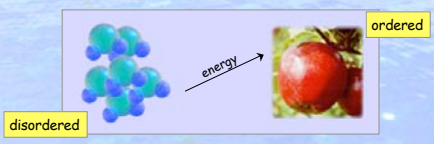
Matter and Energy

1st and 2nd Law of Thermodynamics

First Law: energy is conserved; neither created nor destroyed

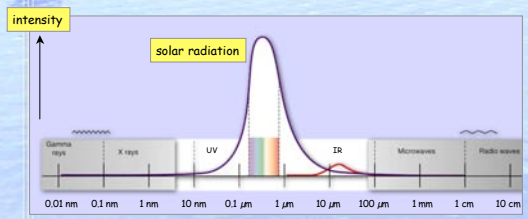
Second Law: with each successive energy transfer, less energy is available to do work

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

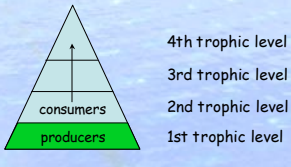
$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \underset{\text{glucose}}{C_6H_{12}O_6} + 6O_2$$

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



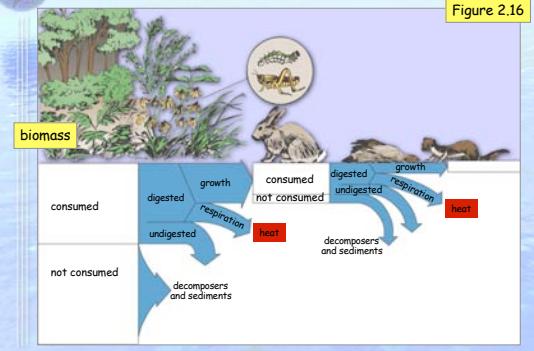
More Food Chains and Webs

Although arranging producers and consumers into food pyramids and chains greatly oversimplifies the truth, it does help us visualize what's going on.

bioconcentration (biomagnification)				energy loss
	10 ppm	humans	1¢	
	1000 ppb = 1 ppm	fish	10¢	
	100 ppb	frogs	$1 = 100¢	
	10 ppb	grasshoppers	$10	
	1 ppb	grass	$100	

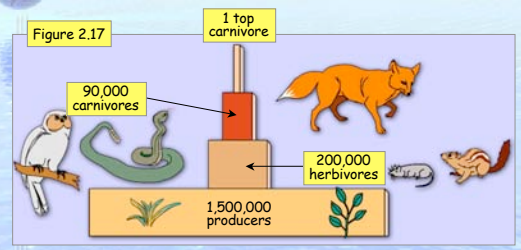
More Food Chains and Webs

Figure 2.16

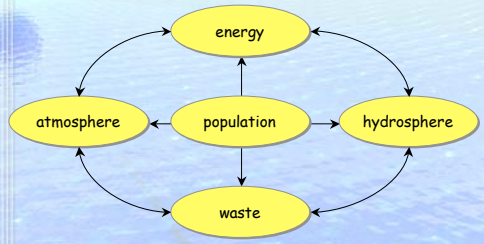


More Food Chains and Webs

Figure 2.17



Biogeochemical Cycles



Biogeochemical Cycles

Cycling times differ greatly

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

Biogeochemical Cycles

The Carbon Cycle

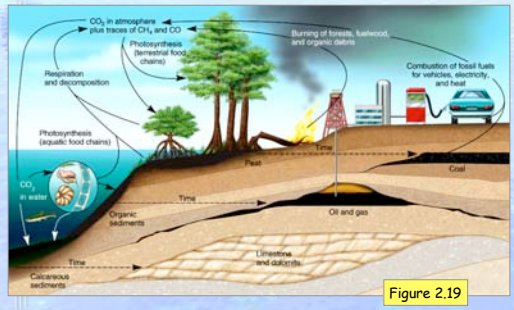


Figure 2.19