Chemistry CP

Name:

Review Sheet

Bonding (Chapter 6)

After studying chapter 6, you should be able to:

- Infer the number of valence electrons in an atom of a main-group element, and then construct its Lewis dot structure.
- Explain why most atoms form chemical bonds.
- Describe the formation of a cation from a metallic element and the formation of an anion from a non-metallic element.
- State the octet rule.
- List the characteristics of a covalent bond.
- Create Lewis structures for covalent compounds containing single, double, and triple bonds.
- Explain the modern interpretation of resonance bonding.
- List the characteristics of an ionic bond.
- Explain the properties of metals by using the concept of metallic bonding.
- Compare and contrast the properties of ionic and molecular compounds.
- Classify bonds as ionic, covalent, or polar based on electronegativity differences.
- Use electron dot formulas to determine chemical formulas for binary ionic compounds.
- Describe the shapes of simple covalently bonded molecules using VSEPR theory.
- Use the bond types and geometry of molecules to determine molecular polarity.
- Explain the relationship between bond length and bond energy.

Problems for you to try:

1. For the following elements, write out the electron configuration of a ground state atom, state the number of valence electrons, draw the Lewis structure, and predict how many electrons the atom needs to lose or gain to achieve the electron structure of a noble gas. (pp. 170, 177)

Element	Electron configuration	Valence Electrons	Lewis Structure	Electrons to Lose or Gain
Li				
N				
Ne				
P				

2. Calculate the electronegativity difference for the atoms that are bonded in the following diatomic molecules. Then tell whether the bond is nonpolar covalent, polar covalent, or ionic, and which atom has the greater share of the bonding electrons. (pp. 162-163)

Formula	Electronegativity Difference	Type of Bond	Atom With Greater Electron Share
NO			
SrO			
Br_2			
LiH			

3. State the octet rule. (p. 169)

4. What is the difference between a polar bond and a nonpolar bond? (p. 162)

5. What is resonance? Give an example of a molecule with resonance. Explain your choice. (p. 175)

6. Explain how metallic bonds give rise to the characteristic properties of metals. (pp. 181-182)

7. Use Lewis structures to show the transfer of electrons to form ionic compounds from the following combinations of atoms. State the formula of the compound that forms. (p. 177)

   a. Na and F

   b. Mg and Br

   c. Be and O

   d. K and S

8. Draw Lewis structures for the following covalent compounds. (pp. 170-174)

   a. ClF

   b. Cl_2O

   c. C_2Cl_2

   d. PH_3

   e. C_2Br_4

   f. SiO_2

Methane (CH_4), ammonia (NH_3), and water (H_2O) are common molecular compounds that have hydrogen atoms bonded to atoms of second period elements. Use the table below to answer the following questions. (pp. 167-168)

Bond	Bond dissociation energy (kJ/mol)
C-H	414
N-H	391
O-H	463

9. Review the relationship between bond length and bond energy to predict which molecules have the longest bonds.

10. Which has the strongest (most stable) bonds?

11. Identify the following shapes of molecules. (pp. 183-185)

a) _____ b) _____

c) _____ d) _____

e) _____ f) _____

g) _____ h) _____

12. Draw each molecule using lines to represent bonds and dots to represent lone pairs. Indicate the geometry of the molecule. Use electronegativity differences (see p. 151 in your textbook) of the atoms involved and determine if whether each bond is polar. If it is polar, add an arrowhead to the lines representing the bonds, pointing toward the more electronegative atom. Finally, decide whether the molecule as a whole is polar. (Hint: Do the arrows cancel out or not?) If it is, draw a large arrow near the molecule to indicate the direction of polarity. The first substance has been done as an example. (p. 191)

Formula	Representation	Shape	Polarity of Bonds	Polarity of Molecule
NI_3				
NCl_3				
BCl_3 (note: does not obey octet rule for B)				
CCl_4				
CH_3Cl				

13. Complete the following table on the properties of ionic and covalent compounds. (p. 179)

Property	Covalent Compounds	Ionic Compounds
Types of elements in formula		
How bond forms between atoms		
Molecule or lattice?		
Common state of matter		
Boiling point		
Melting point		
Soluble in water?		
Conductivity of aqueous solution		