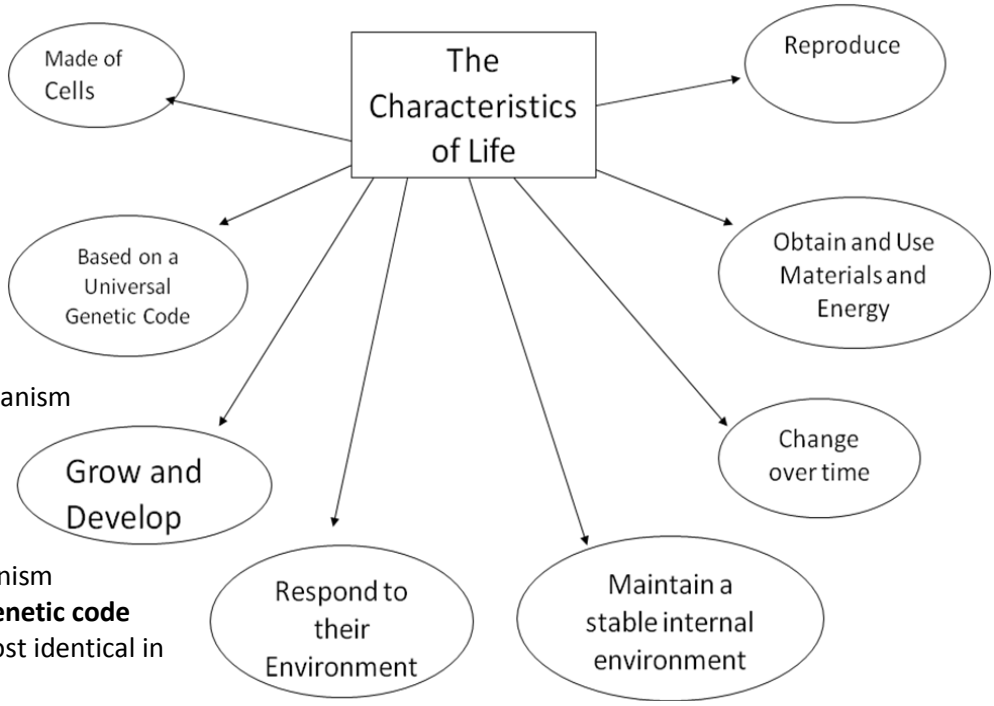
Themes of Life

Vocabulary

Biology
Biotechnology
Forensics
Homeostasis
Homeostatic mechanism
Scientific law
Scientific mechanism
Organ
Organ system
Organism
Scientific principle
Science
System
Temperature
theory
hypothesis
eukaryote
prokaryote

Concepts to Know

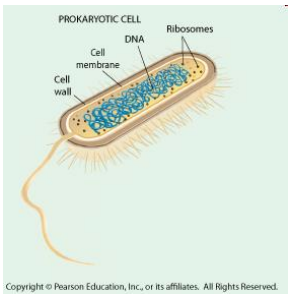
Characteristics of Life:



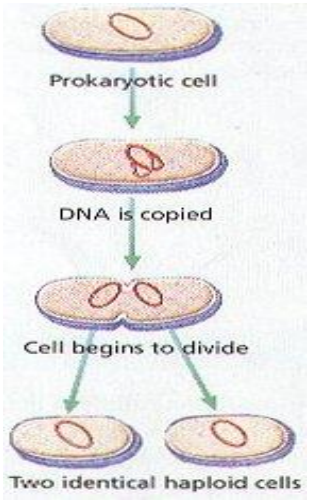
- **Living things are made of cells**
  - Smallest unit of an organism that is considered alive
  - Can be unicellular (bacteria) or multicellular (humans)
- **Living things reproduce**
  - Asexual: formation of a new organism from one parent. Offspring is a clone
  - Sexual: two cells from different parents unite to produce the 1st cell of new organism
- **Living things are based on a universal genetic code**
  - Based on 1 molecule that is almost identical in every organism on earth: DNA (Deoxyribonucleic Acid)
- **Living things grow and develop**
  - Growth: an increase in size of an organism
  - Development: progression through a life cycle
- **Living things obtain materials and use energy**
  - Autotroph: obtains energy from the sun
  - Heterotroph: obtains energy from consuming other organisms.
- **Living things respond to environment**
  - ex. Find shelter from rain
  - ex. Hibernating to survive the winter
  - ex. Produce toxins to ward off predators
- **Living things maintain a stable internal environment**
  - Homeostasis: keeping internal condition stable relative to the external environment
- **Living things change over time (evolve)**
  - Populations evolve over time

1. Read through the characteristics of life on this page. These 8 characteristics are what tell biologists if something is living or non-living. Remember, biology literally means “Study of life”.

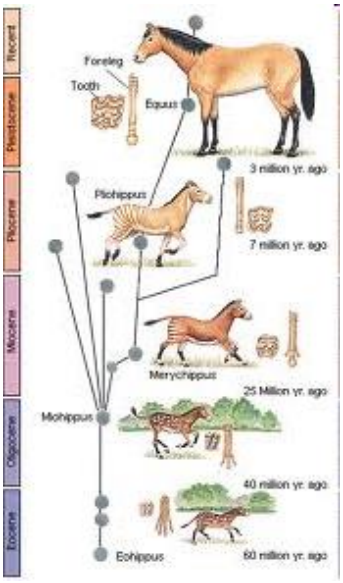
2. Look at the images below. Each one is related to a characteristic of life. Some images may be related to more than one characteristic of life. See if you can match at least one characteristic of life to each image:



A._____



C. _____



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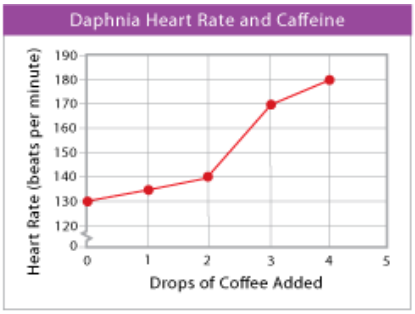
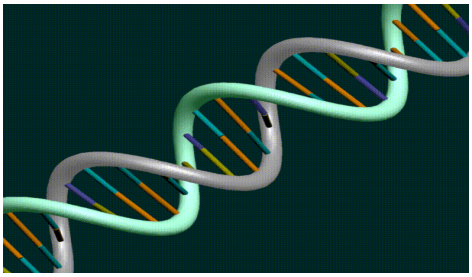
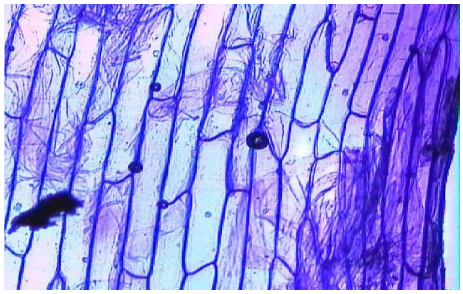


B. _____

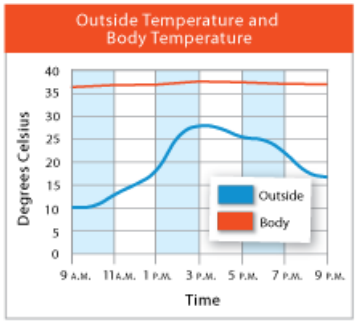


E._____

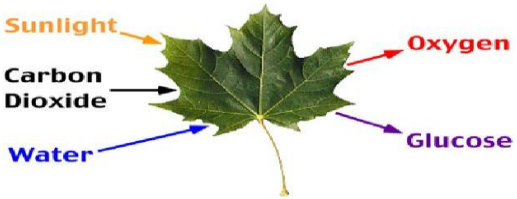
F._____



G._____



H._____

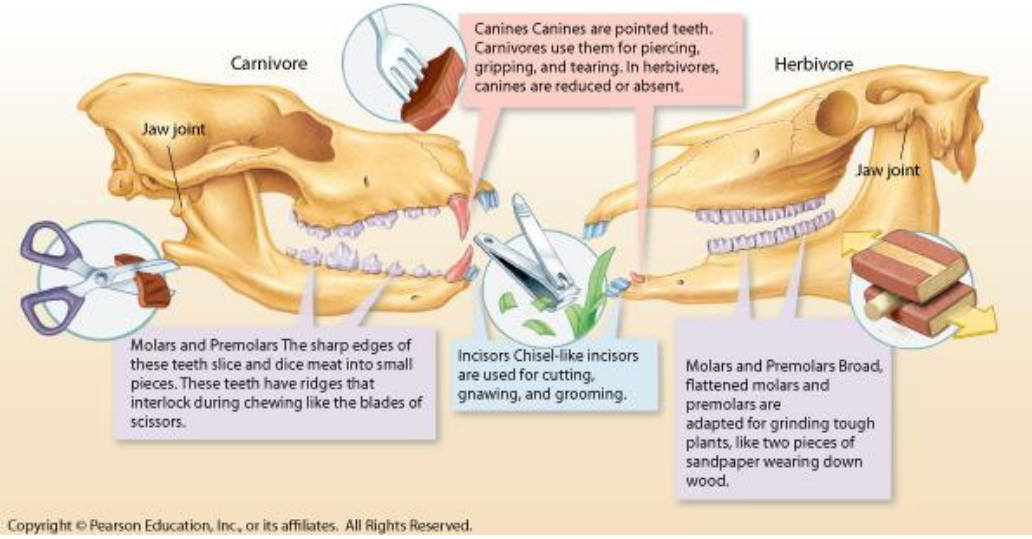


I._____

Structure and Function:

Structure and function is a central theme to the study of biology. Each major group of organisms has evolved its own particular body part "tool kit" – a collection of structures that have evolved in ways that make particular functions possible. From capturing food to digesting it, and from reproducing to breathing, organisms use structures that have evolved into different forms as species have adapted to life in different environments. The structure of wings, for example enable birds and insects to fly. The structures of legs enable horses to gallop and kangaroos to hop.

➔ Examine the figure below that shows carnivore and herbivore skulls. Don't forget to read the captions!



Now, since you've got some specific ideas about what structure and function are all about answer the questions below:

1. Think about your own teeth. What kinds of foods do you think human teeth are suited for?

2. List at least **three** ways the structure of human teeth serve the function of eating meat and plant material.

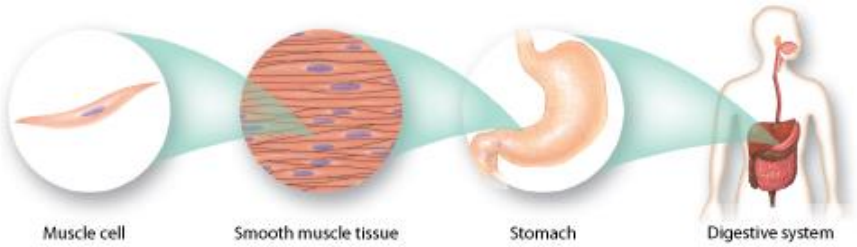
   a. _____

   b. _____

   c. _____

3. Now, last but not least apply the theme of structure and function to something you're very familiar with - your hands. List out all the ways you can think of that the structure of your hands serve the function of your hands. Hint – you are a primate!

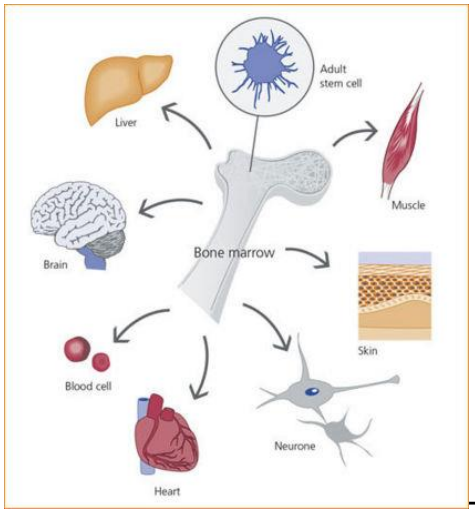
Levels of Organization



The specialized cells of multicellular organisms are organized into an organ system, as shown above. A tissue is a group of similar cells that perform a particular function. Many tissues work together as an organ to complete complicated tasks. A group of organs that work together to perform a specific function is called an organ system.

3. The Venn diagram to the right consists of four concentric circles. Complete the diagram to show the relationships among four levels of organization of life. Use the terms ***cells, organ, organ system,*** and ***tissue***.

4. See if you can include the level of organization called "**organism**" in the Venn diagram. Show where it would be added.



The diagram to the left shows a few of the different types of cells found in your body. Luckily, the cells in our body are specialized. Some cells are specialized to move, to react to the environment; still others to produce substance that the organism needs. Each of these specialized cells contributes to homeostasis in the organism.

Describe how cells of a multicellular organism are like a baseball team, or choose any type of team you like.

_____

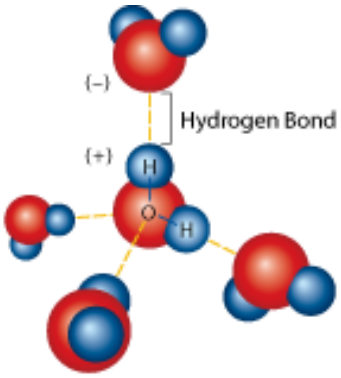
_____

_____

_____

Chemistry of water:

Life is connected to water. Nearly 75% of our earth is covered in water. Why is it so special and vital to living things? Let's look at the chemistry of water. Notice in the diagram to the right that water is composed of two hydrogen atoms and one oxygen (H_2O).



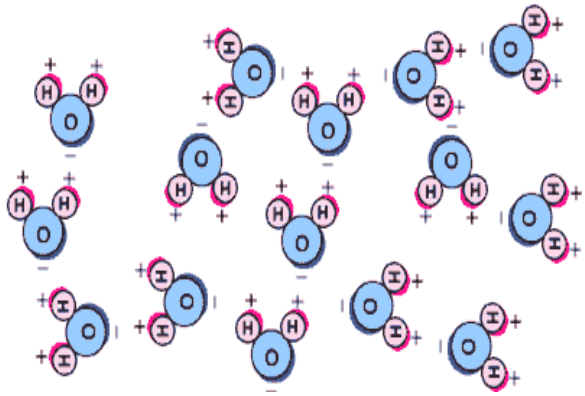
The diagram shows that one side of the water molecule is **positively charged** and the other is **negatively charged**. These opposite charges make water a **polar** molecule.

The **negative oxygen** of one water molecule is attracted to the **positive hydrogen** of another molecule forming a **hydrogen bond**. In other words water likes to stick to itself. Water sticking to water is called **cohesion**. Water sticking to something else is called **adhesion**.

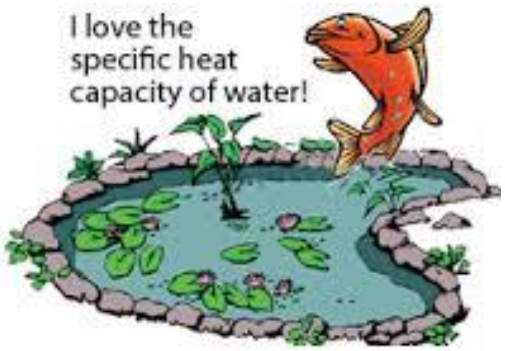
5. In the diagram to the right use dotted lines to draw in the bonds that form between water molecules.

6. What is the name of this type of bond?

7. What special property do the bonds give to water.



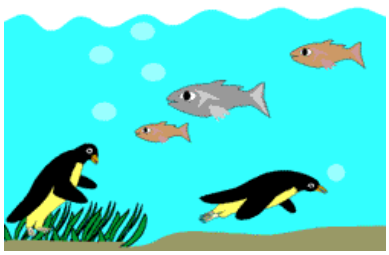
It turns out that hydrogen bonds are important for a few more reasons. Hydrogen bonds give water a **high specific heat** and also cause water to **expand upon freezing**.



Specific heat is the amount of energy required to raise one gram of water 1 degree Celsius.

8. Can you think of a reason why water can absorb so much heat? Hint – think bonds

It turns out that water expands when frozen and actually becomes **less dense** than when in the liquid state. We call this frozen water ice, which we know floats.

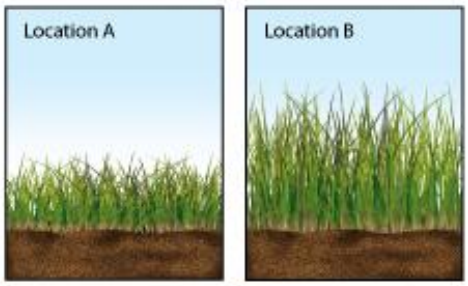


9. Challenge yourself to think of two ways that specific heat and the freezing point of water help support life on earth.

Scientific Method/Scientific Terms:

The scenes below show the steps involved in the scientific method read through the experimental scenario and answer the questions below.

OBSERVING AND ASKING QUESTIONS

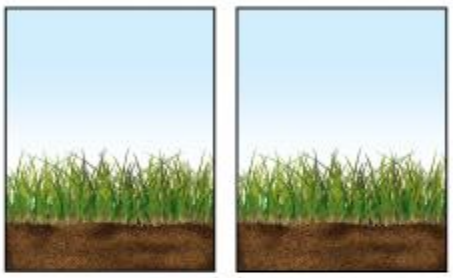


Researchers observed that marsh grass grows taller in some places than others. This obesrvation led to a question: *Why do marsh grasses grow to different heights in different places?*

INFERRING AND HYPOTHESIZING

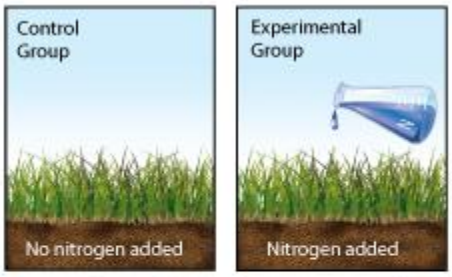
The researchers inferred that something limits grass growth in some places. It could be any environmental factor—temperature, sunlight, water, or nutrients. Based on their knowledge of salt marshes, they proposed a hypothesis: *Marsh grass growth is limited by available nitrogen.*

DESIGNING CONTROLLED EXPERIMENTS



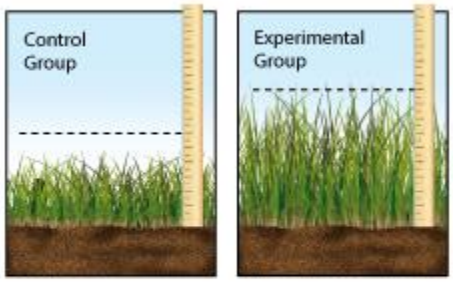
The researchers selected similar plots of marsh grass. All plots had similar plant density, soil type, input of freshwater, and height above average tide level. The plots were divided into control and experimental groups.

DESIGNING CONTROLLED EXPERIMENTS *cont.*



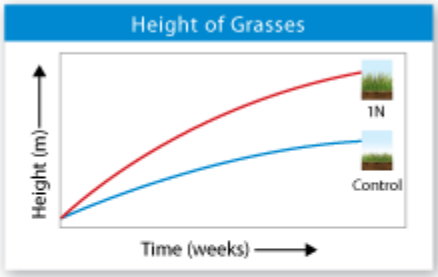
The researchers added nitrogen fertilizer (the independent variable) to the experimental plots. They then observed the growth of marsh grass (the dependent variable) in both experimental and control plots.

COLLECTING AND ANALYZING DATA



The researchers sampled all the plots throughout the growing season. They measured growth rates and plant sizes, and analyzed the chemical composition of living leaves.

DRAWING CONCLUSIONS



Data from all plots were compared and evaluated by statistical tests. Data analysis confi rmed that marsh grasses in experimental plots with additional nitrogen did, in fact, grow taller and larger than controls. The hypothesis and its predictions were supported.

10. Based on the scenario what is the difference between a hypothesis and an inference?

11. How did the control group differ from the experimental group?

12. What were the dependent and independent variables?

13. What was the observation that started the research?

In science the word **theory** applies to a well-tested explanation that unifies a broad range of observations and hypotheses and that enables scientists to make accurate predictions about new situations

A **hypothesis** is a scientific explanation for a set of observations that can be tested in ways that support or reject it.

Identify whether each statement is a hypothesis or a theory. For a hypothesis, write an "H" on the line. For a theory, write a "T."

_____ **14.** The rate that grass grows is related to the amount of light it receives.

_____ **15.** All life is related and descended from a common ancestor.

_____ **16.** The universe began about 15 billion years ago.

_____ **17.** New tennis balls bounce higher than old tennis balls.

_____ **18.** Caffeine raises blood pressure.

19. Someone might argue against evolution and say that its "just a theory". Why is this not a very good argument?

Practice Questions:

1. Which characteristic is shared by **all** prokaryotes and eukaryotes?
   a. ability to store hereditary information
   b. use of organelles to control cell processes
   c. use of cellular respiration for energy release
   d. ability to move in response to environmental stimuli

2. Living organisms can be classified as prokaryotes or eukaryotes. Which two structures are common to both prokaryotic and eukaryotic cells?
   a. cell wall and nucleus
   b. cell wall and chloroplast
   c. plasma membrane and nucleus
   d. plasma membrane and cytoplasm

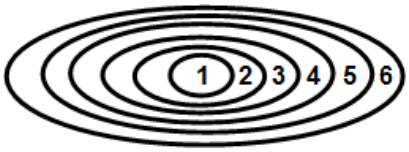
3. Alveoli are microscopic air sacs in the lungs of mammals. Which statement **best** describes how the structure of the alveoli allows the lungs to function properly?
   a. They increase the amount of energy transferred from the lungs to the blood.
   b. They increase the flexibility of the lungs as they expand during inhalation.
   c. They increase the volume of the lungs, allowing more oxygen to be inhaled.
   d. They increase the surface area of the lungs, allowing efficient gas exchange.

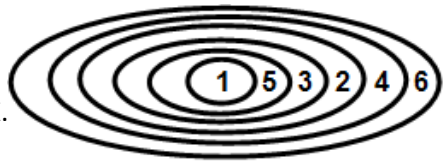
4. Which example is an activity that a fish **most likely** uses to maintain homeostasis within its body?
   a. using camouflage to avoid predators
   b. feeding at night to regulate body temperature
   c. moving to deeper water to regulate metabolic wastes
   d. exchanging gases through its gills to regulate oxygen levels

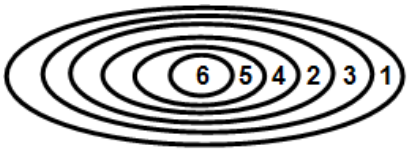
5. Which statement best describes an effect of the low density of frozen water in a lake?
   a. When water freezes, it contracts, decreasing the water level in a lake.
   b. Water in a lake freezes from the bottom up, killing most aquatic organisms.
   c. When water in a lake freezes, it fl oats, providing insulation for organisms below.
   d. Water removes thermal energy from the land around a lake, causing the lake to freeze.

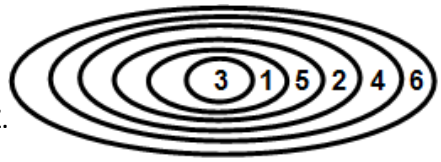
6. Which diagram best represents the relationship of the items in the list below?

   1. cell
   2. organ
   3. organelle
   4. organ system
   5. tissue
   6. whole organism

W. 

X. 

Y. 

Z. 

   A. X
   B. Y
   C. Z
   D. W

Open-ended question:

7. Prokaryotic cells are generally much smaller than eukaryotic cells.

   Part A: Identify a structural difference between prokaryotic cells and eukaryotic cells that is directly related to their difference in size.

   _____
   _____
   _____
   _____
   _____
   _____

   Part B: Based on the structural difference, explain why prokaryotic cells can be much smaller than eukaryotic cells.

   _____
   _____
   _____
   _____
   _____
   _____

   Part C: Describe one similarity between prokaryotic cells and eukaryotic cells that is independent of size.

   _____
   _____
   _____
   _____
   _____
   _____

Organic Chemistry

Vocabulary

Adhesion
Cohesion
Atom
Concentration
Biological macromolecules
monomer
Freezing point
carbohydrate
amino acid
protein
Macromolecule
lipid
nucleic acid
enzyme
catalyst
pH
molecule
specific heat
organic molecule

Concepts to Know

1st Idea: Due to its properties, carbon is uniquely suited to form biological macromolecules.

➔ *Use the diagrams below to fill in the blanks and describe why carbon is so important to life.*

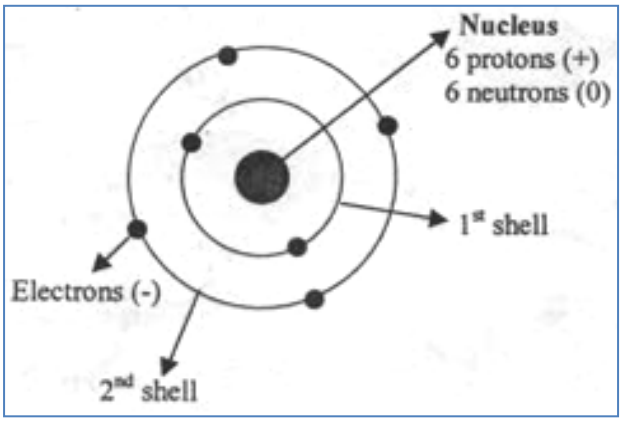


Figure 1: Carbon Atom

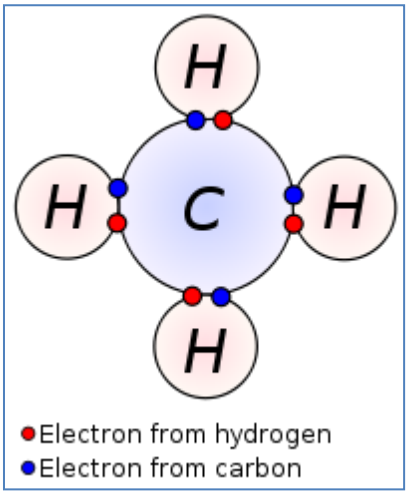


Figure 2: Covalent Bonding between Carbon and Hydrogen

- Carbon has _____ in the outer (valence) shell
  - **Valence shell** enables easy formation of four covalent bonds
  - **Covalent bonds** involve _____ of _____ between two atoms

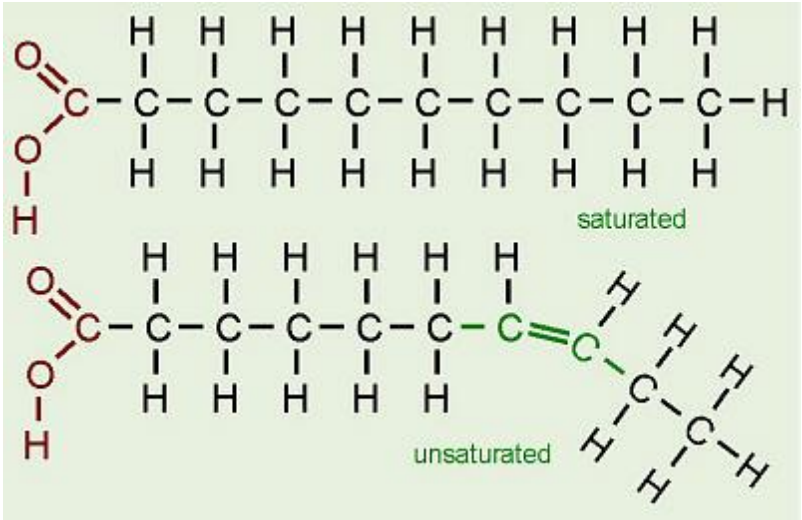
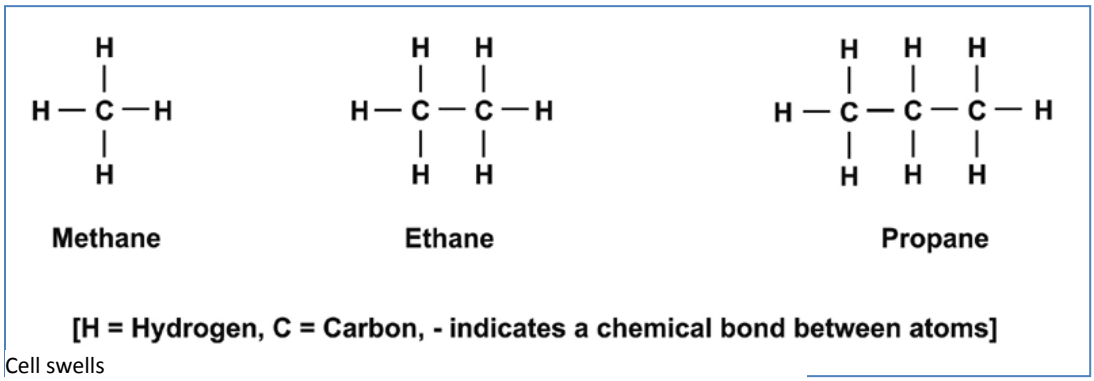


Figure 3: Long Chain Carbon Compounds

- **Carbon** has the ability to form _____ _____ by forming several bonds in a row

➔ *Use the diagrams to fill in the blanks and describe how the variety of organic compounds can be explained by carbon's properties.*



- **Organic compounds** – Contain _____
- **Variety** is created by the many partners that carbon can bond with

Cell swells

- **Organic compounds** – Contain _____
- **Variety** is created by the many partners that carbon can bond with
- **Properties** include polarity of molecule
- **Polarity** is a description of the balance of charges in a molecule
  - _____ means the charges are not balanced
  - **Nonpolar** means _____ balance of charges

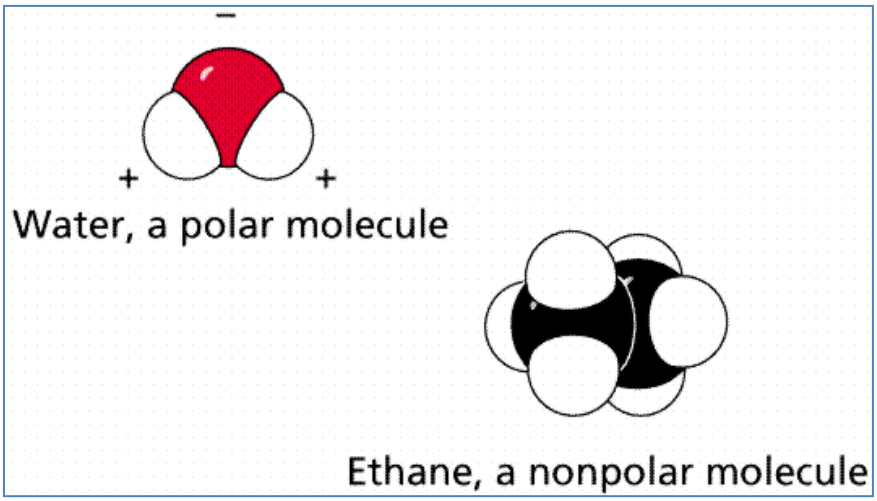
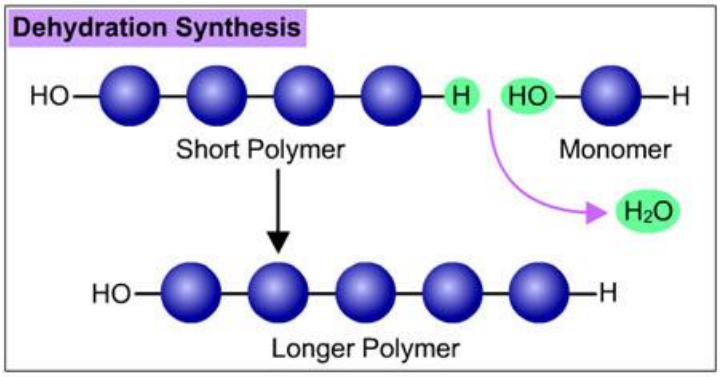


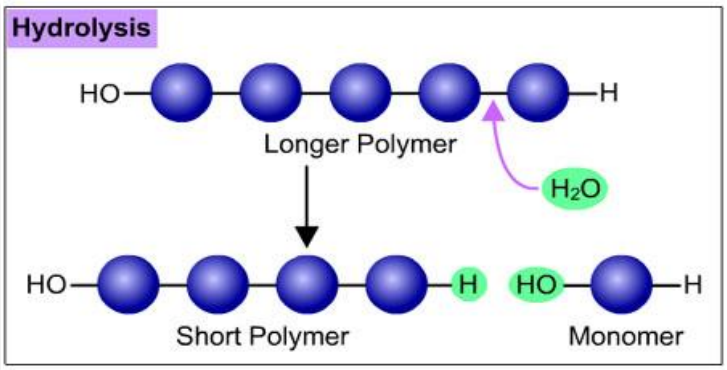
Figure 2: Polar and Nonpolar Compounds

2nd Idea: Biological macromolecules form from monomers.

➔ *Use the diagrams to fill in the blanks and describe how carbon allows for the formation of macromolecules.*

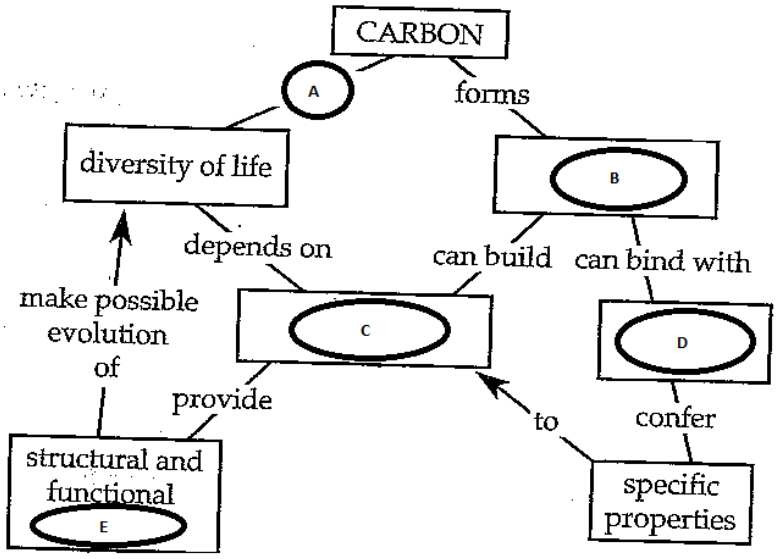
- **Macromolecules** are very large molecules
- Most **macromolecules** are polymers
- _____ are long chains of bonded groups
- _____ are the molecules that link to form polymers





- **Dehydration Synthesis** generates _____ and is a common way for polymers to form
- **Hydrolysis** is the process of breaking apart _____

➔ *Use the outline above and video called "The Molecules of Life" (https://udkeystone.wikispaces.com/Organic+Chemistry) to complete the following concept map and answer the review questions at the end of this section.*



A _____

B_____

C_____

D_____

E_____

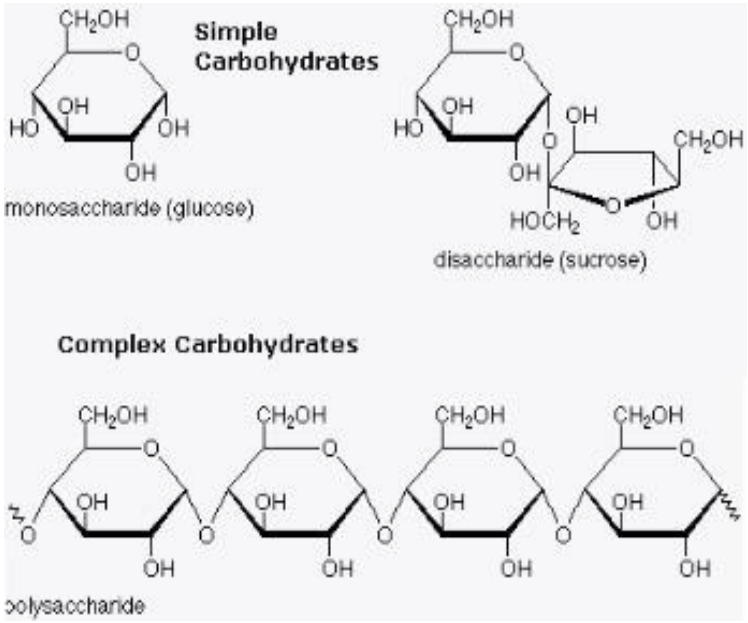
MACROMOLECULES: STRUCTURE AND FUNCTION

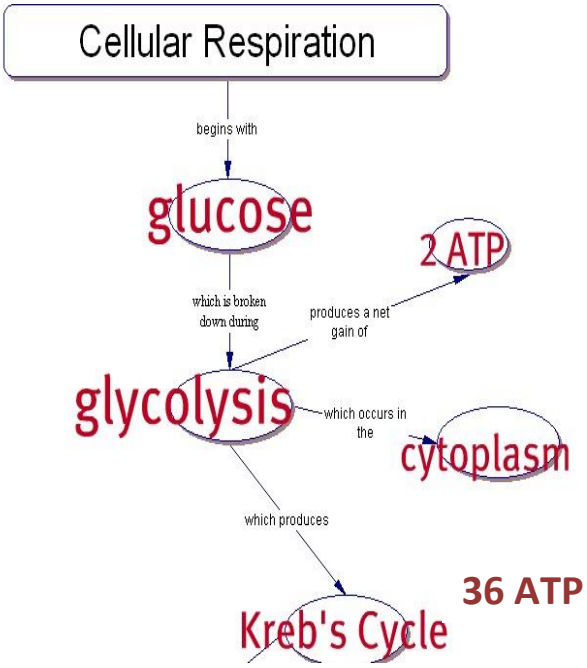
Macromolecules and Their Function		
Class	*Monomers*	*Functions*
Carbohydrates	Monosaccharides	Energy, raw materials, energy storage, structural compounds
Lipids	Glycerol, fatty acids, steroids	Energy storage, membranes, steroids, hormones
Proteins	Amino acids	Enzymes, transport, movement, receptors, defense, structure
Nucleic acids	Nucleotides	Heredity, code for amino acid sequence

Carbohydrates are broken down through hydrolysis to serve as fuel for the body or a source of carbon

- **Saccharide** means sugar

  Carbohydrates can be
  _____
  (1 sugar)
  _____,
  (2 sugars), or
  _____
  (more than 2 sugars)



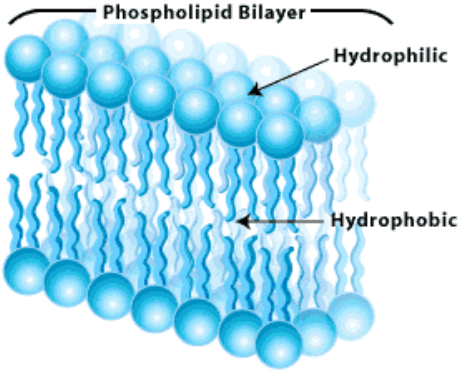


- _____ breaks down carbohydrates like glucose for use in cellular respiration

- **Cellular respiration** is the process through which the body generates energy, or _____

Lipids are nonpolar macromolecules made from long carbon chains

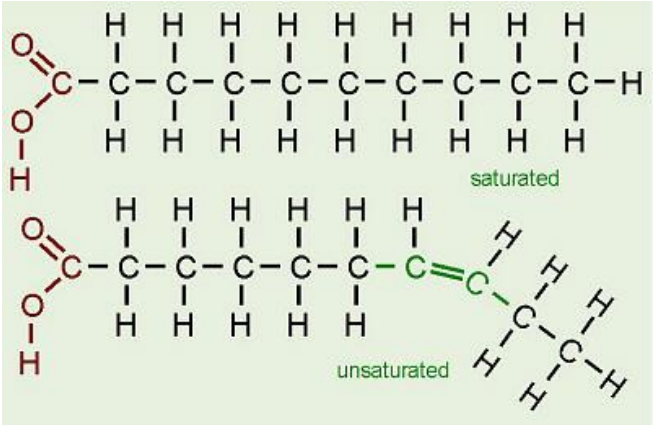
- Lipids can be **fats, phospholipids, or steroids**
- **Fats** store large amounts of energy



- _____ compose cell membranes
- **Steroids** are made of four connected carbon rings with functional groups attached

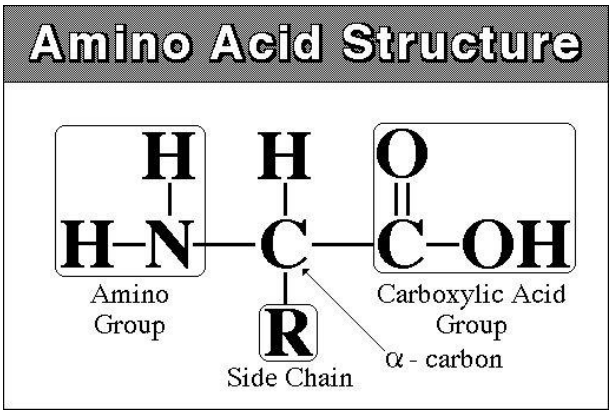
- **Lipids** can be saturated or _____

- **Saturated** lipids have a _____ shape and only single bonds between carbons, while **unsaturated** lipids have a nonlinear shape and _____ or triple bonds



Proteins are amino acid polymers that are essential to life

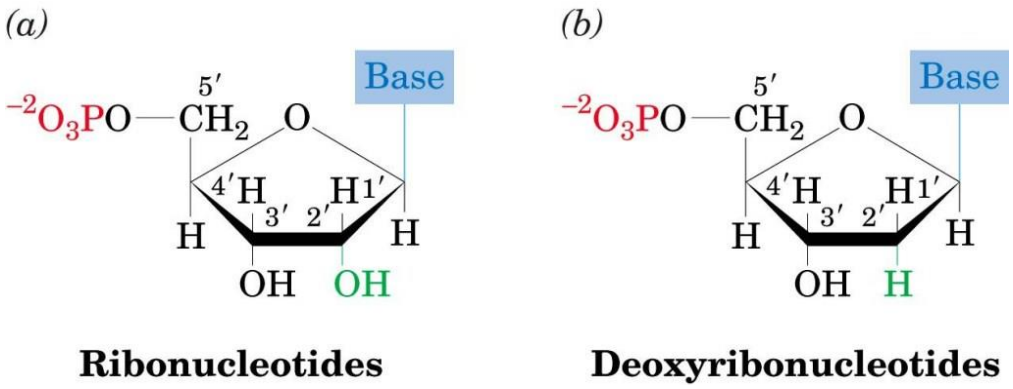
- **Amino acids** have _____ and _____ groups. They are unique by the "R" group that is attached to carbon
- **"R"** is like a variable in algebra class. It can have many values (structures).
- **Function** of the amino acid is determined by structure and conformation of the "R" group the



Nucleic acids are polymers of nucleotides

- **Nucleotides** are monomers that consist of pentose (the hexagon shape in the diagram) attached to a phosphate group (in red on diagram) and nitrogen base (in blue on diagram)
- **Pentose** can be deoxyribose (as in DNA or deoxyribose nucleic acid) or ribose (as in RNA or _____nucleic acid)
- **DNA and RNA** are central to heredity and are made unique by the nitrogenous _____ that is attached

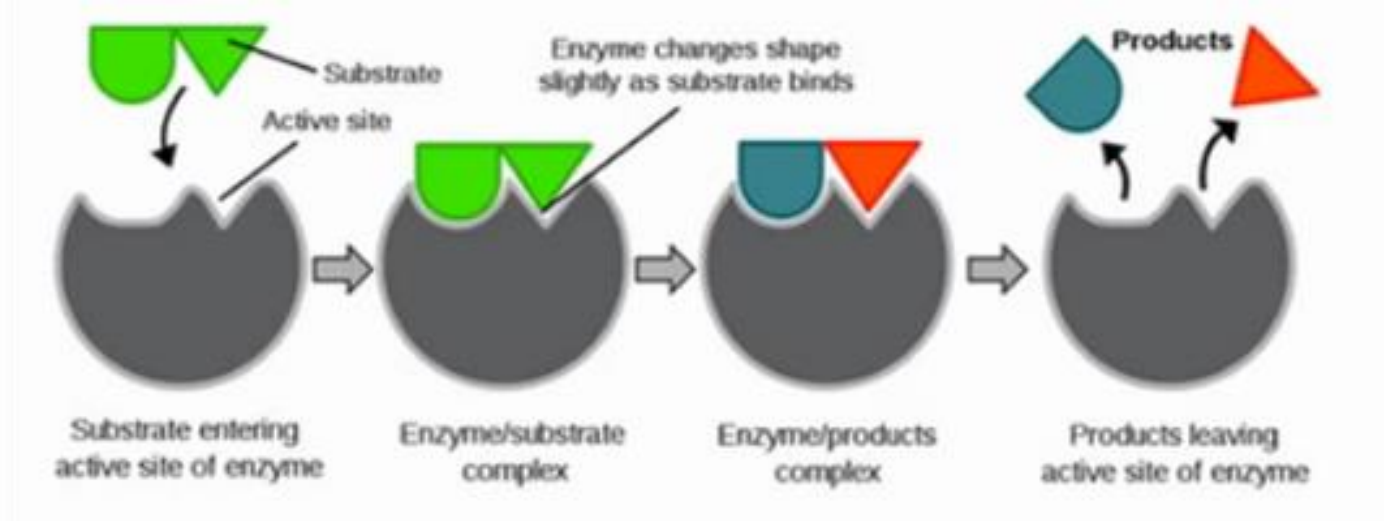
- **Nitogenous bases** can be cytosine (C), thymine (T), uracil (U), adenine (A), or guanine (G)



➔ *Use the outline above and video called "Biological Molecules" (https://udkeystone.wikispaces.com/Organic+Chemistry) to answer the review questions at the end of this section.*

3rd Idea: **Enzymes** are mostly macromolecule proteins that act as biological catalysts

- **Catalysts** increase the rate of a reaction without being changed by the reaction
- **Substrates** are the reactants on which enzymes (catalysts) work
- **Rate of reaction** in both directions is increased by the presence of specific enzymes.
- _____ _____ refers to the part of an enzyme that interacts with a substrate

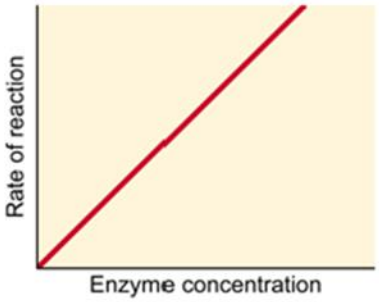


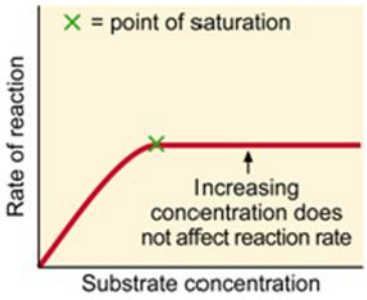
The **rate of a reaction** involving enzymes has to speed up at times and slow down at other times based on the needs of the organism.

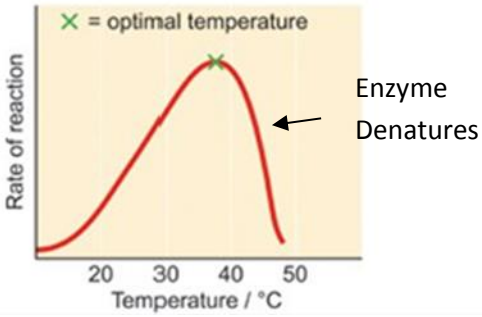
➔ *Use the video called "Enzymes" (https://udkeystone.wikispaces.com/Organic+Chemistry) to answer the questions*

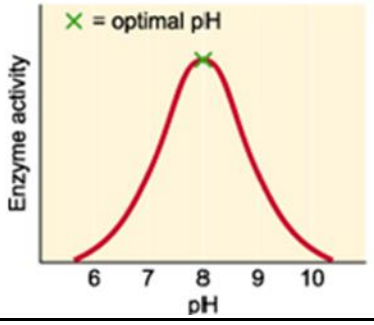
- The process of turning enzymes on occurs through _____ or _____
  - _____ means the body only produces the enzyme when it is needed
- **Deactivation** of enzymes occurs through _____ or _____ inhibition
  - **Competitive inhibition** means another chemical bonds with and _____ the active site of the enzyme
  - _____ **inhibition** means another chemical bonds to the enzyme in a position away from the active site, but blocks or alters the active site as a result

4th Idea: **Enzyme reaction rates** are impacted by temperature, pH & substrate concentration









- **Temperature** is a measure of kinetic energy
  - **Kinetic energy** is the energy of motion. Higher temperature means _____ moving particles.
  - The **number of collisions** between enzymes and substrates is increased if the particles move around _____ (higher temperature)
  - Enzymes do not function well above or below the _____ temperature
  - The enzyme denatures, or breaks down, if the enzyme gets too _____

- **pH** measures acidity
  - Enzymes function best at the _____ pH level
  - If the conditions are too acidic (low pH) or too basic (high pH), the enzyme may denature

- **Concentration** is a measure of how many substrate molecules are present in a given volume.
  - _____ ____ _____ is the concentration where the reaction rate is maximized, the active sites of the enzymes are all used adding more substrate does not increase the rate of reaction.

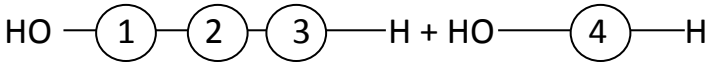
➔ *Use the outline above and video called "Enzymes" (https://udkeystone.wikispaces.com/Organic+Chemistry) to answer the questions on the next page.*

Practice Questions:

1. Which statement correctly describes how carbon's ability to form four bonds makes it uniquely suited to form macromolecules?
   A. It forms short, simple carbon chains.
   B. It forms large, complex, diverse molecules.
   C. It forms covalent bonds with other carbon atoms.
   D. It forms covalent bonds that can exist in a single plane.

Use the diagram below to answer the question.

Chemical Reaction



2. The diagram shows a reaction that forms a polymer from two monomers. What is this type of reaction called?
    A. glycolysis
    B. hydrolysis
    C. photosynthesis
    D. dehydration synthesis

3. Carbohydrates and proteins are two types of macromolecules. Which functional characteristic of proteins distinguishes them from carbohydrates?
    A. large amount of stored information
    B. ability to catalyze biochemical reactions
    C. efficient storage of usable chemical energy
    D. tendency to make cell membranes hydrophobic

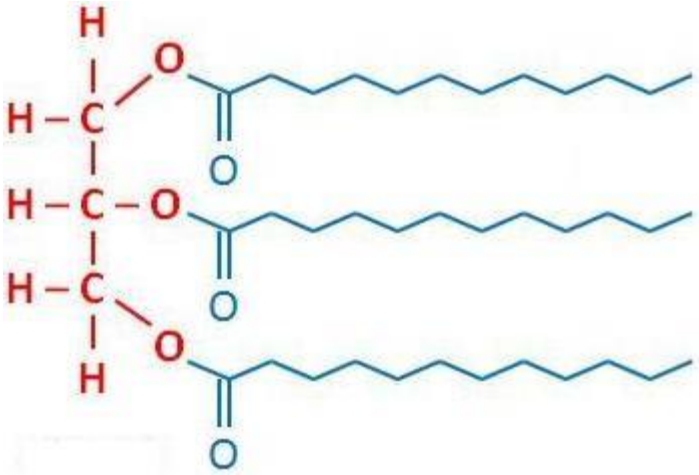
4. Substance A is converted to substance B in a metabolic reaction. Which statement **best** describes the role of an enzyme during this reaction?
    A. It adjusts the pH of the reaction medium.
    B. It provides energy to carry out the reaction.
    C. It dissolves substance A in the reaction medium.
    D. It speeds up the reaction without being consumed.

5. A scientist observes that, when the pH of the environment surrounding an enzyme is changed, the rate the enzyme catalyzes a reaction greatly decreases. Which statement **best** describes how a change in pH can affect an enzyme?
    A. A pH change can cause the enzyme to change its shape.
    B. A pH change can remove energy necessary to activate an enzyme.
    C. A pH change can add new molecules to the structure of the enzyme.
    D. A pH change can cause an enzyme to react with a different substrate.

6. Whenever biological organic compounds, such as proteins and carbohydrates, are broken down or synthesized...
    a. a phase change of matter results.
    b. thermal expansion occurs.
    c. sunlight is required.
    d. energy is absorbed or released.

7. Why does an enzyme function as a catalyst in a reaction?
    a. It creates the right pH needed for the reaction.
    b. It decreases the amount of energy needed for the reaction.
    c. It provides the extra energy needed for the reaction.
    d. It maintains the proper temperature needed for the reaction.

Examine the structural formula below.



8. Which of the following biomolecules is best represented by this formula?
    a. nucleic acid
    b. protein
    c. carbohydrate
    d. lipid

Open-ended Question:

9. Proteins are a major part of every living cell and have many different functions within each cell. Carbohydrates also perform numerous roles in living things.

    Part A: Describe the general composition of a protein molecule.

    _____
    _____
    _____
    _____
    _____
    _____

    Part B: Describe how the structures of proteins differ from the structures of carbohydrates.

    _____
    _____
    _____
    _____
    _____
    _____

    Part C: Describe how the functions of proteins differ from the functions of carbohydrates

    _____
    _____
    _____
    _____
    _____
    _____

Cells and Cell Transport

Vocabulary

cell
tissue
cell membrane (plasma membrane)
nucleus
ribosome
mitochondrion
chloroplast
protein synthesis
active transport
carrier (transport) proteins
concentration gradient
diffusion
endocytosis
endoplasmic reticulum
endosymbiosis
exocytosis
facilitated diffusion
extracellular
golgi apparatus
impermeable
intracellular
organelle
osmosis
passive transport
plastids
pumps (ion or molecular)
unicellular
multicellular

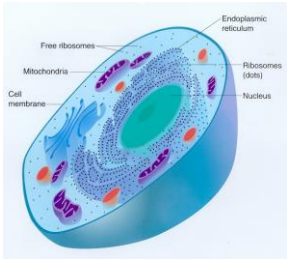
Concepts to Know

What is the Cell Theory?

1. All living things are made of cells.
2. Cells are the basic units of structure and function in living things.
3. New cells are produced from existing cells.

Differences between Prokaryotic vs Eukaryotic Cells

Eukaryotic



1. **Prokaryotic Cells:** Single-celled organisms that lack internal membrane Bound compartments (Genetic material (DNA) is in a circular molecule) (simple) i.e. bacteria.
   -Hypothesized that the first type of cells on earth were prokaryotic
2. **Eukaryotic Cells:** Cells with membrane bound compartments with organelles such as, the nucleus. (more complex) i.e. animal and plant cells

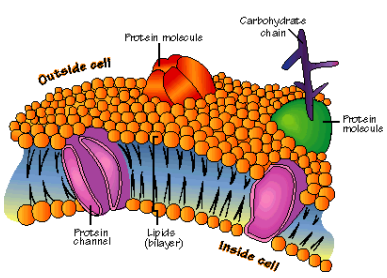
Directions: Write a **P** if the statement refers to Prokaryotes and an **E** if the statement refers to Eukaryotes, if the statement refers to both Prokaryotes and Eukaryotes write a **B** on the line.

___ 1. This type(s) of cell does not have bound compartments.
___ 2. This type(s) of cell contains DNA.
___ 3. This type(s) of cell contains organelles.
___ 4. A bacteria cell is an example of this type of cell.
___ 5. This type(s) of cell contains a nucleus.

Cell Structures & Functions

All cells are enclosed by a cell membrane (plasma membrane). Within the membrane is the nucleus and the cytoplasm. Within the cytoplasm are organized structures that perform specific functions. These structures are called organelles.
Please Note-The letters next to the structure of the cell indicates if it is found in A =animal cells and P = plant cells.

(A, P) Cell Membrane- surrounds the cell. It plays an active role in determining which substances enter and exit the cell. Some substances can pass freely through the cell membrane and others cannot, the membrane is said to be selectively permeable, or semipermeable. The cell membrane is composed of lipids (phospholipids) and proteins.



(A, P) Nucleus- control center for all cell functions. Within the nucleus are chromosomes and at least one nucleolus. The **nucleolus is a site of RNA synthesis**, and it may also be responsible for the production of ribosomes.

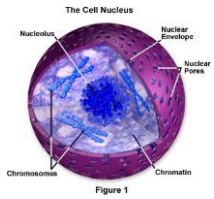
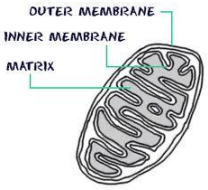


Figure 1

(A, P) Cytoplasm- the material in the cell outside the nucleus. It consists

mainly of water. Within the cytoplasm are the various organelles of the cell. The cytoplasm provides the environment in which the organelles carry on the life processes of the cell.

(A, P) Mitochondria- are found in the cytoplasm. Most stages of cellular respiration occur in the mitochondria. The energy released during respiration is stored in the form of high-energy chemical bonds in molecules of ATP.



(P)Chloroplasts-contain green pigment called chlorophyll, which carries on the process of photosynthesis.

Mitochondria & Chloroplast-Developed from prokaryotic cells? WHAT?!?!

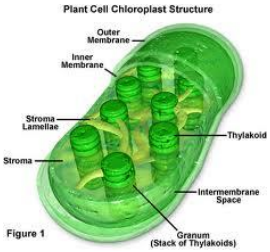
Check out this really good explanation…http://www.youtube.com/watch?v=fAjev01mDZM

Related questions:

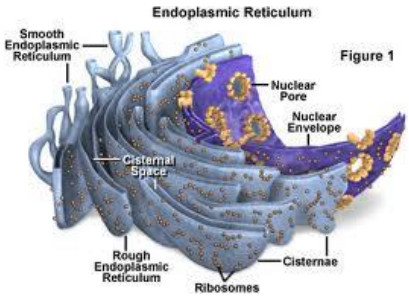
1. Why are these two organelles unique?

2. What are two characteristics about mitochondria and chloroplast that make it similar to prokaryotic bacteria cells?

3. What is the endosymbiotic theory?

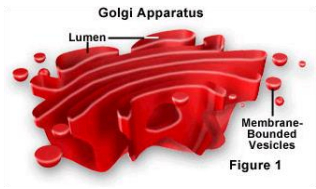


(A, P) Ribosomes- are small, dense granules(look like tiny circles on the diagrams) found free in the cytoplasm and the nucleus and lining the membranes of some endoplasmic reticulum. Ribosomes are composed mainly of RNA. They are the centers of protein synthesis in the cell.



(A, P) Endoplasmic reticulum-is a membrane-bound system of channels or tubes through which materials are transported within the cell. The membranes of the ER may also serve as sites of biochemical reactions. There are two types smooth and rough. The rough appearance is due to the presence of ribosomes on the membrane. **Rough ER** is found mainly in cells involved in protein synthesis. **Smooth ER** which has no ribosomes, is found mainly in cells involved in synthesis of nonprotein substances.

(A, P) Golgi Apparatus- is made up of a series of membrane-enclosed sacs, and it is usually found near the nucleus. This organelle is associated with the production of lysosomes and with the synthesis of various secretions.

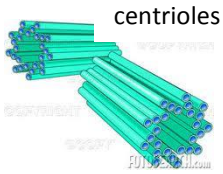


(A) Lysosomes- are "packages" or sacs, of digestive enzymes. They keep the enzymes separated from the rest of the cell contents until they are needed.

(A, P) Vacuoles: are membrane-enclosed structures that are generally filled with water containing various dissolved substances. Vacuoles in animal cells are usually small, and

vacuoles in plants are using large. The pressure created by the large vacuole helps to maintain the rigid structure of the plant cell and of the plant.

(A, P) Centrosome-are small organelles found just outside the nucleus in animal cells. Within the centrosome of animal cells are two small structures called **centrioles**, which are necessary for the movement of chromosomes during cell division.


centrioles

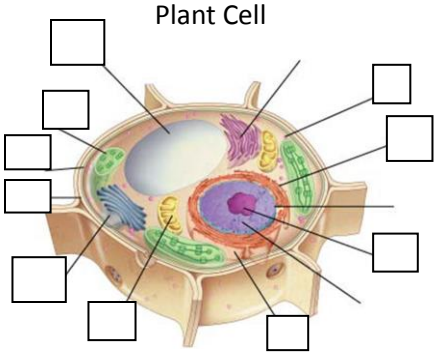
(P) Cell Wall- structure found outside the cell membrane of plant cells. The cell wall is made up mostly of cellulose, and it provides support for the cell.

(A, P)Cytoskeleton- is a filamentous network of proteins that are associated with the processes that maintain and change cell shape and produce cell movements in animal and bacteria cells. In plants, it is responsible for maintaining structures within the plant cell, rather then whole cell movement. **The main types of filaments the** make up the cytoskeleton are Microfilaments and Microtubules.

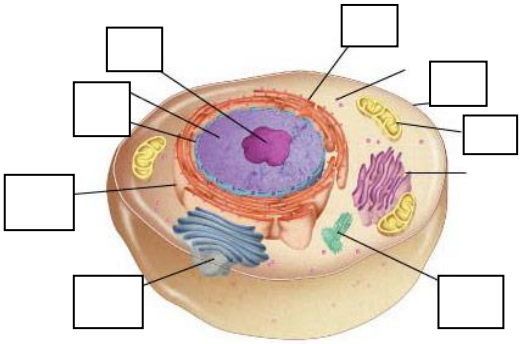
3. *Use the following structure letters to label the structures indicated in the eukaryotic plant and animal cells.*

A. Cell membrane
B. Nucleus
C. Nucleolus
D. Chromosome
E. Cell Wall
AB. Centriole
AC. Mitochondria
AD. Lysosome
AE. Endoplasmic reticulum
BC. Golgi Apparatus
BD. Vacuole
BE. Chloroplast

Plant Cell



Animal Cell

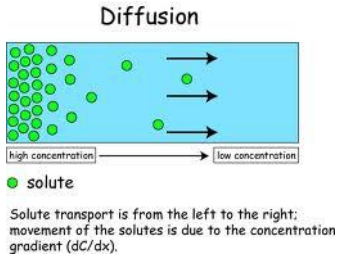


4. *Fill in the names of the structures whose functions are listed below. Use the list of structures above for help.*

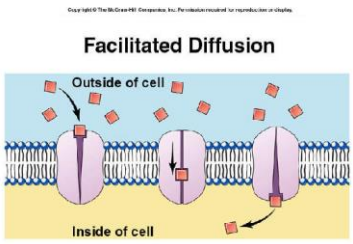
Structure	Function
	Cellular Respiration
	Protein Synthesis
	Contains the hereditary information
	Storage of water, undigested food, and/or waste
	Active in movement of the chromosomes during cell division
	Storage of digestive enzymes
	Transport within the cytoplasm
	Packages secretions

Two Types of Cellular Transport

The cell membrane is semipermeable, some substances can pass through it freely, while others cannot. The movement of substances that can pass freely through the membrane depends only on the concentration gradient for that substance.

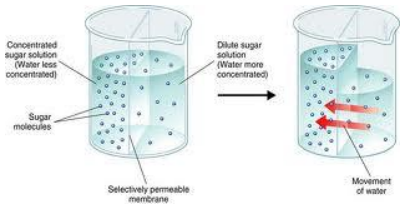


1. **Passive Transport**
   - Does not use energy
   - Moves from a high concentration to a low concentration

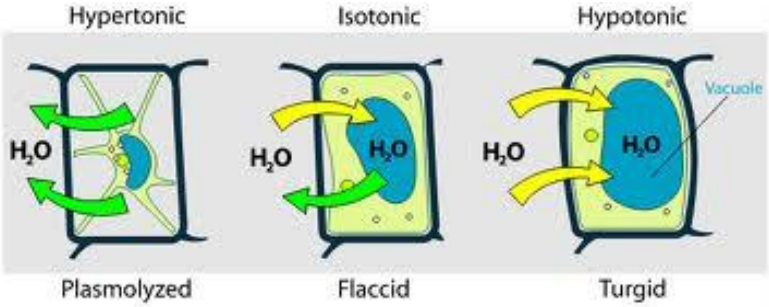


Examples:

- **Diffusion**: The movement of particles from regions of higher density to regions of lower density across the cell membrane
- **Facilitated Diffusion**: Transport proteins help ions and polar molecules diffuse through the membrane
- **Osmosis:** The diffusion of water across a selectively permeable membrane.



Types of Solutions



Cell shrinks | Cell stays same | Cell swells

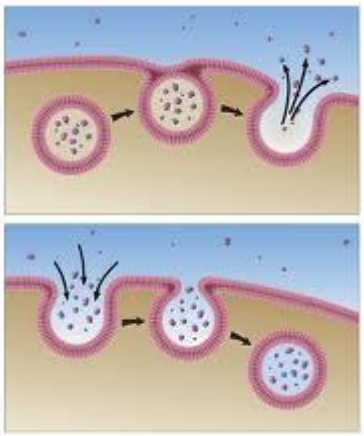
2. **Active Transport**
   - Requires energy
   - Moves from a low concentration to a high concentration

Examples:

- **Endocytosis**: The movement of a large substance **into** a cell by means of a vesicle
- **Exocytosis**: The movement of material **out** of a cell by means of a vesicle

6. Circle the diagram letter that shows **Endocytosis**? A or B

7. Circle the diagram letter that shows **Exocytosis**? A or B



A

B

Sodium-potassium pump: One of the most important carrier proteins in animal cells. In nerve cells the pump is used to generate gradients of both sodium and potassium ions. These gradients are used to propagate electrical signals that travel along nerves.

➔ *Watch this cool animation on the sodium-potassium pump, and take the quiz! Record your answers to the questions below as you take the quiz.*
http://highered.mcgraw-hill.com/sites/9834092339/student_view0/chapter38/sodium-potassium_exchange_pump.html

1. ____ 2. ____ 3. ____ 4. ____ 5. ____

More Questions!

8. What is passive transport?

9. The paramecium is a fresh water protozoan. The salt content of its cytoplasm is greater than that of the surrounding medium.

    a. Does water tend to enter or leave the paramecium? Is this process of passive or active transport?

    b. How does the paramecium expel water? Is this a process of passive or active transport? Explain.

10. Where does the energy for active transport come from?

Practice Questions:

1. Using a microscope, a student observes a small, green organelle in a plant cell. Which energy transformation **most likely** occurs first within the observed organelle?
    a. ATP to light
    b. light to chemical
    c. heat to electrical
    d. chemical to chemical

2. Carbon dioxide and oxygen are molecules that can move freely across a plasma membrane. What determines the direction that carbon dioxide and oxygen molecules move?
    a. orientation of cholesterol in the plasma membrane
    b. concentration gradient across the plasma membrane
    c. configuration of phospholipids in the plasma membrane
    d. location of receptors on the surface of the plasma membrane

3. A sodium-potassium pump within a cell membrane requires energy to move sodium and potassium ions into or out of a cell. The movement of glucose into or out of a cell does not require energy. Which statement **best** describes the movement of these materials across a cell membrane?
    a. Sodium and potassium ions move by active transport, and glucose moves by osmosis.
    b. Sodium and potassium ions move by active transport, and glucose moves by facilitated diffusion.
    c. Sodium and potassium ions move by facilitated diffusion, and glucose moves by osmosis.
    d. Sodium and potassium ions move by facilitated diffusion, and glucose moves by active transport.

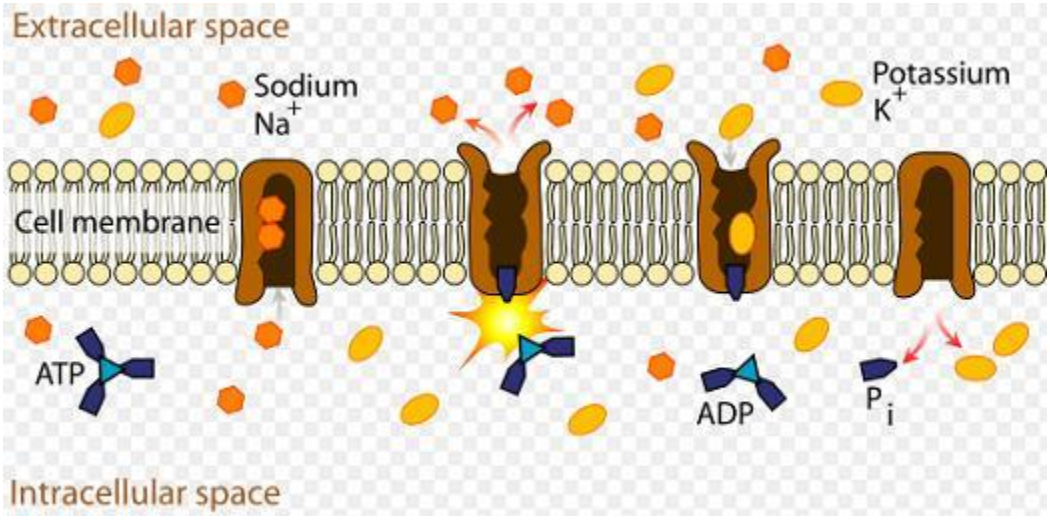
4. The rough endoplasmic reticulum and Golgi apparatus work together in eukaryotic cells. What is one way that the rough endoplasmic reticulum assists the Golgi apparatus?
    a. It assembles nucleic acids from monomers.
    b. It breaks down old, damaged macromolecules.
    c. It packages new protein molecules into vesicles.
    d. It determines which protein molecules to synthesize.

In many eukaryotic cells, DNA stored in the nucleus is transcribed into messenger RNA. The mRNA is then transported into the cytoplasm where ribosomes assist in their translation into proteins. Finally, these proteins are packaged and sorted in the Golgi apparatus for use in other parts of the cell or in preparation for secretion into other cells.

5. Which of the following statements is supported by this description?
    a. Various organelles within a cell interact with each other to carry out life processes.
    b. Organelles within a cell act independently of each other at all times.
    c. Some organelles are more important than other organelles within a cell.
    d. Only up to three organelles may interact with each other at any given moment in time.

6. The cell membrane serves many functions. One of the cell membrane's functions is to help the cell maintain homeostasis. Which of the following statements best supports this claim?
    a. The cell membrane contains a polar region and a nonpolar region.
    b. The cell membrane contains proteins.
    c. The cell membrane contains phospholipids.
    d. The cell membrane regulates what goes in and out of the cell.

In order for nerve cells and muscle cells to function properly, they require a high concentration of potassium ions inside the cells and a high concentration of sodium ions outside the cells.
To maintain this condition, cells utilize sodium-potassium pumps embedded within their cellular membranes to move the ions against their concentration gradients.



7. Since sodium-potassium pumps require an input of energy to operate, they are an example of...
    a. passive transport.
    b. facilitated diffusion.
    c. filtration.
    d. active transport.

8. Most organisms can be divided into two categories - prokaryotes and eukaryotes. What is the main difference between these two categories?