CHAPTER 7
COVALENT BONDS AND MOLECULAR STRUCTURE

We will spend three lecture days on this chapter. In this chapter we will learn more about the structure of the covalent molecules. We will start with a discussion of electronegativity, bond polarity, dipoles, ion electron configuration and relative size, lattice energy, covalent bond energies, and Lewis dot structures. Once we are able to sketch Lewis dot structures for molecules, we will take up some exceptions to the octet rule, the concept of resonance, formal charge, and the shape of molecules. Finally, we will cover expanded octets, hybridization, σ and π bonds.

Section 7.1
- ❑ Determine the H–H bond length from a plot of potential energy versus internuclear distance for the hydrogen mlecule.
- ❑ Use atomic radii to estimate bond length.

Section 7.2
- ❑ Define bond dissociation energy, *D*.
- ❑ Give a range of bond dissociation energies for common bonds.

Section 7.3
- ❑ From a list of compounds, predict which are ionic and which are molecular.

Section 7.4
- ❑ Using only the periodic table, predict which of two elements is more electronegative.
- ❑ Using only the periodic table, predict whether a given bond is ionic, polar covalent, or nonpolar covalent.
- ❑ Using a table of electronegativities, predict which of two bonds is expected to be more polar.
- ❑ Do Problems 1 – 3 on pg 228, Problems 38, 40, 42 (a-e), and 44 on pg 267

Section 7.5
- ❑ Write Lewis symbols for atoms, and tell how many electrons must be shared to enable the atom to achieve a completed valence shell. Give the symbol of the noble gas with the same number of valence electrons.
- ❑ Draw electron-dot structures for simple molecules.
- ❑ Do Problems 4 and 5 on page 232

Section 7.6
- ❑ Draw electron-dot structures for polyatomic molecules and ions, recognizing when multiple bonding is needed.
- ❑ For each atom in an electron-dot structure, give the number of bonded electron pairs and the number of nonbonded electron pairs.
- ❑ For a given electron-dot structure, give the number of single bonds, double bonds, and triple bonds. Give the bond order of each bond.
- ❑ Do Problems 6 – 8 on pg 235, Problems 9 – 11 on pg 238, Problem 36 on pg 266, Problem 48 on pg 267, Problems 94 and 96 on pg 269 and Problem 104 on pg 270.

Section 7.7
- ❑ Draw electron-dot structures for polyatomic molecules and ions, recognizing when resonance structures are needed.
- ❑ Give the bond order of each bond in an electron-dot structure that requires resonance structures.
- ❑ Do Problems 12 – 14 on pg 240, Problems 50, 52, 56, 58 on pg 267, and Problems 98 and 110 on pg 270.

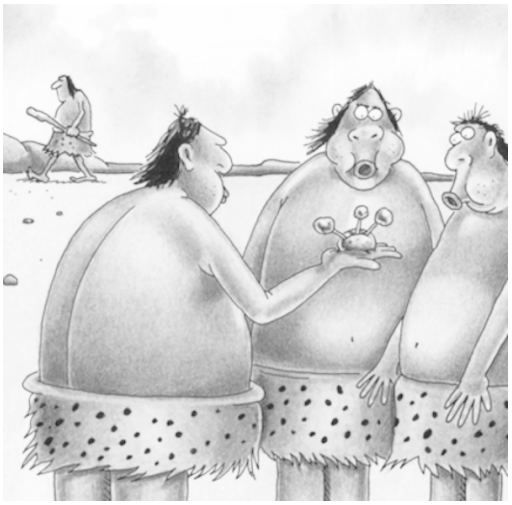
Section 7.8
- ❑ Calculate the formal charge on each atom in a molecule.
- ❑ Determine the formal charge on each atom in a resonance structure, and use the formal charges to select the best resonance structure.
- ❑ Do Problems 15 – 16 on pg 242, Problem 60 on 267, and Problems 62 and 64 on pg 268.

Section 7.9

- ❏ Use the VSEPR model to predict the geometries of molecules and polyatomic ions, including those with more than one central atom.
- ❏ Do Problems 17 – 19 on pages 249 and 250, Problems 32 and 34 on pg 266, Problems 66, 68, 70 (a, c, d), 72 (a – c), 74 (a, c – f), 76, 78, and 80 on pg 268, and Problems 100 and 116 on pg 271.

Section 7.10

- ❏ For molecules and polyatomic ions, sketch and identify the orbitals used by each atom to form bonds. Show which orbital overlaps result in σ bonds and which result in π bonds.
- ❏ Do Problem 112 on pg 271.



The structure of ammonia surprised early scientists.

Section 7.11

- ❏ Describe the formation of sp^3 hybrid orbitals, and give the spatial orientation of the four sp^3 hybrid orbitals.
- ❏ Describe the bonding in a polyatomic molecules, and tell which atoms use of sp^3 hybrid orbitals to form bonds.
- ❏ Do Problem 20 on pg 253

Section 7.12

- ❏ Describe the formation of *sp* and sp^2 hybrid orbitals, and give the spatial orientation of the two *sp* hybrid orbitals and the three of sp^2 hybrid orbitals, and identify the orbitals involved in bonding.
- ❏ Describe the bonding in a polyatomic molecules, and tell what kinds of orbitals on each atom overlap to form bonds.
- ❏ Do Problem 21 on pg 254, Problem 22 on pg 255, Problems 23 – 25 on pg 256, Problems 84 and 86 on pg 269, and Problem 102 on pg 270.

Skip Section 7.13 – 7.15.