

Chemistry Activity Shape and Polarity of Covalent Molecules
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### Purpose

To use models and electron-dot diagrams to determine the shape and polarity of covalently bonded molecules.

### Introduction

When the structures of molecules are drawn on paper or on the board, it is difficult to show the three-dimensional shape. The shape of a molecule is important because it affects the properties of the molecule. In this lab you will use models to help visualize the shapes of molecules, learn how to draw three-dimensional shapes on paper and relate the structure of a molecule to its properties.

### Directions

1. Draw the electron dot diagram for each molecule. This represents a two-dimensional picture of the molecule.
2. Determine the polarity of the **bond** between each element in the molecule. You will need to use your electronegativity table (p. 194) and the chart on page 195 in your textbook.
3. Construct each molecule listed on the attached chart by using the model kits provided.
4. Classify the molecule based on its shape. (example: linear, bent, planar, pyramidal, or tetrahedral)
5. Determine the polarity of the entire **molecule** by considering the symmetry of the molecule. Symmetrical molecules are nonpolar and asymmetrical molecules are polar.

### Questions

1. Classify each of the following as an ionic crystal, a polar covalent molecule or a nonpolar covalent molecule.

a. Br <sub>2</sub>	c. CCl <sub>4</sub>	e. CO <sub>2</sub>	g. N <sub>2</sub>
b. MgCl <sub>2</sub>	d. HI	f. H <sub>2</sub>	h. BaBr <sub>2</sub>
2. How does the presence of a double or triple bond affect the shape of the molecule?
3. Describe the relationship between the number of atoms in a molecule and its resulting shape.
4. Although boron hydride and ammonia (NH<sub>3</sub>) both contain 4 atoms, ammonia is pyramidal in shape whereas boron hydride is planar (all atoms lie in the same plane). Explain.
5. Both water and carbon dioxide are triatomic molecules (they have three atoms in the molecule). Explain why one of these molecules is polar while the other is nonpolar.
6. Explain how a molecule can have all polar bonds but still be nonpolar.

Formula	Electron-dot formula	Bond type (polar or nonpolar)	Shape of molecule (linear, bent, pyramidal, tetrahedral)	Kind of molecule (polar or nonpolar)	Sketch of molecule
H <sub>2</sub>					
Cl <sub>2</sub>					
O <sub>2</sub>					
N <sub>2</sub>					
HCl					
BrCl					
HBr					
H <sub>2</sub> O					
CO <sub>2</sub>					
H <sub>2</sub> S					
NH <sub>3</sub>					
CH <sub>4</sub>					
CCl <sub>4</sub>					
CH <sub>3</sub> Cl					