Section 1: Atoms, Ions, and Molecules

Study Guide B

KEY CONCEPT
All living things are based on atoms and their interactions.

VOCABULARY

<table>
<thead>
<tr>
<th>atom</th>
<th>ion</th>
<th>molecule</th>
</tr>
</thead>
<tbody>
<tr>
<td>element</td>
<td>ionic bond</td>
<td></td>
</tr>
<tr>
<td>compound</td>
<td>covalent bond</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: Living things consist of atoms of different elements.

1. How are atoms and elements related?

2. Sketch the structure of an atom. Label the protons, neutrons, nucleus, and electrons.

3. How do compounds differ from elements?

MAIN IDEA: Ions form when atoms gain or lose electrons.

4. What is an ion?
5. Why does an ion have an electrical charge?

_______________________________________________________________
_______________________________________________________________

6. In the spaces provided below, sketch how both positive and negative ions form. Label the nucleus and the electrons. Use Figure 1.3 as a reference.

MAIN IDEA: Atoms share pairs of electrons in covalent bonds.

7. What is a covalent bond?

_______________________________________________________________

8. What determines the number of covalent bonds that an atom can form?

_______________________________________________________________

Vocabulary Check

<table>
<thead>
<tr>
<th>element</th>
<th>compound</th>
<th>ion</th>
<th>molecule</th>
</tr>
</thead>
<tbody>
<tr>
<td>_________</td>
<td>9. atoms held together by covalent bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_________</td>
<td>10. composed of different types of atoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_________</td>
<td>11. composed of one type of atom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>_________</td>
<td>12. atom that has gained or lost electrons</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. What is the difference between how ionic and covalent bonds form?

_______________________________________________________________
_______________________________________________________________
Section 2: Properties of Water

Study Guide B

KEY CONCEPT
Water’s unique properties allow life to exist on Earth.

VOCABULARY

<table>
<thead>
<tr>
<th>Hydrogen bond</th>
<th>Solution</th>
<th>Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesion</td>
<td>Solvent</td>
<td>Base</td>
</tr>
<tr>
<td>Adhesion</td>
<td>Solute</td>
<td>pH</td>
</tr>
</tbody>
</table>

MAIN IDEA: Life depends on hydrogen bonds in water.

1. What is a polar molecule?

2. Explain why water is a polar molecule.

3. What is a hydrogen bond?

4. Describe where a hydrogen bond can form among water molecules.

Complete the table by writing short descriptions about the properties of water.

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High specific heat</td>
<td>5.</td>
</tr>
<tr>
<td>Cohesion</td>
<td>6.</td>
</tr>
<tr>
<td>Adhesion</td>
<td>7.</td>
</tr>
</tbody>
</table>
Study Guide B continued

MAIN IDEA: Many compounds dissolve in water.
8. What is the difference between a solvent and a solute?

__________________________________________________________________________

9. What types of substances dissolve easily in water?

__________________________________________________________________________

10. What types of substances do not dissolve easily in water?

__________________________________________________________________________

MAIN IDEA: Some compounds form acids or bases.
11. Take notes about the characteristics of acids and bases in the table below.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Acid</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect on H⁺ concentration in a solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effect on pH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary Check
12. In the space below, sketch a solution using the Visual Vocab in Section 2 as a reference. Label the solution, solvent, and solute. Next to these labels, write brief definitions for the terms.

...
Section 3: Carbon-Based Molecules

KEY CONCEPT
Carbon-based molecules are the foundation of life.

VOCABULARY

<table>
<thead>
<tr>
<th>monomer</th>
<th>lipid</th>
<th>amino acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>polymer</td>
<td>fatty acid</td>
<td>nucleic acid</td>
</tr>
<tr>
<td>carbohydrate</td>
<td>protein</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: Carbon atoms have unique bonding properties.

1. Why is carbon often called the building block of life?

(Blank space for student response)

2. What ability allows carbon atoms to form a large number of molecules?

(Blank space for student response)

3. In the space below, sketch the three basic structures of carbon-based molecules: straight chain, branched chain, and ring.

(Blank space for student response)
MAIN IDEA: Four main types of carbon-based molecules are found in living things.

Complete the table with functions and examples of each type of carbon-based molecule.

<table>
<thead>
<tr>
<th>Molecule Type</th>
<th>Functions</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>4.</td>
<td>5.</td>
</tr>
<tr>
<td>Lipid</td>
<td>6.</td>
<td>7.</td>
</tr>
<tr>
<td>Protein</td>
<td>8.</td>
<td>9.</td>
</tr>
<tr>
<td>Nucleic acid</td>
<td>10.</td>
<td>11.</td>
</tr>
</tbody>
</table>

12. What determines a protein’s structure and function?

13. What are nucleic acids made of?

Vocabulary Check

14. The prefix *mono-* means “one,” and the prefix *poly-* means “many.” How are these meanings related to the terms *monomer* and *polymer*?
Section 4: Chemical Reactions

Study Guide B

KEY CONCEPT
Life depends on chemical reactions.

VOCABULARY

<table>
<thead>
<tr>
<th>chemical reaction</th>
<th>bond energy</th>
<th>exothermic</th>
</tr>
</thead>
<tbody>
<tr>
<td>reactant</td>
<td>equilibrium</td>
<td>endothermic</td>
</tr>
<tr>
<td>product</td>
<td>activation energy</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: Bonds break and form during chemical reactions.

1. Label the reactants and products in the chemical reaction shown below. Write brief definitions for these terms next to their labels.

   \[ \text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} \]

2. What causes chemical bonds to break during a reaction?

3. What is bond energy?

4. In a chemical equation, what symbol is used to show that a chemical reaction goes in both directions?

5. When does a chemical reaction reach equilibrium?
MAIN IDEA: Chemical reactions release or absorb energy.

6. The ________________ of the reactants and products determines whether energy will be released or absorbed during a chemical reaction.

7. Before a chemical reaction can start, ________________ must be absorbed by the reactants. The amount that must be absorbed to start the reaction is called the ________________.

8. In an exothermic reaction, the products have a ________________ bond energy than the reactants. Overall, energy is ________________.

9. In an endothermic reaction, the products have a ________________ bond energy than the reactants. Overall, energy is ________________.

Vocabulary Check

10. Write one sentence that uses the words chemical reaction, reactant, and product.

_______________________________________________________________

11. Write your own analogy to remember the meaning of activation energy.

_______________________________________________________________

12. The term equilibrium is based on two Latin roots that mean “equal” and “balance.” How do these meanings tell you the meaning of equilibrium in a chemical reaction?

_______________________________________________________________

_______________________________________________________________

13. The prefix exo- means “out,” and the prefix endo- means “in.” What do these prefixes tell you about exothermic and endothermic reactions?

_______________________________________________________________

_______________________________________________________________
KEY CONCEPT
Enzymes are catalysts for chemical reactions in living things.

VOCABULARY

<table>
<thead>
<tr>
<th>catalyst</th>
<th>substrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>enzyme</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: A catalyst lowers activation energy.

1. What is activation energy?

2. Take notes about catalysts in the chart below. In the first two boxes, write detail notes about the main functions of catalysts. In the third box, write a detail about another characteristic.

3. When a catalyst is present, more/less activation energy is needed to start a chemical reaction.
MAIN IDEA: Enzymes allow chemical reactions to occur under tightly controlled conditions.

4. Take notes about enzymes by filling in the Main Idea Web below.

   Why enzymes are necessary: ____________________________

   How structure affects function: _______________________

   Important factors in enzyme structure: __________________

   Lock-and-key model: _________________________________

5. How do enzymes weaken the bonds in substrates?

   ___________________________________________________

   ___________________________________________________

Vocabulary Check

6. The word catalyst comes from the Greek word meaning “to dissolve.” How does this definition relate to the meaning of catalyst?

   ___________________________________________________

7. How are substrates like keys and enzymes like locks?

   ___________________________________________________

   ___________________________________________________