

Unit 1: Biochemistry

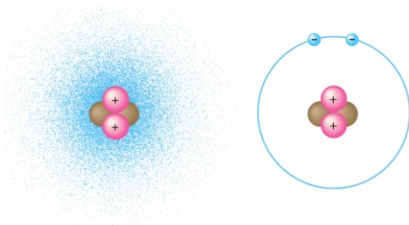
Section 1-2: Basic Chemistry, Organic Chemistry and Water

Book Reading: Chapter 2 pages 34-43; Chapter 4 pages 58-66, Chapter 3 pages 47-55

Organization of Matter

❖ Atoms and Subatomic Particles

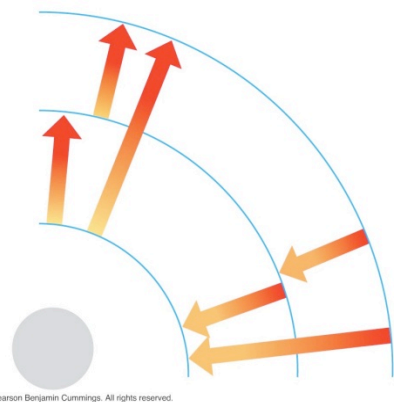
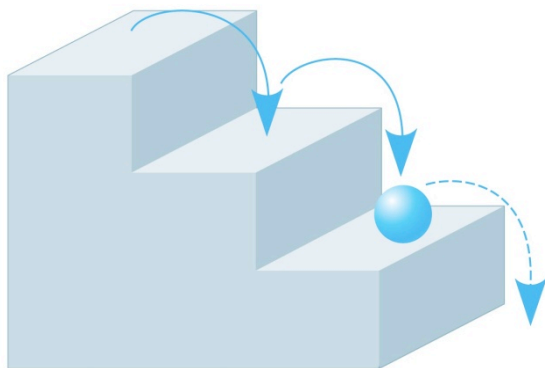
- Atoms are made up of three subatomic Particles
 - Protons- *location and charge*
 - Neutron- *location and charge*
 - Electrons- *location and charge*



- Atomic Number and Atomic Mass
 - Atomic Number- *What is the atomic number equal to?*
 - Atomic Mass- *What is the atomic mass number equal to?*
- Example: Fluorine

❖ Electrons and Energy

- Energy- *Define*
- *What is the cause of potential energy in the electrons of an atom?*
 - Electrons farther from the nucleus contain *more or less energy?*
 - Electrons closer to the nucleus contain *more or less energy?*
 - *How can electron change the shell it occupies?*



Chemical Compounds and Types of Bonds

❖ Chemical Bonding

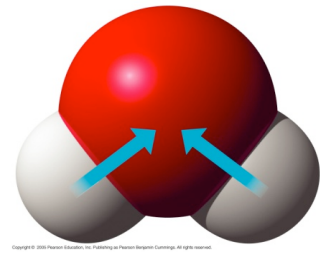
- Chemical bonding is controlled by two factors:
 - Valence electrons- *define*
 - Electronegativity- *define*
- The more valence electrons an atom has, the more electronegative it is

❖ Covalent Bonds

- *How are they formed?*
- Molecule- *define*
- Two atoms can be bonded together by one or multiple pairs of electrons
 - Single bonds- *share how many electrons?*
 - Double bonds- *share how many electrons?*
 - Triple bonds- *share how many electrons?*

❖ Polar Covalent Bonds

- *define*
- *describe*

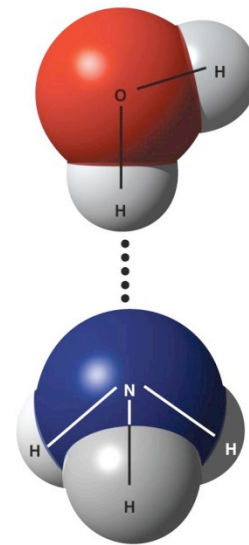


❖ Ionic Bonds

- *define*
- *describe*

❖ Weak Chemical “Bonds”

- Hydrogen Bonds
 - *define/describe*
 - Biological uses of hydrogen bonding include:
 - *list*
 -
 -
 -



- Van der Waals Interactions

- *define*
- Important in the folding and stabilization of large macromolecules such as proteins and nucleic acids

Carbon and Molecular Diversity

❖ Carbon

- Carbon is the main component in all organic compounds
- Tetravalance- *define*
- Simple Carbon Model:

❖ Hydrocarbons

- *define*
- Properties of hydrocarbons include:
 - *What kinds of bonds do they contain? Polar or nonpolar?*
 - *Describe how they interact with water. Hydrophilic or hydrophobic? Soluble or insoluble?*
 - They undergo reactions that can release massive amounts of energy
- Hydrocarbons do not exist alone in biological organisms but form portions of larger more complex molecules

❖ Functional Groups

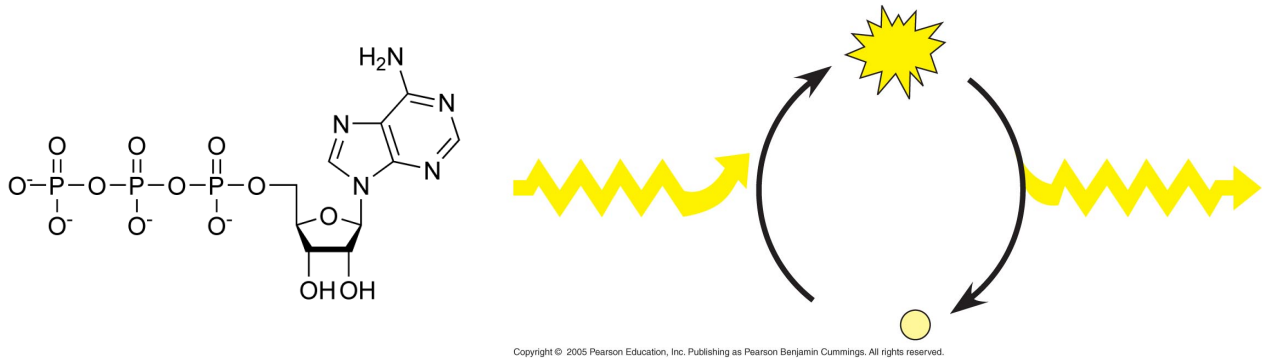
- Function groups are the components of organic molecules that are most commonly involved in chemical reactions
- They in essence are groups of atoms that replace one or more of the hydrogen atoms on a hydrocarbon chain
- The number and arrangement of functional groups gives each macromolecule its unique properties

Functional Groups

Name of Functional Group	Name of Compound	Properties	Picture
Hydroxyl	<i>Fill in this column only, we will do the others in class</i>		
Carbonyl (at the end)			
Carbonyl (within)			
Carboxyl			
Amino			
Phosphate			
Sulfhydryl			

❖ Adenosine Triphosphate: ATP

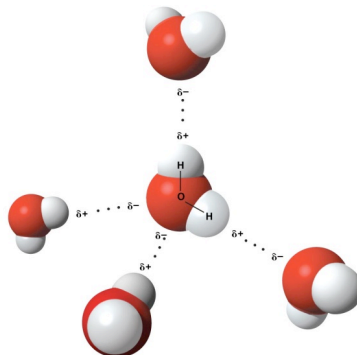
- *Why is ATP important?*
-
- When ATP loses one phosphate *what happens?*



Chemical Structure of Water

❖ Chemical Bonding and Structure

- Water is a polar molecule
 - *Describe how and why the bonds in water are polar.*
 - *What is the overall shape of the water molecule?*
 - *With what element is the partially negative charge associated?*
 - *With what element is the partially positive charge associated?*
- Because of hydrogen bonding, water is more structured than most other liquids



Properties of Water that Contribute to Life on Earth

❖ Cohesive Behavior

- Cohesion
 - *define*
 -

- Adhesion
 - *define*
 -

- Surface Tension
 - *define*
 -

- Application
 - *What are some biological uses for cohesion and adhesion?*
 - *What are some biological uses for surface tension?*

❖ Temperature Moderation

- Heat vs. Temperature
 - Heat- *define*
 - Temperature- *define*
 - Heat always moves- *from what to what*
 - *What must happen for the overall temperature of something to increase?*

- Specific Heat

- *Define*

- *Is the specific heat of water high or low? What does this mean?*

-

-

- Evaporative Cooling

- Water has a high heat of vaporization- *define heat of vaporization*

-

-

- Applications

-

-

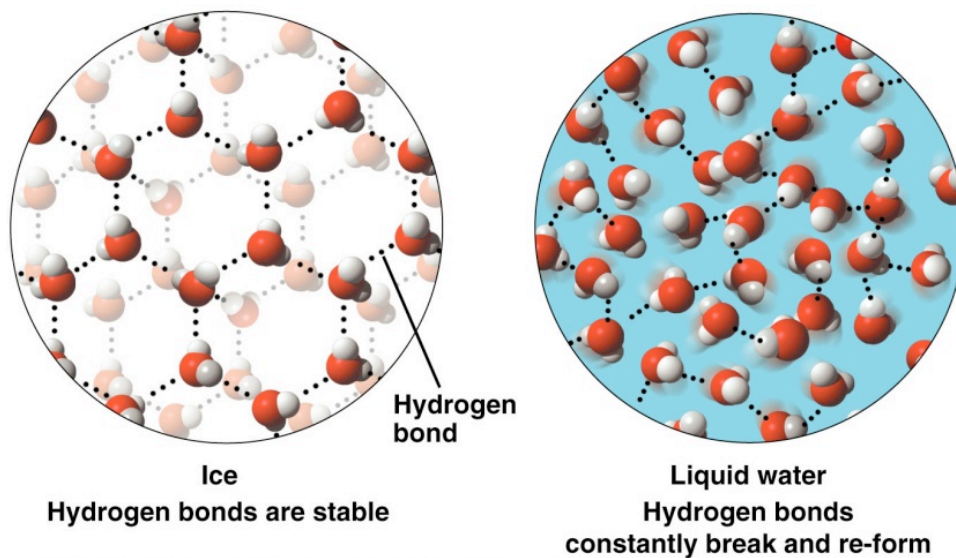
-

-

❖ Expansion Upon Freezing

- *What happens to the density of water as it freezes?*
- *how do the hydrogen bonds contribute to the structure of frozen water?*

- The surface of bodies of water, as heat is lost freeze and float on top, in essence insulating the water below so that it may still sustain life



❖ Solvation Behavior

- Water is the solvent of life
 - *What kinds of compounds are soluble in water?*
 - *Describe the process of water dissolving a substance.*

- Concentration
 - Molarity is a measure of the concentration of a solution
 - *What is the formula for molarity?*

- Hydrophobic vs. Hydrophilic
 - Hydrophilic
 - *define*
 - Not the same thing as soluble
 - Large molecules that have polar regions can be hydrophilic, without actually dissolving
 - Hydrophobic
 - *define*
 - Substances with mostly nonpolar bonds are hydrophobic
 - It does not have to be an entire molecule that is hydrophilic or hydrophobic, regions of molecules can be hydrophobic or hydrophilic as well

Acids, Bases, and pH

❖ Acids and Bases

- Acids
 - *Define, using the definition in your biology book, not the one from chemistry!*
 - Acidic solutions have more hydrogen ions than hydroxide ions
- Bases
 - *Define, using the definition in your biology book, not the one from chemistry!*
 - Accepts hydrogen ions
 - Increases the number of hydroxide ions

❖ pH

- *What is the pH scale?*
- Biological processes have very specific ranges of pH in which they can function at optimal levels
- *As the hydrogen ion concentration increases, what happens to the pH?*
- *How does a change on the pH scale relate to a change in the hydrogen ion concentration? Is it a 1:1 ratio?*
- When the pH changes slightly the H⁺ concentration changes by a factor of 10