**Concept 5: Ecosystems –** Analyzing productivity, energy flow, and chemical cycling.

Chapter 55 – Pre AP Biology 11

**Ecosystems (Ch 55)**

How energy flows through the ecosystem by understanding the terms that relate to food chains and food webs

The difference between gross primary productivity and net primary productivity

The carbon and nitrogen biogeochemical cycles

* *consist of all the organisms living in a community, as well as the abiotic factors with which they interact*

Ecosystems range from a microcosm \_\_\_\_\_\_\_\_\_\_\_\_\_to a large area \_\_\_\_\_\_\_\_\_\_

Ecosystem Dynamics involve two main processes:  *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**Flow of Energy**

* The *first law of thermodynamics* states that **energy cannot be created or destroyed, only transformed**

Energy enters an ecosystem as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, is conserved, and is lost from organisms as \_\_\_\_\_\_.

* The *second law of thermodynamics* states that **every exchange of energy increases the entropy of the universe**

In an ecosystem, energy conversions are not completely \_\_\_\_\_\_\_\_, and some energy is always lost as heat.

**Cycling of Chemicals**

* The ***law of conservation of mass*** states that matter cannot be created or destroyed.

Chemical elements are continually \_\_\_\_\_\_\_\_\_\_\_\_\_\_within ecosystems

Ex) In a forest ecosystem, most \_\_\_\_\_\_\_\_ enter as dust or solutes in rain and are carried away in water

***Overall: Ecosystems are open systems, absorbing energy and mass and releasing heat and waste products***

**Trophic Levels**

***Autotrophs*** - build molecules themselves using photosynthesis or chemosynthesis as an energy source

Example:

***Heterotrophs*** - depend on the biosynthetic output of other organisms

Example:

**Trophic Levels**

Put the words on the screen in order of energy flow:

**Primary Productivity**

*The amount of light energy converted to chemical energy (organic compounds) by an ecosystem’s autotrophs during a given period of time*

*Background:*

Photosynthesis: carbon dioxide + water → glucose + oxygen

Cellular Respiration: glucose + oxygen → carbon dioxide + water

Gross primary production (GPP) -

Net primary production (NPP) -

**Ecological Efficiency**

Describes the proportion of energy represented at one trophic level that is transferred to the next trophic level

* **On average, efficiency is only ~10%**

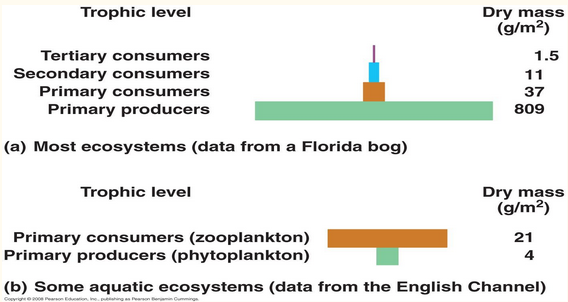
10 percent of the productivity of one trophic level is transferred to the next level.  The remaining 90% is consumed by individual \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_or to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

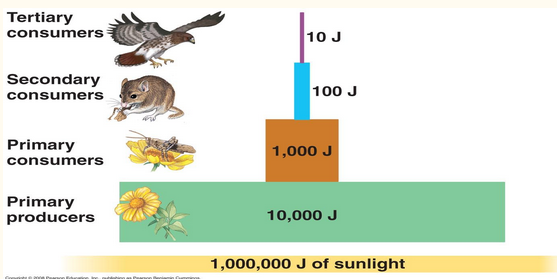
* *Applications*:

**Ecological Pyramid:** *Used to show relationship between trophic levels*

Horizontal bars or tiers: represent relative size in terms of either:

Tiers are stacked in the order in which energy is transferred.





**Biogeochemical Cycle**

*Describes the flow of essential elements from the environment to living things and back to the environment.* **p. 1209-1214 in *Campbell***

For each of the following essential elements, you much know:

The *reservoirs*

The process of *assimilation*

The process of *release*

* **Hydrolytic Cycle** (water cycle)
* **Carbon Cycle** (required for the building of all organic compounds)

* **Nitrogen Cycle** (required for the manufacture the building blocks of proteins and nucleic acids)
* Phosphorus Cycle (required for the manufacture of ATP and all nucleic acids.  Cycle is similar to other mineral cycles like calcium)