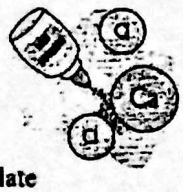
LESSON 26

Electron Glue
Bonding

Name _____

Date _____ Period _____



Purpose

To investigate the different types of bonding found in substances and to relate bonding to the physical properties of substances.

Procedure

Read the handout Four Models of Bonding. Study the information on the Substance cards. Your job is to match each substance to its appropriate type of bonding on the handout.

Use the information on the cards to sort the 16 substances into the four categories of bonding. Write your results in the table.

Ionic	Network covalent	Metallic	Molecular covalent
$NaCl(s)$			
$NaCl(aq)$	$C(s)$	$Na(s)$	$CH_4(g)$
$CaCl_2(aq)$	$Si(s)$	$Hg(l)$	$CH_3CH_2OH(l)$
$NaOH(aq)$	$SiO_2(s)$*	$Cu(s)$	$H_2O(l)$
$MgSO_4(s)$		$Pt(s)$	$C_{12}H_{22}O_{11}(s)$

*Students might classify SiO_2 as molecular covalent.

1. Are there any substances that don't seem to fit properly in the categories you have placed them in? List them here and explain.

   Answers will vary. For example, magnesium sulfate has both ionic and covalent bonding (within the sulfate anion). Silicon is similar to carbon, but silicon conducts.

   Use the handout to answer these questions.

2. What do the pictures of the four models of bonding attempt to show?

   Sample answer: The pictures attempt to show how the valence electrons are distributed among the atoms of each bonded substance.

3. Give the type of bonding for each substance described here.
   a. A substance made up entirely of metal atoms — metallic bonding
   b. A substance made up of both metal and nonmetal atoms — ionic bonding
   c. A substance made up entirely of nonmetal atoms

      either molecular covalent or network covalent bonding

4. Some substances made up entirely of nonmetal atoms are soluble in water, while others are not. Use the bonding models to explain why.

   In network covalent bonding, atoms are linked in all directions, so they can't break off and dissolve. In contrast, molecular covalent solids consist of bonded clusters of atoms.

5. How might the model for network covalent bonding explain the incredible hardness of a diamond?

   There is a strong network of bonds in all directions among all the carbon atoms.

6. Both sugar and salt dissolve in water, but they bond differently. Use the models to explain how these two substances might be different after they dissolve.

   Sugar is molecular covalent. When sugar dissolves, the solid breaks apart into individual molecules. Salt is an ionic solid. When salt dissolves, it breaks apart into individual ions.

7. Which bonding model would you predict for the following substances? Which are compounds and which are elements?

   a. KI, potassium iodide ionic; compound

   b. CO_2, carbon dioxide gas molecular covalent; compound

   c. Au, gold metallic; element

   d. Cl_2, chlorine gas molecular covalent; element

8. Which of the bonding models are found in elemental substances? Explain, using examples.

   All but the ionic model of bonding are found in elemental substances. Diamond, copper, and oxygen gas exhibit three different types of bonding, but each involves only one type of atom.

9. **Making Sense** If you have the chemical formula of a substance, what can you figure out about its properties? Explain. Use the compound silver nitrate, $AgNO_3$, as an example.

   You can figure out the type of bonding in the substance and from there something about its properties, such as hardness, phase, solubility, and conductivity. Silver nitrate is an ionic substance because it has a metal bonded to nonmetal atoms. It is a brittle solid that will dissolve in water, conduct electricity once it is dissolved, and form ions in solution.