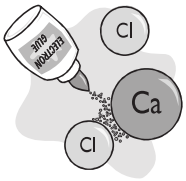
LESSON 26
ACTIVITY

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

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.

Use the handout to answer these questions.

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

3. Give the type of bonding for each substance described here.

a. A substance made up entirely of metal atoms

b. A substance made up of both metal and nonmetal atoms

c. A substance made up entirely of nonmetal atoms

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

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

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.

7. Which bonding model would you predict for the following substances? Which are compounds and which are elements?
   - **a.** KI, potassium iodide
   - **b.** CO_2, carbon dioxide gas
   - **c.** Au, gold
   - **d.** Cl_2, chlorine gas
8. Which of the bonding models are found in elemental substances? Explain, using examples.

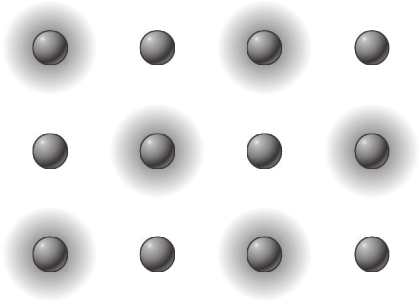
9. **Making Sense** If you have the chemical formula of a substance, what can you figure out about its properties? Explain. Use the compound silver nitrate, $AgNO_3$, as an example.

FOUR MODELS OF BONDING

Each sphere in the drawing represents an atom. The gray shaded areas represent places where the negatively charged valence electrons might be found with each type of bond.

Model 1: Ionic

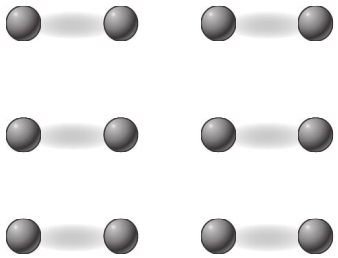
Properties:
Dissolve in water
Conduct electricity when dissolved
Brittle solids
Made of metal and nonmetal atoms combined



Metal atoms "give up" their valence electrons to nonmetal atoms.

Model 2: Molecular Covalent

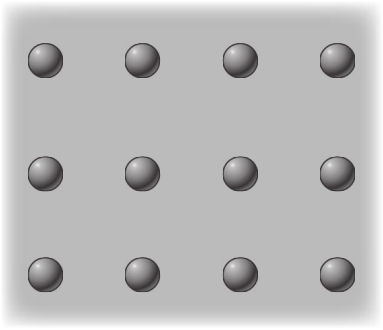
Properties:
Some dissolve in water, some do not
Do not conduct electricity
Some are liquids or gases
Made entirely of nonmetal atoms



Valence electrons are shared between some atoms. This creates small stable units within the substance.

Model 3: Metallic

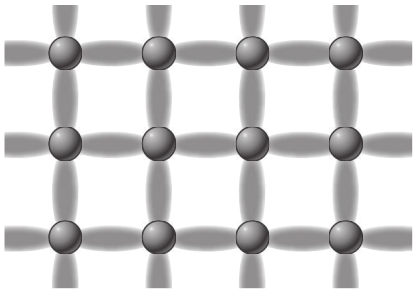
Properties:
Do not dissolve in water
Conduct electricity
Bendable and hard solids
Made entirely of metal atoms



Valence electrons are free to move about the substance.

Model 4: Network Covalent

Properties:
Do not dissolve in water
Do not conduct electricity
Extremely hard solids
Made entirely of nonmetal and metalloid atoms



Valence electrons connect atoms with each other in all directions, like a grid or network.

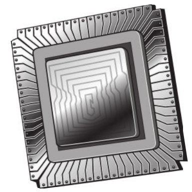
SUBSTANCE CARDS

Water, $H_2O(l)$

Liquid

Does not conduct

Silicon, $Si(s)$

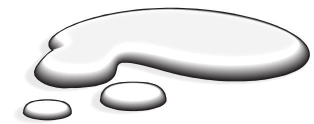


Hard solid

Does not dissolve

Sometimes conducts

Mercury, $Hg(l)$



Liquid

Does not dissolve

Conducts

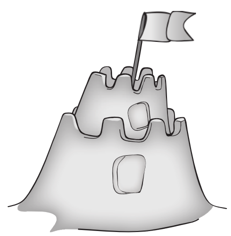
Methane, $CH_4(g)$

Gas

Does not dissolve

Does not conduct

Sand, $SiO_2(s)$

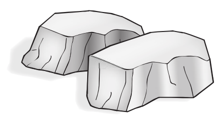


Hard solid

Does not dissolve

Does not conduct

Sodium, $Na(s)$



Soft, very malleable solid

Does not dissolve

Conducts

Salt Water, $NaCl(aq)$

Aqueous solution

Dissolved

Conducts

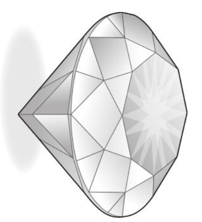
Platinum, $Pt(s)$

Malleable, ductile solid

Does not dissolve

Conducts

Diamond, $C(s)$

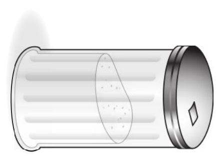


Very hard solid

Does not dissolve

Does not conduct

Table Sugar, $C_{12}H_{22}O_{11}(s)$

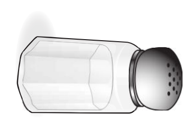


Soft solid

Dissolves

Does not conduct

Table Salt, $NaCl(s)$



Brittle solid

Dissolves

Does not conduct (as a solid)

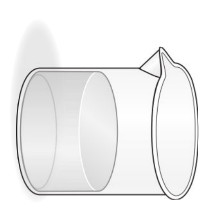
Copper, $Cu(s)$

Malleable, ductile solid

Does not dissolve

Conducts

Aqueous Copper Chloride, $CuCl_2(aq)$



Aqueous solution

Dissolved

Conducts

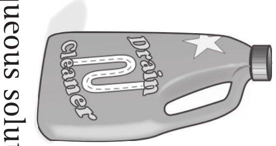
Ethanol, $C_2H_6O(l)$

Liquid

Dissolves

Does not conduct

Drain Cleaner, $NaOH(aq)$



Aqueous solution

Dissolved

Conducts

Epsom Salt, $MgSO_4(s)$

Brittle solid

Dissolves

Does not conduct (as a solid)