Biology Test 2 Study Guide

Chapter 1

The Unity of Life: All Forms of Life Have Common Features

- The foundation for unity of life is the genetic information in DNA molecules.
- Diversity comes from differences in DNA sequences.
- There are certain properties common to all living organisms.
  - Order: All living organisms show complex organization.
  - Regulation: The environment outside an organism may change a lot, but mechanisms inside regulate an organism's internal environment.
  - Growth and Development: Inherited information carried by genes controls an organism's pattern of growth and development.
  - Energy Utilization: Organisms take in energy and transform it to perform all of life's activities.
  - Response to the Environment: All organisms respond to environmental stimuli.
  - Reproduction: Organisms reproduce their own kind.
  - Evolution: Species have the capacity to change and evolve over time.

Chapter 2

Living Organisms are Composed of About 25 Chemical Elements

- The most common elements in the human body are oxygen, carbon, hydrogen, and nitrogen.

Elements Can Combine to Form Compounds

- A compound is a substance containing two or more elements in a fixed ratio.
- New properties emerge when two or more elements join into a compound.
  - For example, NaCl has different properties from Na or Cl alone.

Differences in Bonding

- Ionic bonds are attractions between ions of opposite charge.
- Covalent bonds join atoms into molecules through electron sharing, which creates a molecule.

Hydrogen Bonds are Weak Bonds Important in the Chemistry of Life

- The partial positivity of an H atom in a polar covalent bond allows it to share attractions with other electronegative atoms, such as O or N.
- This is called a hydrogen bond.

Hydrogen Bonds Make Liquid Water Cohesive

- The tendency for molecules to stick together is called cohesion, which is stronger for water than most other liquids.
- Hydrogen bonds also give water very high surface tension, which is a measure of how difficult it is to stretch or break the surface of a liquid.

Water's Hydrogen Bonds Moderate Temperature

- Because of hydrogen bonding, water is able to resist temperature change better than most other substances.
- When water is heated, the heat energy disrupts hydrogen bonds and makes the water molecules move faster. As the bonds break, heat is absorbed, which lets water store a lot of heat while only warming up a few degrees.
- When water is cooled, more hydrogen bonds form, which releases the heat energy and slows the cooling process.
- Water also has a high boiling point because the hydrogen bonds hold the molecules in place.

Ice is Less Dense than Liquid Water

- Unlike most substances, water is less dense as a solid than a liquid because of hydrogen bonds.
- As water freezes, each molecule makes stable hydrogen bonds with four neighbors to make a three dimensional crystal. These crystals are less tightly packed than the liquid water, which makes it less dense.

The Chemistry of Life is Sensitive to Acidic and Basic Conditions

- A compound that donates hydrogen ions to solutions is called an acid. A base is a compound that accepts hydrogen ions and removes them from solution; some do this by donating hydroxide.
- The pH scale describes how acidic or basic a solution is.
- Some fluids contain buffers, which are substances that resist changes in pH by accepting hydrogen ions when they are in excess and donating hydrogen ions when it is depleted.

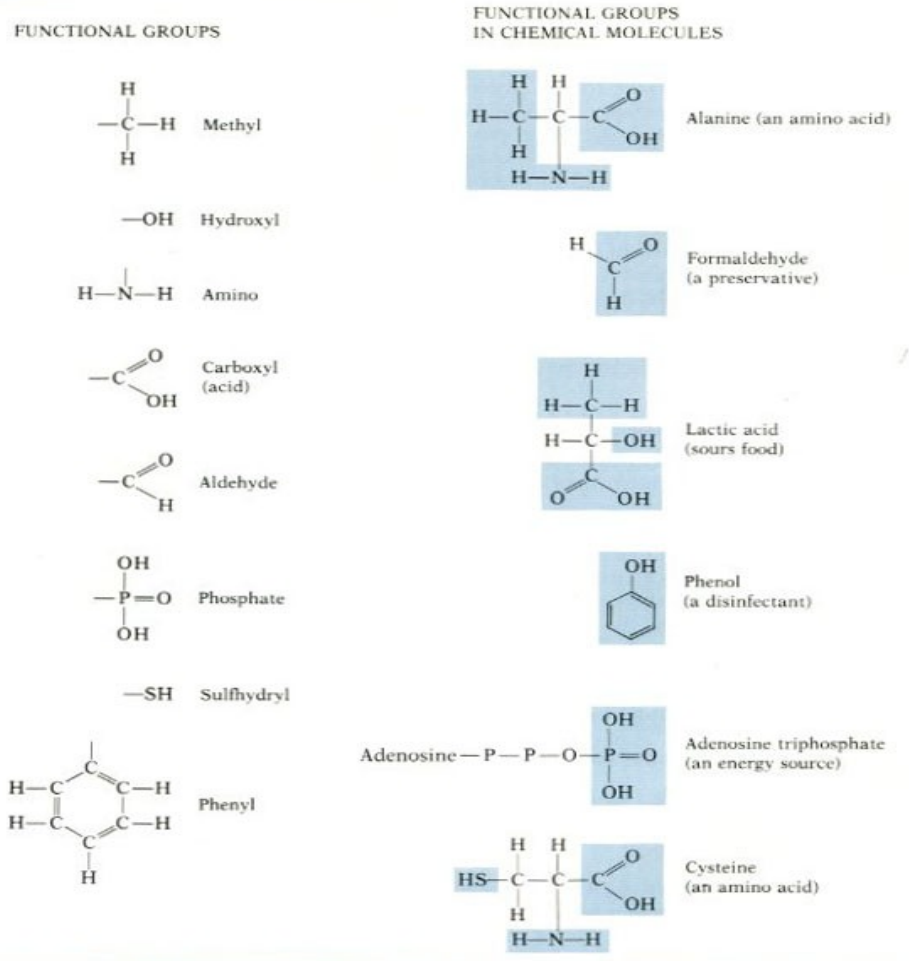
Chapter 3

Life's Molecular Diversity is Based on the Properties of Carbon

- Chains of carbon atoms in organic molecules are called carbon skeletons, which can be unbranched or branched.
- Compounds composed of only carbon and hydrogen are called hydrocarbons.

Functional Groups Help Determine the Properties of Organic Compounds

- All functional groups are polar because the oxygen or nitrogen atoms exert a strong pull on the shared electrons. This makes the compounds containing these groups hydrophilic and thus soluble in water.



Cells Link Two Single Sugars to Form Disaccharides

- Two monosaccharides are constructed into a disaccharide by a dehydration synthesis. Two hydroxide groups bond, and a water molecule leaves.
- Polysaccharides are polymers of monosaccharides linked together by many dehydration syntheses. Some examples are starch, glycogen, cellulose, and chitin.

Fats are Lipids That are Mostly Energy-Storage Molecules

- Lipids are diverse compounds that consist primarily of carbon and hydrogen atoms linked by nonpolar covalent bonds, so they're not attracted to water molecules – they're hydrophobic.
- A fat is a large lipid made from a glycerol (alcohol with three carbons, each with a hydroxyl group) and fatty acids (carboxyl groups and hydrocarbon chains with fifteen carbons).
    - Functions: energy storage, cushioning, insulation
- Fatty acids link to glycerol through dehydration reactions.
- Fats with double bonds are unsaturated (less than the maximum number of hydrogens) and fats with single bonds are saturated.
    - Oils are unsaturated and liquid.

Phospholipids, Waxes, and Steroids are Lipids with a Variety of Functions

- Phospholipids are a major component of cell membranes, contain the element phosphorous, and have two fatty acids instead of three.
    - Function: part of cell membrane
- Waxes have one fatty acid linked to an alcohol. They are more hydrophobic than fats.
- Steroids are lipids with fused rings, such as cholesterol.
    - Function: hormones

Proteins are Essential to the Structures and Activities of Life

- A protein is a polymer constructed from amino acid monomers.
    - Function: structure in cells, as enzymes, antibodies, signals, transport, storage
- An important role is as enzymes, the chemical catalysts that speed and regulate all chemical reactions in cells.
- Signal proteins are those that coordinate body activities by communicating between cells.
- Hemoglobin is a transport protein that delivers oxygen to working muscles.
- Some proteins are storage proteins, such as milk proteins, which provide amino acids for baby mammals.

Proteins are Made From Amino Acids Linked by Peptide Bonds

- Protein diversity is based on differing arrangements of a common set of 20 amino acids, which all have an amino group and a carboxyl group.
- The R group is the variable group of the acid and determines the specific properties of each of the 20 amino acids in proteins.
- There are two main types of amino acids, hydrophobic and hydrophilic.
- Amino acids join together in dehydration reactions that link the carboxyl group of one amino acid to the amino group of the next amino acid as a water molecule is removed.
    - Covalent linkage here is called a peptide bond.
- A chain of amino acids is a polypeptide.

Nucleic Acids are Information-Rich Polymers of Nucleotides

- Nucleic acids are polymers that can serve as the blueprint for proteins.
    - Two types: DNA and RNA
- The monomers that make up nucleic acids are called nucleotides, which has three parts: a five-carbon sugar, deoxyribose or ribose with a phosphate group, and a nitrogenous base.

- Adenine and guanine are purines, and thymine and cytosine are pyrimidines.
  - Purines have two carbon-nitrogen rings, while pyrimidines only have one.
- A nucleic acid polymer forms from its monomers by dehydration reactions, where the phosphate group of one nucleotide bonds to the sugar of the next monomer.