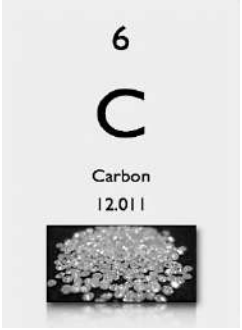
Unit 1 - Chemistry of Life - Atomic Basics, Matter, & Water
FALL SEMESTER 2023

INSTRUCTOR: Mr. Simmons
matthewsimmons@hebisd.edu

Vocabulary / Key Terms/ Concepts	Unit 1: Chemistry of Life Notes

Composition of Matter



- ***Matter*** -
- Everything in the universe is composed of _____.
- _____– quantity of matter an object as.
- _____– pull of gravity on an object.

_____:

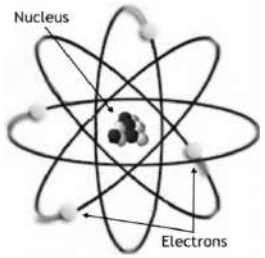
- Pure substances that cannot be broken down chemically into simpler kinds of matter.
- More than 100 elements (92 naturally occurring).

_____:

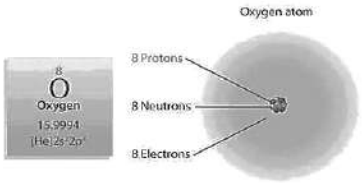
- The simplest particle of an element that retains all the properties of that element.
- Properties of atoms determine the _____and _____of the matter they compose.

- Our understanding of the structure of atoms is based on scientific models, not observation.

  - The _____:
    - ✶ Central core
    - ✶ Consists of positively charged _____and neutral _____.
    - ✶ _____charged.
    - ✶ Contains most of the _____of the atom.



  - The _____
    - ✶ All atoms of a given element have the _____number of protons.
    - ✶ Number of protons is called the _____ _____.
    - ✶ Number of protons balanced by an _____number of negatively charged electrons.

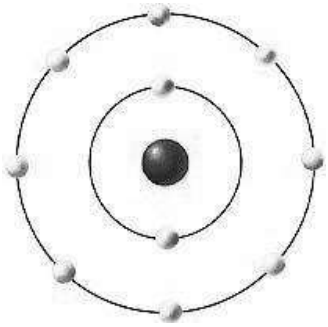


  - The _____
    - ✶ The number varies slightly among atoms of the same element.
    - ✶ Different numbers of neutrons produce isotopes of the same element.

- _____:
  - _____& _____are found in the nucleus of an atom.
  - Protons and neutrons each have a mass of 1 _____(atomic mass unit).

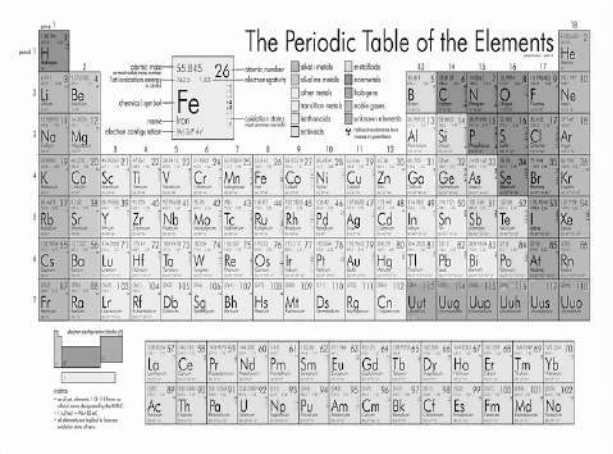
  - The mass number of an atom is found by _____the atomic mass of an element to a whole number.

- The mass number tells you the number of _____and _____in the atom.



- The _____
  - ✶ _____charged high energy particles with little or no mass.
  - ✶ Travel at very high speeds at various distances (energy levels) from the nucleus.
  - ✶ Electrons in the same energy level are approximately the same distance from the nucleus.
  - ✶ Outer energy levels have more energy than inner levels.
  - ✶ Each level holds only a _____number of electrons (2, 8, 18...)

Periodic Table



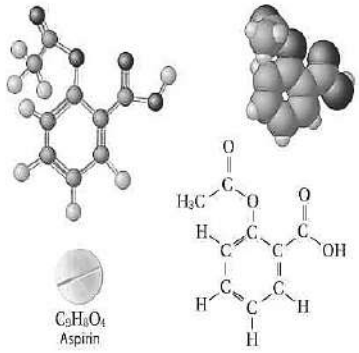
- _____are arranged by their atomic number on the _____.
- The horizontal rows are called _____.
- Vertical groups are called _____& tell the outermost number of _____(_____electrons).
- Combinations:
  - _____: A compound is a pure substance made up of atoms of two or more elements.

★ The proportions of atoms are always fixed.

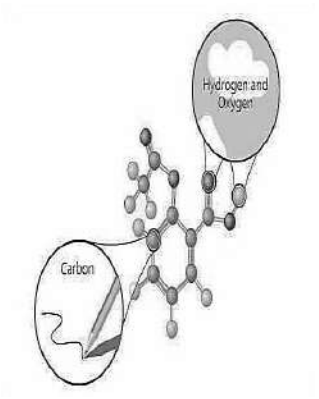
★ _____ shows the kind and proportion of atoms of each element that occurs in a particular compound.

★ The tendency of elements to combine and form compounds depends on the number and _____of valence electrons in their outermost energy level.

★ Atoms are _____ stable when their outermost energy level is filled.

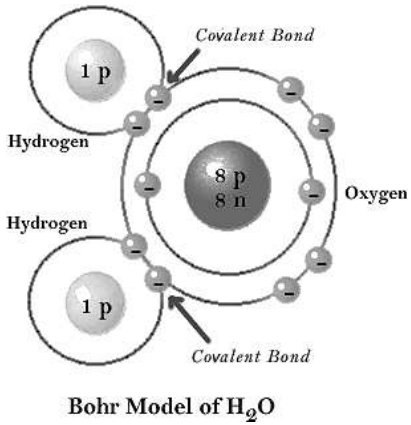


- ***Molecules***:
  - _____are the simplest part of a substance that retains all of the _____of the substance and exists in a free state.
  - Some molecules are _____and complex.



- ***Chemical Formulas***:
  - _____after a symbol tells the number of atoms of each element.
  - H_20 has 2 atoms of hydrogen & 1 atom of oxygen.
  - _____before a formula tell the number of molecules.
  - $3O_2$ represents 3 molecules of oxygen or (3x2) or 6 atoms of oxygen.
  - $\underline{6}CO_2 + \underline{6}H_2O \quad C_6H_{12}O_6 + \underline{6}O_2$

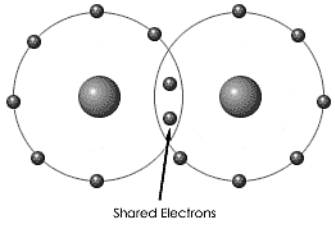
Properties of Matter



Bohr Model of H_2O

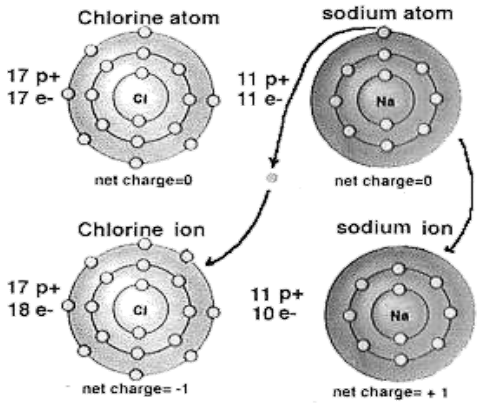
- The physical and chemical properties of a compound _____ from the physical and chemical properties of the individual elements that compose it.
- _____
  - Most atoms are _____ stable in their natural state.
  - Tend to _____ (combine) with other atoms in order to become more stable (undergo chemical reactions).
  - In chemical reactions _____ are _____ ; atoms rearranged and new chemical bonds are formed that _____ energy.

Bonding



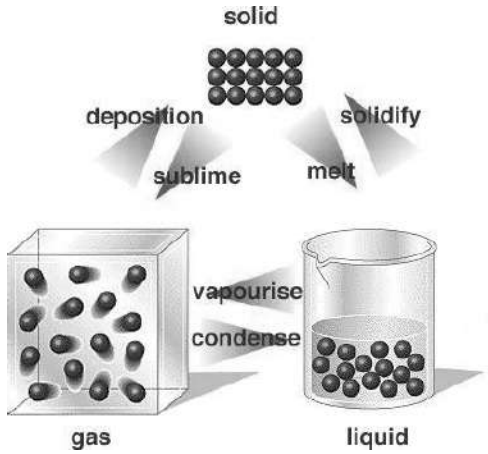
- _____ ***Bonds***:
  - Formed when two atoms _____ one or more pairs of electrons.
  - Usually formed between two _____ .
- _____ ***Bonds***:
  - Some atoms become stable by _____ or _____ electrons.
  - Atoms that lose electrons are called _____ ions or _____ .
  - Atoms that gain electrons are called _____ ions or _____ .

- Because positive and negative electrical charges attract each other _____ bonds are formed.
- Formed between _____ and _____



States of Matter:

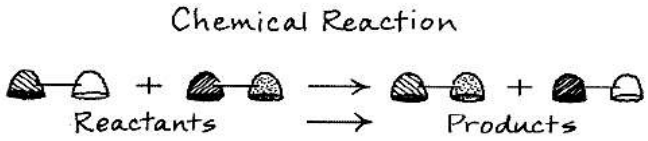
- _____ are in constant _____
- The _____ at which atoms or molecules in a substance move determines its state.
- _____
  - Molecules _____ linked together in a _____ shape.
  - _____ in place.
  - _____ volume and shape.
- _____
  - Molecules are _____ as tightly linked as a solid.
  - Maintain _____ volume.
  - Able to _____ and _____ to the shape of the container.
- _____
  - Molecules have _____ or no attraction to each other.



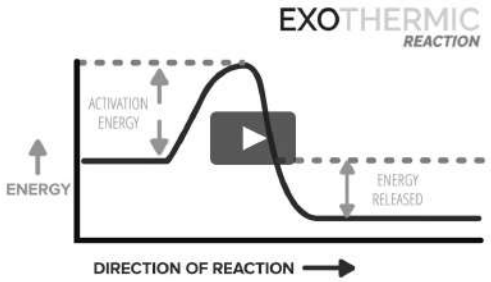
- _____ the volume of the occupied container.
- Move most _____ .
- To cause a substance to change state, _____ energy (heat) must be added to or _____ from a substance.

Energy of Chemical Reactions

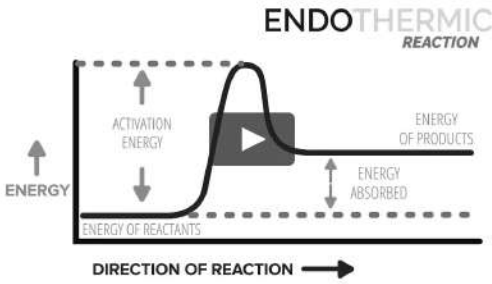
- Living things undergo thousands of chemical reactions as part of the life process.
- Many are very complex involving multi-step sequences called _____ ***pathways***.
- Chemical equations represent chemical reactions.
- _____ are shown on the left side of the equation.
- _____ are shown on the right side



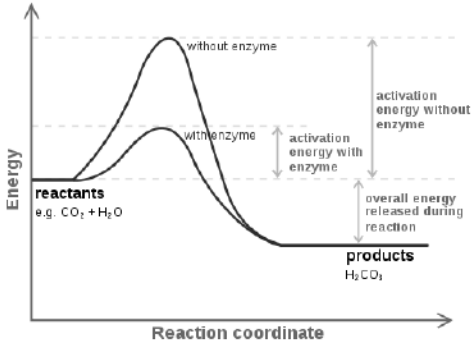
- _____ / _____
  - Much of the energy organisms need is provided by sugar (food)
  - The net _____ of free energy is called an exergonic (exothermic) reaction



- _____ /
  _____
  - Reactions that involve a net _____ of free energy are called endergonic (endothermic) reactions.
  - _____ reactions in living organisms are endergonic;
    therefore living organisms require a constant source of energy.

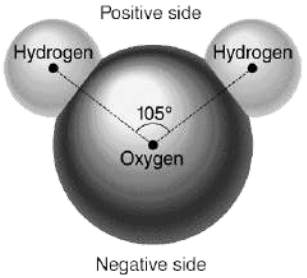


- _____ ***Energy***
  - Most chemical reactions require energy to begin.
  - The amount of energy needed to start the reaction is called _____ energy.

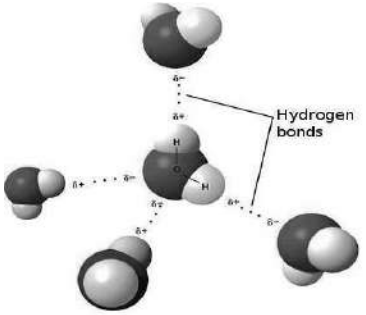


- _____
  - Certain chemical substances (catalysts) _____ the amount of activation energy required
  - *Biological catalysts* are called _____ **(***more later***)**

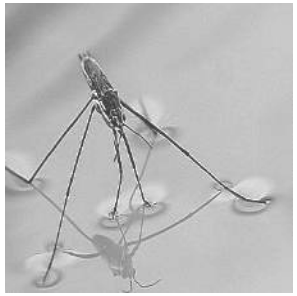
Properties of Water



- A _____ molecule (H_2O) is made up of three atoms --- one _____ and two _____ atoms.
- In each water molecule, the oxygen atom attracts more than its "fair share" of electrons.
- The oxygen end “acts” _____ .
- The hydrogen end “acts” _____ .
- Causes the water to be _____ , however water is neutral.
  - _____ ***Bonds*** Exist Between Water Molecules
  - Formed between a highly Electronegative atom of a polar molecule and a Hydrogen
  - One hydrogen bond is _____ , but many hydrogen bonds are _____



Cohesion / Adhesion



- _____ - Attraction between particles of the same substance (why water is attracted to _____).
  - Results in _____ tension (a measure of the strength of water’s surface).
  - Produces a surface film on water that allows insects to walk on the surface of water.

- _____ - Attraction between two _____ substances.
  - Water will make _____ bonds with other surfaces such as glass, soil, plant tissues, and cotton.
  - _____ _____ -water molecules will pull each other along when in a thin glass tube.
  - Example: transpiration process in which plants and trees remove water from the soil, and paper towels soak up water.

- A _____ is a _____ mixture of two or more substances. A solution may exist in any phase.
- A solution consists of a _____ and a _____ . The _____ is the substance that is dissolved in the _____ . The amount of solute that can be dissolved in solvent is called its solubility. For example, in a saline solution, salt is the solute dissolved in water as the solvent.

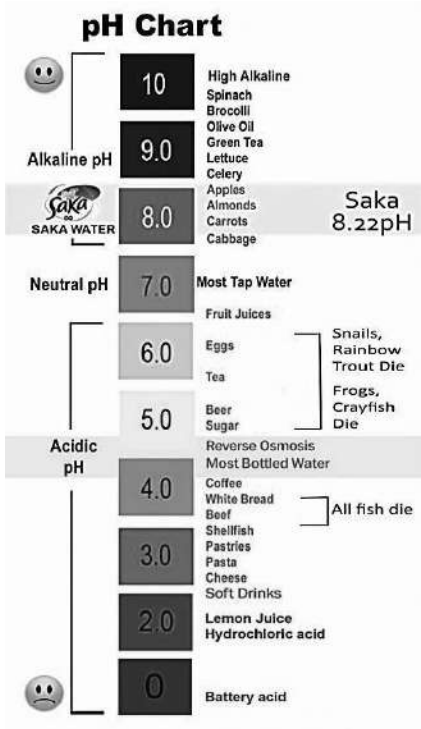
_____ :

- **Less Dense as a Solid**
  - Water is Less Dense as a Solid.
  - Ice is less dense as a solid than as a liquid (ice floats)
  - Liquid water has hydrogen bonds that are constantly being broken and reformed.
  - Frozen water forms a crystal-like lattice whereby molecules are set at fixed distances.

Acids, Bases, & pH

- One water molecule in 550 million naturally dissociates (breaks apart) into a Hydrogen Ion (H+) and a Hydroxide Ion (OH).

- ***pH Scale***:
  - Indicates the concentration of H+ ions.
  - Ranges from 0 – 14.
  - pH of _____ is neutral.
  - pH _____ (_____) up to 6.9 (weakest) is **acid** … H+.
  - pH above _____ (_____) – 14 (strongest) is **basic**… OH- .
  - Each pH unit represents a factor of 10X change in concentration.
  - pH 3 is 10 x 10 x 10 (1000) stronger than a pH of 6.



- _____
  - _____ : Weak acids or bases that react with strong acids or bases to prevent sharp, sudden changes in pH.
  - Produced naturally by the body to maintain _____ ***:*** the maintenance of a constant internal state in a changing environment; a constant internal state that is maintained in a changing environment by continually making _____ to the internal and external _____ . Homeostasis represents internal balance or the steady state of an organism.

Summary of Topics	☐ **Composition of Matter:** ☐ **Periodic Table** ☐ **Properties of Matter** ☐ **Bonding** ☐ **States of Matter** ☐ **Energy of Chemical Reactions** ☐ **Properties of Water** ☐ **Cohesion / Adhesion** ☐ **Acids, Bases, & pH**