

Chapter 1
An Introduction to Chemistry
Advanced Chemistry

1.1 The Nature of Chemistry

Learning Objective	
State the definition of chemistry and why the study of chemistry is important	<ul style="list-style-type: none"> Chemistry is the science of composition, structure, properties, and reactions of matter, especially of atomic and molecular systems. Importance of studying chemistry: <ul style="list-style-type: none"> Chemistry is important to everyone because chemistry occurs all around us in our daily lives. Chemistry is the science dealing with matter and the changes in composition that matter undergoes. Chemists seek to understand the general principles governing the behavior of all matter. Chemistry “looks inside” ordinary objects to study how their components behave. Chemistry connects the macroscopic and microscopic worlds.
Key Term	
Chemistry	Chemistry is the science of composition, structure, properties, and reactions of matter, especially of atomic and molecular systems.

1.2 A Scientific Approach to Problem Solving

Learning Objective	
Describe the steps involved in the scientific method.	<ul style="list-style-type: none"> The scientific method is a procedure for processing information in which we: <ul style="list-style-type: none"> Collect the facts Formulate a hypothesis Plan and do experiments Modify the hypothesis <p>© 2014 John Wiley & Sons, Inc. All rights reserved.</p> <ul style="list-style-type: none"> Scientific thinking helps us solve problems in our daily lives. General steps for solving problems include: <ul style="list-style-type: none"> Defining the problem Proposing possible solutions Solving the problem
Key Terms	
Scientific Method	A method of solving problems by observation; recording and evaluating data of an experiment; formulating hypothesis and theories to explain the behavior of nature; and devising additional experiments to test the hypothesis and theories to see if they are correct.
Hypothesis	A tentative explanation of certain facts to provide a basis for further experimentation.

Theory	An explanation of the general principles of certain phenomena with considerable evidence to support it; a well-established hypothesis.
Scientific laws	Simple statements of natural phenomena to which no exceptions are known under the given conditions.

1.3 The Particulate Nature of Matter

Learning Objective

Describe the characteristics of matter, including states of matter	<ul style="list-style-type: none"> Matter is anything with the following two characteristics: has mass and occupies space. On the macroscopic level matter appears continuous. On the microscopic level matter is discontinuous and composed of atoms. Solid—rigid substance with definite shape Liquid—fluid substance with a definite volume that takes the shape of its container Gas—takes the shape and volume of its container
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Key Terms

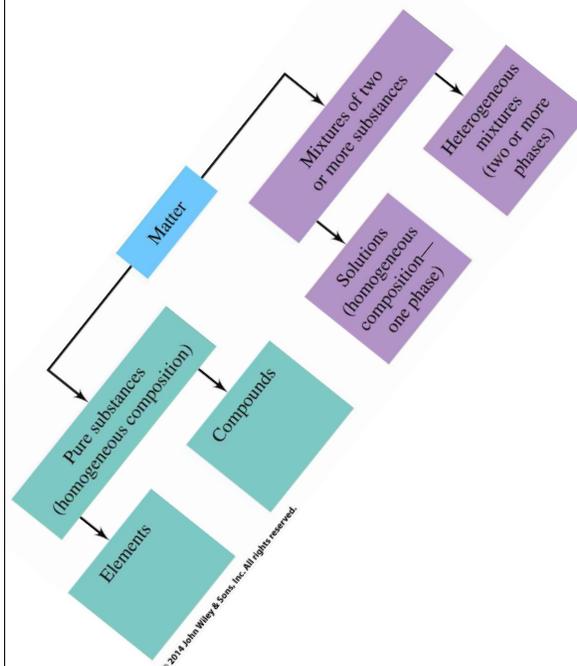
Matter	Anything that has mass and occupies space.
Solid	A state of matter having definite shape and a definite volume, whose particles cohere rigidly to one another, so that a solid can be independent of its container.
Amorphous	A solid without shape or form (e.g., plastics, glass, and gels do not have any regular, internal geometric pattern).
Liquid	A state of matter in which the particles move about freely while the substance retains a definite volume; thus, liquids flow and take the shape of their containers.
Gas	A state of matter that has no shape or definite volume so that the substance completely fills its container.

1.4 Classifying Matter

Learning Objective

Distinguish among pure substances, a homogeneous mixture, and a heterogeneous mixture.

- Matter can be classified as a pure substance or a mixture.
- A mixture has variable composition:
 - Homogeneous mixtures have the same properties throughout.
 - Heterogeneous mixtures have different properties in different parts of the system.
- A pure substance always has the same composition. There are two types of pure substances: elements and compounds.



Key Terms	
Substance	Matter that is homogeneous and has a definite, fixed composition; substances occur in two forms—as elements and as compounds.
Homogeneous	Matter that has uniform properties throughout.
Heterogeneous	Matter without a uniform composition—having two or more components or phases.
Phase	A homogeneous part of a system separated from other parts by a physical boundary.
System	A body of matter under consideration.
Mixture	Matter containing two or more substances, which can be present in variable amounts; mixtures can be homogeneous (sugar water) or heterogeneous (sand and water).