

## Guided Notes

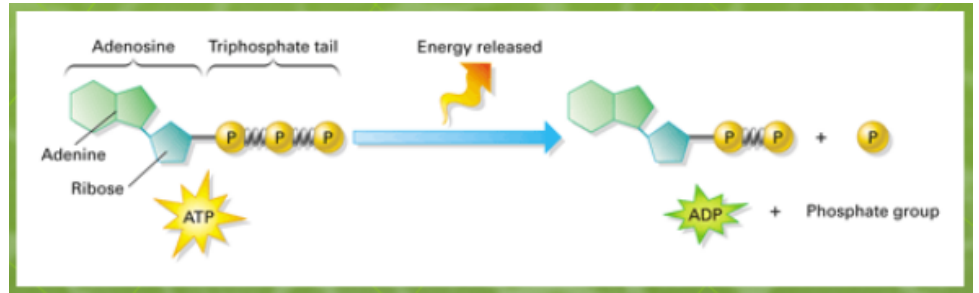
### Unit 3: Matter and Energy

#### Chapter 4: Cells and Energy

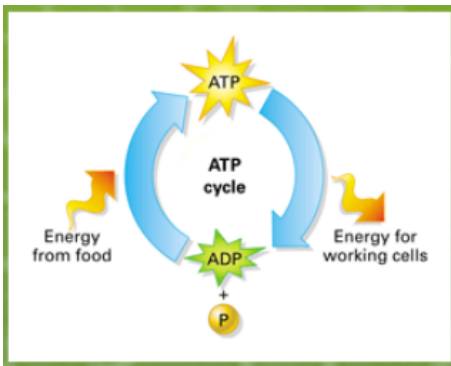
##### I. Concept 4.1: Chemical Energy and ATP

a. ATP Holds Energy

- i. ATP = \_\_\_\_\_
- ii. \_\_\_\_\_
- iii. When a phosphate group breaks off of ATP, energy is released. (ATP becomes ADP (Adenosine Diphosphate).)



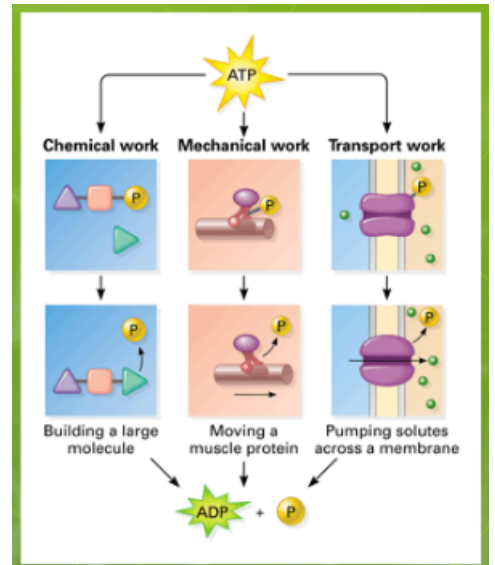
b. The ATP Cycle



- i. \_\_\_\_\_ – it has a continual cycle.
- ii.  $ATP \rightarrow ADP \rightarrow ATP \rightarrow ADP \rightarrow ATP$

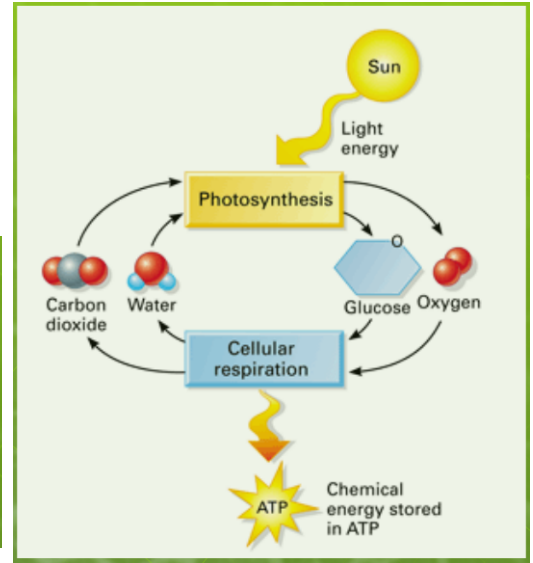
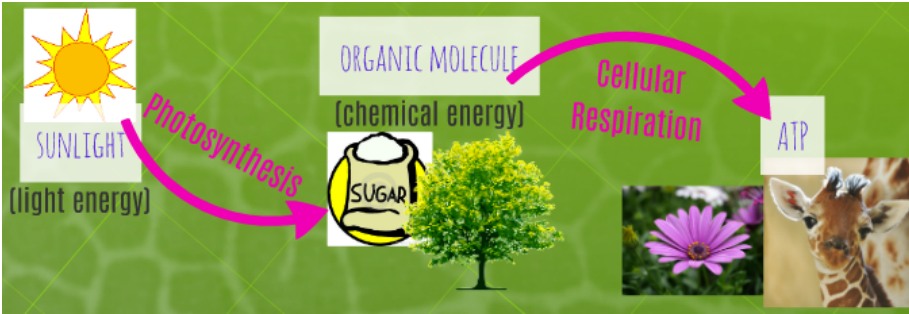
c. ATP and Cellular Work

- i. Three types of cellular work that ATP helps with:
  - 1. \_\_\_\_\_
  - 2. \_\_\_\_\_
  - 3. \_\_\_\_\_



d. Photosynthesis and Cellular Respiration

- i. \_\_\_\_\_  
\_\_\_\_\_
- ii. These organic molecules are used to \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



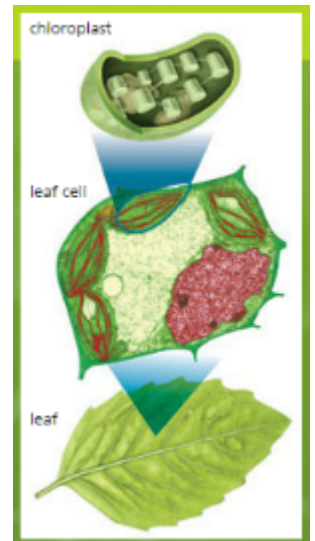
II. Concept 4.2: Photosynthesis

a. Producers

- i. \_\_\_\_\_  
\_\_\_\_\_
- ii. Producers produce the source of chemical energy for \_\_\_\_\_  
\_\_\_\_\_

b. Chloroplasts

- i. Chloroplast: \_\_\_\_\_  
\_\_\_\_\_
- ii. Chlorophyll: chemical compound that \_\_\_\_\_  
\_\_\_\_\_
  - 1. (A plant's leaves have the most photosynthesis occurring – therefore, leaves are usually always green.)
- iii. Stomata: part of the leaf where \_\_\_\_\_  
(how they get to the chloroplast for photosynthesis)



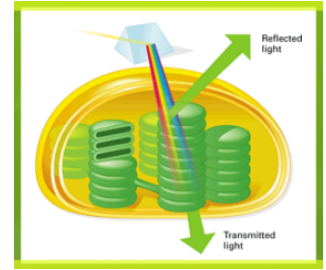
c. Light Energy and Pigments

- i. Sunlight = electromagnetic energy (travels in waves)
- ii. Wavelength: length between each wave of electromagnetic energy; determines different types of electromagnetic energy

d. Pigments and Color

i. Pigment: \_\_\_\_\_  
 \_\_\_\_\_

ii. Waves are either: \_\_\_\_\_  
 \_\_\_\_\_

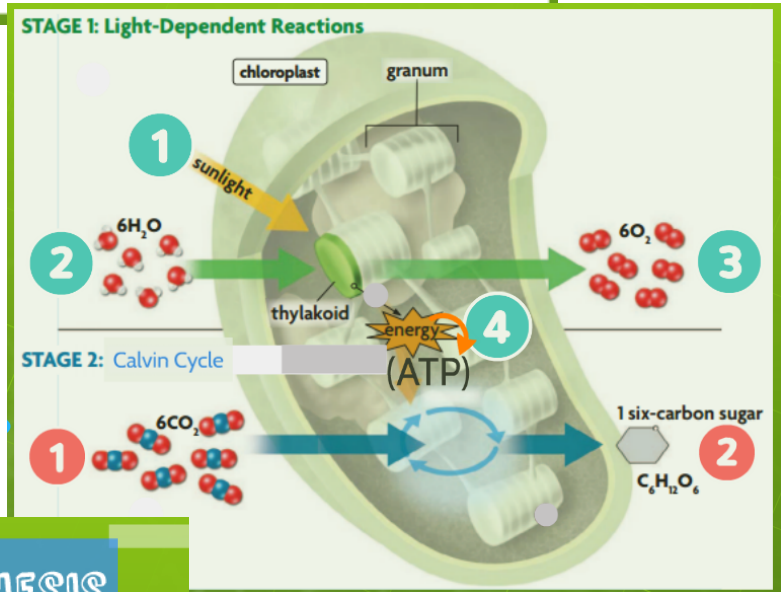
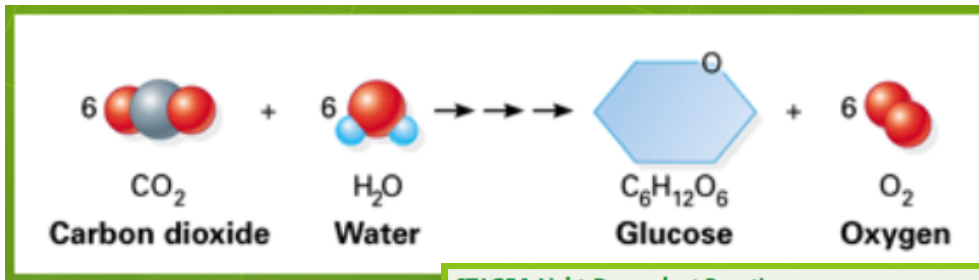


iii. Leaf chloroplasts absorb blue-violet and red-orange light. They do not absorb green – it is transmitted or reflected.

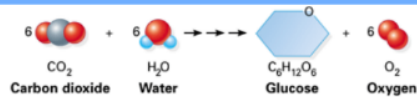
e. Overview of Photosynthesis

i. Photosynthesis is almost the complete opposite of cellular respiration

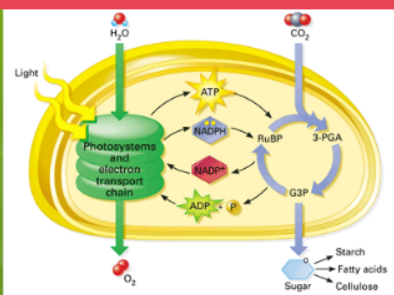
ii. Reactants: \_\_\_\_\_ and \_\_\_\_\_ → products: \_\_\_\_\_ and \_\_\_\_\_



## SUMMARY OF PHOTOSYNTHESIS



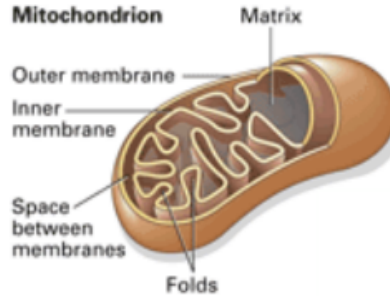
REMEMBER: PHOTOSYNTHESIS IS THE ULTIMATE SOURCE OF ALL THE FOOD YOU EAT AND ALL THE OXYGEN YOU BREATHE.



### III. Concept 4.4: Cellular Respiration

#### a. Mitochondria

- i. Found in almost all \_\_\_\_\_ cells
- ii. Where \_\_\_\_\_ takes place
- iii. Makes \_\_\_\_\_

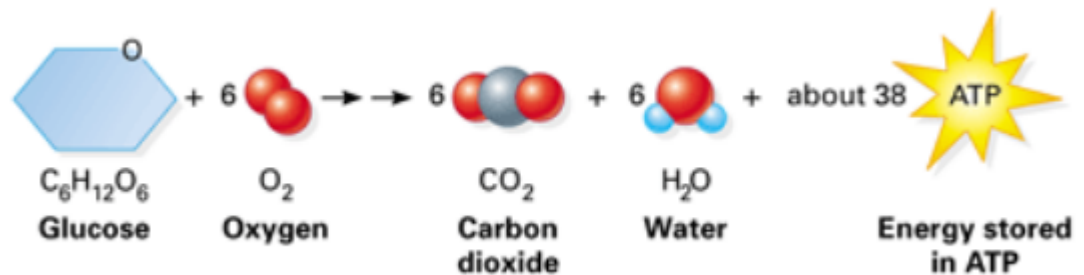


#### b. Overall Equation for Cellular Respiration

- i. Glucose (sugar) = \_\_\_\_\_
- ii. \_\_\_\_\_ ATP molecules are produced from each glucose molecule through cellular respiration.

#### c. Overview of Cellular Respiration

- i. Metabolism: \_\_\_\_\_



- ii. Therefore, cellular respiration is considered to be a “metabolic pathway.”

#### d. Adding up the ATP Molecules

- i. \_\_\_\_\_ → \_\_\_\_\_



e. Comparing Cellular Respiration to Photosynthesis

## COMPARING CELLULAR RESPIRATION TO PHOTOSYNTHESIS

PHOTOSYNTHESIS

CELLULAR RESPIRATION

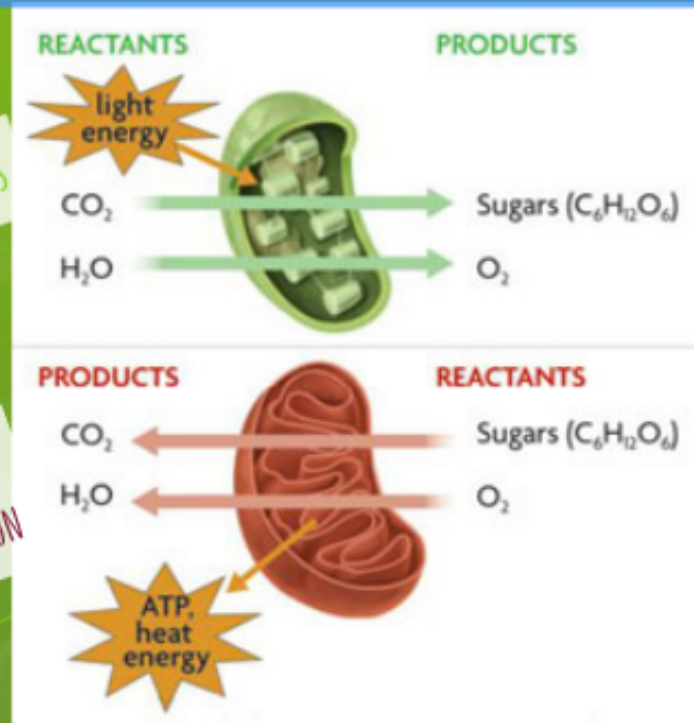


FIGURE 5.5 PHOTOSYNTHESIS AND CELLULAR RESPIRATION

	PHOTOSYNTHESIS	CELLULAR RESPIRATION
Organelle for process	chloroplast	mitochondrion
Reactants	$\text{CO}_2$ and $\text{H}_2\text{O}$	sugars ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) and $\text{O}_2$
Electron transport chain	proteins within thylakoid membrane	proteins within inner mitochondrial membrane
Cycle of chemical reactions	Calvin cycle in stroma of chloroplasts builds sugar molecules	Krebs cycle in matrix of mitochondria breaks down carbon-based molecules
Products	sugars ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) and $\text{O}_2$	$\text{CO}_2$ and $\text{H}_2\text{O}$

HONORS ONLY

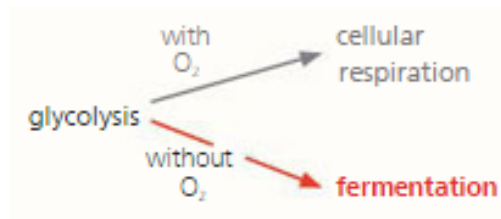
**IV. Concept 4.6: Fermentation**

a. Aerobic vs. Anaerobic

- i. Aerobic: \_\_\_\_\_
- ii. Anaerobic: \_\_\_\_\_
- iii. Cellular respiration is \_\_\_\_\_ - it requires oxygen in order to take place.

b. Fermentation

- i. Fermentation is an \_\_\_\_\_ process.
- ii. Fermentation: \_\_\_\_\_
- iii. Begins with glycolysis (the same as cellular respiration), giving the organism \_\_\_\_\_

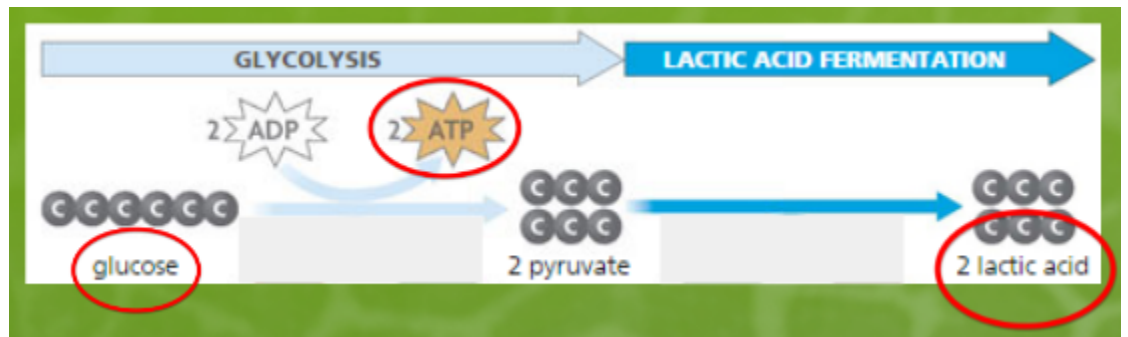


c. Importance of Fermentation in Humans

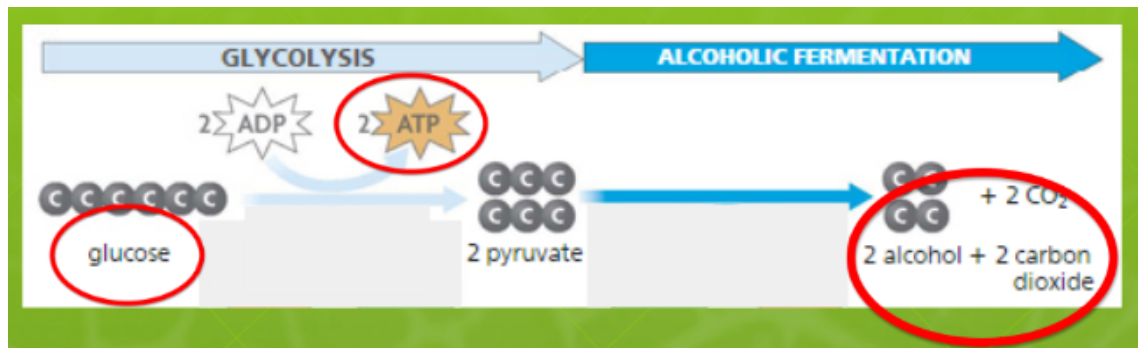
- i. Humans can use fermentation as a back-up if they \_\_\_\_\_ than what they get from cellular respiration.

d. Examples

i. Lactic Acid Fermentation



ii. Alcoholic Fermentation



## Chapter 13: Principles of Ecology

### I. **Concept 13.3: Energy in Ecosystems**

#### a. Review Vocabulary

- i. Producers: convert the light energy from sunlight to the chemical energy of organic compounds
- ii. Consumers: obtain chemical energy by feeding on producers or other consumers
- iii. Decomposers: \_\_\_\_\_

#### b. Autotrophs

- i. \_\_\_\_\_
- ii. "Producer"
- iii. Examples: plants, algae, photosynthetic bacteria

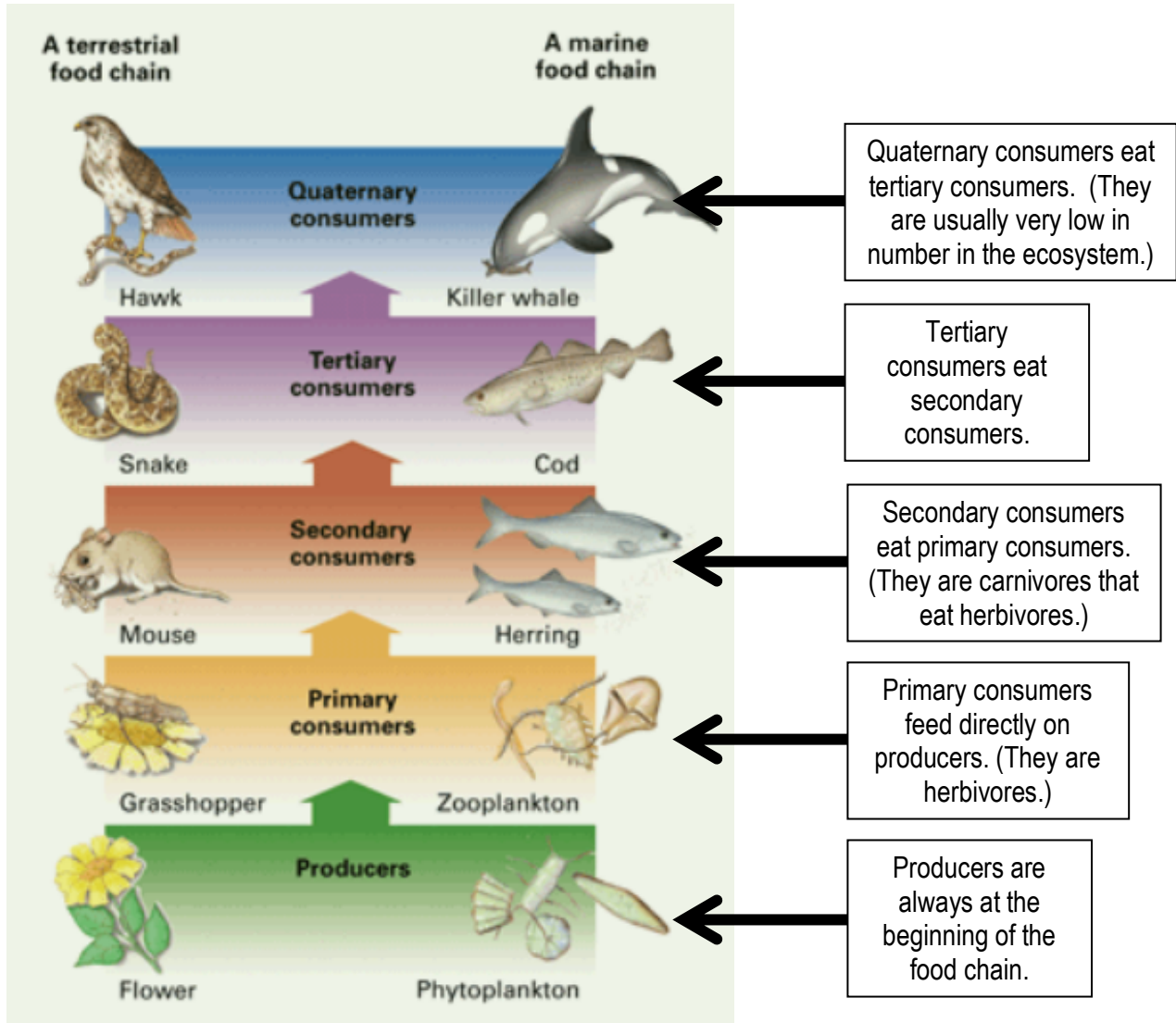
#### c. Heterotrophs

- i. \_\_\_\_\_  
\_\_\_\_\_
- ii. "Consumer" or "Decomposer"
- iii. Examples: humans, squirrels, jaguars, fungi, etc.

### II. **Concept 13.4: Food Chains and Food Webs**

#### a. Food Chains

- i. Food chain: \_\_\_\_\_  
\_\_\_\_\_
- ii. Follows the connection between one producer and a single chain of consumers within an ecosystem
- iii. Trophic level: \_\_\_\_\_
- iv. Energy flows up a food chain from the lowest trophic level to the highest
- v. What types of consumers are there?
  1. Herbivore: \_\_\_\_\_
  2. Carnivore: \_\_\_\_\_
  3. Omnivore: \_\_\_\_\_
  4. Decomposer: \_\_\_\_\_



vi. (Omnivores, such as humans that eat both plants and animals, may be listed at different trophic levels in different food chains.)

vii. Decomposers

1. At each level, organisms produce waste and eventually die.

2. Decomposers are \_\_\_\_\_

\_\_\_\_\_.

These are not always shown in diagrams of food chains, but all ecosystems include decomposers – they are vital to the ongoing recycling of chemicals in the ecosystem.

3. Examples: scavengers (earthworms, some rodents and insects, crayfish, catfish, and vultures), bacteria, and fungi



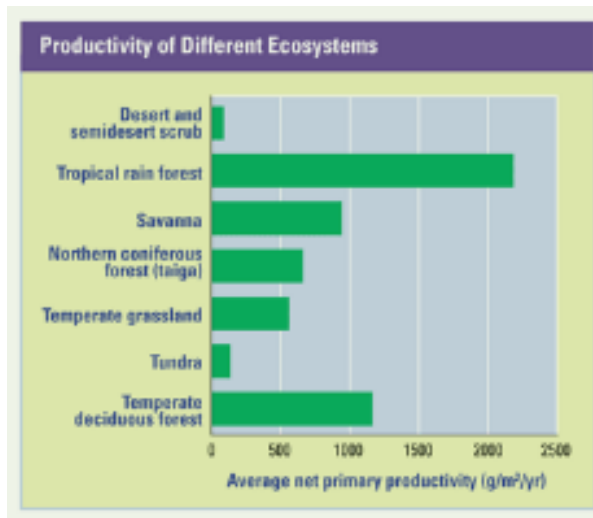
b. Food Webs

- i. Simple food chains do not show the complicated feeding relationships that exist in most ecosystems.
- ii. Consumers have a \_\_\_\_\_ and feeding relationships can become \_\_\_\_\_.
- iii. The stability of any food web depends on the presence of producers, as they form the base of the food web.

**III. Concept 13.6: Pyramid Models**

a. Productivity of Ecosystems

- i. There is a limited amount of energy available in an ecosystem - "energy budget." This budget influences the types and numbers of organisms in the ecosystem.
- ii. Only \_\_\_\_\_ of sunlight reaching producers is captured for photosynthesis.
- iii. The level of primary productivity sets the "energy budget."
  1. (This means that the productivity of producers determines how much energy available to higher trophic levels in an ecosystem.)
- iv. Not all ecosystems are equal.



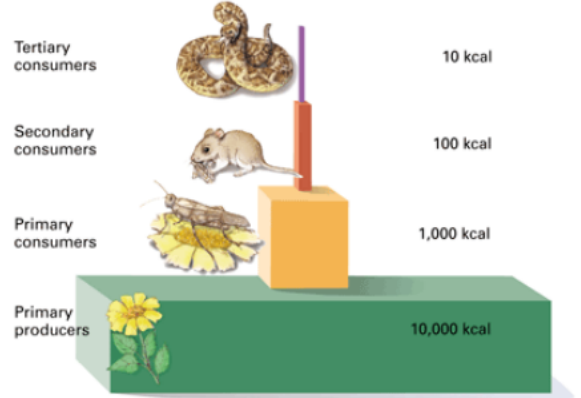
b. Ecological Pyramids

- i. At each step of the food web, energy is "spent" in three ways when it is transferred to higher levels (given to its consumer):
  1. Used as waste
  2. Used for energy for life processes
  3. Transformed into consumer's biomass (AKA growth)
- ii. Example: Caterpillar eats a leaf.
  1. \_\_\_\_\_% of leaf energy is passed through the caterpillar as waste.
  2. \_\_\_\_\_% of leaf energy is used for caterpillar energy.
  3. \_\_\_\_\_% of leaf energy is used for caterpillar to grow.

c. Energy Pyramids

- i. Energy pyramid: \_\_\_\_\_
- ii. Energy pyramids compare energy used by producers and other organisms on trophic levels.
1. \_\_\_\_\_% of energy in each trophic level goes to the next.
  2. \_\_\_\_\_% is lost as heat.

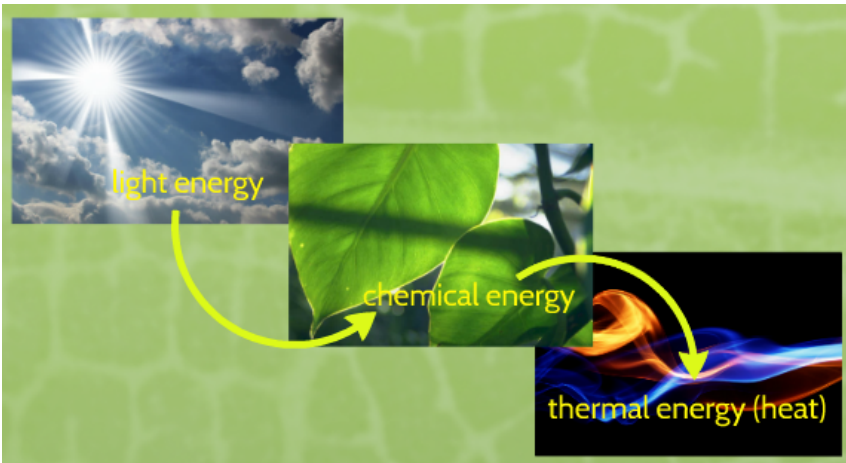
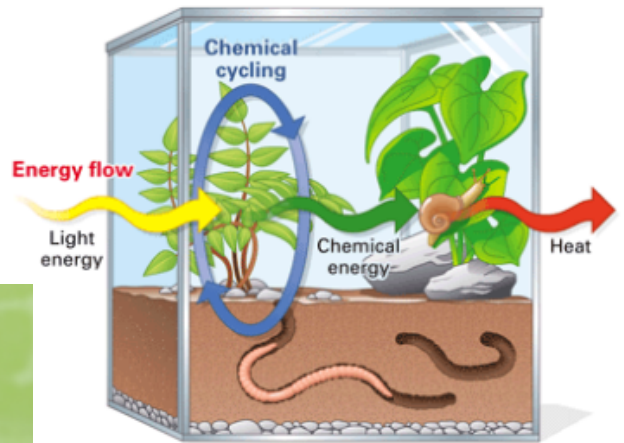
- a. Note: The amount of energy provided to support the higher trophic levels is significantly smaller than what is available to primary consumers.



IV. **Concept 13.5: Cycling of Matter**

a. Energy Flow and Chemical Cycling

- i. As living things use chemical energy, they release \_\_\_\_\_ in the form of heat to their surroundings.



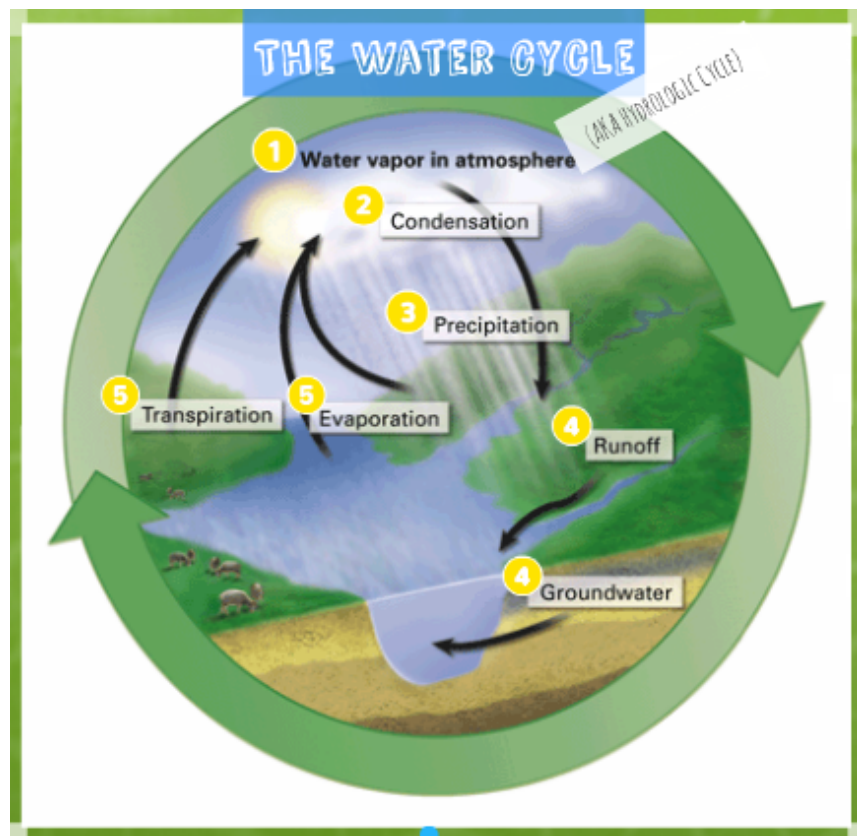
- ii. \_\_\_\_\_ within an ecosystem - it flows through it and out! (Producers must continue to receive energy as input for the ecosystem to survive.)
- iii. \_\_\_\_\_  
\_\_\_\_\_ between living and nonliving parts of the ecosystems and the biosphere.

b. The Basic Pattern of Chemical Cycles

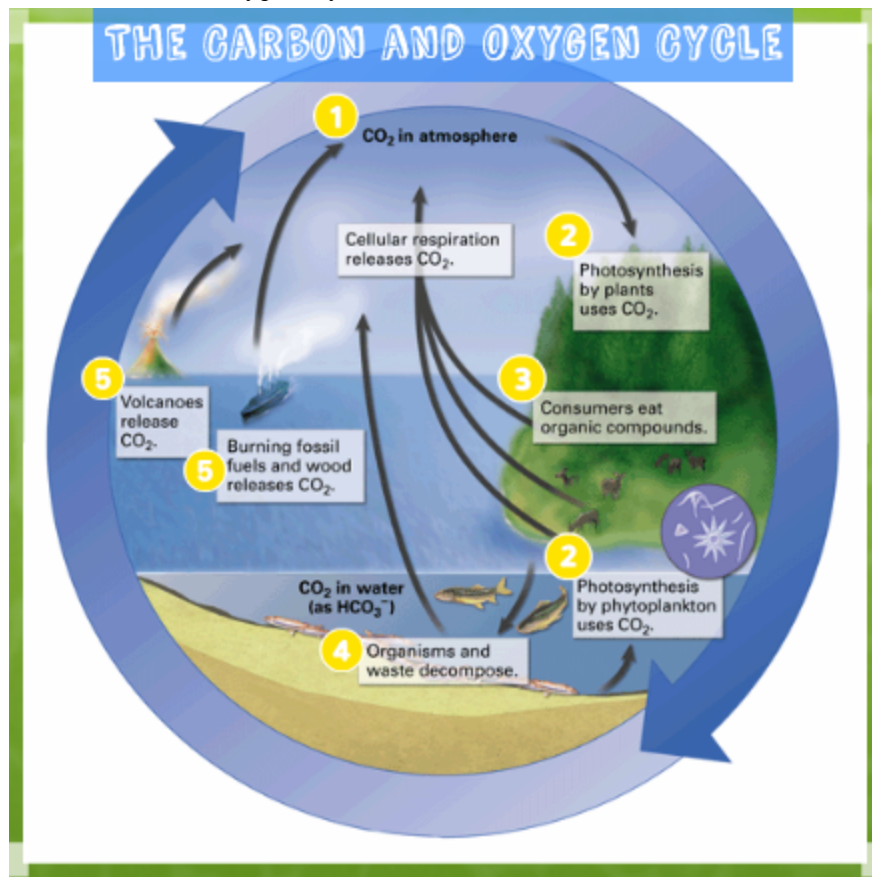
- i. Unlike energy, \_\_\_\_\_  
\_\_\_\_\_
- ii. Chemical cycles involve three steps:
  1. Producers make organic compounds by using chemicals from the non-living environment.
  2. Consumers eat these producers - using some of their own chemicals and the producer's chemicals - and release some back into the environment as waste.
  3. Decomposers break down dead producers and consumers - supplying the soil, water, and air with the chemicals from detritus in an inorganic (non-living) form.
- iii. Producers then use these inorganic components to restart the cycle.

c. Biogeochemical Cycles

- i. Biogeochemical cycle: \_\_\_\_\_  
\_\_\_\_\_
- ii. Cycles we will study:
  1. \_\_\_\_\_
  2. \_\_\_\_\_
  3. \_\_\_\_\_
  4. \_\_\_\_\_
- iii. The Water Cycle



iv. The Carbon and Oxygen Cycle

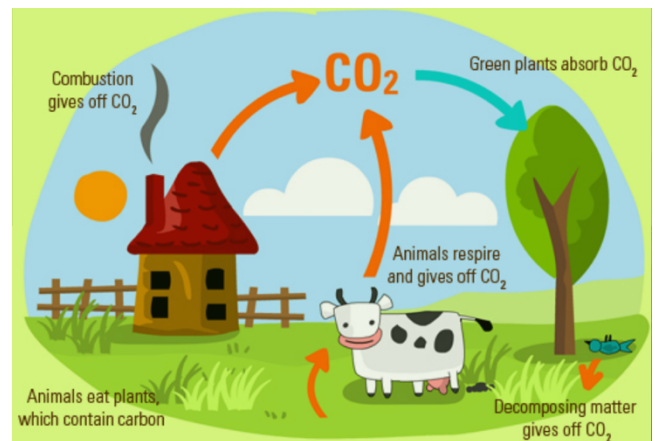


v. The Oxygen Cycle

1. Oxygen cycles indirectly through an ecosystem by the cycling of other nutrients.

vi. Carbon Cycle

1. Carbon is emitted by the burning of fossil fuels. Some carbon is stored for long periods of time in areas called carbon sinks.



vii. The Nitrogen Cycle

1. \_\_\_\_\_% of atmosphere is nitrogen gas.
2. Some bacteria convert \_\_\_\_\_ through a process called \_\_\_\_\_. Ammonia released into the soil is transformed into ammonium.
3. Nitrifying bacteria change the \_\_\_\_\_ through a process called \_\_\_\_\_.
4. Nitrogen moves through the food web and returns to the soil during decomposition.

