8.6 Incomplete Lewis structures for the nitrous acid molecule, HNO_2, and the nitrite ion, NO_2^-, are shown here. (**a**) Complete each Lewis structure by adding electron pairs as needed. (**b**) Is the formal charge on N the same or different in these two species? (**c**) Would either HNO_2 or NO_2^- be expected to exhibit resonance? (**d**) Would you expect the N=O bond in HNO_2 to be longer, shorter, or the same length as the N—O bonds in NO_2^-? [Sections 8.5 and 8.6]

$$H—O—N=O \qquad O—N=O$$

8.9 (**a**) True or false: An element's number of valence electrons is the same as its atomic number. (**b**) How many valence electrons does a nitrogen atom possess? (**c**) An atom has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^2$. How many valence electrons does the atom have?

8.11 Consider the element silicon, Si. (**a**) Write its electron configuration. (**b**) How many valence electrons does a silicon atom have? (**c**) Which subshells hold the valence electrons?

Write the Lewis symbol for atoms of each of the following elements: (**a**) Al, (**b**) Br, (**c**) Ar, (**d**) Sr.

8.17 Predict the chemical formula of the ionic compound formed between the following pairs of elements: (**a**) Al and F, (**b**) K and S, (**c**) Y and O, (**d**) Mg and N.

8.21 (**a**) Is lattice energy usually endothermic or exothermic? (**b**) Write the chemical equation that represents the process of lattice energy for the case of NaCl. (**c**) Would you expect salts like NaCl, which have singly charged ions, to have larger or smaller lattice energies compared to salts like CaO which are composed of doubly-charged ions?

Covalent Bonding, Electronegativity, and Bond Polarity (Sections 8.3 and 8.4)

8.31 (**a**) State whether or not the bonding in each substance is likely to be covalent: (i) iron, (ii) sodium chloride, (iii) water, (iv) oxygen, (v) argon. (**b**) A substance XY, formed from two different elements, boils at −33 °C. Is XY likely to be a covalent or an ionic substance?

8.37 Which of the following statements about electronegativity is false? (**a**) Electronegativity is the ability of an atom in a molecule to attract electron density toward itself. (**b**) Electronegativity is the same thing as electron affinity. (**c**) The numerical values for electronegativity have no units. (**d**) Fluorine is the most electronegative element. (**e**) Cesium is the least electronegative element.

8.41 Which of the following bonds are polar? (**a**) B—F, (**b**) Cl—Cl, (**c**) Se—O, (**d**) H—I. Which is the more electronegative atom in each polar bond?

8.42 Arrange the bonds in each of the following sets in order of increasing polarity: (**a**) C—F, O—F, Be—F; (**b**) O—Cl, S—Br, C—P; (**c**) C—S, B—F, N—O.

8.51 Write Lewis structures that obey the octet rule for each of the following, and assign oxidation numbers and formal charges to each atom: (**a**) OCS, (**b**) $SOCl_2$ (*S is the central atom*), (**c**) BrO_3^-, (**d**) $HClO_2$ (H is bonded to O).

Exceptions to the Octet Rule (Section 8.7)

8.59 (**a**) Which of these compounds is an exception to the octet rule: carbon dioxide, water, ammonia, phosphorus trifluoride, or arsenic pentafluoride? (**b**) Which of these compounds or ions is an exception to the octet rule: borohydride (BH_4^-), borazine ($B_3N_3H_6$, which is analogous to benzene with alternating B and N in the ring), or boron trichloride?

8.71 State whether each of these statements is true or false. (**a**) The longer the bond, the larger the bond enthalpy. (**b**) C—C bonds are stronger than C—H bonds. (**c**) A typical single bond length is in the 5–10 Å range. (**d**) If you break a chemical bond, energy is released. (**e**) Energy is stored in chemical bonds.

8.72 State whether each of these statements is true or false. (**a**) A carbon–carbon triple bond is shorter than a carbon–carbon single bond. (**b**) There are exactly six bonding electrons in the O_2 molecule. (**c**) The C—O bond in carbon monoxide is longer than the C—O bond in carbon dioxide. (**d**) The O—O bond in ozone is shorter than the O—O bond in O_2. (**e**) The more electronegative the atom, the more bonds it makes to other atoms.