

# Chapter 1      Chemistry: An Introduction

## 1.1    The Science of Chemistry

### Key Term

chemistry

### Summary

A knowledge of chemistry is useful to almost everyone. Chemistry is central to people's efforts to create new products; to produce cleaner, more abundant sources of energy; and to cure diseases that harm people as well as animals and plants that provide food. However, the knowledge of chemicals sometimes results in problems for people, other living things, and the environment. Studying chemistry can help solve these problems. Studying chemistry has other important benefits. It broadens a person's understanding of how the natural world operates, and it can make a person a better problem solver. The logical, step-by-step approach used to solve complicated chemistry problems can be applied to the solution of problems in many areas of life.

*Chemistry* can be defined as “the science that deals with the materials of the universe and the changes that these materials undergo.” Most of the natural events that occur involve chemical changes in which one or more substances transform into different substances. Chemists “look inside” ordinary objects to see how their most basic parts—atoms and molecules—work.

## 1.2    Using Science to Solve Problems

### Key Terms

scientific method  
measurement

theory

natural law

### Summary

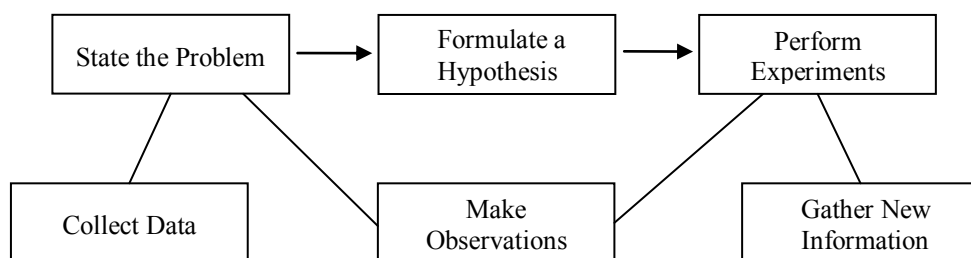
Almost everyone uses similar steps to solve problems. First, people recognize the problem and state it clearly. Next, they propose possible solutions to the problem or suggest possible explanations for what they know about the problem. Finally, they decide which solutions to the problem are the best or which explanation is the most reasonable.

Scientists solve complex problems by breaking them down into manageable parts. Scientific thinking involves three main activities: making observations to collect information and help define the problem; forming a hypothesis, or educated guess, as to what the observations mean; and testing the hypothesis by performing experiments. After these three steps are completed, a scientist may come up with a theory, or an overall explanation of the findings that summarizes the hypothesis and agrees with the results of the experiment. This process can be used to solve most kinds of problems, not just scientific ones.

Science is a framework for gaining knowledge of nature and putting it together in a way that makes sense. Science is based on facts, but it is also a plan of action for studying and understanding certain types of information. When scientists use scientific thinking specifically to understand how the world of nature works, the step-by-step process of problem solving is called the *scientific method*. The scientific method has three steps:

1. State the problem and then collect data by making observations.
2. Formulate a hypothesis, or a possible explanation for the observations.
3. Perform experiments to test the hypothesis. Experiments produce new observations and allow scientists to gather new information. Such new information leads scientists to restate the problem, and the process begins again.

### Steps in the Scientific Method



Once the observations, experiments, and hypothesis support one another, a theory can be formed. A *theory* is a possible explanation of some part of nature. Theories are not permanent. They are being changed constantly as new information becomes available. When the same observation applies to many different natural systems, this observation may be summarized in a statement called a *natural law*. A law and a theory differ in the following way: A *law* is a summary of observed behavior that tells what happens. A *theory* is an explanation of why it happens.

## 1.3 Learning Chemistry

### Summary

Learning chemistry involves understanding nature on a level so tiny that we do not ordinarily see it—the microscopic level. Chemistry involves memorizing many unfamiliar terms and definitions and working hard to understand basic ideas and models that explain how complex chemical processes work. To achieve this, someone learning chemistry should be patient with trial and error. Even an experienced chemist does not expect to be right the first time he or she tackles a difficult problem in chemistry.

## **Additional Active Reading Questions**

1. How can studying chemistry make a person a better problem solver?
2. What is the definition of chemistry?
3. What is the first step in solving a problem using a scientific approach?
4. What is a theory?
5. What is the difference between a law and a theory?
6. Why do you think trial and error is important in learning chemistry?