Making Molecules

Lesson Concept Most of the time atoms do not travel alone. Atoms bond with other atoms to make molecules. When atoms bond with all the same type of atoms, they are called elements because they are purely one type of atom. Sometimes different kinds of atoms bond together. When this happens a *compound* molecule is formed. Chemical formulas are a simple shorthand chemists use to indicate the type and number of atoms in a molecule.

Link Previously students learned that there are different kinds of atoms.

Time 1 hour 30 min

Materials

Whole Class

Meeting the Molecules (Teacher Tube Video)

Samples of common compounds: water (H_2O), sugar ($C_6H_{12}O_6$), Salt (NaCl)

Samples of pure molecules: graphite (carbon), helium, iron nail, copper wire, and aluminum foil.

Per Group (Groups of 2)

20-25 Toothpicks (preferably flat if doing "Paper" molecules)

25-30 Gumdrops (An equal amount of the four colors.)

Individual

Common Molecules worksheet

Making Connections, Making Bonds worksheet

Gumdrop Molecules worksheet

How Many Atoms? worksheet

Advance Preparation

1. Photocopy worksheets.

2. Acquire approximately 20-25 toothpicks for each pair of students.

3. For "Gumdrop" molecules, purchase four bags of multi-colored gumdrops. However, since the "hydrogen" atom is more often distribute double the number of the color designated for hydrogen.

4. For "Paper" molecules, have 3" x 3" squares of colored paper: black, orange, brown, green, red and purple.

Procedure:

Engage (15 min) When atoms bond they create molecules. If atoms of the same type bond, they are called pure elements. When different types of atoms bond they create compound molecules.

1. Show "Meeting the Elements" from Teacher Tube.
2. Display several samples of common compounds and pure elements; water (H_2O), sugar ($C_6H_{12}O_6$), pure molecules: graphite (carbon), helium, iron nail, copper wire, and aluminum foil.
3. Ask students to pair share and discuss how these samples are similar and different as well as how they might be grouped.
4. Separate the examples into two groups based on whether they are made of compound molecules or are purely one type of element.
5. Tell the students that they will come back to these two groups later and discuss what the teacher's criteria might have been for this grouping, i.e., separating the samples into materials made of compound molecules versus those made of only one element.

Explore / Explain (45 min) When atoms bond they create molecules. If atoms of the same type bond, they are called pure elements. When different types of atoms bond they create compound molecules. Atoms are limited in the number of bonds they can make. Chemists use the "HONC" rule to remember the maximum number of bonds for Hydrogen, Oxygen, Nitrogen and Carbon. Hydrogen can make one bond, Oxygen two, Nitrogen three and Carbon four.

6. Distribute *Common Molecules* worksheet.
7. Ask students, "What do we know about matter?" (Matter is made up of tiny particles called atoms).
8. Explain that molecules are two or more atoms bonded together. If a molecule is more than one kind of atom then it is called a compound.
9. Explain that scientists use chemical formulas as a quick way to show the composition of molecules.
10. Have students complete the *Common Molecules* worksheet as you discuss the concepts of chemical formulas and compound molecules.
11. Have students work with a partner to answer the following questions found on the *Common Molecules* worksheet and then share their answers with the whole class.
    a. Which of these molecules has the most atoms? Sugar
    b. Which type of atom is the most common element in this group of molecules? Hydrogen

c. What types of atoms do you breathe out? Carbon and Oxygen
d. If you split the bonds in a water molecule, what two types of atoms would you have? Hydrogen and Oxygen

12. Distribute Making Connections, Making Bonds worksheet. Read information with students. Note: It is important for students to know that these atoms are limited in the number of bonds they can make. This determines their structure and their properties in general. Explore the possible bonding possibilities with the toothpicks and paper (or gumdrops) to show that some molecular structures are not possible due to their limited bonding possibilities. Use the Making Molecules worksheet and the Gumdrop Molecules worksheet to have students construct molecules using flat toothpicks and either colored paper or gumdrops.

Extend (15 min) Chemists use the "HONC" rule to remember the maximum number of bonds for Hydrogen, Oxygen, Nitrogen and Carbon. HONC Rule = Hydrogen can make one bond, Oxygen-two, Nitrogen-three and Carbon-four. Another concept introduced is that chemical formulas are a simple shorthand chemists use to indicate the type and number of atoms in a molecule.

13. Direct students to create their own molecules. The students must continue to use the HONC rules of bonding.

Evaluate (15 min)

14. Distribute the How Many Atoms? worksheet. Have students identify the number and type of atoms that make up each substance. Have students complete the cloze sentences to evaluate their understanding of molecules.