Name_____

Biology Unit 2 Chemistry of Life (Ch. 6) Guided Notes

Atoms, Elements, and Chemical Bonding

- I can draw atom models and identify the # protons, # neutrons, and # electrons in an atom.
- I can identify the 6 most common elements that make up living things.
- I can differentiate between ionic and covalent bonds.

_____ are the building blocks of matter. _____ are made of matter.

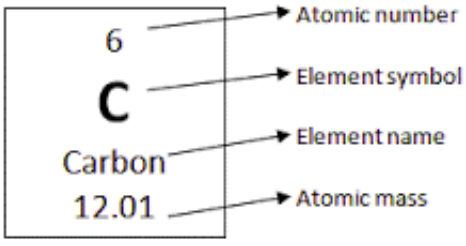
Atom = _____
_____.

Element = _____
_____.

Structure of an ATOM
3 Parts:

1. Protons = _____ charge and located in the _____ of an atom.
2. Neutrons = _____charge (neutral) and located in the _____ of an atom.
3. Electrons = _____ charge and located in the _____ of an atom.
   1st energy level can hold a maximum of _____ electrons
   2nd energy level can hold a maximum of _____ electrons
   3rd energy level can hold a maximum of _____ electrons

The periodic table identifies the atomic number and atomic mass of an element.



Mass number = atomic mass rounded to nearest whole number

The periodic table is arranged in order of increasing _____.

The vertical columns of the periodic table are called _____.

The horizontal rows of the periodic table are called_____.

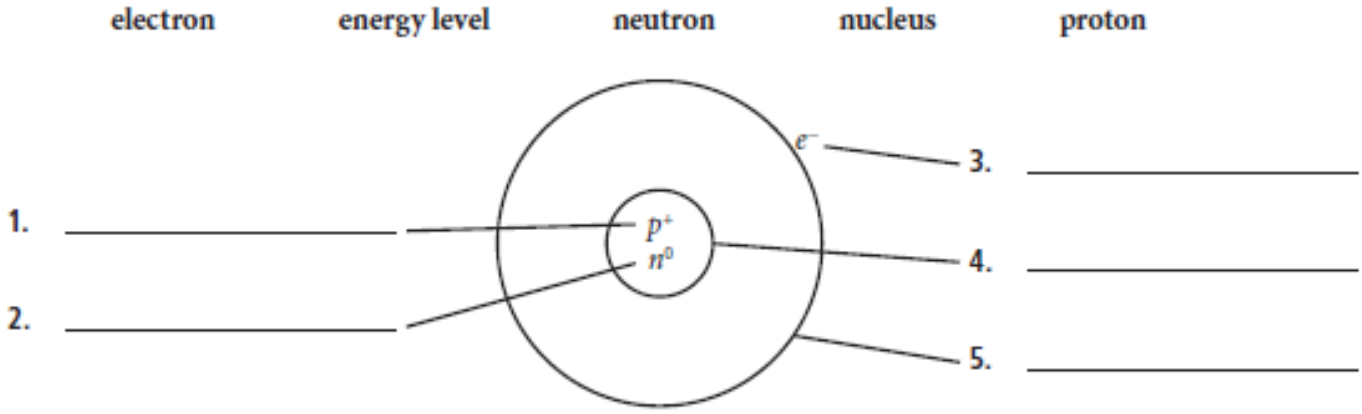
To calculate how many protons, electrons, and neutrons an atom or given element has use the following:

Atomic Number = # of Protons = # Electrons
Atoms are NEUTRAL/have NO CHARGE; therefore # Protons = # Electrons
Neutrons = Atomic Mass (rounded) – Atomic Number

For each element identify the # Protons, # Electrons, # Neutrons, Atomic #, and Atomic Mass (Mass Number). Then, draw and label the atom.

Lithium	Carbon	Oxygen

Fill in the diagram and chart below.



Statement	Electron	Neutron	Proton
Positively charged particle			
Located outside the nucleus			
Can be shared by two atoms			
Has no charge (neutral)			

Atoms with different number of neutrons are called _____.

Notice the type of notation used for atoms: ${}^{A}_{Z}X$

X = chemical symbol of the element
Z = "atomic number"
A = "mass number"

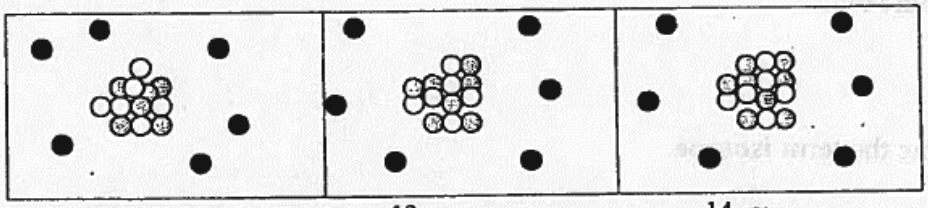
${}^{12}_{6}C$, ${}^{13}_{6}C$, and ${}^{14}_{6}C$ are notations that represent **isotopes** of carbon atoms.

${}^{1}_{1}H$, ${}^{2}_{1}H$ and ${}^{3}_{1}H$ are notations that represent **isotopes** of hydrogen atoms.

Note the following symbols: (they are not to scale)

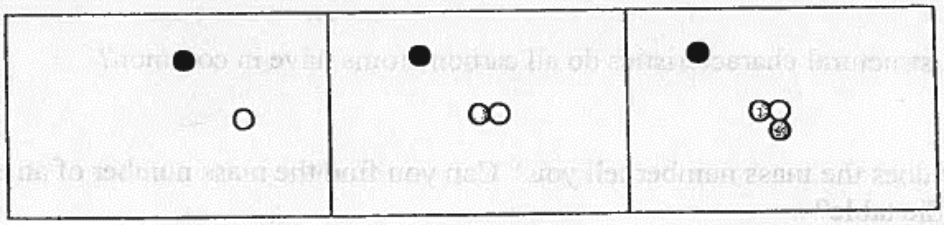
○ = proton (positive charge)
● = electron (negative charge)
⊛ = neutron (no charge)

The following three diagrams are carbon atoms:



${}^{12}_{6}C$ (6 protons, 6 neutrons) ${}^{13}_{6}C$ (6 protons, 7 neutrons) ${}^{14}_{6}C$ (6 protons, 8 neutrons)

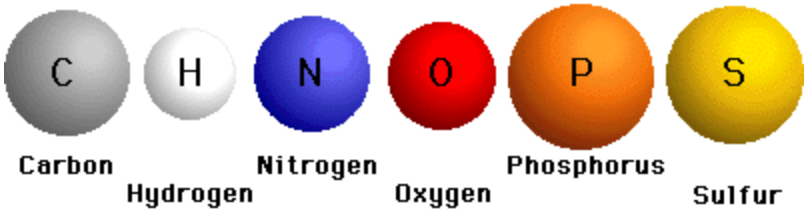
The following three diagrams are hydrogen atoms:



${}^{1}_{1}H$ ${}^{2}_{1}H$ ${}^{3}_{1}H$

List the _____ most common elements found in living things.

C_____
H_____
N_____
O_____
P_____
S_____



Why do atoms bond together?

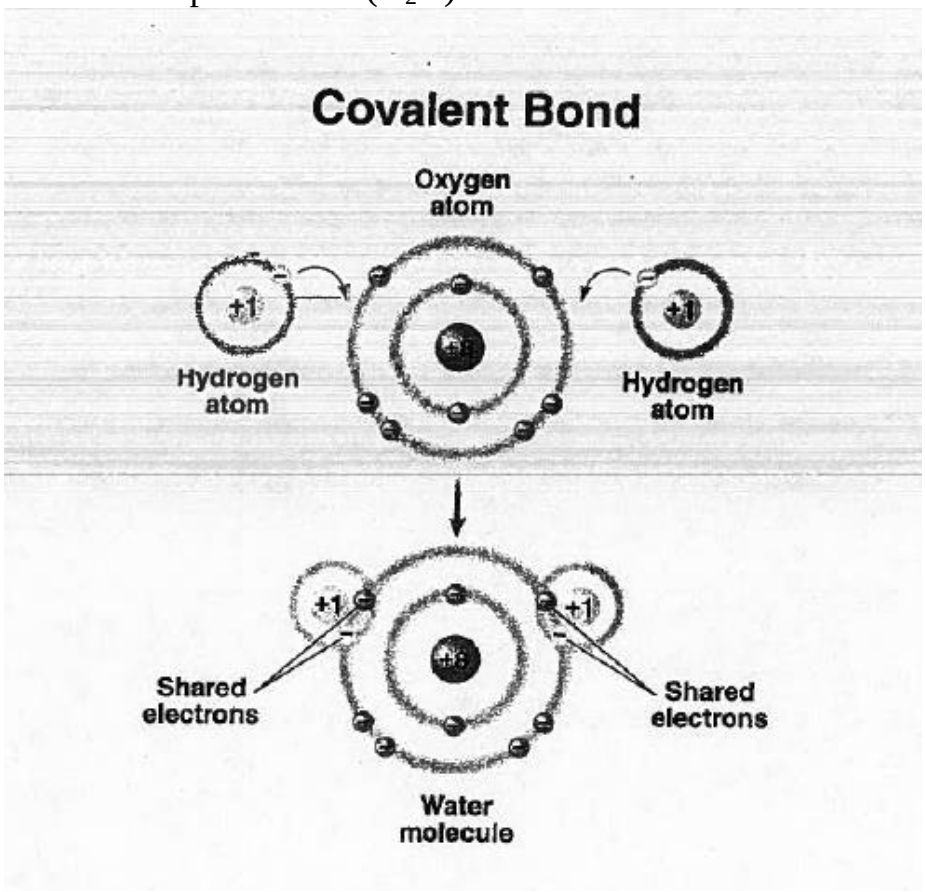
Atoms bond together to fill their valence (outer) electrons to become _____.
When atoms bond together they form _____ and _____.

Compound =_____

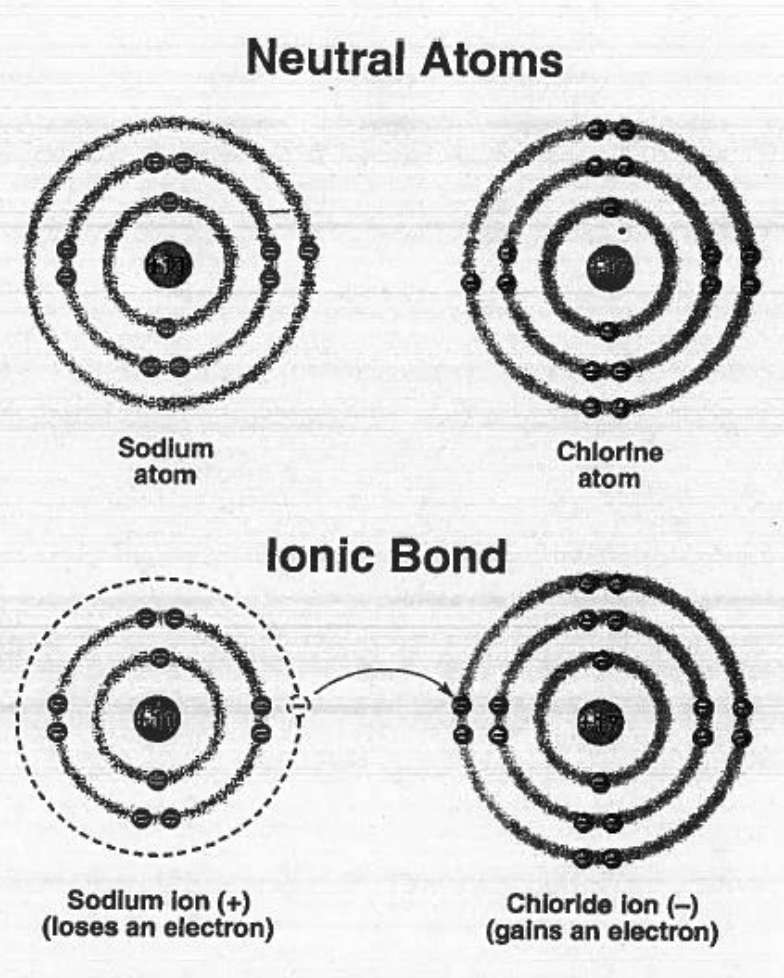
Molecule = _____

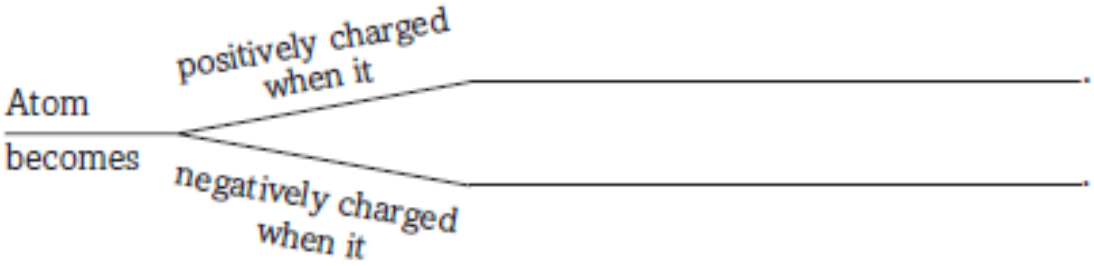
TYPES OF BONDING

1. _____ bonding is when two or more atoms _____ electrons to form molecules. Example: Water (H_2O)

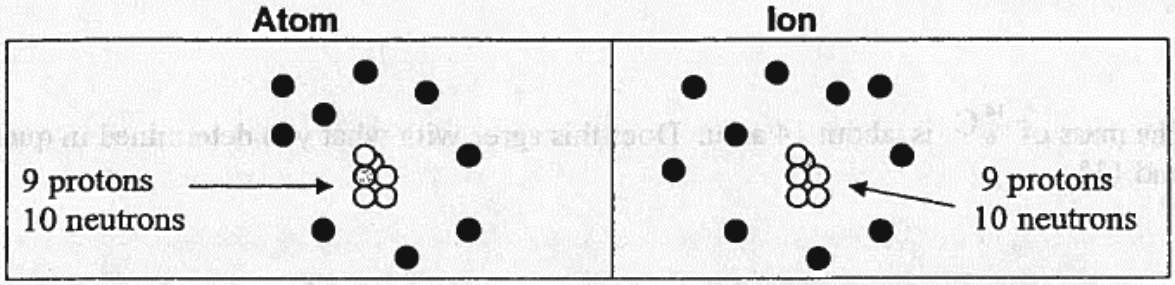


2. _____ bonding is the attractive force between two ions of opposite charge to form compounds. Example: NaCl (table salt)





The atomic mass unit (amu) is a special unit for measuring the mass of very small particles such as atoms. The relationship between amu and grams is the following: 1.00 amu = 1.66×10^{-24}g
Note the following diagrams comparing atoms and ions.

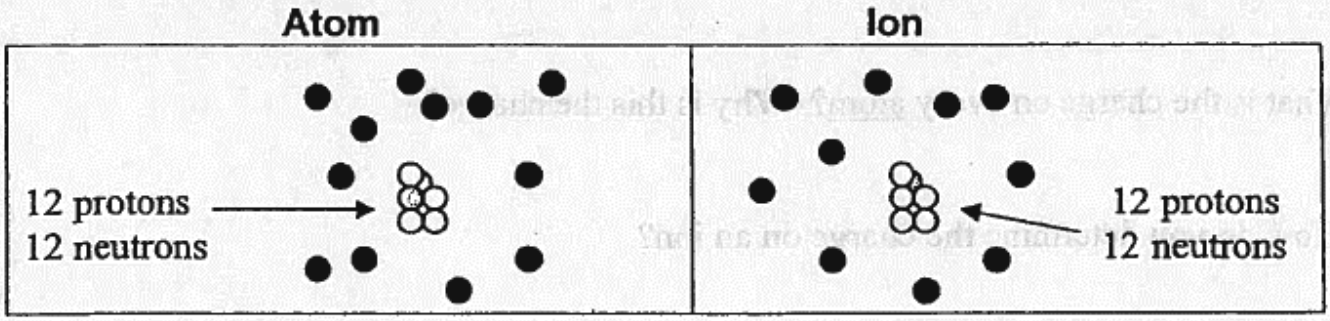


$^{19}_{9}F$ mass = 18.9980 amu

$^{19}_{9}F^{-1}$ mass = 18.9985 amu

How many protons, neutrons, and electrons does the Fluorine ATOM have?

What is different in the Fluorine ION?



$^{24}_{12}Mg$ mass = 23.9978 amu

$^{24}_{12}Mg^{+2}$ mass = 23.9968 amu

How many protons, neutrons, and electrons does the Magnesium ATOM have?

What is different in the Magnesium ION?

Chemical Reactions & Enzymes

- I can differentiate between reactants and products in a chemical reaction.
- I can summarize the functions of enzymes.
- I can create a model showing how enzymes function.
- I can explain how pH, temperature, and other substances affect enzyme function.

Physical change = a change in which the physical form (_____ or _____) of a substance is changed, but not what it is made of.
Ex. Water changing states from solid (ice) to liquid to gas (vapor), cutting paper, painting a house

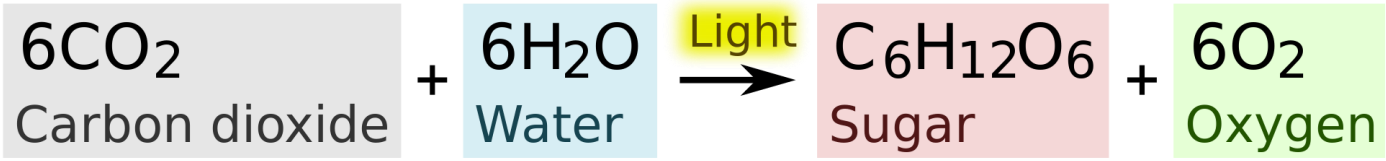
Chemical change = a change in which a substance is converted into a _____ substance with _____ composition and properties.

- Involves chemical reactions that break the _____ _____ of _____ to rearrange and make new _____.

Ex. Photosynthesis, cellular respiration, combustion of methane (natural gas)

PHOTOSYNTHESIS CHEMICAL REACTION

_____ ⟶ _____

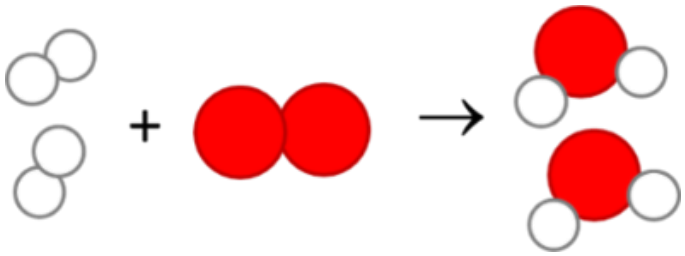


Chemical Reactions

- Written as chemical formulas using symbols.
- Atoms from the reactants (left side of arrow) are the atoms that form the products (right side of arrow).
- Subscripts (numbers below and to right of symbol) identify how many of that atom are in the compound/molecule.
- Coefficients (numbers in front of compound/molecule) identify the number of that compound/molecule.
- Reactions must be balanced to show conservation of matter.
- NEVER CHANGE SUBSCRIPTS WHEN BALANCING CHEMICAL REACTIONS! ONLY CHANGE THE COEFFICIENTS TO BALANCE CHEMICAL REACTIONS!
- An arrow shows the reaction (breaking and making of chemical bonds).
- Activation energy is needed for reactants to become products.
- Reactions are either endothermic (absorb energy) or exothermic (release energy).

Circle the subscripts and underline the coefficients in the following chemical reaction.

$2\ H_2 \quad + \quad O_2 \quad \rightarrow \quad 2\ H_2O$



Practice: Add the correct coefficient to balance the chemical equations below.

1. _____ N_2 + _____ O_2 → _____ N_2O

2. _____ H_2O_2 → _____ H_2O + _____ O_2

3. _____N_2 + _____ H_2 → _____ NH_3

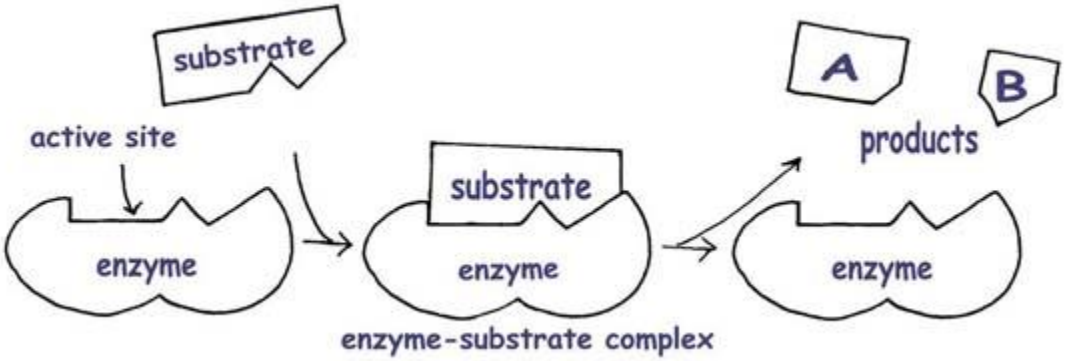
4. _____ CH_4 + _____ O_2 → _____ CO_2 + _____H_2O

5. Sodium (solid) + Chlorine (gas) → Sodium Chloride (solid)

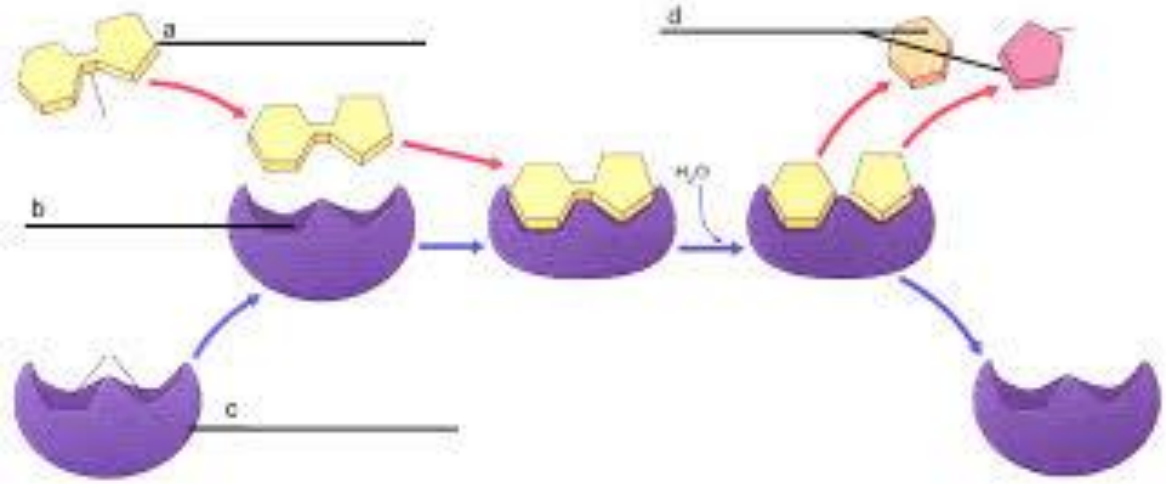
Enzymes

- _____ that speed up chemical reactions by _____ activation energy.
- Biological catalysts ending in -_____.
- Involved in _____ (energy needed for all the chemical reactions in your body.
- Are _____ and do not get used up during the chemical reaction.
- Changes to factors such as _____, _____, and _____ _____ affect an enzyme's ability to work.
- When an enzyme changes shape and loses its function, it becomes _____.

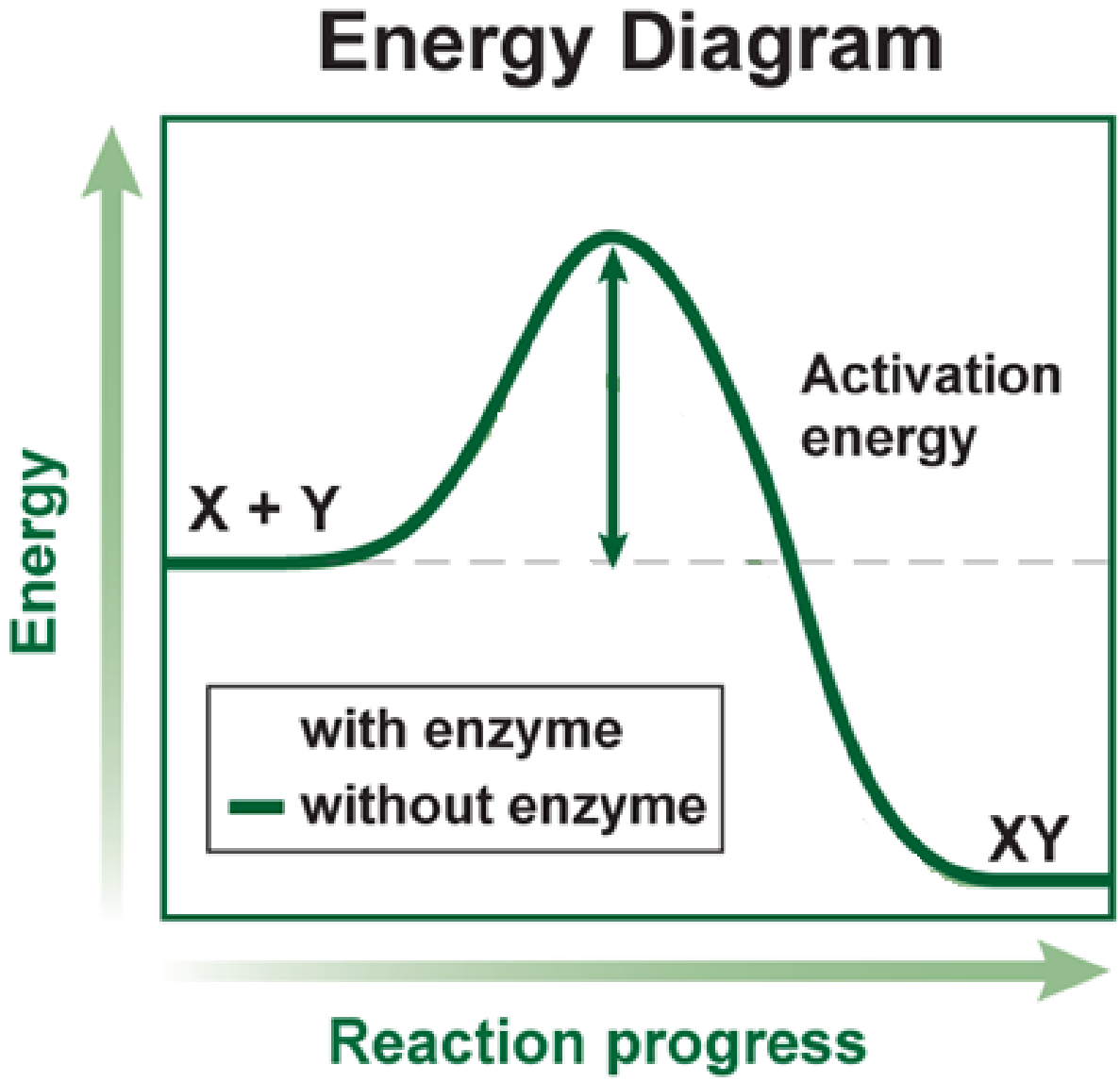
Label and briefly describe what is happening at each step in the chemical reaction above.



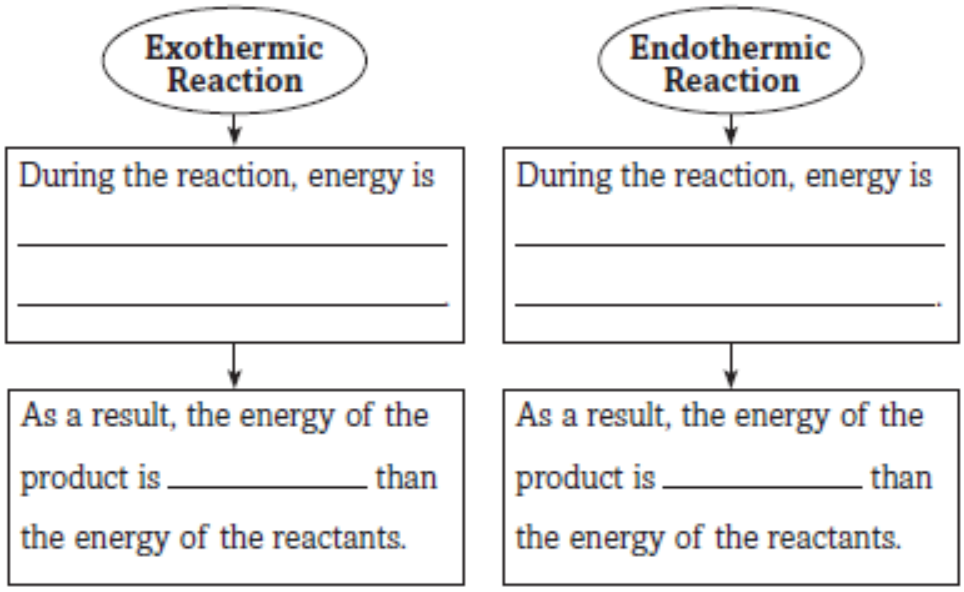
Label the diagram below.



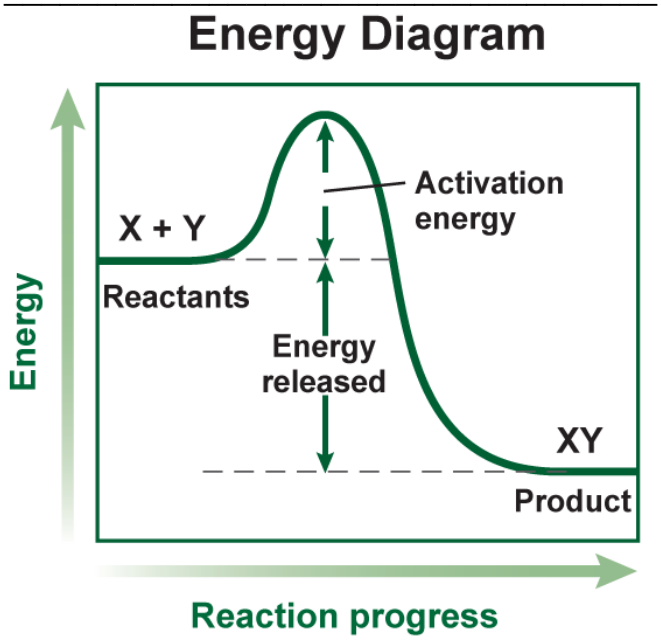
Draw a dotted line to represent how the chemical reaction would occur with an enzyme. Label the reactants and products on the energy diagram.

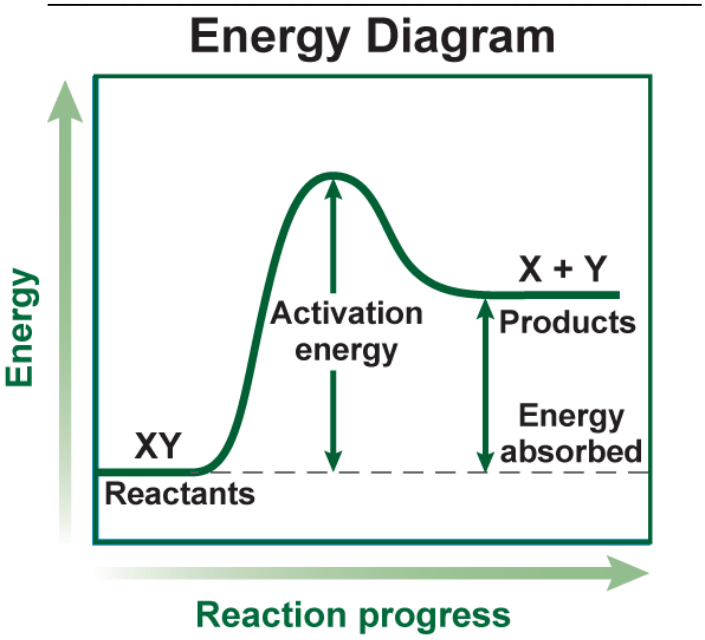


Compare *what happens to energy in exothermic and endothermic reactions by completing the diagram below.*



Label the type of reaction (exothermic or endothermic) shown by the energy diagrams below and justify your reasoning below the pictures.

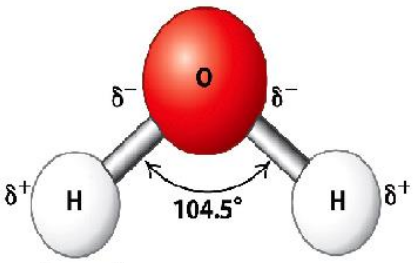




Properties of Water, Acids, Bases, & pH

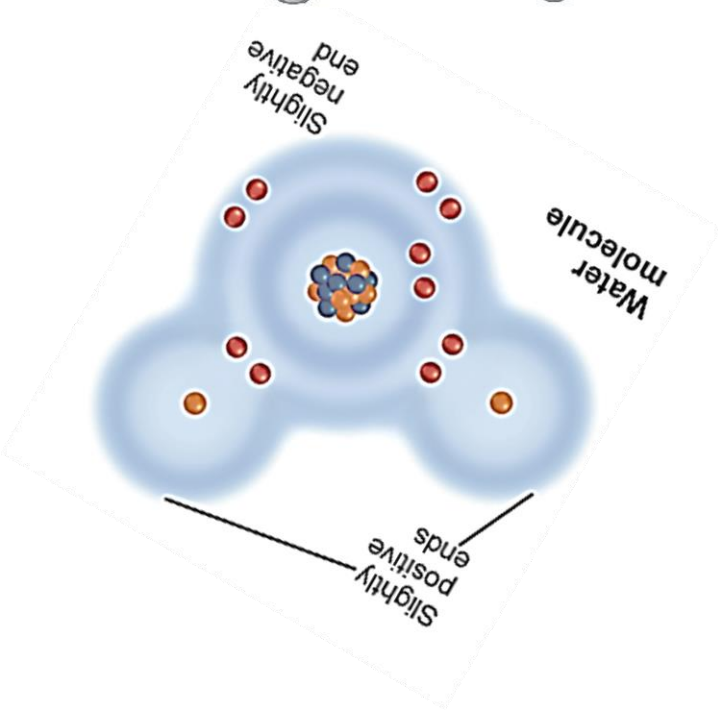
- I can describe the importance of water.
- I can describe the properties of water.
- I can explain why hydrogen bonds form.
- I can describe dehydration synthesis (condensation) and hydrolysis reactions.
- I can differentiate between acids and bases and provide examples of each.

Water is a compound/molecule formed by _____ bonds.



The oxygen atom and hydrogen atoms _____ their valence electrons.

Since _____ is a very electronegative atom, it DOES NOT share the electrons equally with the two hydrogen atoms in a water molecule.



The unequal sharing of electrons results in charged ends (poles) of the molecule.

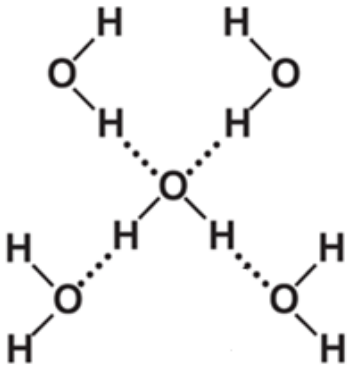
_____ molecules result when atoms do not share electrons equally between atoms.

Water is a _____ molecule.

Water molecules are attracted to one another and form _____ bonds.

Hydrogen bonding is also known as _____.

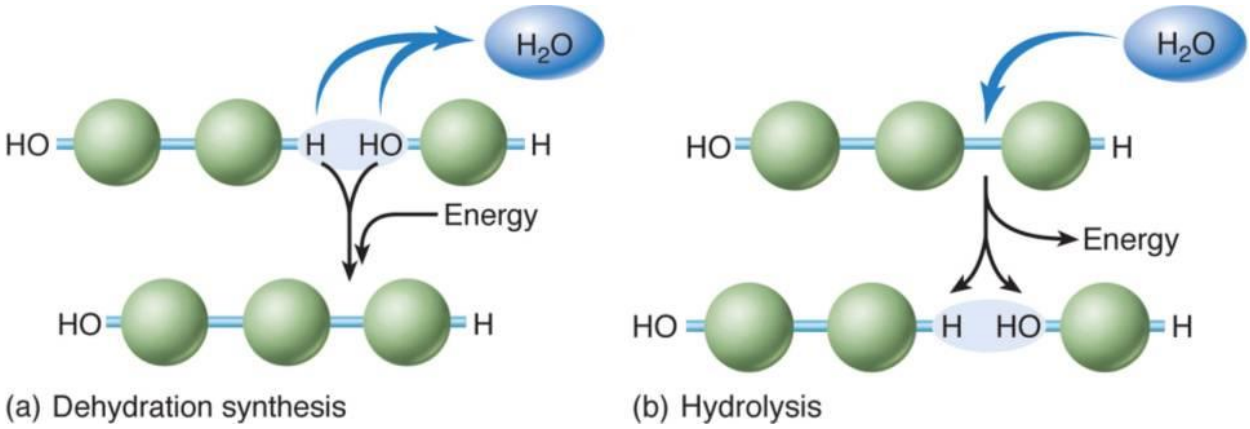
Circle and count the number of water molecules in the picture to the right. Label the types of bonds that form between the atoms in individual water molecules and between different water molecules.



Properties of Water

Property	Description
Polar	
Universal Solvent	
Cohesion	
Adhesion	
High Surface Tension	
High Heat Capacity	
Density	

Water is important in _____. It is involved in _____ and _____ of chemical bonds in macromolecules.



Acids and Bases

Water dissociates into _____ and _____ ions.

$$H_2O \Leftrightarrow H^+ + OH^-$$

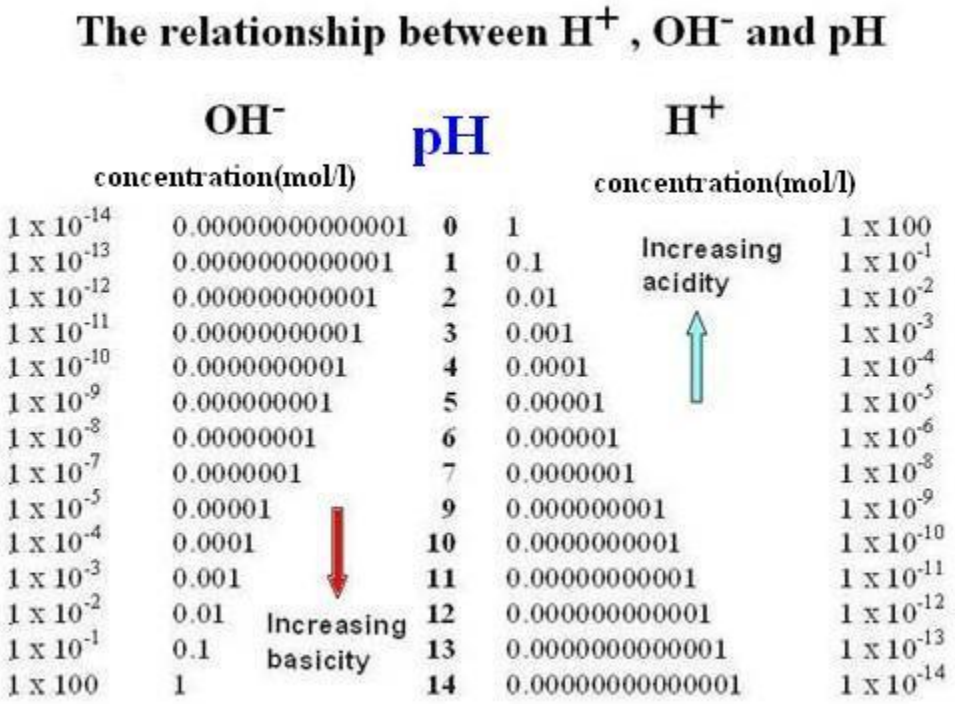
Acids release _____ ions or _____ ions in solution.

Bases release _____ ions in solution.

The pH scale is used to measure the concentration of _____ ions.

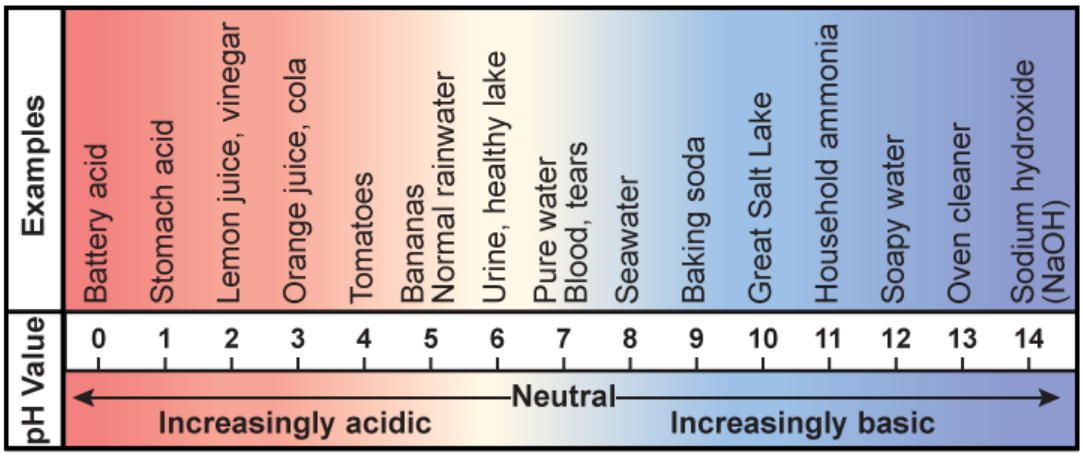
The _____ the H^+ concentration, the more _____.

_____ have a low concentration of H^+ ions.



Identify examples from the pH diagram below to fill in the table.

Acids	Bases	Neutral
weak	Weak	
strong	strong	



_____ help neutralize acids and bases to maintain a certain pH level. Many organisms need buffers to maintain a certain pH allowing them to maintain _____.

Macromolecules

- I can identify the specific elements in each of the organic macromolecules.
- I can identify examples of the organic macromolecules.
- I can summarize the major functions of each organic macromolecule.
- I can recognize the structural formulas of each organic macromolecule.
- I can describe the individual subunits in each of the organic macromolecules.
- I can predict what would happen to my body if certain organic macromolecules were not available.
- I can describe hydrolysis and dehydration reactions.

Life on earth is _____- based. = _____

Each carbon atom is special because it forms _____.

Carbon joins in ways that it forms large molecules in 3 shapes:

1) Straight chain

2) Branched

3) Ring

The six most common elements that make up living things are _____.

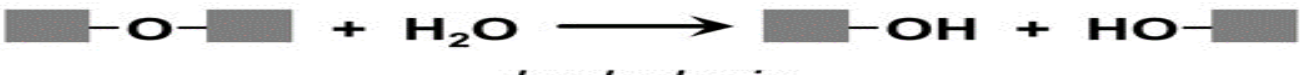
_____ - large molecules formed from smaller molecules (monomers).

4 Major Categories of Organic Macromolecules:

1. _____
2. _____
3. _____
4. _____

Made by _____ Broken down by _____

dehydration synthesis



hydrolysis

(1)_____ "Sugars and Starches"

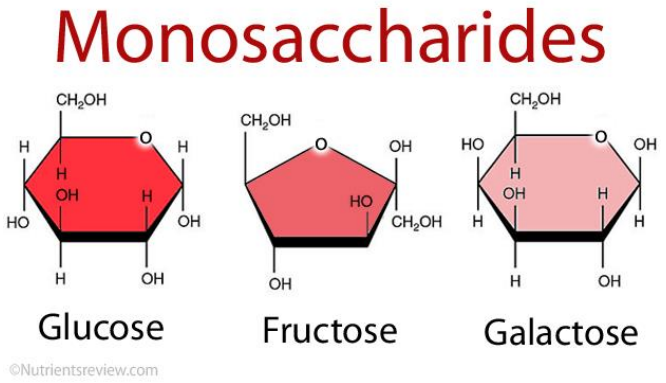
Elements:_____

Jobs/Functions:

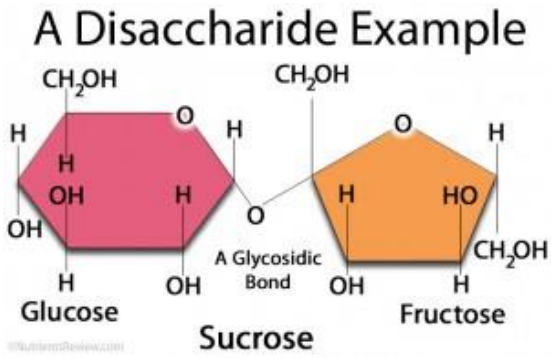
- _____
- _____
- _____

Examples of Carbohydrates:

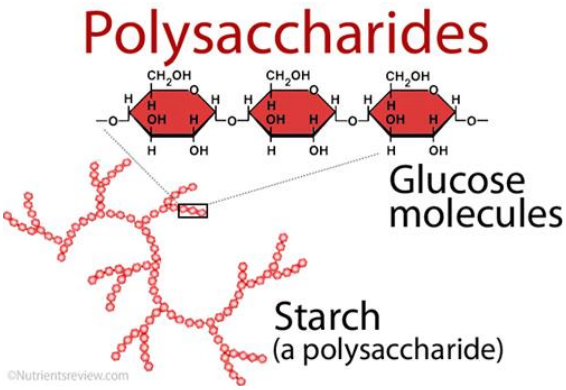
Monosaccharides (subunits of carbohydrates) - _____



Disaccharides - _____



Polysaccharides - _____



(2)_____ "Fats, Oils, and Waxes"

Elements:_____

General Structure:
Fatty acids – chain of carbon/hydrogen "tails"
Glycerol – 3-carbon alcohol "backbone"
Other components – phosphate chain (ATP) or 4-carbon rings (steroids)

Jobs/Functions:

- _____
- _____
- _____

Types of Lipids:

1. _____ - chains with phosphate groups (found in cell membrane)
2. _____ - lipids like cholesterol and sex hormones (estrogen and testosterone)
3. _____ (fats) – long-term energy storage

Three Structures of Fatty Acids:

1. _____

- No double bonds between carbon atoms in chain [all single bonds (−)]

Examples:_____

2. _____

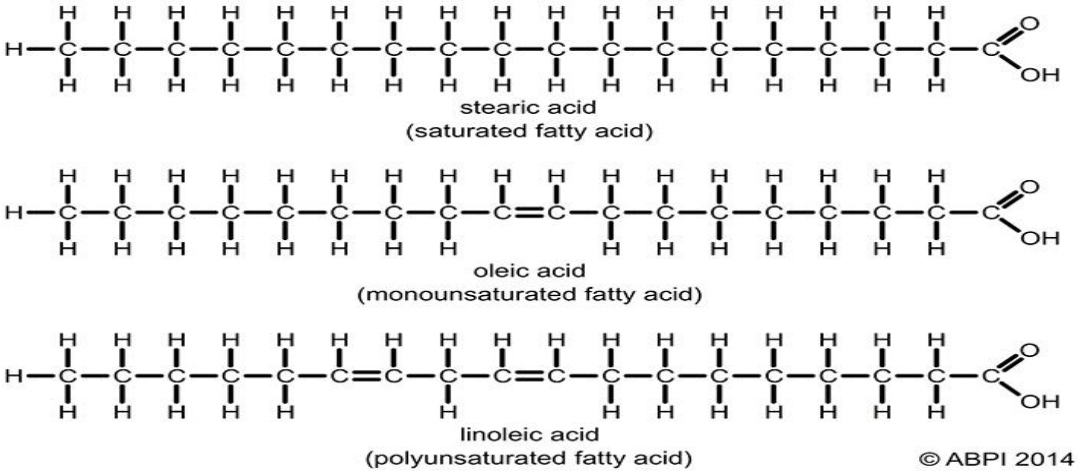
- One double bond (=) between carbon atoms in chain

Examples:_____

3. _____

- Two or more double bonds (=, =) between carbon atoms in carbon chain

Examples:_____



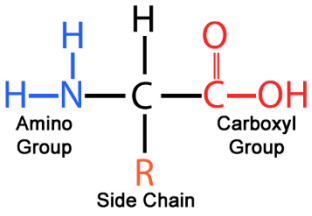
(3)_____

Elements:_____

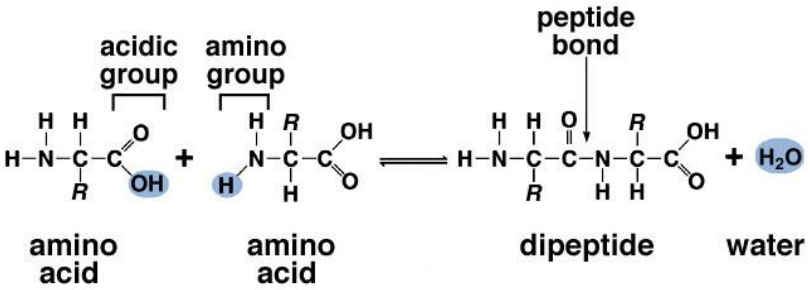
General Structure:

_____ - subunits held together by _____ bonds.

Amino Acid Structure



Dipeptide = 2 Amino Acids



Jobs/Functions:

- _____
- _____
- _____
- _____
- _____

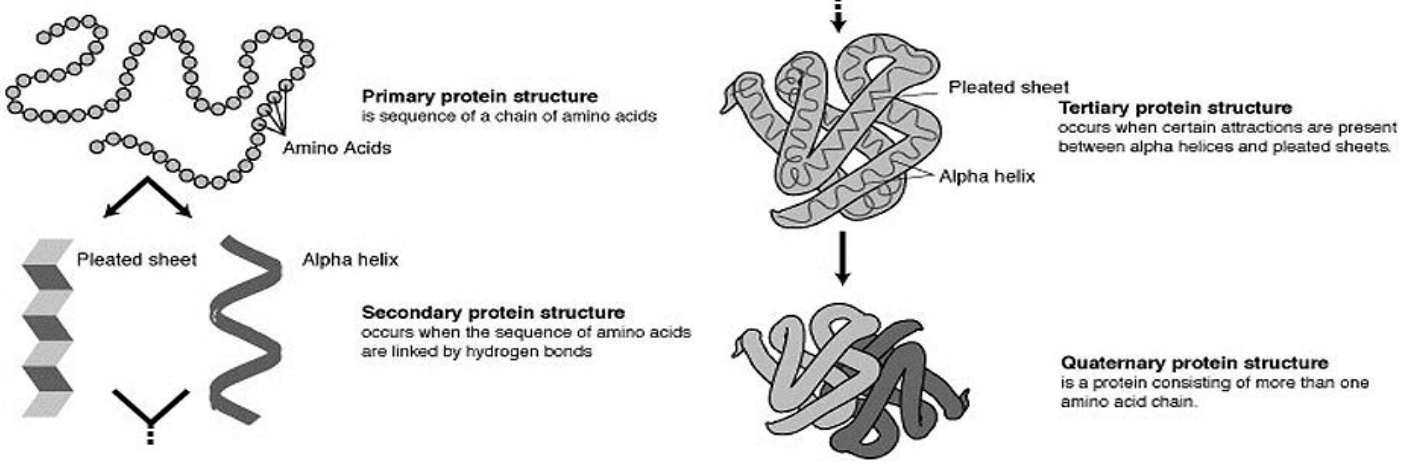
Examples of Proteins:

_____

_____

_____

Levels of Protein Structure:



(4)_____ "Genetic Information"

Elements:_____

General Structure:

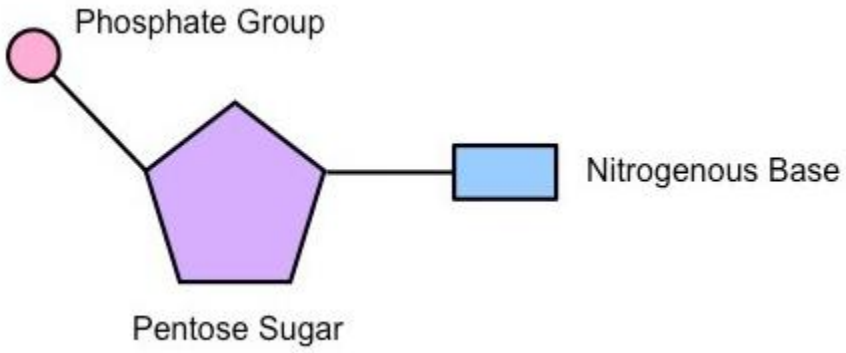
_____ - subunits of nucleic acids.

Nucleotides (subunits) are made of 3 parts:

(1) _____

(2) _____

(3) _____



Jobs/Functions:

- _____
- _____
- _____

2 Types of Nucleic Acids:

1) DNA = _____
2) RNA = _____