Chapter

2

Chemical Bonding

In this chapter, you will be able to

- describe the role of electrons in ionic and covalent bonding;
- relate the physical and chemical properties of compounds to the nature of their chemical bonds;
- predict the nature of bonds by comparing electronegativity values;
- use a variety of models to represent the formation and structure of compounds and molecular elements;
- name a variety of compounds using common names, classical names, and IUPAC chemical nomenclature.

In caves we can sometimes see large structures known as stalagmites (**Figure 1**). These formations are made of crystals of calcium carbonate, $CaCO_{3(s)}$, also known as limestone. Calcium carbonate, as its name and formula suggest, is a compound made up of three different elements. In addition to its crystalline structure, calcium carbonate has high melting and boiling points and dissolves to some extent in water. Many other compounds have similar physical and chemical properties, such as ordinary table salt, sodium chloride. Other compounds, such as water, H_2O, and carbon dioxide, CO_2, have significantly different properties. How can we explain these similarities and differences? The answer lies in an understanding of the special forces of attraction, or bonds, that hold atoms together in compounds. These forces form the foundation of chemical properties and reactions.

As you know, we often develop models to help us understand abstract concepts. You are already familiar with several models: Bohr's model of the atom; the water cycle; the collision model. In this chapter we will develop theories and models of chemical bonding (including the character of atomic bonds) to explain the nature and behaviour of matter and to classify compounds.

Reflect on your Learning

1. Why do atoms form compounds? Use examples of compounds you are familiar with in your explanation.
2. Is there more than one type of force present between the atoms in compounds and, if so, how do these forces compare in strength and other properties?
3. How could the forces that hold atoms together in a compound determine the chemical properties of that compound? Again, use examples of familiar compounds and their properties in your speculations.

Throughout this chapter, note any changes in your ideas as you learn new concepts and develop your skills.

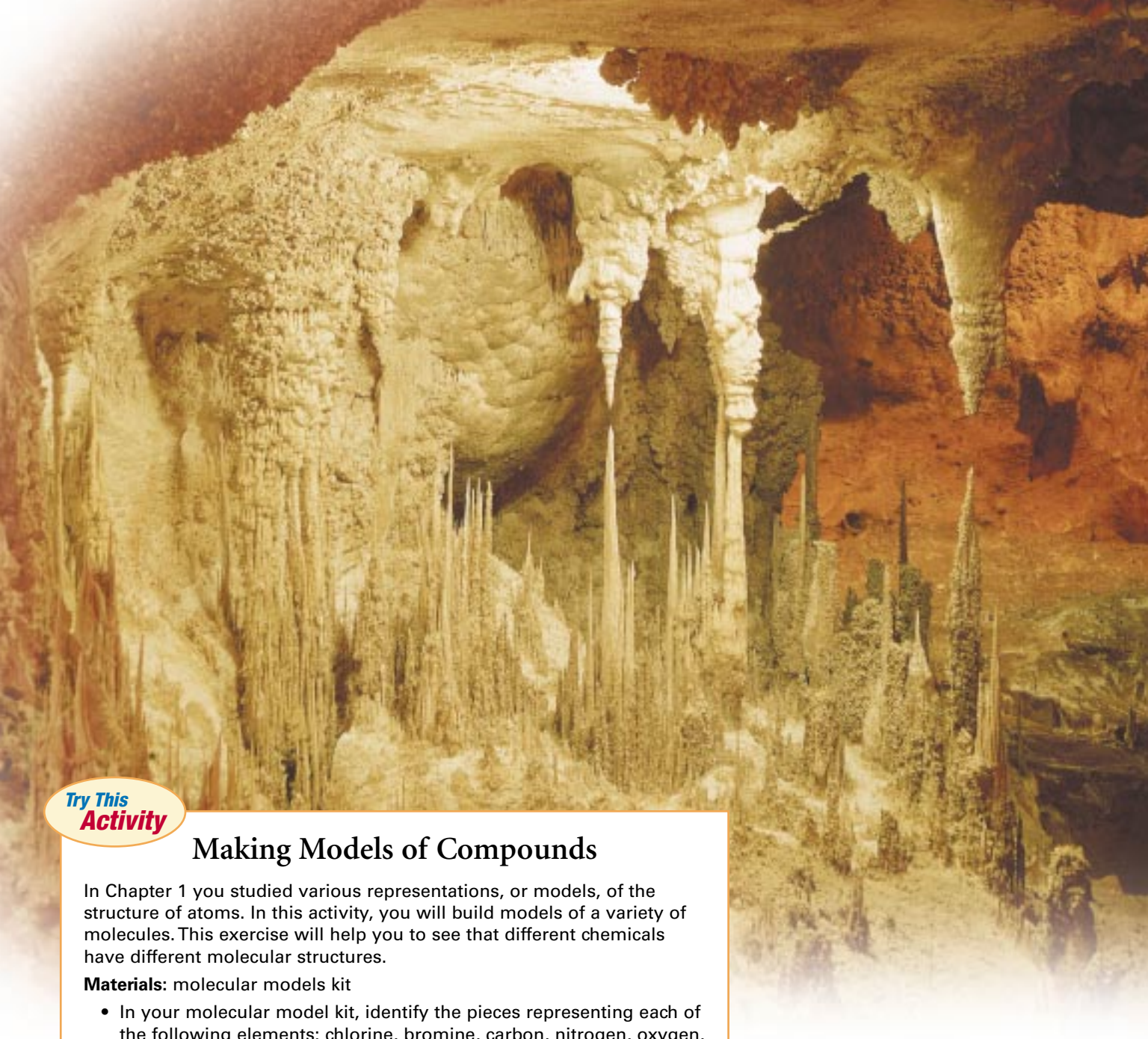

Figure 1
Stalagmites are shown extending upward from this cavern floor. As you can see, these calcium carbonate formations have the potential to join floor to ceiling in a continuous pillar.

Try This Activity

Making Models of Compounds

In Chapter 1 you studied various representations, or models, of the structure of atoms. In this activity, you will build models of a variety of molecules. This exercise will help you to see that different chemicals have different molecular structures.

Materials: molecular models kit

- In your molecular model kit, identify the pieces representing each of the following elements: chlorine, bromine, carbon, nitrogen, oxygen, iodine, and hydrogen.
- Group the different pieces according to the number of holes present.
  (a) To what chemical family or families do these groups of pieces correspond on the periodic table?
  (b) What do the holes in the pieces represent?
  (c) What do the sticks represent in your molecular model kit?
- Construct as many different compounds as possible using the pieces in the kit.
  (d) As best you can, name the compounds you have modelled (later in this chapter you will learn a system for naming compounds).
  (e) How do the connections differ among your models?
  (f) Classify the models by dividing them into groups. Provide a rationale for your classification.
  (g) Organize the models into two more classification schemes. Provide a rationale for each classification.