Chapter Objectives

As you study this chapter, you should be able to do the following:

1. Define chemistry and describe its five major divisions.

2. Explain the relationship among the terms experiment, hypothesis, theory, and law in the scientific method.

3. Distinguish between matter and a substance.

4. Name and characterize the three states of matter.

5. Identify physical changes of matter.

6. Classify a sample of matter as a substance or a mixture; as homogeneous or heterogeneous.
   Examples:
   a. hand cream
   b. apple
   c. copper
   d. ink
   e. flower
   f. glue

7. Explain the difference between an element and a compound.
8. Distinguish the symbols of common elements, and match the names of common elements to their symbols.

Examples:

a. aluminum  

b. nitrogen  
c. copper  
d. O  
e. C  
f. S  

9. Compare physical and chemical changes in matter.

10. State the law of conservation of mass.

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**Answers to Objectives**

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**Objectives Worksheet 1**

1. Chemistry is the study of the composition of substances and changes that they undergo. Organic chemistry is the study of essentially all substances containing carbon. Inorganic chemistry specializes largely in substances without carbon. Analytical chemistry is concerned primarily with the composition of substances. Physical chemistry is concerned with theories and experiments that describe the behavior of chemicals. Biochemistry is the study of the composition and changes in composition of living organisms.

2. Observation → hypothesis → experiments and observations → refined hypothesis → experiments and observations → theory or law.

3. Matter is anything that takes up space. A substance is a single kind of matter that is the same throughout.

4. Solid: matter that has a definite shape and volume. Liquid: matter that flows, has a fixed volume, and takes the shape of its container. Gas: matter that takes both the shape and the volume of its container.

5. Answers will vary; for example, breaking a teapot and melting ice.

6. a. mixture  
b. mixture  
c. substance  
d. homogeneous  
e. heterogeneous  
f. homogeneous

7. An element is the simplest form of matter that can exist under laboratory conditions.

8. a. Al  
b. N  
c. Cu  
d. oxygen  
e. carbon  
f. sulfur

9. A change in the properties of a substance without a change in composition is a physical change. When a chemical change occurs, there is a change in the composition of a substance.

10. In any physical or chemical reaction, mass is neither created nor destroyed; it is conserved.
A. Completion

Use this completion exercise to check your understanding of the concepts and terms introduced in this chapter. Each blank can be completed with a term, short phrase, or number.

Chemistry is a natural science that deals with __1__ and the changes it undergoes. Matter is anything that has __2__ and occupies __3__. Matter exists in three states, __4__, __5__, and __6__.

Chemists use the __7__ method to learn how matter can be changed. An __8__ is a means that a chemist can use to test a hypothesis about changes in matter. A physical combination of two or more substances is a __9__. A mixture has a variable composition and may be identified as __10__ or __11__. Homogeneous mixtures are known as __12__ and have uniform properties.

A pure substance is either a __13__ or a __14__. Compounds are made up of __15__, which are always present in the same __16__ in a given compound. Compounds can be separated into their constituent elements only by __17__ reaction. A change in the properties of a substance without a change in the composition is a __18__ change. If the composition changes, then a __19__ reaction has occurred. In a chemical reaction, __20__ are converted to products. __21__ changes are usually reversible; many __22__ changes are not easily reversible. The law of __23__ states that mass is neither created nor destroyed in any physical or chemical reaction.
B. Questions

Answer the following questions in the space provided.

24. State whether each of the following is a homogeneous or heterogeneous mixture.

   a. oxygen dissolved in water
   b. carbon mixed with sand
   c. apple juice
   d. vegetable soup
   e. sour milk

25. When 400 grams of wood are burned, 30 grams of ash remain. What happened to the missing 370 g of matter?

26. Car batteries give off a potentially explosive mixture of gases. What kind of change is taking place in the battery?

Reviewsheet

A. Completion

1. matter
2. mass
3. space
4. solid
5. liquid
6. gas
7. scientific
8. experiment
9. mixture
10. heterogeneous or homogeneous
11. homogeneous or heterogeneous
12. solutions
13. element or compound
14. compound or element
15. elements
16. ratio
17. chemical
18. physical
19. chemical
20. reactants
21. physical
22. chemical
23. conservation of mass

B. Questions

24. a. homogeneous  
   b. heterogeneous  
   c. homogeneous  
   d. heterogeneous  
   e. heterogeneous

25. The products of the chemical change are gases and water vapor that mix with the air.

26. a chemical change