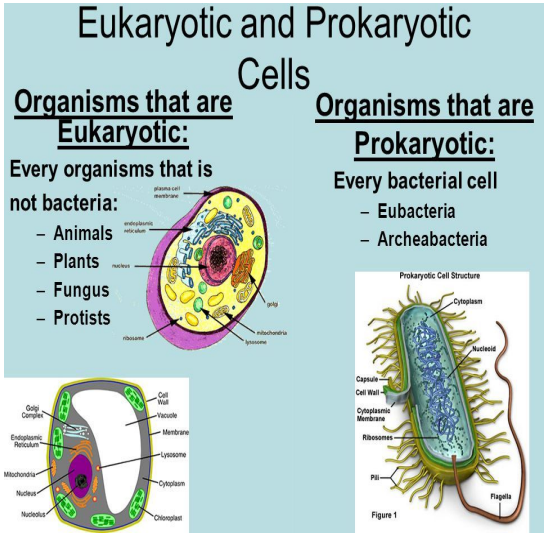
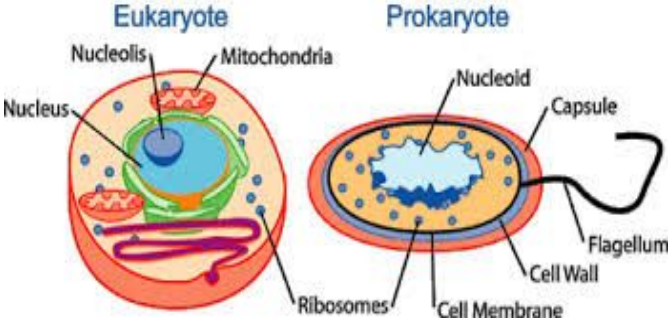
Basic Biological Principle

OBJECTIVE: Students will be able to identify the differences between prokaryotic and eukaryotic cells and what organisms are within these cells. They will learn different examples that fit into each cell and what are the cells abilities.

Eukaryotic cells contain membrane-bound organelles such as a nucleus. Eukaryotic cells can be both single-celled and multi-celled and there are many examples like plants, fungi, and insects. Eukaryotic cells are bigger in size and contain more DNA. In eukaryotic cells, the DNA structures are linear. The nucleus within the cell does not have a surrounded nuclear membrane. Prokaryotic cell do not contain a nucleus or any other membrane-bound organelle. There are two groups within prokaryotes, which includes bacteria and archaea. Bacteria is tiny and do not require organelles though our body contain many they are still small enough to the naked eye. The prokaryotic cell contains circular DNA. While it also does not contain a nucleus it does have a nucleoid. Both prokaryotic cells and eukaryotic cells can obtain and use energy, maintain a stable internal state like pH level, temperature, and more. This process is called homeostasis. These cells have the ability to grow, reproduce, and respond to stimuli in the environment. All cells consist of genetic makeup, a plasma membrane, and a cytoplasm. Eukaryotic cells contain a nucleus, mitochondria, a endoplasmic reticulum(ER), golgi apparatus, and chloroplasts within animal and plant cells.



Eukaryortic Vs. Prokaryotic Cells



PRACTICE!

Which organism in the eukaryotic and prokaryotic cell do they not have in common?

A. Nucleus
B. Cells
C. Ribosome

Can viruses be considered eukaryotic or prokaryotic?

A. Eukaryotic
B. Prokaryotic
C. Neither

What kingdoms are made up of prokaryotic cells?

A. Bacteria and Archaea
B. Animals and Plants
C. Archaea and Plants

Which type of cell has membrane bound organelles and how do you know give examples and an explanation?

Plant cells
Animal cells
Bacteria cells
Eukaryotic cells

_____
_____
_____
_____
_____

Prokaryotic cells do not have a nucleus. What do they have in its place?

_____
_____
_____
_____

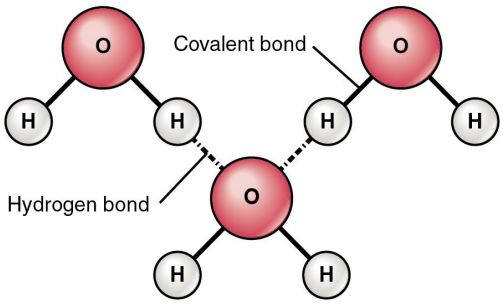
The Chemical Basis of Life

OBJECTIVE: Students will be able to describe how the unique properties of water support life on Earth, describe and interpret relationships between structure and function at various levels of biochemical organization, such as, atoms, molecules and macromolecules. Students will also be able to explain how enzymes regulate biochemical reactions within a cell by describing the role of an enzyme as a catalyst in regulating a specific biochemical reaction and explaining how factors such as pH, temperature, and concentration levels can affect enzyme function.

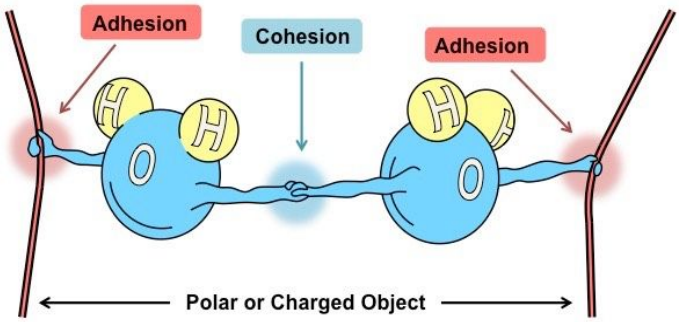
KEY TERMS:

- **Cohesion**
- **Adhesion**
- **Hydrogen Atoms**
- **Hydrogen Bonds**
- **Lipids**
- **Monomer**
- **Catalyst**
- **Enzyme**

The chemical basis of life consist of essential chemicals that are important to the function of an organism. These chemical basis include, water, monomers, and macromolecules. Each of theses chemicals have a unique properties or functions that are critical to living organisms. Water for example, has very unique properties. Water is one of the most important, stable, abundant, molecules found in living things. The unique properties of water come from its molecular structure. Water molecules are made of two hydrogen atoms and one oxygen atom, they are held together by covalent bonds, these bonds share electrons within water, the oxygen atom is strongly forced not sharing electrons equally this will be a polar covalent bond. Water's ability to dissolve ionic compounds is very important for life. Water being a polar molecule have the ability to dissolve other polar molecules creating hydrogen bonds, water's ability to dissolve many substances give it the name "the universal solvent." Table sugar is an example of a polar molecule that easily dissolves in water. Those substances that are harder to dissolve in water are insoluble. Lipids for example are insoluble to water. Lipids create the makeup of the plasma membrane of a cell, which creates a barrier to the outside water environment. Hydrogen bonds hold polar water molecules which gives water the property of cohesion, allowing water to stick to itself. Adhesion allows water to stick to other substances. Water also have the ability to absorb or retain heat which is described as specific heat. Water requires a lot of heat for its temperature to have an effect for it to change. Water releases and absorbs heat slowly so it can be safe for both the environment and organisms. In addition to water, monomers, such as nucleic acids, are also important in an organism's life. Nucleic acids form together to create DNA, which gives instructions to make proteins, known as genes. Another form of protein that is critical to the life of an organism are enzymes. Enzymes are substances produced by a living organism that acts as a catalyst to bring about a specific biochemical reaction. Each enzyme is shaped specifically in order to catalyze one particular reaction. Temperature, pH levels and molecules can affect the activity that takes place.

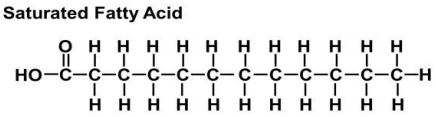


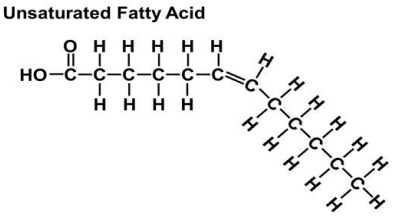
- **Covalent bonds occur when atoms share electrons**
- **A hydrogen bond is an interaction involving a hydrogen atom located between a pair of other atoms.**



Adhesion holds water molecules to other surfaces
Cohesion is water's ability to stick together

The major class of macromolecules are lipids, carbohydrates, nucleic acids, and proteins.

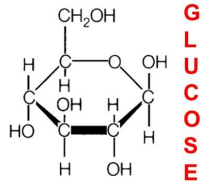


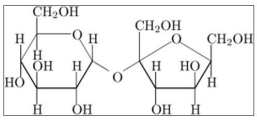


Saturated fats are solid at room temperature, while unsaturated fats are liquid at room temperature. This is because saturated and unsaturated fats have different chemical structures. Saturated fats have no double bond between molecules, which means there are no gaps and the fat is saturated with hydrogen molecules.

Carbohydrates

- Monosaccharide: Only one sugar molecule
- Disaccharide: Two sugar molecules bonded together

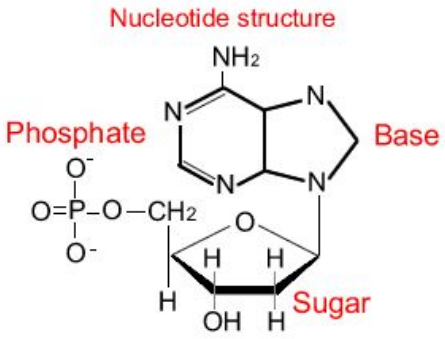




- **Carbohydrates consist of carbon, hydrogen, and oxygen**
- **Monosaccharide are simple sugars that can not be broken down anymore, such as glucose**
- **Disaccharides are two sugar molecules that are bonded together**

- **Polysaccharides are multiple sugar molecules bonded together.**

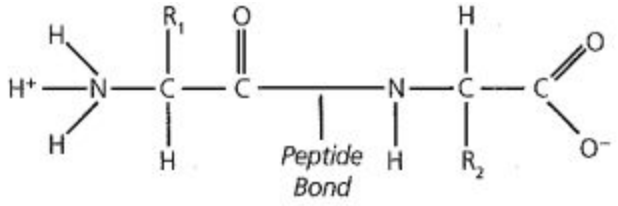
One of the most important polymers in living organisms are nucleic acids, such as, DNA and RNA. These polymers are made up of nucleotides.



- **DNA stands for deoxyribonucleic acid**
- **RNA stands for ribonucleic**
- **Nucleotides are composed of carbon, hydrogen, nitrogen, oxygen, phosphorus**
- **Each nucleotide consist of 3 parts: a phosphate, 5 carbon sugar, and a nitrogenous base**
- **DNA molecules have Adenine (A), Thymine (T), Guanine (G), and Cytosine (C)**
- **RNA molecules have similar nucleotides. Instead of Thymine, RNA molecules have Uracil**

Nucleic acids have the functions of:

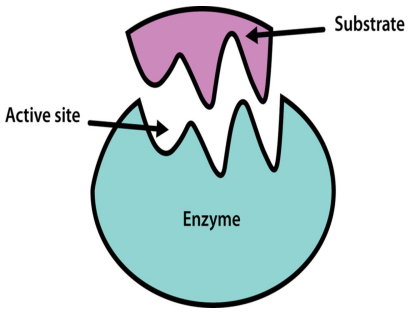
- **DNA encodes genetic information of the cell. DNA gives instructions for making genes, which gives instructions for making proteins.**
- **In protein synthesis, RNA transports genetic material to ribosomes for the production of proteins.**
- **These monomers are responsible for composing ribosomes**



Proteins help living organisms to catalyze reactions, transport molecules, copy and synthesis, and communicate between cells.

Proteins have the functions of:

- **Providing structures for cells**
- **Proteins make up hair, nails, and muscles**
- **Proteins in cell membranes help determine what substances to enter and exit the cell.**
- **A special type of protein are enzymes, which carry out chemical reactions**



the structure of the enzymes active site is specific to the shape of its substrate

PRACTICE!

Enzymes are special types of ?

A.Nothing

B.Proteins

C.Carbohydrates

D.Both b and c

When catalyst speeds up chemical reaction does the reaction change?

A. No
B. Yes
C. Sometimes

What are the affective factors of the rate of an enzyme reaction?

A. pH
B. Temperature
C. Substrate concentration
D. All of the above

What does RNA and DNA have in common?

_____
_____
_____
_____

How does the structure of an enzyme affect its function?

_____
_____
_____
_____

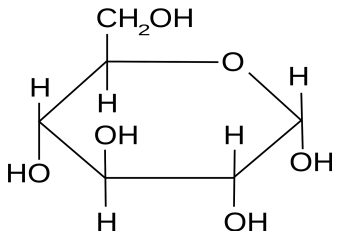
Bioenergetics: Photosynthesis and Cellular Respiration

OBJECTIVE: Students will be able to identify and describes the cell structures involved in processing energy, describe the fundamental roles of plastids, such as, the chloroplast, and mitochondria in energy transformations. Students will also be able to compare the basic transformation of energy during photosynthesis and cellular respiration and describe the role of ATP in biochemical reactions.

KEY TERMS:

- **Photosynthesis**
- **Cellular Respiration**
- **ATP**
- **ADP**
- **Mitochondria**

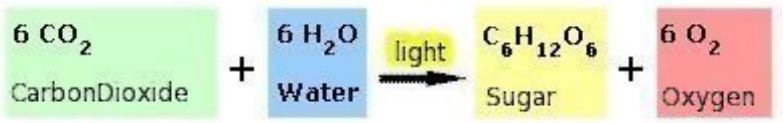
Bioenergetics is the process of energy involved in making or breaking chemical bonds in the molecules that are found in biological organisms. Cells get nutrition from the environment. Mostly all plants rely on Photosynthesis to provide food. During the process of photosynthesis, cells use carbon dioxide and energy from the sun to make sugar molecules and oxygen. Plants go through photosynthesis in order to provide them with food and energy that they need to grow and go through cellular respiration. The key molecule in cell respiration is glucose . Glucose is a sugar made of a 6 carbon ring. Glucose is the starting molecule for cellular respiration. It is an important factor in the energy of cells. The food we eat gets its energy by converting light energy into stored chemical energy within the bonds of glucose. Cellular Respiration uses oxygen and glucose to synthesize energy. During this process molecules like ATP (Adenosine triphosphate) and carbon dioxide are produced but becomes a waste product. ADP (adenosine diphosphate) is another starting molecule or cell respiration. It is formed when a phosphate group on ATP is lost. ADP can convert back into ATP easily this also happens in cellular respiration. We convert the chemical energy stored in



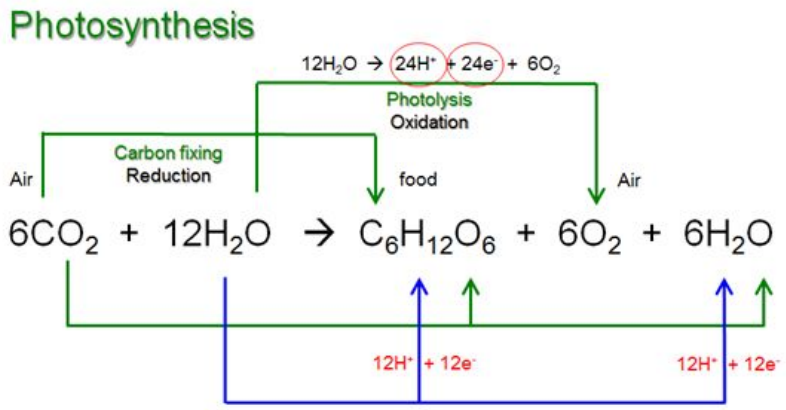
food into chemical energy stored within the bonds of ATP through the process of cellular respiration.

The Process of Photosynthesis:

The process in which plants and other organisms use light energy to convert water and carbon dioxide into oxygen. Also high energy carbohydrates like sugars and starches.



Why?



PRACTICE!

1. What colors of light most useful in photosynthesis is?

A.) Red , Violet, and blue

B.)Green, yellow, and orange

C.) Red , white and blue

D.) Infrared, red , and yellow

2. What is an ATP molecule parts?

A.) Ribose, Energy , Adenine

B.) Adenine, Ribose, 3 Phosphate groups, and Sugar

C.) 3 Phosphate groups , Adenine , Oxygen

D.) Oxygen, Energy Adenine

3. Where in the plant cell is Glucose produced?

A.) Chloroplast
B.) Nucleus
C.) Mitochondria
D.) Everywhere.

4. Describe structure and how it supports the cell the following terms and what they are responsible for in the cell? (Cell Wall, Chloroplast, Chlorophyll, Cytoplasm.)

_____
_____
_____
_____
_____

5. Explain the difference between ADP and ATP?

_____
_____

Homeostasis and Transport

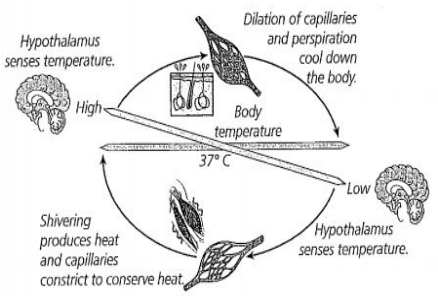
OBJECTIVE: This guide will review how the human body self regulates in order to maintain a stable internal environment for proper function. After reviewing this guide, you will be able to identify and define key terms related to homeostasis, describe the different homeostatic mechanisms, and explain how homeostasis is achieved.

KEY TERMS:

- **Homeostasis-the process of maintaining a stable internal environment**
- **Equilibrium-balance**
- **Negative Feedback loop-reverses the changes to restore stable internal conditions**
- **Positive FeedBack loop-continues the change that moves the system further away from equilibrium**
- **Osmoregulation**
- **Thermoregulation**
- **Gas exchange**
- **Glucose regulation**

What is Homeostasis?

Do you ever wonder why you sweat or shiver? Or what causes you to be thirsty? This is all because of homeostasis! Homeostasis is the tendency to maintain a stable environment within the body. Homeostasis is broken is made of the greek words "homeo," meaning similar and "stasis," meaning stable." The ultimate goal of homeostasis is the maintenance of equilibrium around a set point. In order for the body to function properly, these conditions must be regulated and maintained at a specified point. Living organisms work to balance internal conditions such as temperature, water, oxygen, and levels of glucose. When the body senses a change in these conditions, changes take place in the body to reverse the condition to its normal state, this is an example of a negative feedback loop. In this study guide, we will review the different types of homeostasis, such as thermoregulation, osmoregulation, gas exchange, and the regulation of blood glucose.

Negative Feedback loops Vs. Positive Feedback loops	
When the body senses a change that disturbs the internal state, negative feedback loops work to reverse the initial change and regulate the body's internal environment.	<u>Positive feedback loop</u> moves the condition further away from the target of equilibrium by enhancing the changes, making the system more and more unstable.
EX: Temperature Regulation The human body's normal temperature is 98.6 degrees fahrenheit. When the temperature rises too high or falls too low, mechanisms begin to reverse the change.  According to this diagram, when the body's temperature rises above 98.6 degrees, hypothalamus senses these high temperatures and instructs the body to widen its capillaries, this causes perspiration, which causes the body to cool down. On the other hand, when hypothalamus senses low temperatures, the brain sends instructions that causes the body to shiver, which produces heat. As well as shivering, the brain instructs the capillaries to constrict in order to conserve heat given off from shivering. The regulation of body temperature is called Thermoregulation.	**EX: Ripening of Fruit** Let's use the ripening of an apple in a fruit bowl as an example. Once apples begin to ripen, it will give of a gas known as ethylene. This will cause other apples around it to also ripen. As those apples ripen, they will also give off the ethylene gas, which will keep the ripening process continuous.  **The process of ripening fruit is an example of a positive feedback loop**

This process of thermoregulation shows a negative feedback loop	

Types of Homeostasis

In addition to Thermoregulation there is…..

- **Osmoregulation**

Concerns itself with one of the most vital components of life, water. During this process, organisms regulate the balance of water and solutes, in order to keep the homeostasis of the organism's water level balanced. Osmoregulation keeps the water in the human body from becoming too diluted or too concentrated. Kidneys play a major in osmoregulation in humans. Regulation of water in the body is carried out through excretion of waste through urination. Another way of balancing the amount of water in the body is through the sensation of thirst. The hypothalamus of the brain sends signals to the mouth that causes dryness and produces and urge to drink fresh water, which replaces the water that was lost from urination.

- **Gas Exchange**

Tiny blood vessels, called capillaries, surround each small air sac in the lungs that are called the alveoli. The gases in the alveoli are unbalanced. They contain too much carbon dioxide and too little oxygen. Too much carbon dioxide can be very dangerous to the body. Before it can build up, the blood carries excess carbon dioxide to lungs, where it gets released through breathing.

- **Regulation of Blood Glucose**

The human body requires a glucose level of 90mg/100ml. If the levels stray away from that point, a negative feedback loop is used to bring it back into range. Returning the blood glucose levels back to normal is achieved with the help of the pancreas and the liver. If the blood sugar falls too low, the pancreas secretes a hormone called glucagon, which breaks down the stored glycogen, from the liver, and releases glucose into the bloodstream. When the sugar level raise too high, the pancreas releases insulin. Insulin allows cells to cross the plasma membrane , where the liver stores excess glucose as glycogen, which brings the glucose level back to normal.

PRACTICE!

Choose the best answer.

1. **If the environment gets cold our bodies will _____ in order to _____ the body's temperature, to bring the body's temperature back to normal. This is an example of a _____ feedback loop.**
    a. **Sweat, regulate, positive**
    b. **Shiver, decrease, positive**
    c. **Shiver, increase, negative**
    d. **Sweat, increase, negative**
2. **_____ is secreted in response to low glucose levels.**
    a. **Ethylene**
    b. **Carbon Dioxide**
    c. **Insulin**
    d. **Glucagon**

3. **_____feedback loop is used in homeostasis.**
    a. **Negative**
    b. **Positive**
4. **Describe a change inside or outside the human that would be an example of homeostasis. Explain how the body will respond to this change.**

_____
_____
_____
_____
_____

5. **What regulatory process would your body use if you ate a meal that was high in carbohydrates. Explain how the process will work.**

_____
_____
_____
_____
_____

Types of Transport

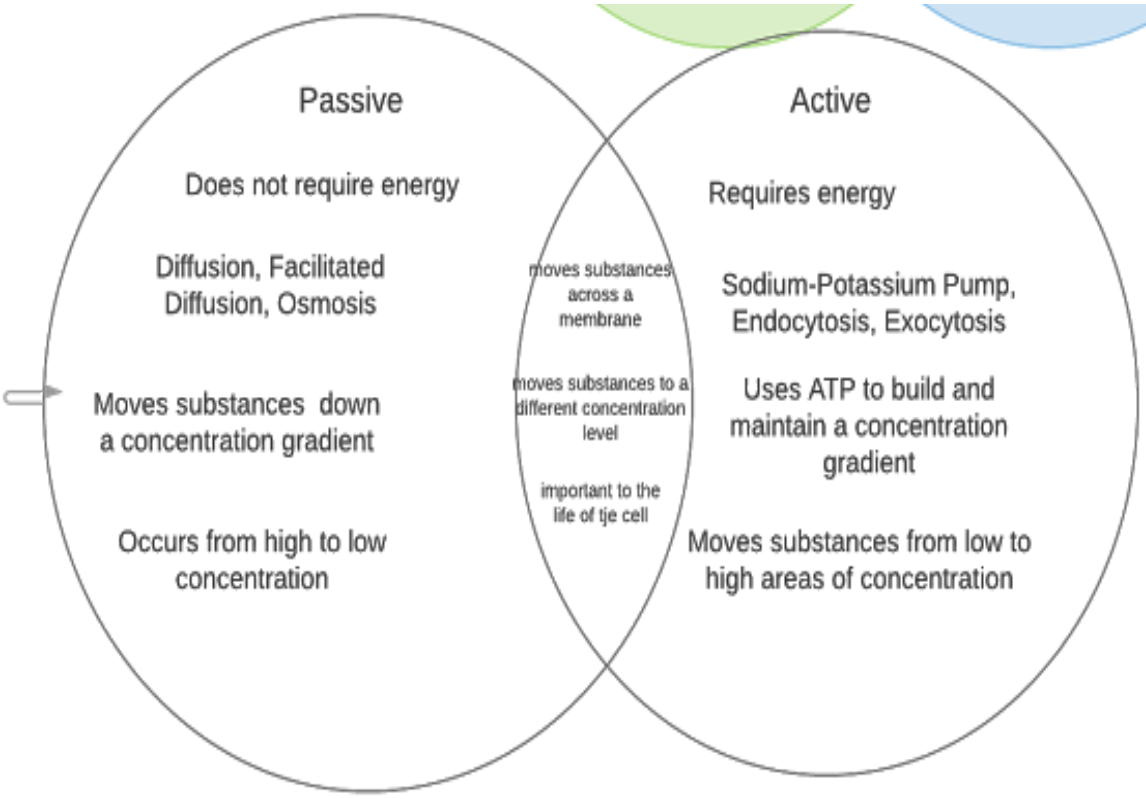
OBJECTIVE: After reviewing this guide, students will be able to differentiate between passive and active transport, compare the different the mechanisms of passive and active transport, and describe the role of ATP in active transport mechanisms.

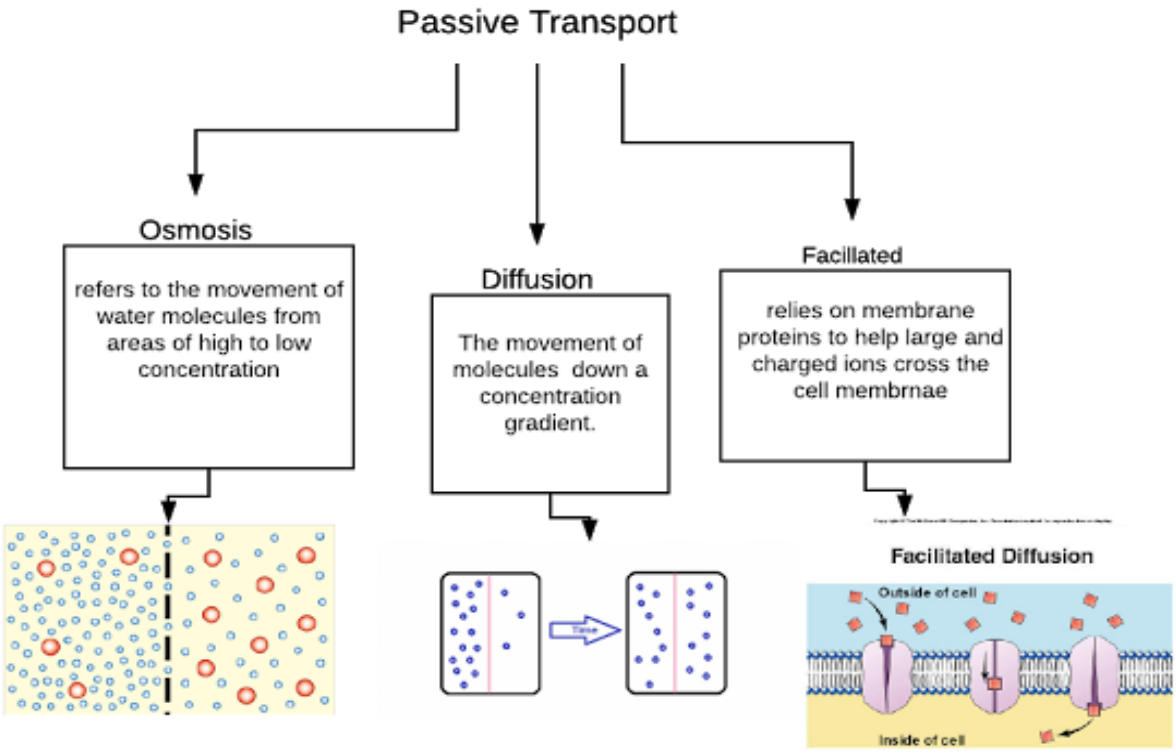
KEY TERMS:

- **Passive Transport-The movement of molecules from high to low concentration until equilibrium is reached**
- **Active Transport-The movement of molecules from low concentration to high concentration are that requires energy**
- **ATP-Provides energy**
- **Concentration Gradient-a gradual difference in the concentration of a substances in a solution as a function of distance**
- **Concentration-the amount of solutes dissolved in a given substance**
- **Hypotonic- having lower concentration of dissolved substances than the cells interior**
- **Hypertonic- having a great concentration of dissolved substances than the cells interior**
- **Isotonic- having equal levels of concentration in the cell and in the extracellular fluid**

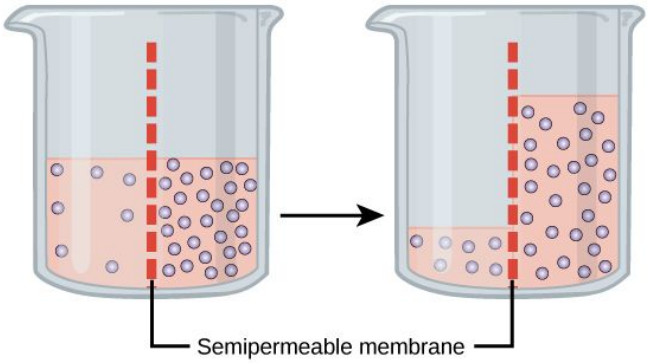
Types of Transport

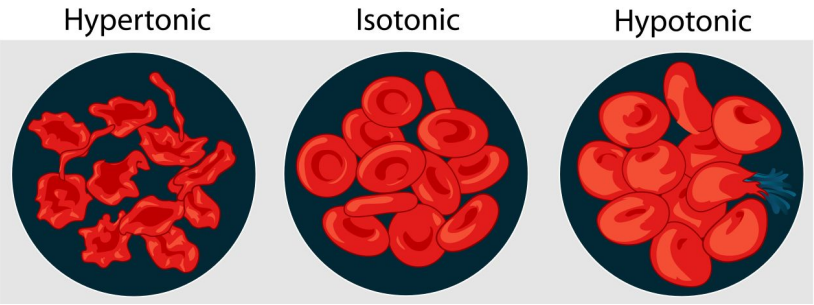
Cells inside the plasma membrane are constantly moving in various directions. Without the movement of these cells, waste will build up and material important to the cell would not be able to enter. The movement of the cells is based on the differences of concentration inside and out the cell. The word concentration refers to the amount of dissolved solutes in an area. There are two types of transport. One types of transport is known as passive transport. Passive Transport does not require energy or any form of ATP in order to move substances across the plasma membrane. There are several types of passive transport such as, diffusion, facilitated diffusion, and osmosis. Passive transport stops once equilibrium is reached. The other form of cellular transports is known as active transport. Active Transport require energy to move particles from a low to high area of concentration. Active transport uses ATP as an energy source to build up and maintain a concentration gradient. Cells resort to active transport, when passive transport can not get the job done.


Passive
Does not require energy
Diffusion, Facilitated Diffusion, Osmosis
Moves substances down a concentration gradient
Occurs from high to low concentration
moves substances across a membrane
moves substances to a different concentration level
important to the life of tje cell
Active
Requires energy
Sodium-Potassium Pump, Endocytosis, Exocytosis
Uses ATP to build and maintain a concentration gradient
Moves substances from low to high areas of concentration

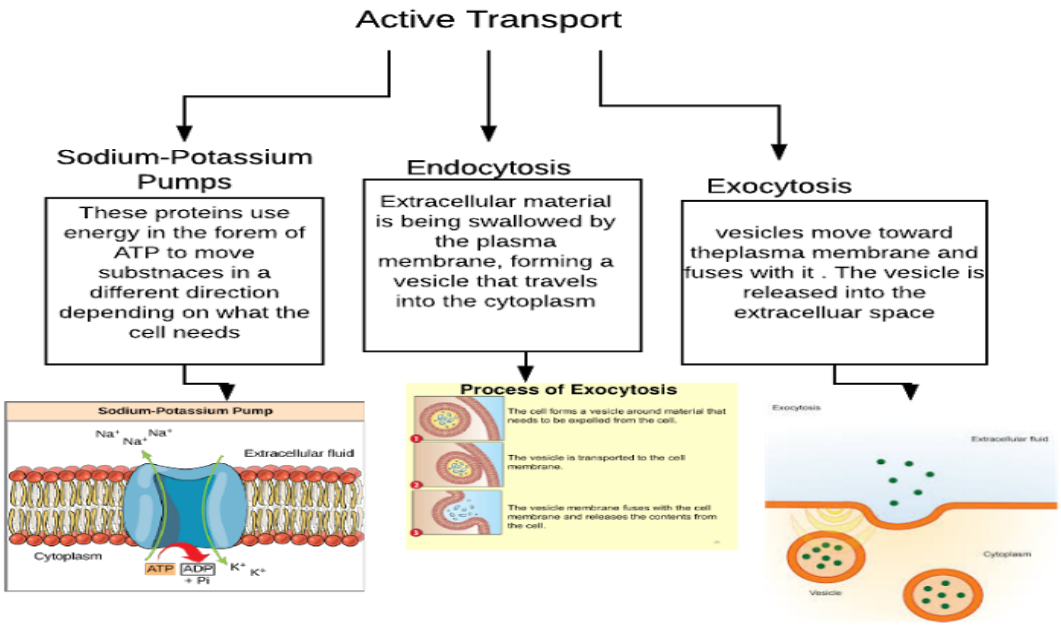


As shown above, during the process of osmosis, water molecules move from areas of high to low concentration. Osmosis can result in a change in volume. The fluids inside and outside the cell can be compared using words such as, hypotonic, hypertonic, and isotonic. These terms refer to extracellular fluid that is less than, greater than, or equal to the concentration of the cell's interior.





- **In hypertonic solutions, water will leave the cell and go to the area that has a higher solute concentration. This will cause the cell to shrivel and decreases in size.**
- **In isotonic solutions, the cell will remain the same.**
- **In hypotonic solutions, water will travel into the cell because that is where the concentration levels are higher. This will cause the cell to swell and increase in size.**



PRACTICE!

1. **Materials that can move across a membrane during passive transport include:**
    a. **Water, oxygen, and carbon dioxide**
    b. **Polysaccharides**
    c. **Large proteins**
    d. **DNA and RNA**
2. **Molecules from areas of low concentration to areas of high solute concentration in….**
    a. **Passive Transport**
    b. **Diffusion**
    c. **Osmosis**
    d. **Active Transport**
3. **Passive transport _____require energy. During this type of transport molecules move_____ a concentration gradient. _____, _____, and _____ are types of passive transport.**
    a. **Does not, against, osmosis, diffusion, facilitated diffusion.**
    b. **Does not, down, osmosis, diffusion, facilitated diffusion**
    c. **Does, down, endocytosis, exocytosis, sodium-potassium pumps**
    d. **Does, against, endocytosis, exocytosis, sodium-potassium pumps.**
4. **Students perform an experiment, where an egg acts as a cell, with a semi-permeable membrane. The egg is placed in solutions with different concentration levels. Predict what will happen to the "cell" in these solutions.**
    a. **What will happen to the cell if it is placed in a solution with a concentration that is greater than inside the "cell"? Explain.**

    _____
    _____
    _____
    _____

    b. **What will happen to the cell if it is placed in a solution that is has a lower concentration than inside the cell.**

_____
_____
_____
_____

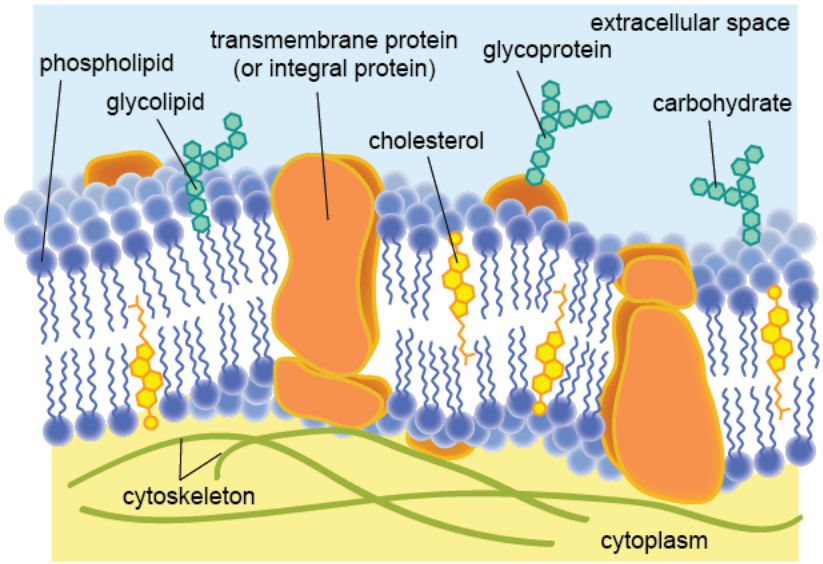
Membranes of the Cell

OBJECTIVE: Students will be able to describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell. Students will also be able to describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.

KEY TERMS:

- **Plasma membrane-surrounds the cytoplasm of a cell and control what enters and exits a cell**
- **Hydrophobic-avoiding water**
- **Hydrophilic-attracted to water**

Cell membranes consist of a series of lipids and proteins. The phospholipid bilayer gives the membrane its structure. The Phospholipid bilayer consists of phospholipids arranged into sheets. Phospholipids consist of a polar head and two nonpolar tails. The molecules are arranged in a way so that the hydrophilic heads are on the outside, facing the watery surroundings, and the hydrophobic tails are sandwiched in the middle so that they are hidden from water. The middle section of these molecules are made up of fatty acids, that are nonpolar and hydrophobic. These properties determine how easily different substances are able to cross the membrane. Small, nonpolar, molecules are able to cross the membrane easily while large molecules and charged ions are not able to cross the membrane. Membrane proteins assist molecules that are polar, like water move slowly across the membrane. In addition to the cell membranes, membranes inside the cytoplasm are also very important. Organelles such as, the smooth and rough ER, golgi apparatus, ribosomes, and vesicles are equally important.



Phospholipid Molecule

- **Major component of the cell membrane**
- **Consist of a negatively charged head, making it polar**
- **Hydrophilic properties make it attracted to water**
- **Consist of two negatively charged hydrophobic tails**

Glycolipid

- **Lipids with a carbohydrate attached by a glycosidic bond. The maintain stability within a cell. Their main function is to act as recognition site for cells during cell interactions.**

Glycoproteins

- **Proteins with a carbohydrate attached to it**

Carbohydrate Chain of a Glycoprotein

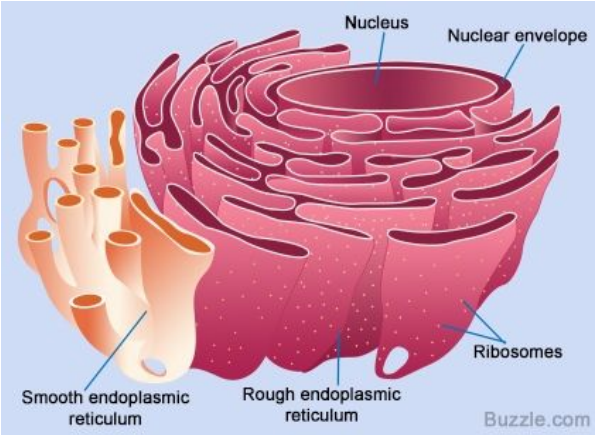
- **Made of joined sugar molecules. These chains are on the outer surface of cells. They act as distinctive cellular markers that allow cells to recognize each other.**

Protein Channel

- **Transports substances across the cell membrane**
- **Transports ions and macromolecules in and out of the cell**

Membrane Proteins

- **There are many proteins within the cell membrane such as transport proteins and receptor proteins. Each protein plays a different role in the cell membrane.**

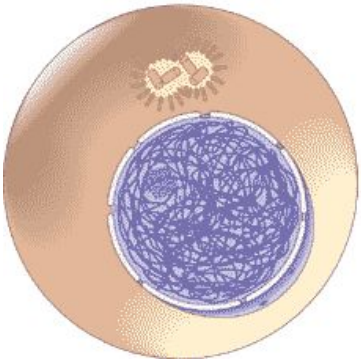


The nucleus and the ER membranes are connected and located close together, making it easy for mRNA to travel from the nucleus to the ribosomes of the rough ER , which assembles proteins. Similar to that, the smooth ER synthesizes molecules such as fatty acids and hormones.

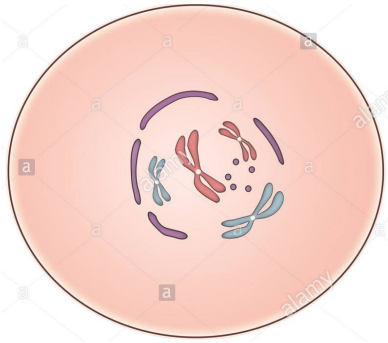
To reach the Golgi apparatus, substances from the ER are packaged into vesicles that move through the cytoplasm and fuse with the membrane of the Golgi Apparatus. This organelle modifies and prepares substances for transport.

Cell Growth and Reproduction

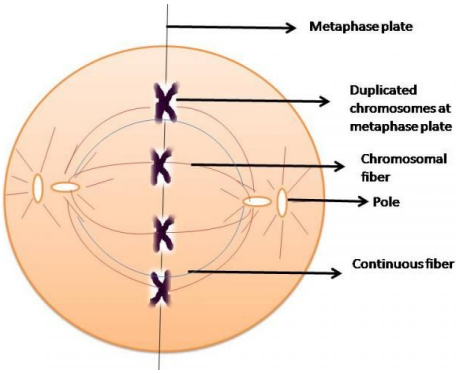
Cell division is the start of every multicellular organism. Life starts out as one cell; that cell then divides into two cells; those cells then divide into four; etc. This process continues into the trillions. To understand this process more, let's start at the beginning. Each cell goes through a "cell cycle." This cycle contains three steps: Interphase, Mitosis, and Cytokinesis. The goal of this cycle is to make sure each parent cell can divide into two identical copies called daughter cells.



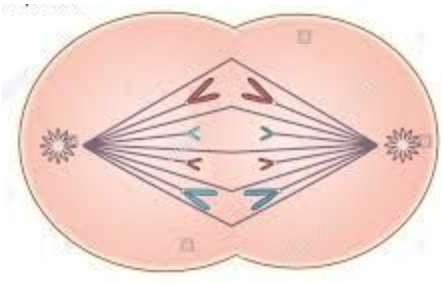
The first phase a cell goes through is interphase. Before interphase, a cell's Chromosomes are shaped in a very long and thin strand that swirls around itself. The purpose of Interphase is to replicate the cell's DNA and to synthesize proteins needed for mitosis. This is the longest stage of the cycle.



The Next stage is Mitosis. Mitosis is divided into four phases: prophase, metaphase, anaphase, and telophase. The first phase, prophase, breaks down the nuclear membrane or the cell and coils up the DNA molecules. This makes them much smaller and compact and easier to handle. As this is happening, small structures called centrioles start to move toward the poles of the cell.

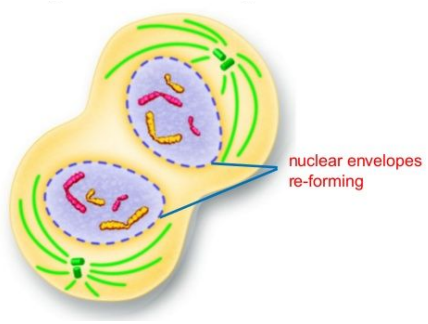


The second stage of Mitosis is Metaphase. During this phase, the centrioles produce structures called spindles. These structures connect to the centromeres on the sister chromatids (the center of the chromosomes). The spindles line the sister chromatids up vertically in the center of the cell.

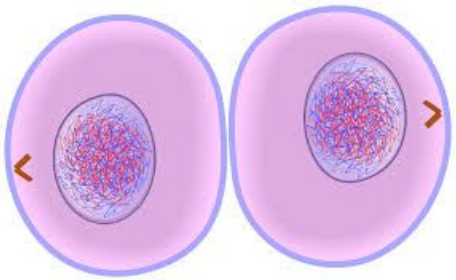


The third phase of Mitosis is anaphase. During this phase, the spindles are pulled back to the poles of the cell, splitting the sister chromatids apart and bringing them toward the poles.

The fourth and final phase of Mitosis is telophase. During this final phase, the nuclear membranes form around each set of chromosomes. The chromosomes then unwind and go back to their old, long and thin strand. As the chromosomes unwind, the genes then become active again.



After Mitosis, the final stage of the cell cycle kicks in: Cytokinesis. Cytokinesis is the process that actually separates the parent cell into two daughter cells. The parent cell is "pinched in" at the middle until the parent cell splits into the two, identical daughter cells. It is important to know that cytokinesis can either start while the last stage of mitosis is happening, or can occur after mitosis is finished.



The new daughter cells then go through the same process, splitting into four cells, then to eight, then to sixteen, etc. Estimated by weight, there are about 37.2 trillion cells (on average) in a human body.

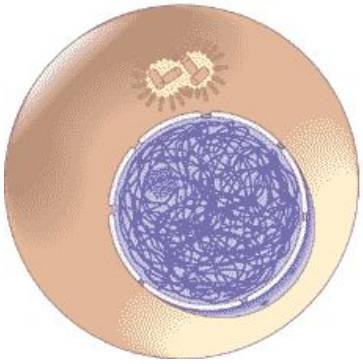
Write the Correct Phase of the Cell Cycle Next to its Corresponding Diagram

(Diagrams are in Correct Order, Terms are not)

Terms:

- Metaphase
- Interphase
- Anaphase
- Prophase
- Cytokinesis
- Telophase

Diagrams:



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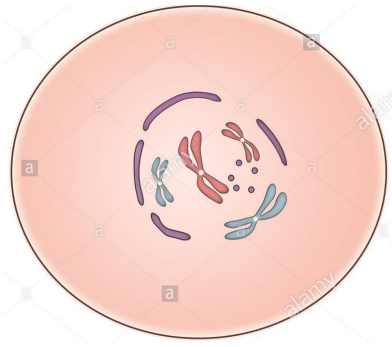

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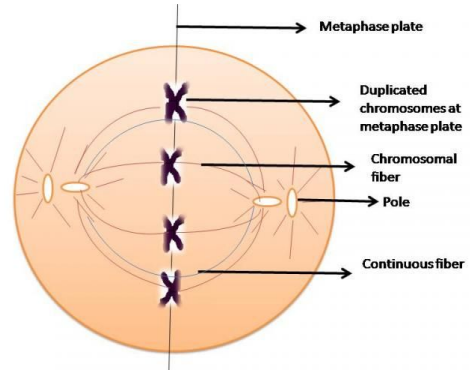

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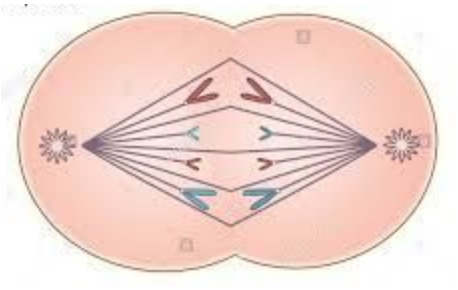

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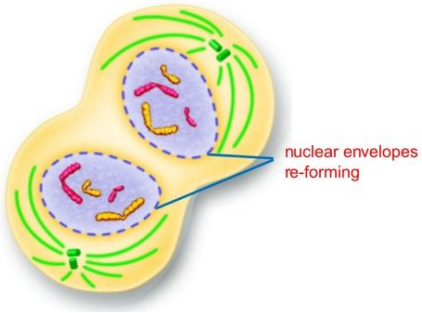

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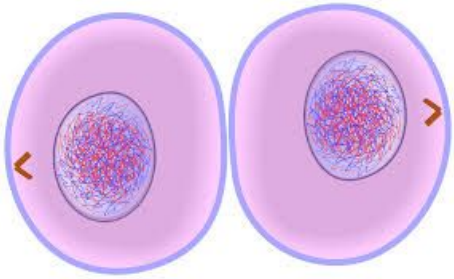


_____

Write the Letter of Each Definition next to its Correct Term

Words

_ 1. Genes

_ 2. Alleles

_ 3. Homologous Chromosomes

_ 4. Genotype

_ 5. Phenotype

_ 6. G1 Phase

Definitions

A. Both chromosomes have the same genes in the same locations.
B. When a cell synthesizes a copy of its DNA.
C. A segment of a DNA molecule that gives the instructions for making a protein.
D. Refers to observable characteristics.
E. The new cell grows
F. Give the instructions for making

different versions of a protein.

_ 7. S Phase

G. Combinations of alleles in a person's cells.

_ 8. G2 Phase

H. The cell produces proteins needed for mitosis.

Choose Words from the Word Bank to Complete the Sentences

Word Bank

Cell Cycle DNA Replication Chromosome DNA Sister Chromatids Spindle Fibers Daughter Cells Centrioles Centromeres Semiconservative Replication M Phase Cell Division

1. _____ line up the chromosomes in the middle of the cell during metaphase.
2. As a result of _____ there are two identical copies of DNA (this occurs during interphase).
3. During cytokinesis, the cell divides into two _____, each with a complete set of chromosomes.
4. During metaphase, the spindles attach to the _____ on the sister chromatids.
5. Each _____ contains a long molecule of DNA.
6. A cell undergoes changes at each step of the _____ to create two daughter cells.
7. _____ means that each copy double strand of DNA contains one original strand and one copy strand of DNA.
8. Tiny structures called _____ begin to move toward the poles of the cell during prophase.
9. Each _____ molecule contains many genes and is the genetic makeup of a cell.
10. The two copies of DNA are condensed into shorter, fatter _____ during mitosis.
11. The _____ refers to cell division (mitosis and cytokinesis).
12. _____ refers to the process of a cell dividing into two cells, which then divide into four cells, which then divide into 8 cells, etc.

Anchor Questions

Multiple Choice:

1. Which phase of the cell cycle replicated the cells' DNA and synthesizes the required proteins?

A. Metaphase
B. Interphase
C. Telophase
D. Cytokinesis

2. What are the four main phases of Mitosis?

A. Prophase, Metaphase, Anaphase, Telophase
B. Prophase, Metaphase, Interphase, Telophase
C. Cytokinesis, Metaphase, Anaphase, Telophase
D. Prophase, Cell Division, Anaphase, DNA Replication

3. What is produced by the centrioles during metaphase?

A. Spindles
B. centromeres
C. Chromosomes
D. Alleles

Short Answer:

1. Why are spindle fibers (spindles) important? Explain what they do and what stage(s) they occur in.

_____

_____

_____

_____
_____

2. Why is it important for the parent cell to replicate its DNA before mitosis begins? What would happen if the DNA was never replicated?

_____
_____
_____
_____
_____

ECOLOGY

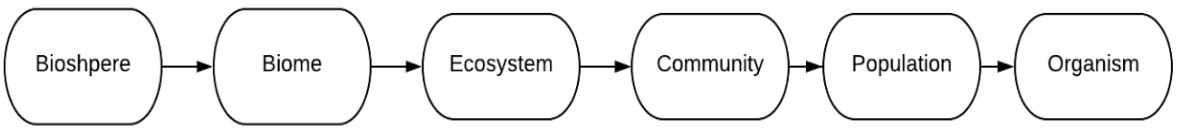
OBJECTIVE: Students will be able to describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, and biosphere), describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems, describe how energy flows through an ecosystem, describe biotic interactions in an ecosystem, describe how ecosystems change in response to natural and human disturbances,

KEY TERMS:

- **Ecology**
- **Organism**
- **Community**
- **Population**
- **Biosphere**
- **Ecosystem**
- **Biotic Factors**
- **Abiotic Factors**

Ecology is the study of the relationship between organisms and their environments. Ecologist study the different levels of organization, from small, individual organism, such as, insects and trees. Individual species in a specified area make up the population. All the populations in a certain area make up the community. The community along with other non living elements make up an ecosystem. Ecosystems with similar characteristics are put into groups called biomes. These biomes make up the Earth's biosphere, which is the largest ecosystem. The biosphere is the layer of Earth, where life exist. The biosphere is unique. So far, there has been no existence of life anywhere else in the universe. Life on Earth depends on the sun. The sun provides energy to all living organisms.

ORGANIZATION OF THE BIOSPHERE



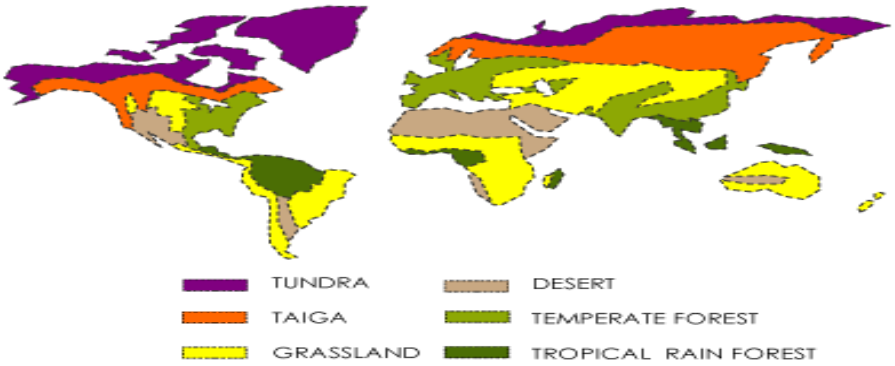
Broadest level of organization to the most specific

Biosphere

- The biosphere includes the part of the Earth where organisms live.
- It extends from the crust of the Earth to the atmosphere.
- All of the ecosystems are included within the biosphere

Biome

- Geographic region that has a distinct climate
- A biome is made up of separate ecosystems that share similarities



Examples of Biomes			
Biomes	**Characteristics**	**Soil**	**Organisms**
Tundra	● Short, cool, summers ● Long, cold winters ● Little participation	● Thin, nutrient-poor soil ● Has a permanently frozen layer of soil	● Small shrubs ● Grasses ● Caribou ● Wolves ● Polar Bears
Taiga	● Short warm, wet, summers ● Long, cold, dry winters	● Thin ● Nutrient-poor ● acidic	● Evergreen trees ● Moose ● Foxes ● Bears
Temperate Forest	● Warm, wet, summers ● Cool, wet winters	● Think ● Nutrient-rich	● Deciduous trees ● Deer ● Squirrels ● Rabbits ● Bears
Tropical Rainforest	● Warm all year ● Long wet season ● Short dry season	● Thick ● Nutrient-poor ● acidic	● Tall trees with wide leaves ● Vines ● Snake ● Butterflies ● chimpanzee
Savanna	● Hot ● Fairly dry ● Alternating wet and dry season	● Thin ● Relatively nutrient-poor	● Grasses ● Shrubs ● lion
Desert	● Long, hot, dry summers ● Shorter dry winters ● Little precipitation	● Sandy nutrient-poor ● nutrient -poor	● Cacti, shrubs, lizards, small rodents

Ecosystem

- An ecosystem is made up of the biotic and abiotic, or nonliving, environment.

An example of an ecosystem would include all of the living and nonliving factors that are inside a pond.

Community

- A community includes all of the populations that live and interact in the same area.
- An example of a community is all of the plants and animals inside of a forest.
- All of these organisms interact and depend on one another for survival

Population

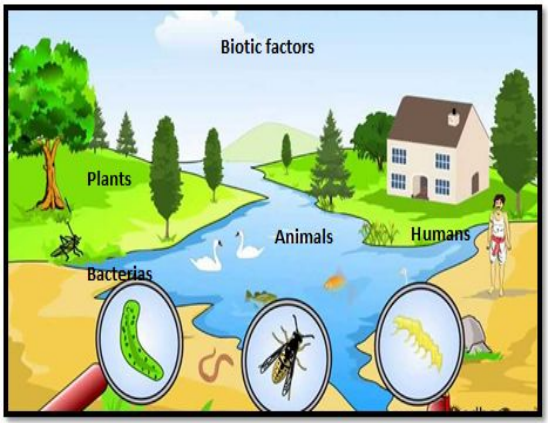
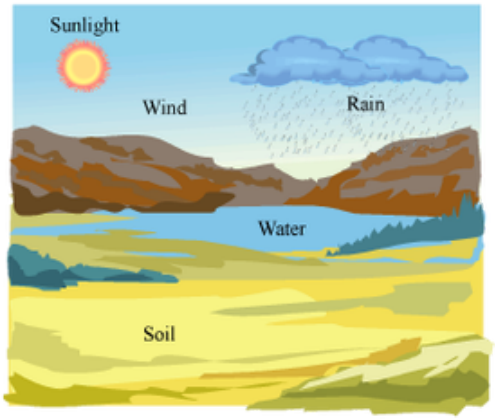
- A population is a group of individuals of the same species living in the same area at the same time

  ***an example of a population is a herd of elephant**

BIOTIC VS. ABIOTIC FACTORS

Factors that can affect a change in a population or species are usually divided into two types: abiotic and biotic. Abiotic refers to the nonliving environmental factors. Biotic refers to the influence or effect created by a living organism.

Examples of Biotic and Abiotic Factors

Biotic **animals, bacteria, fungi**	**Abiotic** **Sunlight, Temperature, Gases, Water, Soil**
	

Ecosystem Interactions

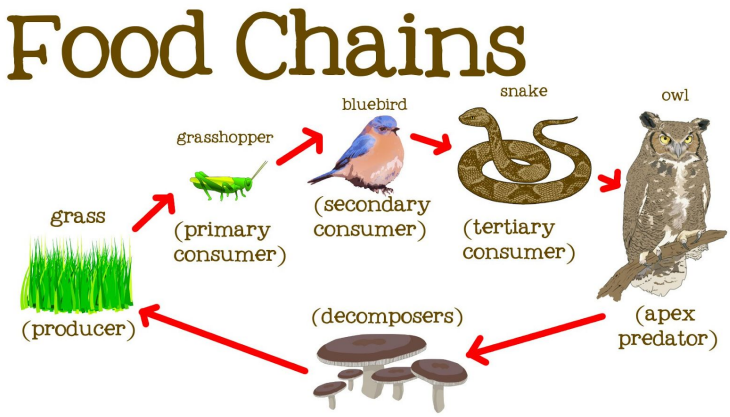
Organisms in ecosystem must interact with the community that surrounds it. Organisms may depend on some populations to provide them with food. Others avoid becoming the food of larger populations. Organisms in a community must

interact through symbiosis. A **symbiotic relationship** may harm or benefit either species. Types of symbiotic relationships are shown below:

Interactions	**Who Benefits?**	**Example**
Mutualism	Both organisms benefit	Cleaner fish have the job of eating parasites and dead cells so that other fish, such as, grouper fish, can avoid disease. The cleaner fish get fed and the grouper fish avoid diseases.
Commensalism	Only one organism is benefited. The other is neither harmed or benefited.	Mites attach to flies for transportation. The mite gets the benefit and fly goes unharmed and unbenefitted.
Parasitism	One organism is benefited the other is harmed.	Mosquitoes feed on the blood of mammals. They get fed, but the mammal is left feel itchy and uncomfortable.

Food Chains and Food Webs

The organisms in a community may be classified as producers, consumers, or decomposers. Producers, such as, plants, algae, and bacteria are able to make their own food through the process of photosynthesis. Consumers are organisms that obtains energy by feeding on producers or other consumers. Within an ecosystem, all consumers depend on other populations for food.



A food chain shows the flow of energy from one organism to another. Energy moves from the producer, to the primary consumer, to the secondary consumer, etc.

Questions for Biosphere

1. True or False: In the "Organization of the Biosphere," the Biosphere is the most specific level.

   A. True B. False

2. The Biosphere extends from the _____ to the _____.

3. True or False: All Ecosystems are included within the Biosphere.

   A. True B. False

Questions for Community

1. Why do all organisms in a community interact and depend on each other to survive? Give examples.

_____
_____
_____
_____
_____
_____

2. True or False: A community includes all of the populations that live in and interact in the same area?

A. True B. False

Questions for Biotic vs. Abiotic

1. Define Biotic Factors. Included an example.

_____
_____
_____
_____
_____
_____

2. Define Abiotic Factors. Included an example.

_____
_____
_____
_____
_____
_____

Questions for Ecosystem Interactions

1. True or False: A symbiotic relationship may *only* benefit one species or the other.

A. True B. False

2. Mutualism benefits which of the following:

A. Both Organisms C. The Bigger Organism
B. The Cleaner Organism D. Neither Organism

3. Which of the following is true about Commensalism:

A. Both organisms are benefited
B. One organism is benefited, the other is neither benefited or harmed
C. Both organisms are harmed
D. It is a neutral interaction: neither organisms is benefited or harmed

4. Which of the following is true about Parasitism:

A. Both organisms are benefited
B. Both organisms are harmed
C. It is a neutral interaction: neither organism is benefited or harmed
D. One organism is benefited, the other is harmed

Overall Questions

1. Name the organization of the biosphere in order from broadest to most specific.

_____, _____, _____, _____, _____, _____

2. Name *at least three* examples of a biome and *at least two* characteristics for each.

Biome: _____

Characteristics: _____

Biome: _____

Characteristics: _____

Biome: _____

Characteristics: _____

Biome: _____

Characteristics: _____

Biome: _____

Characteristics: _____

Biome: _____

Characteristics: _____

3. In a food chain, the flow of energy from one organism to another moves from the _____, to the _____, to the _____, to the _____, to the _____, to the _____ to the _____, and back to the _____.

4. Give an example of a producer, the primary consumer, and the secondary consumer.

_____
_____
_____
_____
_____
_____

ANSWER KEY: Basic Biological Principle

1. **A. Nucleus**

The answer would be A because prokaryotic cells have a nuclear region where the DNA in the cell acts the same in ways the eukaryotic cells would.

2. **C. Neither**

The best answer that fits is C because viruses lack the characteristics of living things except replication so therefore it would not be able to be a eukaryotic or prokaryotic cell.

3. **A. Bacteria and Archaea**

The correct answer choice would be A because animals and plants are both not considered prokaryotic cells while both having a nucleus and being membrane-bound organelles something prokaryotic cells are not.

4. **Eukaryotic cells are membrane-bound organelles containing a nucleus something prokaryotic cells do not contain and some examples of eukaryotic cells are plants, animals, and fungus.**
5. **Prokaryotic cells have a nucleoid region that contains the DNA which forms the same function as eukaryotic cells while they have a nucleus and other organisms.**

ANSWER KEY: Bioenergetics Photosynthesis & Cellular Respiration

1. A.) Red , Violet, and blue

Red , Violet and Blue are most useful in photosynthesis because in photosynthesis carotenoids help capture light and they also have an important role in getting rid of excess light energy that is produced.

2. B.) Adenine, Ribose, 3 Phosphate groups, and Sugar

A ATP molecule consists of Adenine ribose and 3 Phosphate groups, all of these parts support the structure of the molecule.

3. A.) Chloroplast

4. The Cell wall provides support protection for the plant cells. Chloroplast works by Using the energy from sunlight to make energy food molecules that it found inside of the plants. Chlorophyll gives plants the green pigment.

5. ATP is broken down to ADP and a phosphate group. ATP is changed back to ATP by dehydration synthesis reactions. ATP is a organic chemical that is in all the forms of life.

ANSWER KEY: The Chemical Basis of Life

1. **B. Proteins *Enzymes are a special type of protein that catalyzes chemical reaction***
2. **A. No *Enzymes cause the chemical reaction to speed up, but does not change the reaction.**
3. **D. all of the above *All of these factors can cause an enzyme to denature if they are in extreme cases***
4. **DNA and RNA share the common nitrogenous bases of Adenine, Cytosine, and Guanine. Both of these nucleic acids are linear polymers and are composed of nucleotides.**
5. **Every enzyme has an active site. This is where the substrate reacts to the enzyme. The active site is shaped to perfectly fit the substrate and will not accept any other molecules. Because of this "lock and key" fit, enzymes only catalyze specific reactions.**

ANSWER KEY: HOMEOSTASIS

1. **C. Shiver, increase, negative**
   Shivering causes movement, which gives off heat that increases the body's temperature back to normal. This is an example of a negative feedback loop because the body responded in way to reverse the change, instead of furthering the change.
2. **D. Glucagon**
   Glucagon is a hormone that is secreted from the pancreas. Glucagon breaks down the stored glycogen, from the liver, and releases glucose into the bloodstream, which increases the body's glucose level.
3. **A. Negative**
   negative feedback loops reverse initial changes that disturb the body's internal environment, so the body can stay in an equilibrium state.
4. ***Answers can vary***
   ***If a person is exposed to extreme cold, the extreme temperatures will cause the body's temperature to drop. The hypothalamus of the brain senses the**

drop in bodily temperatures and sends instructions that causes the body to shiver, which produces heat. As well as shivering, the brain instructs the capillaries to constrict in order to conserve heat given off from shivering.*

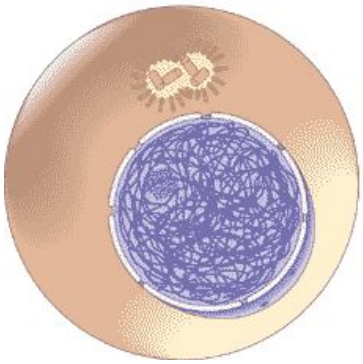
5. ***If a person ate a meal that is high in carbohydrates, there will be a spike in the person blood sugar. The hypothalamus of the brain will sense the increase in the glucose levels. The brain will send a message to the pancreas to release the hormone insulin. Insulin allows cells to cross the plasma membrane , where the liver stores excess glucose as glycogen, which brings the glucose level back to normal.***

TRANSPORT

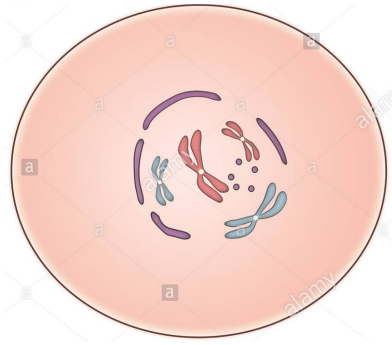
1. **A. Water, oxygen, and carbon dioxide**
   Theses molecules are able to pass through the membrane because they are small in size and they are nonpolar:
2. **D. Active Transport**
   During active transport molecules use energy in order to move molecules against a concentration gradient
3. **B. Does not, down, osmosis, diffusion, facilitated diffusion**
   Passive transport does not require energy. During Passive Transport, molecules move from areas of high concentration to low concentration. There are several types of passive transport such as, diffusion, facilitated diffusion, and osmosis
4. ***** In this scenario, the solution is considered hypertonic to the cell. In hypertonic cells, the amount of solutes are greater outside of the cell than inside of the cell. Osmosis will cause water molecules to move to out of the cell to where the solutes are higher, which causes the cell to shrivel up and decrease in size***
5. ***Solutions that have a lower concentration than the cell are considered hypotonic to the cell. Osmosis will cause the water to move to where the solutes are higher. Which means water will move into the cell, causing the cell to swell, increasing its size***

Answer Key: Cell Growth and Reproduction

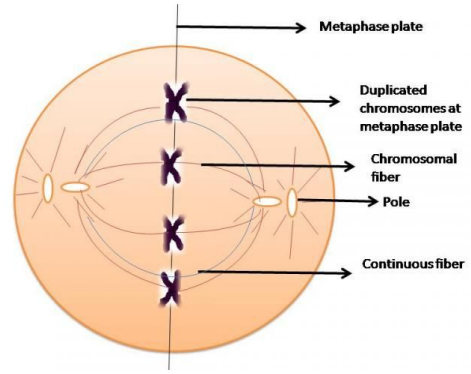
Write the Correct Phase of the Cell Cycle Next to its Corresponding



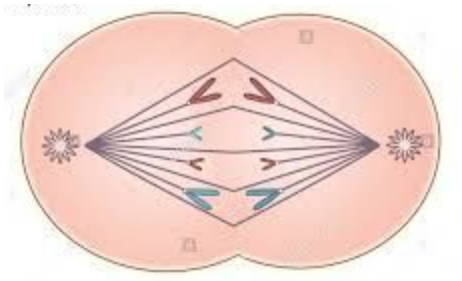
Interphase



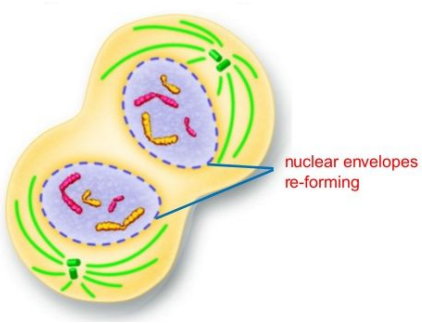
Prophase



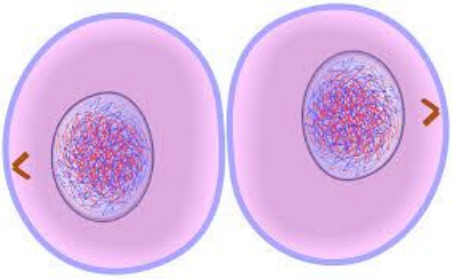
Metaphase



Anaphase



Telophase



Cytokinesis

Write the Letter of Each Definition next to its Correct Term

C 1. Genes

F 2. Alleles

A 3. Homologous Chromosomes

G 4. Genotype

D 5. Phenotype

E 6. G1 Phase

B 7. S Phase

H 8. G2 Phase

Choose Words from the Word Bank to Complete the Sentences

1. Spindle Fibers line up the chromosomes in the middle of the cell during metaphase.
2. As a result of DNA Replication there are two identical copies of DNA (this occurs during interphase).
3. During cytokinesis, the cell divides into two Daughter Cells, each with a complete set of chromosomes.

4. During metaphase, the spindles attach to the Centromeres on the sister chromatids.
5. Each Chromosome contains a long molecule of DNA.
6. A cell undergoes changes at each step of the Cell Cycle to create two daughter cells.
7. Semiconservative Replication means that each copy double strand of DNA contains one original strand and one copy strand of DNA.
8. Tiny structures called Centrioles begin to move toward the poles of the cell during prophase.
9. Each DNA molecule contains many genes and is the genetic makeup of a cell.
10. The two copies of DNA are condensed into shorter, fatter Sister Chromatids during mitosis.
11. The M Phase refers to cell division (mitosis and cytokinesis).
12. Cell Division refers to the process of a cell dividing into two cells, which then divide into four cells, which then divide into 8 cells, etc.

Anchor Questions

1. C. Telophase Telophase is the correct answer because it is the stage before Mitosis. It is the stage that replicates the DNA and synthesizes the required proteins so that Mitosis can duplicate the nucleus and start to organize the future daughter cell's DNA.
2. A. Prophase, Metaphase, Anaphase, Telophase Prophase coils up the DNA making the chromosomes much smaller and easier to handle and the centrioles start moving toward their poles. During Metaphase, the centrioles produce spindles which attach to the centromeres on the sister chromatids, making the sister chromatids line up in the middle of the cell. During Anaphase, the spindles pull the sister chromatids apart and bring them to opposite sides of the cell. During Telophase, a new nuclear membrane forms around the chromosomes. The chromosomes then unwind to let the genes activate.
3. A. Spindles "During metaphase, the centrioles produce structures called spindles. The spindles attach to the centromeres on the sister chromatids. The chromatids line up along the center of the cell."
4. Spindle Fibers are important because during metaphase, the spindles attach to the centromeres of the sister chromatids and line them up in the center of the cell. In the next stage (anaphase), the spindle fibers shorten, pull the sister chromatids apart, and pull them to opposite sides (poles) or the cell.
5. It is important for the parent cell to replicate its DNA before mitosis begins so that each daughter cell can have an exact copy of DNA. If DNA isn't replicated before mitosis begins, each daughter cell would only have half the amount of DNA as the parent cell had. As the cells continue to divide, the amount of DNA in each cell would keep getting less and less.

Answer Key: Ecology

Questions for Biosphere

1. True or False: In the “Organization of the Biosphere,” the Biosphere is the most specific level.

   A. True **B. False**

2. The Biosphere extends from the **Crust of the Earth** to the **Atmosphere**.

3. True or False: All Ecosystems are included within the Biosphere.

   A. True B. False

Questions for Community

1. Why do all organisms in a community interact and depend on each other to survive? Give examples.

_____
_____
_____
_____
_____
_____

Organisms in a community interact and depend on each other for their survival because certain organisms either make help to make food or are the food for other organisms to survive. For example, fish would be food for a bear and bees would make honey which other animals could eat. Another example is a tarantula and a frog. A tarantula will find a small frog to eat any insects that try to eat the spider’s eggs. In return, the spider will watch over and protect the frog from predators (this is an example of a mutualism relationship).

2. True or False: A community includes all of the populations that live in and interact in the same area?

A. True B. False

Questions for Biotic vs. Abiotic

1. Define Biotic Factors. Included an example.

_____
_____
_____
_____
_____
_____

Biotic Factors refer to the influence or effect created by a living organism. Examples of this is animals, bacteria, and fungi.

2. Define Abiotic Factors. Included an example.

_____
_____
_____
_____
_____
_____

Abiotic Factors refer to the nonliving environmental factors. Examples of this is sunlight, temperature, gases, water, and soil.

Questions for Ecosystem Interactions

1. True or False: A symbiotic relationship may *only* benefit one species or the other.

A. True **B. False**

2. Mutualism benefits which of the following:

A. Both Organisms C. The Bigger Organism
B. The Cleaner Organism D. Neither Organism

3. Which of the following is true about Commensalism:

   A. Both organisms are benefited
   B. One organism is benefited, the other is neither benefited or harmed
   C. Both organisms are harmed
   D. It is a neutral interaction: neither organisms is benefited or harmed

4. Which of the following is true about Parasitism:

   A. Both organisms are benefited
   B. Both organisms are harmed
   C. It is a neutral interaction: neither organism is benefited or harmed
   D. One organism is benefited, the other is harmed

Overall Questions

1. Name the organization of the biosphere in order from broadest to most specific.

_____, _____, _____, _____, _____, _____

Biosphere, Biome, Ecosystem, Community, Population, Organism

2. Name *at least three* examples of a biome and *at least two* characteristics for each.

Possible Answers:

Biome: Tundra

Characteristics: Short, cool, summers - Long, cold winters - Little participation

Biome: Taiga

Characteristics: Short warm, wet, summers - Long, cold, dry winters

Biome: Temperate Forest

Characteristics: Warm, wet, summers - Cool, wet winters

Biome: Tropical Rainforest

Characteristics: Warm all year - Long wet season - Short dry season

Biome: Savanna

Characteristics: Hot - Fairly dry - Alternating wet and dry season

Biome: Desert

Characteristics: Long, hot, dry summers - Shorter dry winters - Little precipitation

3. In a food chain, the flow of energy from one organism to another moves from the **Producer**, to the **Primary Consumer**, to the **Secondary Consumer**, to the **Tertiary Consumer**, to the **Apex Predator**, to the **Decomposers**, and back to the **Producer**.

4. Give an example of a producer, the primary consumer, and the secondary consumer.

_____
_____
_____
_____
_____
_____

Answer could be multiple things. An example is grass, grasshopper, bluebird. Another example could be tree leaves, caterpillar, bird.