



CHAPTER 1

CHEMICAL BONDING

Organic chemistry is the study of carbon compounds. It is a vast field, one that encompasses a great deal of information and that is inherently useful. Research in organic chemistry continues to provide new materials that enrich our lives, new drugs that extend them, and new knowledge that describes the chemical basis of life itself. An understanding of organic chemistry must begin with an understanding of molecular structure. **Structure** is the key to everything in chemistry. The properties of a substance depend on the atoms it contains and the way they are connected. What is less obvious, but very powerful, is the idea that someone who is trained in chemistry can look at a structural formula of a substance and tell you a lot about its properties. This chapter begins your training toward understanding the relationship between structure and properties in organic compounds. It reviews some fundamental principles of molecular structure and chemical **bonding**. By applying these principles you will learn to recognize which structural patterns are more stable than others and develop skills in communicating chemical information by way of structural formulas that will be used throughout your study of organic chemistry.

1.1 ATOMS, ELECTRONS, AND ORBITALS

Before discussing bonding principles, let's first review some fundamental relationships between atoms and electrons. Each element is characterized by a unique **atomic number Z**, which is equal to the number of protons in its nucleus. A neutral atom has equal numbers of protons, which are positively charged, and electrons, which are negatively charged. The electrons spend 90–95% of their time near the nucleus in regions of space called **orbitals**.

CHAPTER OUTLINE

- 1.1 Atoms, Electrons, and Orbitals
- 1.2 Ionic Bonds
- 1.3 Covalent Bonds
- 1.4 Double Bonds and Triple Bonds
- 1.5 Polar Covalent Bonds and Electronegativity
- 1.6 Formal Charge
- 1.7 Structural Formulas of Organic Molecules
- 1.8 Isomers and Isomerism
- 1.9 Resonance
- 1.10 The Shapes of Some Simple Molecules
- Molecular Models**
- 1.11 Molecular Polarity
- 1.12 sp^3 Hybridization and Bonding in Methane
- 1.13 Bonding in Ethane
- 1.14 sp^2 Hybridization and Bonding in Ethylene
- 1.15 sp Hybridization and Bonding in Acetylene
- Learning Objectives**
- 1.16 Summary
- Additional Problems**

A glossary of important terms may be found immediately before the index at the back of the book.