

Cycles of Energy and Matter

Everything is cycled throughout the planet!

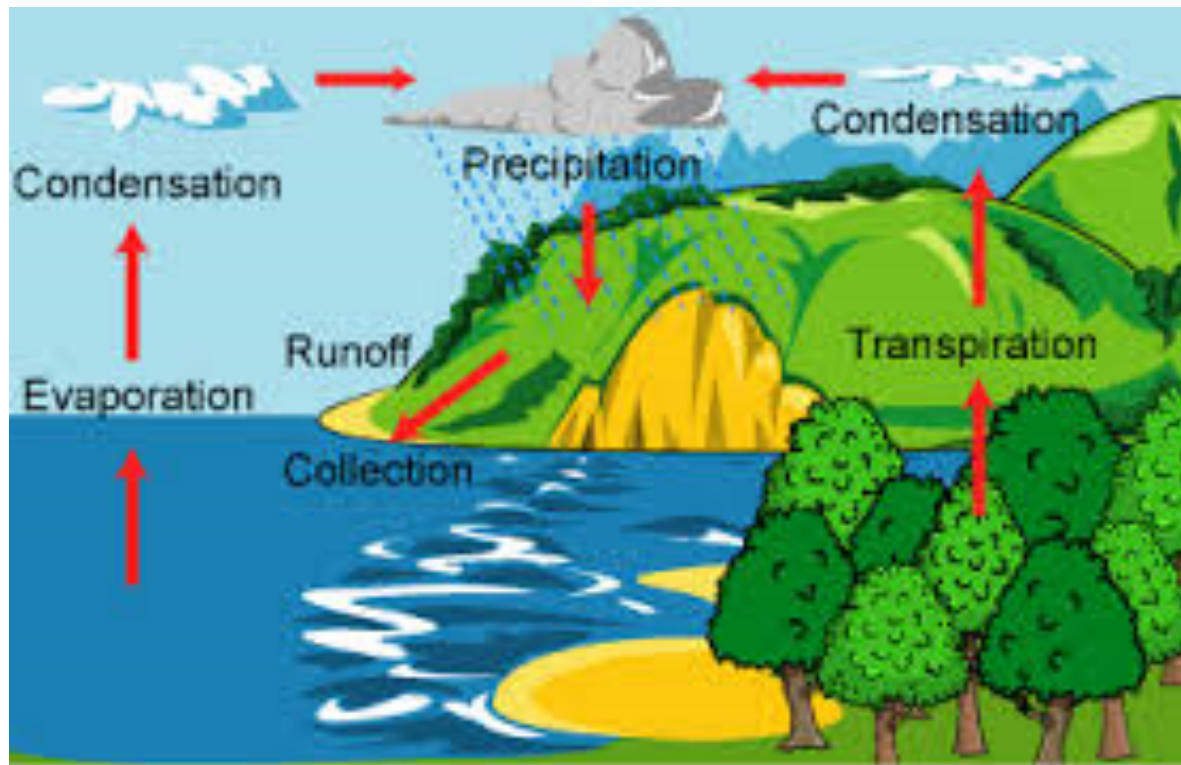
Cycles in Nature

- * Everything in nature is cycled throughout the entire planet. Since matter and energy cannot be created or destroyed, it is changed, or transformed into many different things.
- * What are some examples of cycles that you already know of?



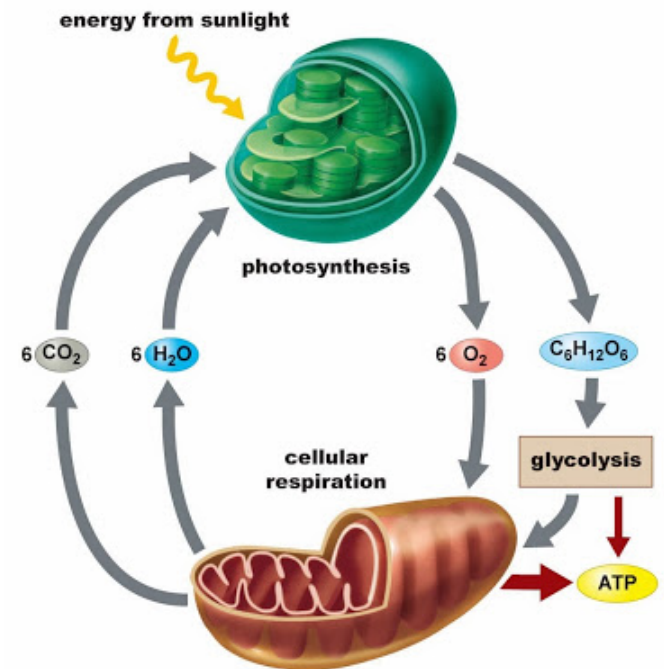
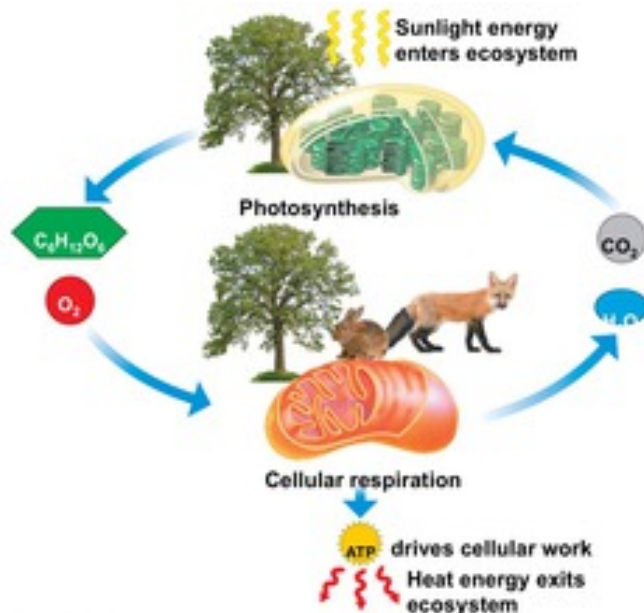
Water Cycle

- * The water cycle shows water's journey as it circulates on our planet

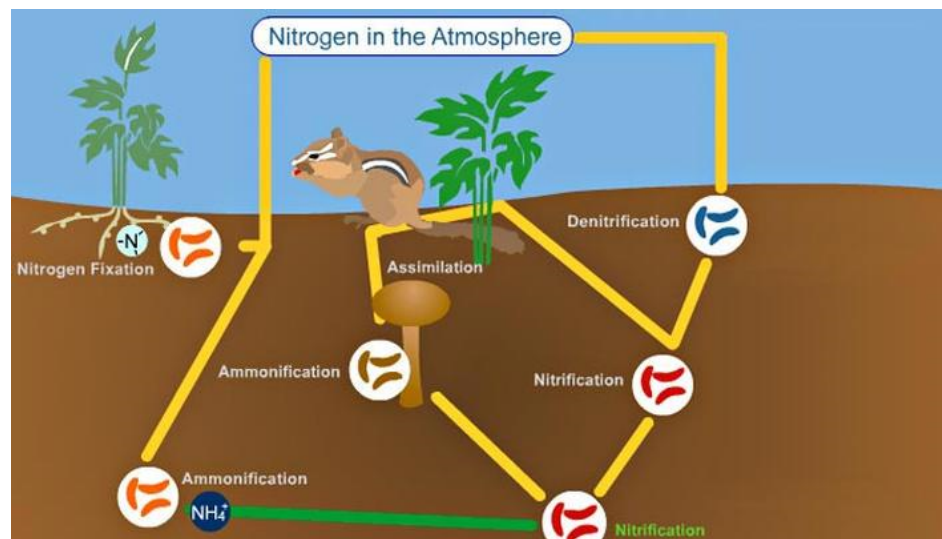
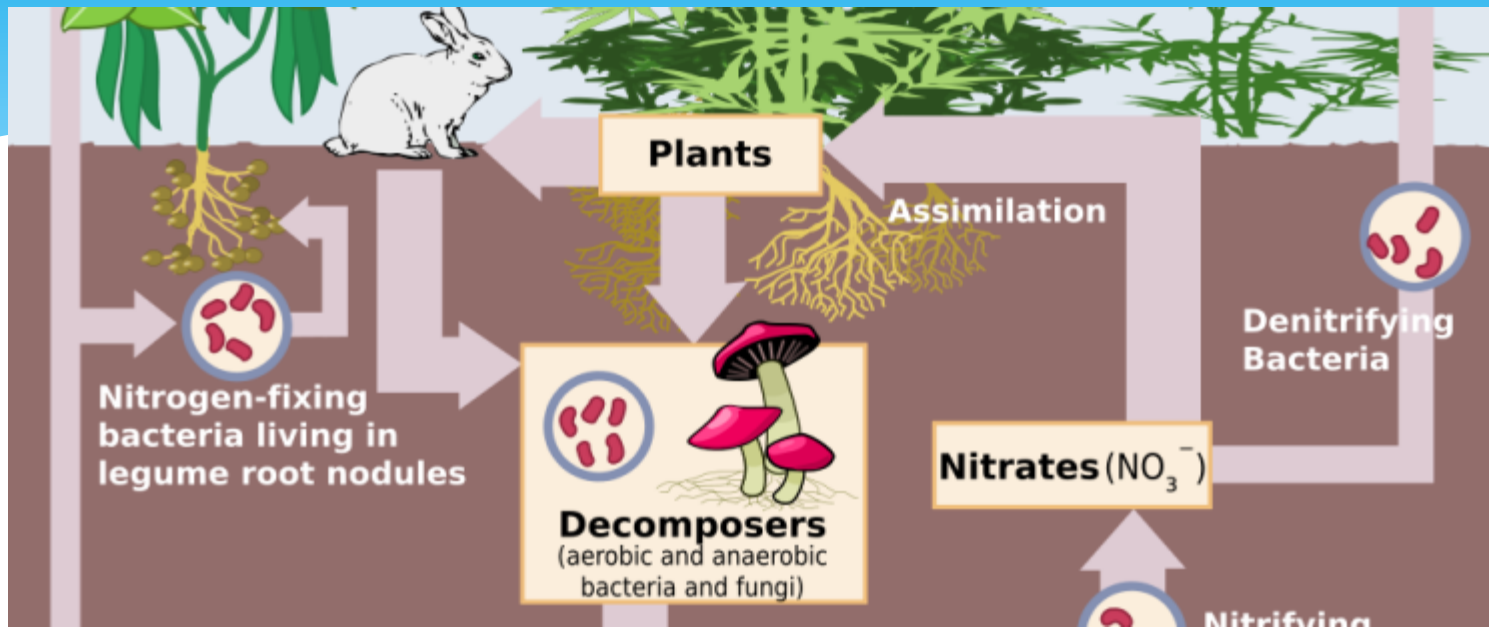


Photosynthesis/ Cell respiration Cycles

- * Plants take in water and carbon dioxide and make oxygen and glucose
- * Plants and animals take in oxygen and glucose and make carbon dioxide and water



Nitrogen Cycle

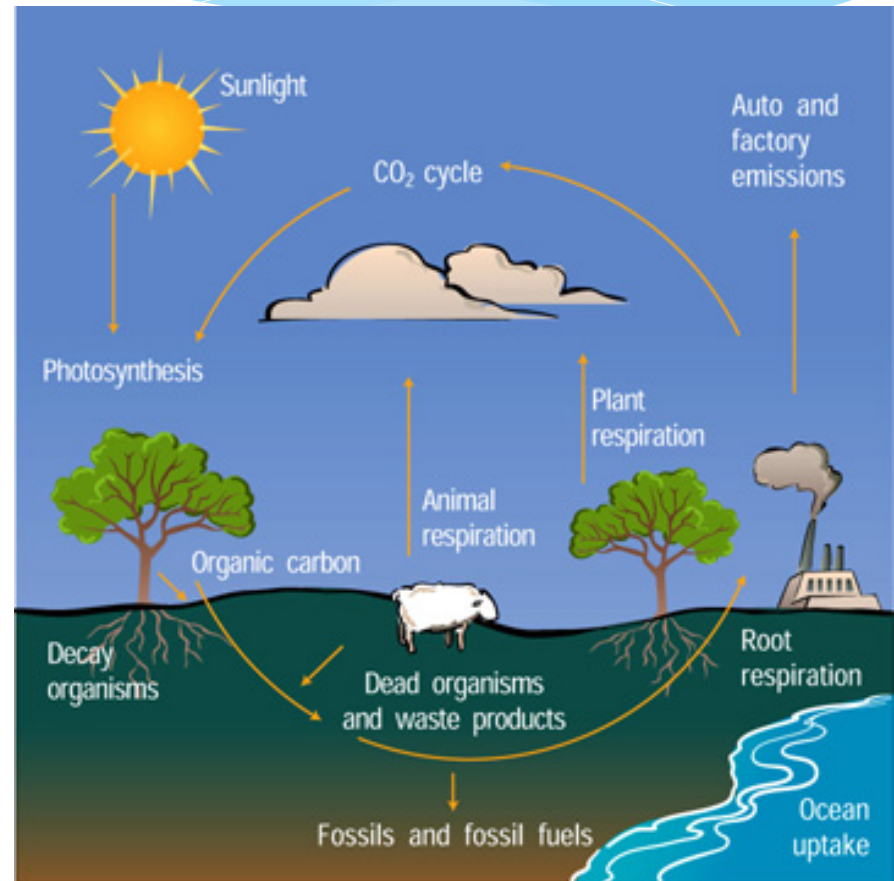


Nitrogen Cycle

- * Plants cannot use nitrogen in the air
- * Plants use nitrogen in soil (fertilizers)
 - * **Decomposers (fungi) break down dead/ decaying matter like leaves and dead animals into useable nitrogen**
 - * Bacteria convert nitrogen in the air to useable nitrogen in the soil
 - * Plants use nitrogen to make important molecules (proteins) for animals
- * Animals return nitrogen to the environment (urine & animal waste)

Carbon Cycle

- * Carbon is another element that is cycled throughout the environment.
- * **Carbon is taken in by plants (photosynthesis)**
- * **Carbon is released by plants and animals (cellular respiration), fossil fuel emissions (cars and factories)**
- * **More things release carbon than take in carbon from the atmosphere**

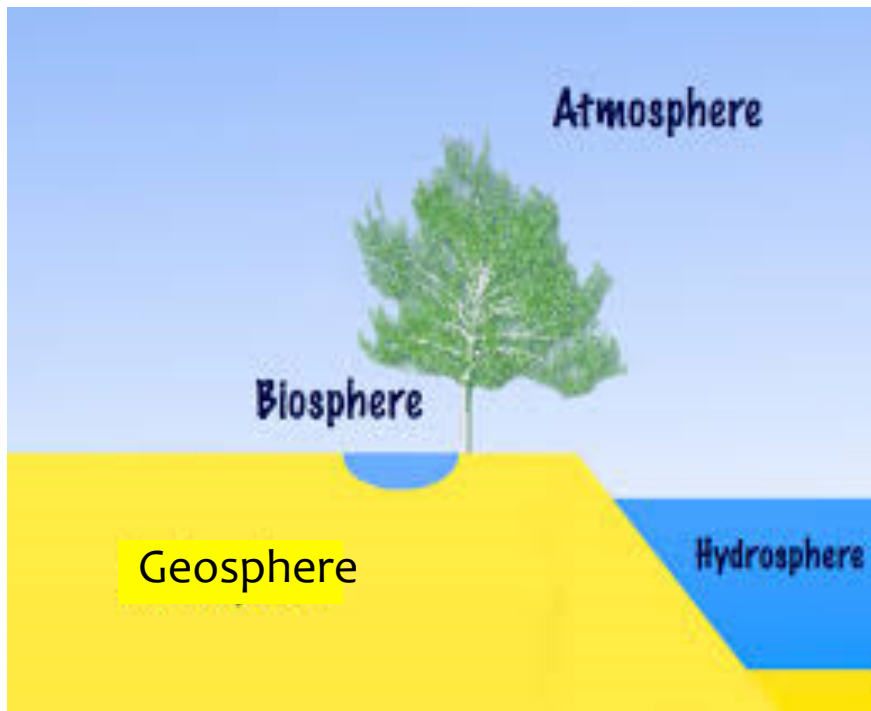


Where are all things cycled?

- * Each part of the planet is given a different name depending on where it is.
- * Geosphere – consists of the solid part of the earth
- * Hydrosphere- consists of all the water on earth
- * Atmosphere – consists of all the air and gases that surround the planet
- * Biosphere- consists of the other three spheres together where living things are found (the whole planet with all living)

Geosphere, Hydrosphere, Atmosphere, Biosphere

All things are cycled in one (or more) of these areas of the planet!



Why are things cycled?

- * One of the major laws of physics that ultimately explains why things are cycled is the Law of Conservation of Energy/Matter
- * This law states that energy and matter cannot be created or destroyed. The energy or matter can only be transformed from one kind of energy/matter to another
- * Or it can be transferred from one place to another

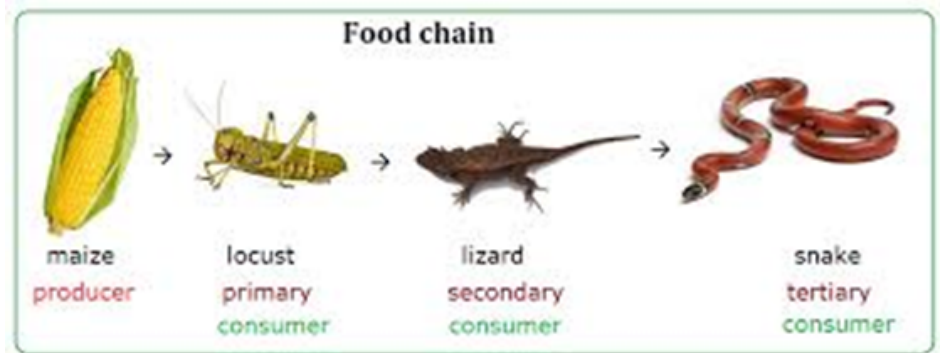
Why is matter/ energy cycled

- * What does this mean?
- * All things (carbon, water, nitrogen, oxygen, energy, etc.) are recycled on the planet.
- * No new carbon, water, oxygen, energy is made brand new on earth, it simply goes somewhere else or is made into a new thing.
- * Example: taking carbon dioxide and water and transforming it into glucose and oxygen (like in photosynthesis)

Energy Cycle

- * Energy is another thing that is cycled in nature.
- * All energy ultimately comes from the sun
- * Sunlight energy is transferred to plants that transform sunlight energy into chemical energy called glucose (process of photosynthesis)
- * That energy is transferred to animals when they eat plants
- * Energy pyramids and food chains show this cycling of energy

Food Chains



- * Food chains show the flow of energy from one organism to the next

Energy Pyramid

Energy Pyramids show the transfer of energy from organism to organism

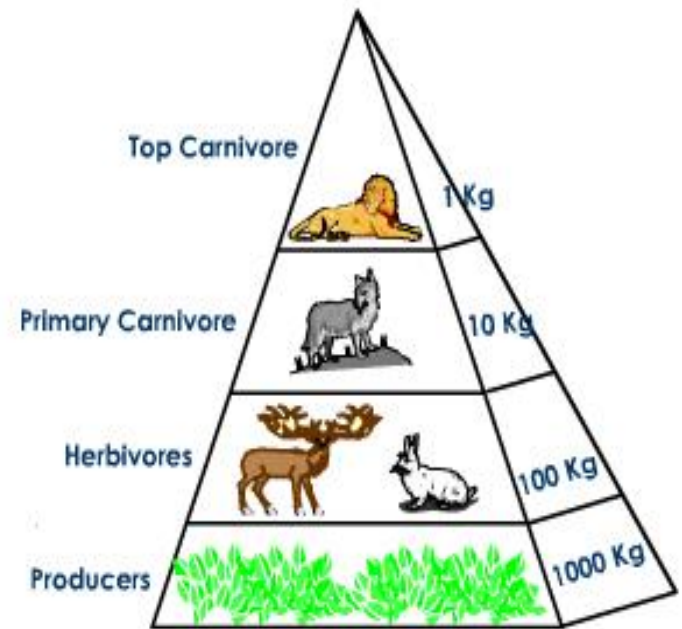
The energy moves from the bottom of the pyramid to the top

Each level is known as a trophic level

Producers – things that make their own food (plants) are at the bottom

Herbivores (primary consumers)– animals that eat plants

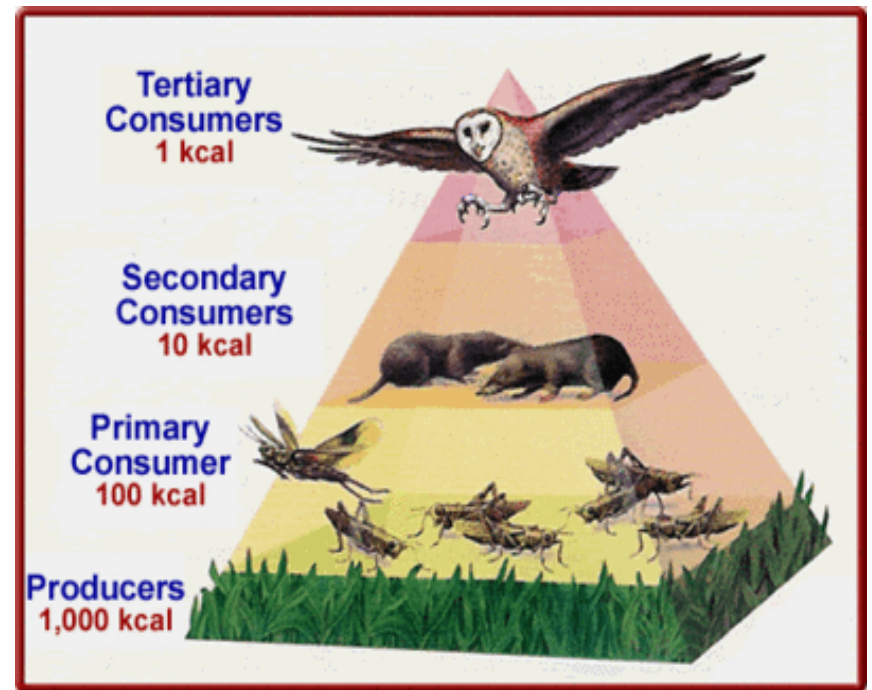
Carnivores (secondary/ tertiary consumers)– eat animals



Upright Pyramid of biomass in a Terrestrial Ecosystem

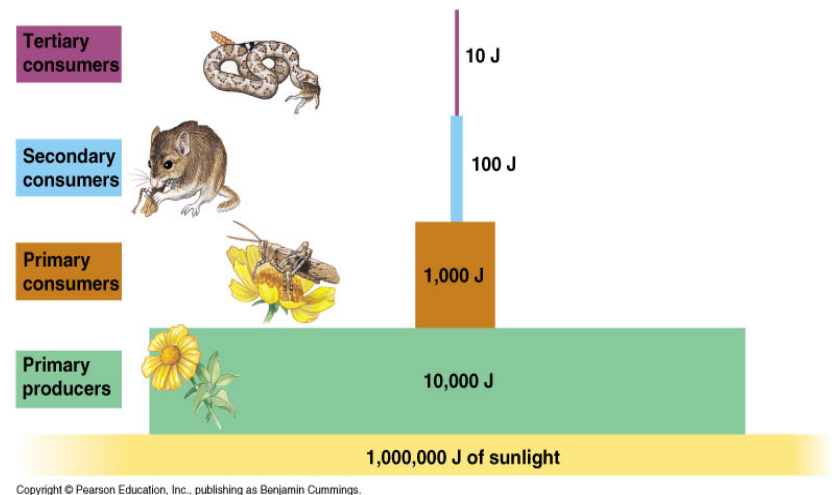
Energy Loss

- * Notice that the bottom of the pyramid where the producers (plants) are is much larger than the top where the top carnivore is
- * Why do you think this?



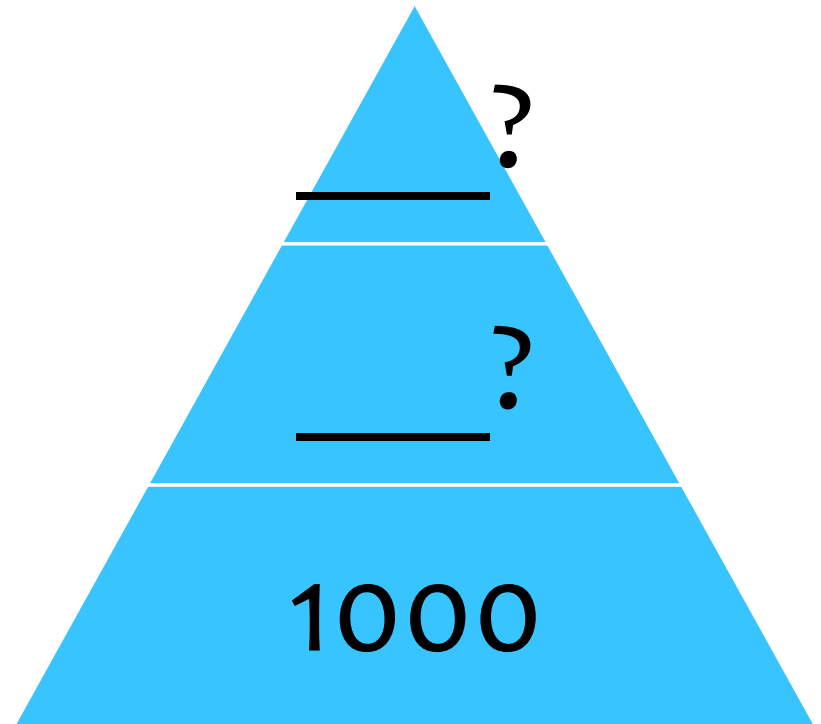
Energy loss and the 10% Rule

- * Energy is lost each time you move up a trophic level
- * In fact only 10% of the energy is available to the level above- This is known as the 10% rule
- * 90% of the energy in each trophic level is lost mostly in the form of heat



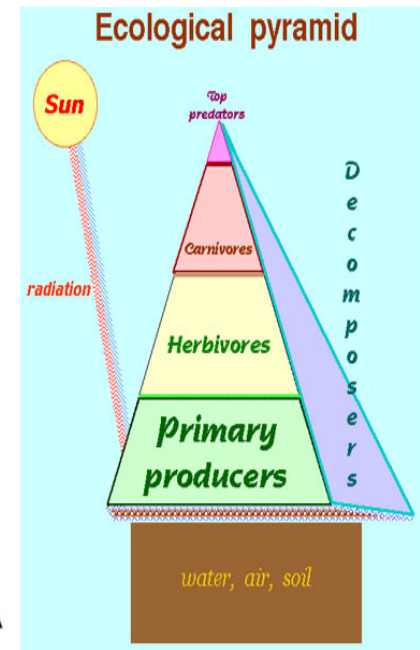
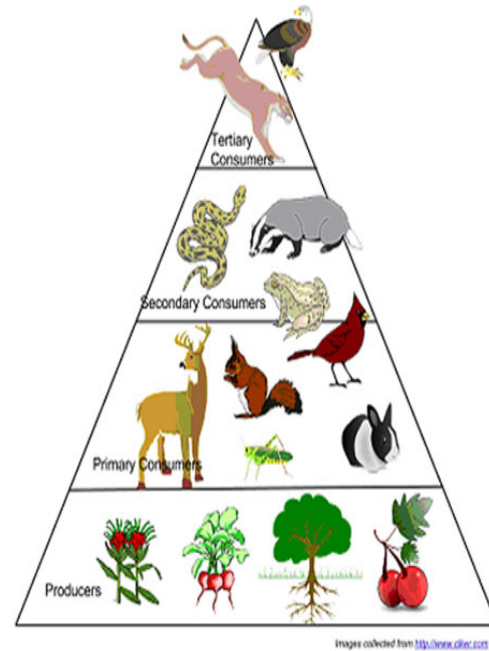
Loss of energy question

- * Knowing the 10% rule, how much energy is available at the second tropic level? _____
- * How much is available at the third? _____



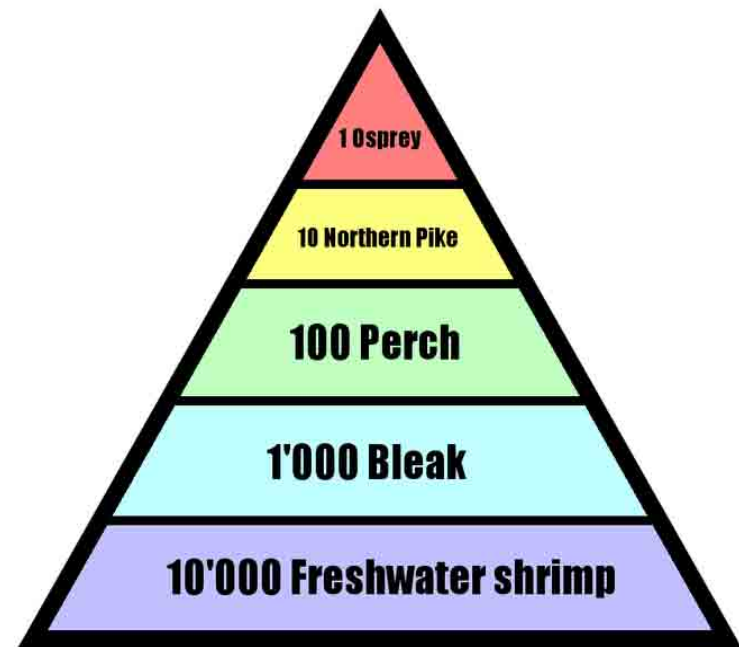
Biomass

- * Biomass refers to the mass of living things at each trophic level.
- * What do you notice happens to the biomass as you move up the trophic levels?



Biomass

- * The amount of biomass decreases you move up the pyramid because the amount of energy available at each level also decreases
- * That's why there are more plants on the planet than top predators like lions, sharks, and humans



How is matter cycled?

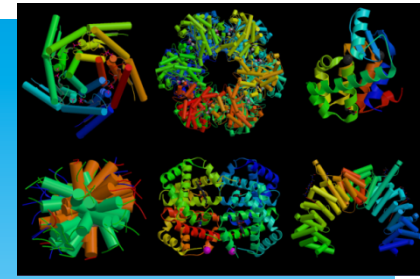
- * Matter which is the stuff all things are made of is made of smaller parts like atoms and molecules
- * Atoms are created when stars explode! The intense heat and pressure cause smaller atoms like hydrogen to fuse together to make larger atoms like carbon, oxygen, and others
- * These atoms can come together to form larger molecules like CO_2 , H_2O , and $\text{C}_6\text{H}_{12}\text{O}_6$

Biomolecules

- * If you remember, one of the characteristics of life is having complex chemistry which means you are made of certain life molecules
- * Biomolecules – life molecules- make up everything living on the planet
- * There are 4 main biomolecules



4 Biomolecules



1. Carbohydrates – simple sugars
2. Lipids- fats, oils, and waxes
3. Proteins – enzymes and hormones
4. Nucleic Acids (DNA/ RNA)



-All Biomolecules are made of smaller parts called subunits
- these compounds **always contain carbon as their key element** and usually hydrogen and oxygen



Carbohydrates



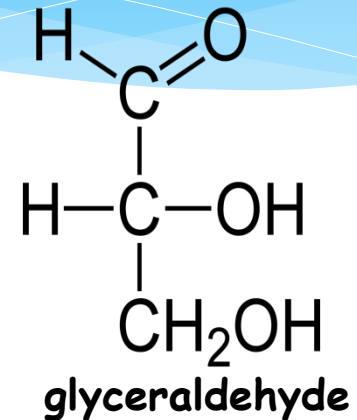
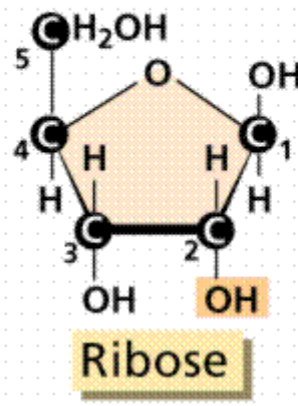
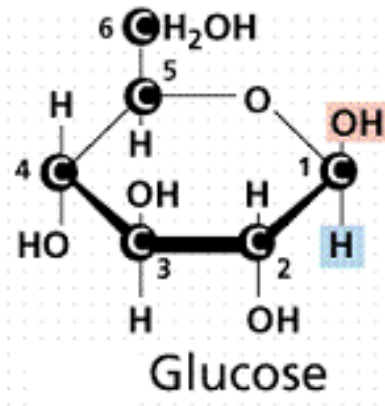
1. Carbohydrates – simple sugars
 - a. subunit – monosaccharides (mono- 1, saccharide – sugar)
 - 3 types monosaccharaides, disaccharides, polysaccharides

Examples: sucrose, **glucose**, **cellulose**, fructose, **starch**, **glycogen**, **chitin**

- * Carbohydrates are made of Carbon, Hydrogen, and Oxygen in a ratio of:
1 Carbon : 2 Hydrogen: 1 oxygen

Function- storing energy (short term), providing short term energy for the cells of living things

Carbohydrates



ALL HAVE 1 C: 2 H: 1 O

Lipids (fats, oils, waxes)

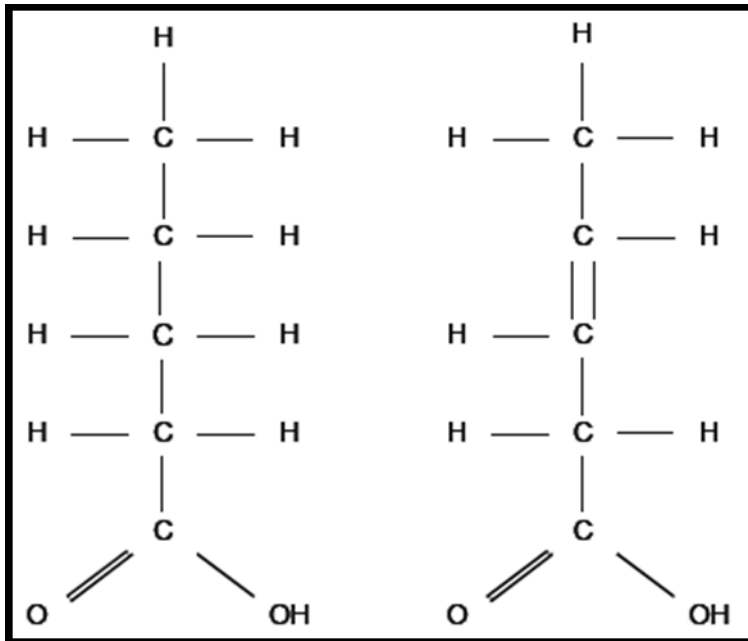
2. Lipids- fats, oils, and waxes
 - a. **Subunits** - fatty acids

- * Lipids are made mostly of Carbon and Hydrogen

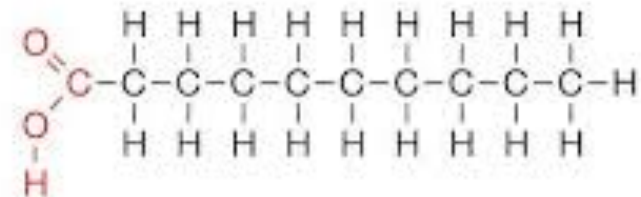
- non-soluble (don't dissolve) in water which makes them nonpolar

Functions- **helps form the cell membrane**, stores energy (long term), insulation, regulates cell activities

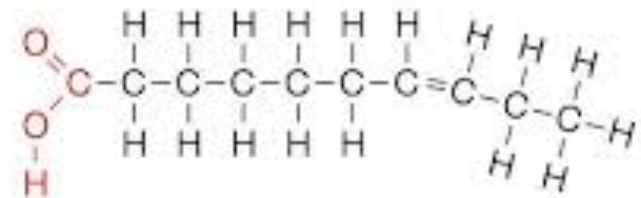
Lipids



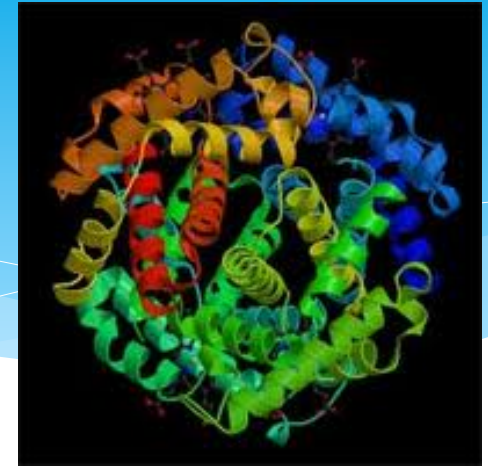
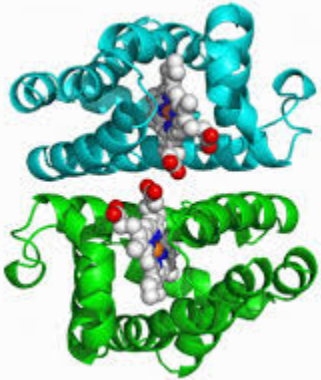
Saturated



Unsaturated



Proteins



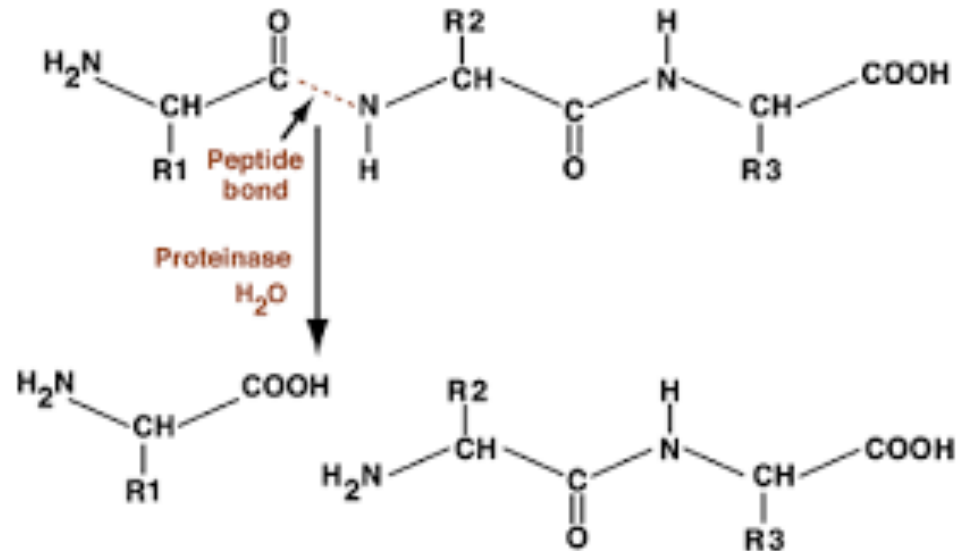
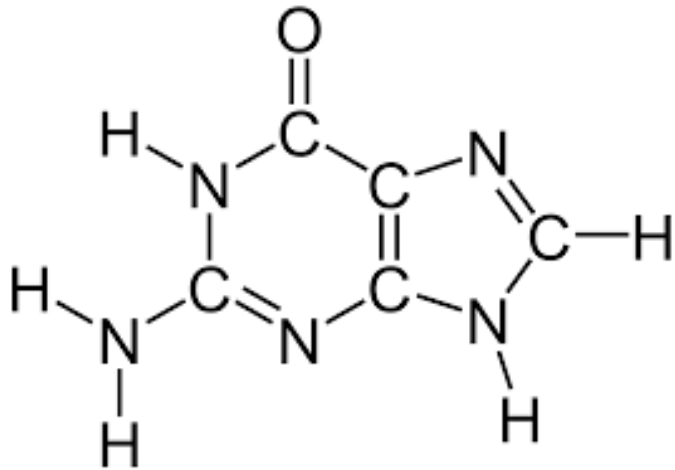
Proteins

a. Subunits called amino acids

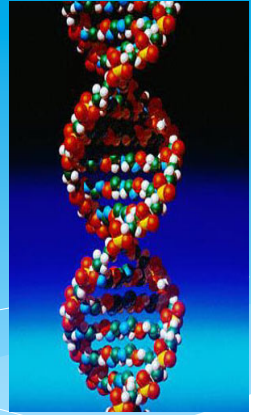
- * Proteins are composed of oxygen, hydrogen, carbon, and nitrogen
- You are literally composed of millions of proteins

Function- repair body tissues, makes enzymes, transports nutrients and is a source of energy

Proteins



Nucleic Acids



4. Nucleic Acids (DNA/ RNA)

a. Subunits called nucleotides

* Contain carbon, hydrogen, oxygen, nitrogen, and phosphorus

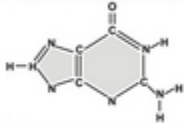
Functions – stores and transports genetic information to make new cells

Nucleic Acid

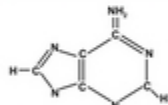
Cytosine



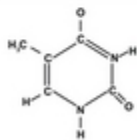
Guanine



Adenine



Thymine



Nitrogenous
Bases



DNA

Deoxyribonucleic Acid



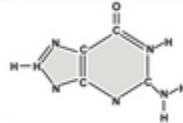
RNA

Ribonucleic Acid

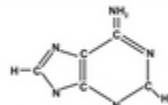
Cytosine



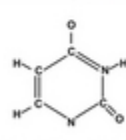
Guanine



Adenine



Uracil



Replaces Thymine in RNA

Nitrogenous
Bases

