Molecular Geometry lab with gumdrops and/or molecular models

Target audience: 10, 11, 12

Background and Notes:

Covalent and Ionic Bonding can be predicted from an electronegativity table. Molecular geometry can be determined by drawing electron dot models. Molecular geometry determines Polarity and subsequent Intermolecular forces. Linear Molecules have an angle of 180 degrees, Bent molecules with one lone pair of electrons have an angle of 105 degrees; trigonal planar molecules have an angle of 120 degrees with no lone pairs of electrons, tetrahedral molecules have an angle of 109.5 degrees with no lone pairs of electrons and trigonal pyramid molecules have an angle of 107 degrees with one lone pair of electrons. Polar molecules can have lone pairs of electrons or be asymmetrical, while symmetrical molecules are nonpolar.

Knowledge and skills:

- Students should know the molecular geometry of different molecules and the resultant polarity.
- Students should be able to build basic small molecules with models or gumdrops.

Fundamental understanding:

- Students should understand why molecules are polar or nonpolar.

Essential Questions:

- Why are molecules polar or nonpolar?

National standard (s):

- National content standard B, students should develop an understanding of the structure of atoms and structure and properties of matter.

State standard(s):

- 1.02 and 1.07 Objectives for North Carolina Standard Course of Study Objective: Bond Polarity and molecular polarity, including intermolecular forces in order to explain polarity

Purpose: to observe physical shapes determine molecular characteristics of polarity or nonpolarity.

Safety Precautions: be careful not to poke your eye with either a toothpick or a model stick.

Materials:

- **Equipment:**
  1. Model kits if possible
  2. Different color gumdrops
  3. Toothpicks
  4. Protractors to determine the correct angles
  5. Worksheet with formulas for any simple molecules, for example: water, ammonia, carbon tetrachloride and HCl

Procedure:

1. Students need to draw the correct Lewis dot structures, giving angles, lone pairs and polarity of the molecules
2. Turn in worksheet with drawings
3. Students assemble molecules using black for Carbon, yellow for hydrogen, green for chlorine and red for oxygen
4. Instructor checks that all molecules are put together correctly either with the ball and stick models and/or with the gumdrops

Conclusion:

1. Restate Purpose and/or hypothesis
2. What was learned?
3. How would you change to improve this activity?

References and Resources:
Chemistry textbook Chapter on Bonding and Molecular geometry

Teacher Notes:
1. Students often have trouble visualizing 3-D, they tend to stay 2-D, and so the instructor needs to check the angles of the molecule models