

Chapter 2 Chemical Composition of the Body

- I. Atoms, Ions, and Chemical Bonds
 - A. Atoms
 - B. Ions
 - C. Isotopes
 - D. Chemical Bonds
 - E. Acids, Bases, and the pH Scale
 - F. Organic Molecule Monomers
- II. Dehydration Synthesis
- III. Hydrolysis

Read and Review all of Chapter 2. You are responsible for knowing the information it contains even if I do not cover the information in class.

Atoms

- Are smallest units of the chemical elements
- Composed of protons, neutrons and electrons

Fig 2.1

- Nucleus contains protons (+ charge) and neutrons (no charge)
- Electrons (- charge) occupy electron shells or clouds outside nucleus
- Atomic mass is sum of protons and neutrons in an atom
- Atomic number is number of protons in an atom

Atoms - Isotopes

- Are different forms of same atom
 - Atomic number is the same, but atomic mass is different
 - Because contain different numbers of neutrons
 - $\#P \neq \#N$
 - $\#P = \#E$

Atoms - Ions

- Are different forms of same atom
 - Atomic number and atomic mass is the same
 - Has a positive (+) charge or a negative (-) charge
 - Because contain different numbers of electrons
 - $\#P = \#N$
 - $\#P \neq \#E$

Chemical Bonds

- Molecules form by chemical bonding between valence electrons of atoms
 - Number of bonds determined by number of electrons needed to complete outermost shell

Covalent Bonds

- Occur when atoms share valence electrons
- In nonpolar covalent bonds electrons are shared equally

Fig 2.2

- In polar covalent bonds electrons are shared unequally
 - Pulled more toward one atom
 - Have + and – poles
 - e.g. H_2O

Fig 2.4

Ionic Bonds

- Occur when valence electrons are transferred from one atom to another
 - Forming charged atoms (ions)

Fig 2.5

- Ionic bonds are formed by attraction of + and - charges
- Ionic bonds are weaker than polar covalent bonds
- Dissociate when dissolved in H₂O

Fig 2.6

Hydrogen Bonds

- When H forms a polar covalent bond with another atom it takes on a slightly + charge
- Making it attracted to any nearby negatively charged atoms
 - Called hydrogen bonds
 - Forms between adjacent H₂O's
 - Creating surface tension

Fig 2.7

Acids, Bases, and the pH Scale

- Acid:
 - Molecule that can release protons (H⁺).
 - Proton donor.
- Base:
 - Negatively charged ion that can combine with H⁺, and remove it from solution.
 - Proton acceptor.

pH

- $\text{pH} = \log \frac{1}{[\text{H}^+]}$
 - $[\text{H}^+] =$ molar concentration of H^+ .
 - pH inversely related to $[\text{H}^+]$.
- Because of logarithmic relationship, a solution with 10 times $[\text{H}^+]$ of H_2O has a pH = 6; solution with 0.1 the $[\text{H}^+]$ has a pH = 8.

Table 2.3

Buffers

- System of molecules and ions that act to prevent changes in $[\text{H}^+]$.
- Stabilizes pH of a solution.
- In blood:
 - $\text{H}_2\text{O} + \text{CO}_2 \leftrightarrow \text{H}_2\text{CO}_3 \leftrightarrow \text{H}^+ + \text{HCO}_3^-$
 - Reaction can proceed in either direction (depending upon the concentration of molecules and ions).

Blood pH

- 7.35 – 7.45
- Constancy achieved in part by HCO_3^- .
 - HCO_3^- and H_2CO_3 act as buffer pair.
- $\text{H}_2\text{O} + \text{CO}_2 \leftrightarrow \text{H}_2\text{CO}_3 \leftrightarrow \text{H}^+ + \text{HCO}_3^-$
- Acidosis:
 - $\text{pH} < 7.35$.
- Alkalosis:
 - $\text{pH} > 7.45$.

Formation of Disaccharides

- Occurs by splitting water out of 2 monosaccharides
 - Makes a larger molecule from 2 smaller ones
 - Called dehydration synthesis

Fig 2.15

Digestion of Polysaccharides

- Is reverse of dehydration synthesis
- H_2O is split, H^+ added to one monosaccharide, OH^- to other - called hydrolysis
- Polysaccharide hydrolyzed into disaccharides, then to monosaccharides

Fig 2.16

- Dehydration Synthesis occurs whenever you make a larger molecule from smaller molecules. This process is done with:
 - Carbohydrates
 - Fats
 - Proteins
 - Nucleic acids

- Hydrolysis occurs whenever you make smaller molecules from a larger molecule. This process is done with:
 - Carbohydrates
 - Fats
 - Proteins
 - Nucleic acids

Molecule	Monomer
Carbohydrate	Monosaccharide
Lipid (fat)	Glycerol and fatty acids
Protein	Amino acids
Nucleic Acid	Nucleotides