**Molecular Geometry and Polarity Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Period\_\_\_\_\_**

### Worked-Out Examples

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| --- | --- | --- | --- | --- | --- |
| Hydrogen bromide has the formula HBr and it has two atoms. Any molecule that has only two atoms is linear. A linear molecule might be polar, it might be nonpolar. In this case, if we look at the two ends of the molecule, the hydrogen end has a different attraction for electrons than the bromine end. Therefore, the molecule will be polar. | |  | | --- | | **·· H : Br :    ··** | | two atoms | | linear | | polar | |

|  |  |  |
| --- | --- | --- |
| Carbon tetrachloride has one carbon and four chlorine atoms. The electron dot diagram for that has a carbon in the center and four chlorine atoms around it. The carbon atom has its own four valence electrons and gains one from each of the four chlorine atoms. Each chlorine atom in return gains one of those four valence electrons from the carbon. | |  | | --- | | **·· : Cl : ··     ··     ·· : Cl : C : Cl : ··     ··     ·· : Cl : ··** | |
| To determine shape and polarity we have to look at the electron arrangement around the central atom; in this case that's the carbon atom, and the carbon atom has four groups of electrons, so it has a tetrahedral arrangement of electrons. Each of those four groups of electrons is a bond to a chlorine atom. There are no unbonded pairs of electrons, so the shape of the molecule is the same as the shape of the electron arrangement. It is a tetrahedral molecule. | |  | | --- | | C bonded to 4 atoms. | | C has no unbonded electron pairs. | | tetrahedral | |
| Regarding the polarity of this molecule, it is true that each carbon-to-chlorine bond is a polar bond in which the electrons are going to be pulled away from the carbon toward the chlorine. This is because chlorine is more electronegative. However, the molecule is symmetric. There is a three-dimensional symmetry in this molecule that has the electrons pulled by the chlorine being pulled out equally in all directions. That symmetry cancels out the polarity of the bonds and carbon tetrachloride has nonpolar molecules. | |  | | --- | | All "outside' atoms are the same. | | symmetric | | nonpolar | |

### Exercises

For each of the following molecular compounds, determine the shape and polarity of the molecules.

a. water

b. ammonia

c. dichlorine monoxide

d. carbon(IV) oxide

e. sulfur(IV) oxide

f. carbon tetrachloride

g. hydrogen chloride