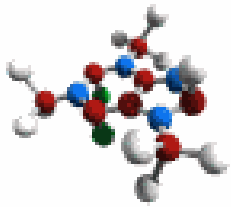
Molecular Geometry



Background

In this activity you will use a molecular model kit to assemble 3-D representations of different molecules to help you visualize the shapes of molecules.

Polarity and Shapes

The geometrical shape of a molecule can be very useful in determining whether or not the molecule is polar or nonpolar. Once the shape and partial charges are known the intermolecular force(s) can also be determined.

A molecule is not necessarily polar simply because it contains polar covalent bonds. The molecule must have oppositely charged poles (ends) in order to be a dipole (polar molecule). Thus, if the bonds are symmetrically arranged about the central atom and are of the same polarity, there will be no net dipole and the **molecule** will be **nonpolar**. Symmetrical molecular shapes include linear, trigonal planar, and tetrahedral shapes.

However, if the bonds are asymmetrically arranged there may be a net dipole and the **molecule** will be **polar**. The asymmetrical shapes include the angular, trigonal pyramidal and trigonal bipyramidal shapes

Isomers

If two different compounds have the same molecular formula they are called **structural isomers**. They have identical molecular formulas but different structural formulas. They also have different physical and chemical properties. Structural isomers play a very important role in organic chemistry. Two common isomers are glucose and fructose.

Structural isomers that are mirror images of each other are called **stereoisomers** and are different from each other in the way that a left hand is different from a right hand. This phenomenon of "handedness" exhibited by stereoisomers is very important to organic chemistry.

Draw a glucose and fructose molecule.

Write the Lewis Dot Symbols for the following elements: H, C, N, O, F, Cl

Determine the charge for the following

_____ H _____ C _____ N _____ O _____ F _____ Cl

Determine the number of bonds for the following

_____ H _____ C _____ N _____ O _____ F _____ Cl

Draw the six basic molecular shapes.

Draw advanced shapes.

Pre-Lab

GOALS

- To assemble 3-D models of several molecules.
- To become familiar with a molecule's shape by drawing it.
- To determine a molecule's polarity using shape.

MATERIALS

Student molecular model kit Styrofoam balls and toothpicks

PROCEDURE

Using the molecular model kit, assemble each of the molecules listed below. Then draw the Lewis structure, determine its geometry, sketch your model and tell whether the molecule is polar or nonpolar.

BeF_2 BF_3 NH_3 CO_2 H_2O N_2 CH_2F_2 HCN OCl_2

SF_4 PCl_5 SF_6 XeF_4

CH_4 C_2H_6 C_2H_2

The balls are color-coded to represent different atoms. The balls are drilled with holes to accept the sticks and springs; the number of holes in the ball represents the maximum number of bonds a given atom can have. Single bonds are represented by the short and long wooden sticks and springs are used for double and triple bonds.

If the molecule is an octet rule exception you will have to use Styrofoam™ balls and toothpicks to build model.

Using the molecular kit build a molecule of bromochlorofluoromethane, CHBrClF and its stereoisomer. Then draw both of them and determine their polarity.

"...success lies in forming the HABIT of doing things that failures don't like to do."

-- Albert E. N. Gray

DATA

You will need to make drawings of each molecule on the data sheet. Use a table to show your shape and polarity determinations.

Data Table

Formula	Lewis Structure	Geometry	Sketch

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