Link

CHAPTER SUMMARY

All life depends on water and its special properties.
Water is a highly polar molecule with strong hydrogen attraction *between* its molecules.

Properties of water:

Strong cohesion attraction

Strong adhesive forces

High heat of fusion

ice is less dense than water

High specific heat

High heat of vaporization

Known as the universal solvent

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Organic compounds (those containing carbon) are all made of building blocks:

- Carbohydrates—monosaccharides
- Lipids—glycerol and fatty acids
- Proteins—amino acids
- DNA and RNA—nucleotides (nitrogen base, phosphate, sugar—deoxyribose and ribose)

Form relates to function:

Proteins function based on their shapes, which result from their unique structure. The sequence of amino acids (primary structure) determines how a protein folds (secondary and tertiary structure) and if it consists of more than one chain (quaternary structure).

Enzymes are proteins that control the rate of reactions based on their shape or conformation. They are specific—only reacting with certain substrates by what is described as an induced fit model

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Living beings maintain internal homeostasis (stability).

An example of homeostasis is how different parts of the human body maintain a constant pH.

The stomach is strongly acidic; the small intestine is mildly basic.

The pH value represents how acidic (less than 7) or alkaline or basic (greater than 7) a substance is

A substance with a pH of 5 is 10 times more acidic than a substance that has a pH of 6, and 100 times more acidic than a substance with a pH of 7.

CHAPTER HIGHLIGHTS

SECTION 1 Composition of Matter

- Matter is anything that occupies space and has mass.
- Elements are made of a single kind of atom and cannot be broken down by chemical means into simpler substances.
- Atoms are composed of protons, neutrons, and electrons. Protons and neutrons make up the nucleus of the atom. Electrons move about the nucleus in orbitals.
- Compounds consist of atoms of two or more elements that are joined by chemical bonds in a fixed proportion.
- Most elements react to form chemical bonds so that their atoms become stable. An atom achieves stability when the orbitals that correspond to its highest energy level are filled with the maximum number of electrons.
- A covalent bond is formed when two atoms share electrons.
- An ionic bond is formed when one atom gives up an electron to another. The positive ion is then attracted to a negative ion to form the ionic bond.

Vocabulary

matter (p. 31)
mass (p. 31)
element (p. 31)
atom (p. 32)
nucleus (p. 32)
proton (p. 32)
neutron (p. 32)
atomic number (p. 32)
mass number (p. 32)
electron (p. 32)
orbital (p. 32)
isotope (p. 32)
compound (p. 33)
chemical bond (p. 33)
covalent bond (p. 33)
molecule (p. 33)
ion (p. 34)
ionic bond (p. 34)

SECTION 2 Energy

- Addition of energy to a substance can cause its state to change from a solid to a liquid and from a liquid to a gas.
- Reactants are substances that enter chemical reactions. Products are substances produced by chemical reactions.
- Enzymes lower the amount of activation energy necessary for a reaction to begin in living systems.
- A chemical reaction in which electrons are exchanged between atoms is called an oxidation-reduction reaction.

Vocabulary

energy (p. 35)
chemical reaction (p. 36)
reactant (p. 36)
product (p. 36)
metabolism (p. 36)
activation energy (p. 36)
catalyst (p. 36)
enzyme (p. 36)
redox reaction (p. 37)
oxidation reaction (p. 37)
reduction reaction (p. 37)

SECTION 3 Water and Solutions

- The two hydrogen atoms and one oxygen atom that make up a water molecule are arranged at an angle to one another.
- Water is a polar molecule. The electrons in the molecule are shared unevenly between hydrogen and oxygen. This polarity makes water effective at dissolving other polar substances.
- Hydrogen bonding accounts for most of the unique properties of water.
- The unique properties of water include the ability to dissolve many substances, cohesion and adhesion, the ability to absorb a relatively large amount of energy as heat, the ability to cool surfaces through evaporation, and the low density of ice.
- A solution consists of a solute dissolved in a solvent.
- Water ionizes into hydronium ions and hydroxide ions.
- Acidic solutions contain more hydronium ions than hydroxide ions. Basic solutions contain more hydroxide ions than hydronium ions.
- Buffers are chemicals that neutralize the effects of adding small amounts of either an acid or a base to a solution.

Vocabulary

polar (p. 39)
hydrogen bond (p. 40)
cohesion (p. 41)
adhesion (p. 41)
capillarity (p. 41)
solution (p. 42)
solute (p. 42)
solvent (p. 42)
concentration (p. 42)
saturated solution (p. 42)
aqueous solution (p. 42)
hydroxide ion (p. 43)
hydronium ion (p. 43)
acid (p. 43)
base (p. 44)
pH scale (p. 44)
buffer (p. 44)

CHAPTER HIGHLIGHTS

SECTION 1 Carbon Compounds

- Organic compounds contain carbon atoms and are found in living things. Most inorganic compounds do not contain carbon atoms.
- Carbon atoms can readily form four covalent bonds with other atoms including other carbon atoms. The carbon bonds allow the carbon atoms to form a wide variety of simple and complex organic compounds.
- Functional groups are groups of atoms that influence the properties of molecules and the chemical reactions in which the molecules participate.
- Condensation reactions join monomers (small simple molecules) to form polymers. A condensation reaction releases water as a by-product. In a hydrolysis reaction, water is used to split polymers into monomers.
- Adenosine triphosphate (ATP) stores and releases energy during cell processes enabling organisms to function.

Vocabulary

organic compound (p. 51)
functional group (p. 52)
monomer (p. 53)
polymer (p. 53)
macromolecule (p. 53)
condensation reaction (p. 53)
hydrolysis (p. 53)
adenosine triphosphate (ATP) (p. 54)

SECTION 2 Molecules of Life

- There are four main classes of organic compounds: carbohydrates, proteins, lipids, and nucleic acids.
- Carbohydrates are made up of monomers called monosaccharides. Two monosaccharides join to form a double sugar called a disaccharide. A complex sugar, or polysaccharide, is made of three or more monosaccharides.
- Carbohydrates such as glucose, are a source of energy and are used as structural materials in organisms.
- Proteins have many functions including structural, defensive, and catalytic. Proteins are made up of monomers called amino acids. The sequence of amino acids determines a protein's shape and function. A long chain of amino acids is called a polypeptide, which is made up of amino acids joined by peptide bonds.
- Enzymes speed up chemical reactions and bind to specific substrates. The binding of a substrate with an enzyme causes a change in the enzyme's shape and reduces the activation energy of the reaction.
- Lipids are nonpolar molecules that store energy and are an important part of cell membranes. Most lipids contain fatty acids, molecules that have a hydrophilic end and a hydrophobic end.
- There are three kinds of lipids: Triglycerides consist of three fatty acids and one molecule of glycerol. Phospholipids, which make up cell membranes, consist of two fatty acids and one glycerol molecule. A wax is made of one long fatty acid chain joined to one long alcohol.
- The nucleic acid, deoxyribonucleic acid (DNA), contains all the genetic information for cell activities. Ribonucleic acid (RNA) molecules play many key roles in building of proteins and can act as enzymes.

Vocabulary

carbohydrate (p. 55)
monosaccharide (p. 55)
disaccharide (p. 56)
polysaccharide (p. 56)
protein (p. 56)
amino acid (p. 56)
peptide bond (p. 57)
polypeptide (p. 57)
enzyme (p. 57)
substrate (p. 57)
active site (p. 57)
lipid (p. 59)
fatty acid (p. 59)
triglyceride (p. 59)
phospholipid (p. 59)
wax (p. 60)
steroid (p. 60)
nucleic acid (p. 60)
deoxyribonucleic acid (DNA) (p. 60)
ribonucleic acid (RNA) (p. 60)
nucleotide (p. 60)