

LESSON
26

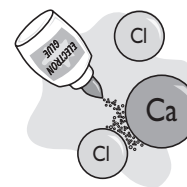
ACTIVITY

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

- 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.

- What do the pictures of the four models of bonding attempt to show?
- Give the type of bonding for each substance described here.
 - A substance made up entirely of metal atoms
 - A substance made up of both metal and nonmetal atoms
 - 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. CO₂, carbon dioxide gas
 - c. Au, gold
 - d. Cl₂, 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, AgNO₃, as an example.

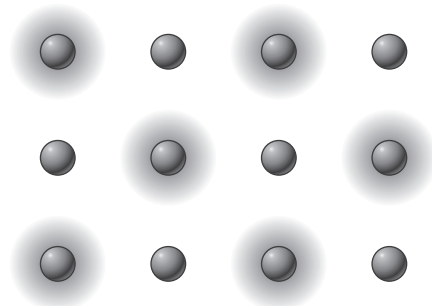
FOUR MODELS OF BONDING

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

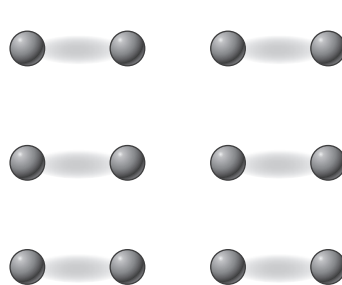


Metal atoms "give up" their valence electrons to nonmetal atoms.

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

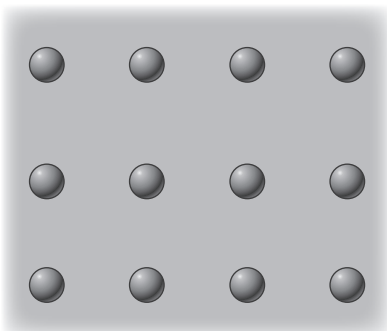


Valence electrons are shared between some atoms. This creates small stable units within the substance.

Model 3: Metallic

Properties:

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

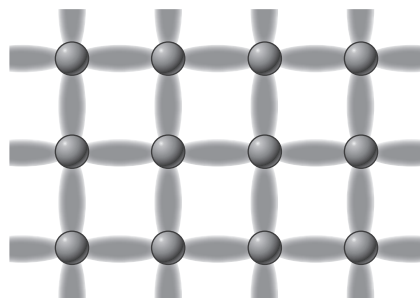


Valence electrons are free to move about the substance.

Model 4: Network Covalent

Properties:

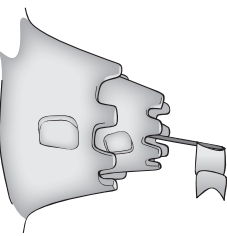
Do not dissolve in water
Do not conduct electricity
Extremely hard solids
Made entirely of nonmetal and metalloid atoms



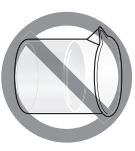
Valence electrons connect atoms with each other in all directions, like a grid or network.

SUBSTANCE CARDS


Sand,
 $\text{SiO}_2(\text{s})$



Hard solid




Does not dissolve

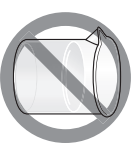


Does not conduct


Sodium,
 $\text{Na}(\text{s})$



Soft, very malleable solid




Does not dissolve

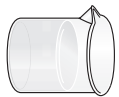


Conducts


Salt Water,
 $\text{NaCl}(\text{aq})$



Aqueous solution




Dissolved

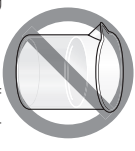


Conducts


Platinum,
 $\text{Pt}(\text{s})$



Malleable, ductile solid

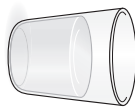


Does not dissolve




Conducts

Water,
 $\text{H}_2\text{O}(\text{l})$

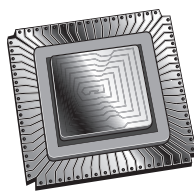


Liquid

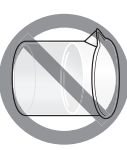


Does not conduct


Silicon,
 $\text{Si}(\text{s})$



Hard solid




Does not dissolve




Sometimes conducts


Mercury,
 $\text{Hg}(\text{l})$



Liquid




Does not dissolve

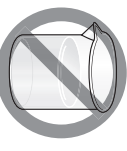


Conducts


Methane,
 $\text{CH}_4(\text{g})$



Gas



Does not dissolve



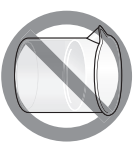
Does not conduct

SUBSTANCE CARDS

Diamond,
C(s)



Very hard solid



Does not dissolve

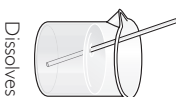


Does not conduct

Table Salt,
NaCl(s)



Brittle solid

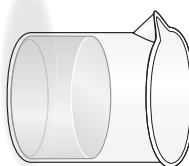


Does not dissolve

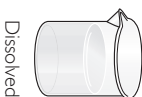


Does not conduct
(as a solid)

Aqueous Copper Chloride,
CuCl₂(aq)



Aqueous solution

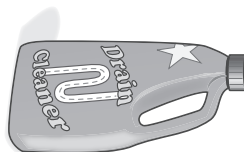


Does not dissolve

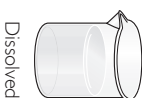


Conducts

Drain Cleaner,
NaOH(aq)



Aqueous solution

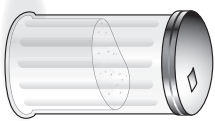


Does not dissolve

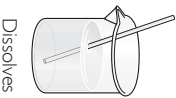


Conducts

Table Sugar,
C₁₂H₂₂O₁₁(s)



Soft solid



Does not dissolve

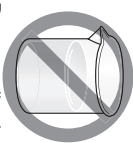


Does not conduct

Copper,
Cu(s)



Malleable, ductile solid



Does not dissolve

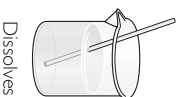


Conducts

Ethanol,
C₂H₆O(l)



Liquid



Does not dissolve

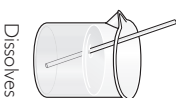


Does not conduct

Epsom Salt,
MgSO₄(s)



Brittle solid



Does not dissolve



Does not conduct
(as a solid)