

## Chapter 2: The Chemical Basis of Life

### I. Basic Chemistry

#### A. Matter, Mass, and Weight

1. All living and nonliving things are composed of \_\_\_\_\_
2. \_\_\_\_\_ represents the amount of matter.
3. \_\_\_\_\_ is caused by the gravitational force acting on mass.
4. Kilogram
  - a. How many pounds in a kilogram? \_\_\_\_\_
  - b. How many grams in a kilogram? \_\_\_\_\_

#### B. Elements and Atoms

1. Atomic Structure - smallest particle of an element
  - a. Which subatomic particle has no electric charge? \_\_\_\_\_
  - b. Which subatomic particle has a positive charge? \_\_\_\_\_
  - c. Which subatomic particle has a negative charge? \_\_\_\_\_
  - d. Which subatomic particles are found in the nucleus? \_\_\_\_\_  
and \_\_\_\_\_
2. Atomic Number and Mass Number
  - a. The atomic number represents the number of \_\_\_\_\_
  - b. The mass number of an element is the sum of \_\_\_\_\_  
and \_\_\_\_\_
3. Isotopes and Atomic Mass
  - a. Isotopes are \_\_\_\_\_  
\_\_\_\_\_
  - b. Isotopes of an element have different numbers of \_\_\_\_\_

#### C. Electrons and Chemical Bonding

1. Ionic Bonding
  - a. An atom that lost or gained an electron is called an \_\_\_\_\_
  - b. A positive charged ion is referred to as a \_\_\_\_\_
  - c. A negative charged ion is referred to as a \_\_\_\_\_
  - d. Describe how ionic bonding works: \_\_\_\_\_  
\_\_\_\_\_

## 2. Covalent Bonding

- a. Covalent bonding occurs when atoms share \_\_\_\_\_  
\_\_\_\_\_
- b. A single covalent bond means:
  1. \_\_\_\_\_ electrons are being shared
  2. A single covalent bond is represented by a \_\_\_\_\_
- c. A double covalent bond means:
  1. \_\_\_\_\_ electrons are being shared
  2. A double covalent bond is represented by a \_\_\_\_\_
- d. Nonpolar covalent bonds are formed when \_\_\_\_\_
- e. When two atoms do not share electrons equally they form  
\_\_\_\_\_

## D. Molecules and Compounds

1. Two or more atoms chemically joining together to form an independent unit create a \_\_\_\_\_
2. When a molecule is composed of more than one type of atoms it is a properly referred to as a \_\_\_\_\_

## E. Intermolecular Forces

1. Hydrogen Bonds
  - a. Results when a positive charged hydrogen atom of one molecule is attracted to the \_\_\_\_\_
  - b. Describe what important role hydrogen bonds play: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. Solubility and Dissociation
  - a. Solubility is \_\_\_\_\_
  - b. Dissolving table salt (an ionic compound) in water will result in the ions separating from each other in the water. This is called \_\_\_\_\_
  - c. Electrolytes are composed of what in water? \_\_\_\_\_

## II. Chemical Reactions and Energy

A. Synthesis Reactions

1. Define what a synthesis reaction is: \_\_\_\_\_  
\_\_\_\_\_
2. Synthesis reactions that result in the removal of water are \_\_\_\_\_
3. Collectively synthesis reactions are referred to as \_\_\_\_\_

B. Decomposition Reactions

1. Define what a decomposition reaction is: \_\_\_\_\_  
\_\_\_\_\_
2. Synthesis reactions that use water in the reaction are \_\_\_\_\_
3. Collectively decomposition reactions are referred to as \_\_\_\_\_

C. Reversible Reactions

1. A chemical reaction in which the reaction can proceed from \_\_\_\_\_  
to \_\_\_\_\_ or from \_\_\_\_\_ to \_\_\_\_\_

D. Oxidation-Reduction Reactions

1. Chemical reactions that result from the exchange of \_\_\_\_\_
2. The loss of an electron by a reactant is referred to as \_\_\_\_\_
3. \_\_\_\_\_ refers to the gain of an electron by a reactant.

E. Energy

1. Stored energy that is not doing work is called \_\_\_\_\_
2. Energy that is actually working and moving matter is \_\_\_\_\_
3. Mechanical Energy
  - a. Results from \_\_\_\_\_
4. Chemical Energy
  - a. Potential energy stored \_\_\_\_\_
5. Heat Energy
  - a. Energy that flows \_\_\_\_\_
6. Speed of Chemical Reactions
  - a. The activation energy is \_\_\_\_\_
  - b. Substances that increase the rate of chemical reactions without being used up in the reaction are called \_\_\_\_\_
    1. Enzymes are \_\_\_\_\_

- c. Increasing temperature \_\_\_\_\_
- d. Increasing concentration of reactants \_\_\_\_\_

### III. Inorganic Chemistry

#### A. Water

- 1. Stabilizing Body Temperature
  - a. Water requires a relatively large amount of heat to raise its temperature it therefore has \_\_\_\_\_
  - b. Water can rid the body of excess heat when it \_\_\_\_\_
- 2. Protection
  - a. Water acts as a lubricant by preventing \_\_\_\_\_
  - b. Water acts as a cushion by preventing \_\_\_\_\_
- 3. Chemical Reactions
  - a. Reacting molecules must be \_\_\_\_\_ in water.
  - b. Water is produced in a \_\_\_\_\_
  - c. Water is required in a \_\_\_\_\_
- 4. Mixing Medium
  - a. Substances that are uniformly distributed with no clear boundary between the substances form a \_\_\_\_\_
    - 1. The liquid that material dissolves in is a \_\_\_\_\_
    - 2. The material dissolving in the liquid is a \_\_\_\_\_
  - b. A mixture of materials that separate from each other when the mixing stops are part of a \_\_\_\_\_
  - c. Describe a colloid: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### B. Solution Concentrations

- 1. A 15% salt solution contains how many grams of salt per 100 ml of water?  
\_\_\_\_\_
- 2. Osmoles express \_\_\_\_\_

- Osmolality represents \_\_\_\_\_
- How many milliosmoles in an osmole? \_\_\_\_\_

#### C. Acids and Bases

- Any substance that releases hydrogen ions is an \_\_\_\_\_
- Any substance that binds to hydrogen ions is a \_\_\_\_\_
- The pH Scale
  - The pH scale refers to \_\_\_\_\_
  - A pH of 7 is said to be \_\_\_\_\_
  - Pure water is an example of a \_\_\_\_\_ and therefore has equal concentrations of \_\_\_\_\_ and \_\_\_\_\_
  - Acidic solutions have \_\_\_\_\_
  - Alkaline solutions have \_\_\_\_\_
  - A change of 1 pH unit represents how much change in hydrogen ion concentration? \_\_\_\_\_

#### 4. Salts

- Salts are formed by \_\_\_\_\_  
\_\_\_\_\_

#### 5. Buffers

- Changes in pH are regulated by the action of buffers, which \_\_\_\_\_  
\_\_\_\_\_

#### D. Oxygen

- An oxygen molecule consists of \_\_\_\_\_
- What percent of the atmosphere is oxygen? \_\_\_\_\_

#### E. Carbon Dioxide

- A molecule of carbon dioxide consists of \_\_\_\_\_

### IV. Organic Chemistry

#### A. Carbohydrates

- Carbohydrates are composed of \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_
- For every oxygen atom in a carbohydrate there are \_\_\_\_\_ hydrogen atoms.
- Functionally carbohydrates are important:

- a. \_\_\_\_\_ of other organic molecules
  - b. They can be broken down to \_\_\_\_\_
  - c. Undigested they \_\_\_\_\_
4. Monosaccharides - simple sugars
- a. \_\_\_\_\_ are five carbon monosaccharides
  - b. \_\_\_\_\_ are six carbon monosaccharides
  - c. Isomers are \_\_\_\_\_
  - d. List 3 common hexoses: \_\_\_\_\_
  - e. List 2 important pentoses: \_\_\_\_\_
5. Disaccharides
- a. Disaccharides are formed by \_\_\_\_\_
  - b. Sucrose is composed of \_\_\_\_\_ and \_\_\_\_\_
  - c. Maltose is composed of \_\_\_\_\_ and \_\_\_\_\_
6. Polysaccharides
- a. Polysaccharides consist of \_\_\_\_\_
  - b. Glycogen is also known as \_\_\_\_\_
    1. It is composed of \_\_\_\_\_
    2. It is an important \_\_\_\_\_
  - c. Starch and cellulose are found in \_\_\_\_\_
    1. Both molecules are composed of \_\_\_\_\_
    2. Starch is used for \_\_\_\_\_
    3. Cellulose is used for \_\_\_\_\_
    4. Which of these polysaccharides can humans digest? \_\_\_\_\_
- B. Lipids
1. Lipids are composed of \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_
  2. Functionally lipids are important:
    - a. Provide \_\_\_\_\_ and \_\_\_\_\_
    - b. Regulate \_\_\_\_\_
    - c. Form \_\_\_\_\_
    - d. Major \_\_\_\_\_
  3. Triglycerides or Triacylglycerols

- a. Composed of:
  1. One \_\_\_\_\_
  2. Three \_\_\_\_\_
- b. Fatty acids differ from one another in \_\_\_\_\_ and \_\_\_\_\_
  1. Saturated means \_\_\_\_\_
  2. Unsaturated means \_\_\_\_\_
4. Phospholipids
  - a. One of the fatty acids is replaced by \_\_\_\_\_
  - b. Which end is polar? \_\_\_\_\_
  - c. Which end is nonpolar? \_\_\_\_\_
  - d. Phospholipids are important \_\_\_\_\_
5. Eicosanoids
  - a. Derived from \_\_\_\_\_
  - b. Are important \_\_\_\_\_ with numerous effects.
6. Steroids
  - a. Carbon atoms bound together into \_\_\_\_\_
  - b. List several examples of steroids: \_\_\_\_\_  
\_\_\_\_\_

### C. Proteins

1. All contain \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_
  - a. Most proteins also contain \_\_\_\_\_
  - b. Some proteins contain \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_
2. Functionally proteins are important:
  - a. Regulate \_\_\_\_\_
  - b. Act as a \_\_\_\_\_
  - c. Help \_\_\_\_\_
  - d. Provide \_\_\_\_\_ and \_\_\_\_\_
3. Protein Structure
  - a. Basic protein building blocks are \_\_\_\_\_
  - b. Covalent bonds between amino acids are called \_\_\_\_\_
4. Structural Levels of a Protein

- a. Primary Structure
    1. Determined by the \_\_\_\_\_
  - b. Secondary Structure
    1. Results from \_\_\_\_\_  
which is caused by \_\_\_\_\_
    2. The two common shapes are \_\_\_\_\_ and \_\_\_\_\_
    3. A change in protein shape that causes it to become nonfunctional is referred to as \_\_\_\_\_
  - c. Tertiary Structure
    1. Results from \_\_\_\_\_
    2. What is a domain? \_\_\_\_\_
    3. Why are domains important? \_\_\_\_\_
  - d. Quaternary Structure
    1. Refers to the \_\_\_\_\_ when two or more proteins join together to form a functional unit.
5. Enzymes
- a. Protein catalyst that \_\_\_\_\_
  - b. The shape of the enzyme determines the structure of the \_\_\_\_\_
  - c. Enzymes control \_\_\_\_\_
- D. Nucleic Acids: DNA and RNA
1. DNA stands for \_\_\_\_\_
    - a. DNA is the cell's \_\_\_\_\_
    - b. DNA contains the information for \_\_\_\_\_
  2. RNA stands for \_\_\_\_\_
    - a. Three types of RNA play \_\_\_\_\_
  3. Nucleic acids composed of \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_
  4. Consist of building blocks called \_\_\_\_\_
    - a. Each building block is composed of 3 parts:
      1. Phosphate Group
      2. Monosaccharide

- a. In DNA this is \_\_\_\_\_
- b. In RNA this is \_\_\_\_\_

3. Nitrogenous Organic Base

- a. The single-ringed pyrimidines are:

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

- b. The double-ringed purines are:

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_

5. DNA has \_\_\_\_\_ strands of nucleotides twisted together to form a \_\_\_\_\_

- a. The uprights of the ladder consist of \_\_\_\_\_

- b. The rungs of the ladder consist of \_\_\_\_\_

- c. Adenine always binds to \_\_\_\_\_ by \_\_\_\_\_ hydrogen bonds

- d. Guanine always binds to \_\_\_\_\_ by \_\_\_\_\_ hydrogen bonds

6. RNA has \_\_\_\_\_ strand of nucleotides.

- a. Thymine is replaced with \_\_\_\_\_

E. Adenosine Triphosphate - ATP

1. Composed of \_\_\_\_\_ and \_\_\_\_\_

- a. Adenosine is composed of \_\_\_\_\_ and \_\_\_\_\_

2. Important because of the energy stored \_\_\_\_\_

3. ATP is often called the \_\_\_\_\_ of cells because \_\_\_\_\_

\_\_\_\_\_