Lab 11 Molecular Geometry

Experiment 1: Molecular Models of Neutral Molecules

In this experiment you will predict the three dimensional geometry of a series of neutral molecules using the VSEPR theory.

Materials

Colored Pencils

35 Marshmallows (Miniature)

Permanent Marker

Protractor

35 Toothpicks

*Camera (camera phone is sufficient)

*You Must Provide

Procedures

Part 1: Periodic Table

1. Use your Periodic Table of Elements to determine the elemental symbol, group number and valence electrons for the elements listed in Table 1. Record this data in Table 1.

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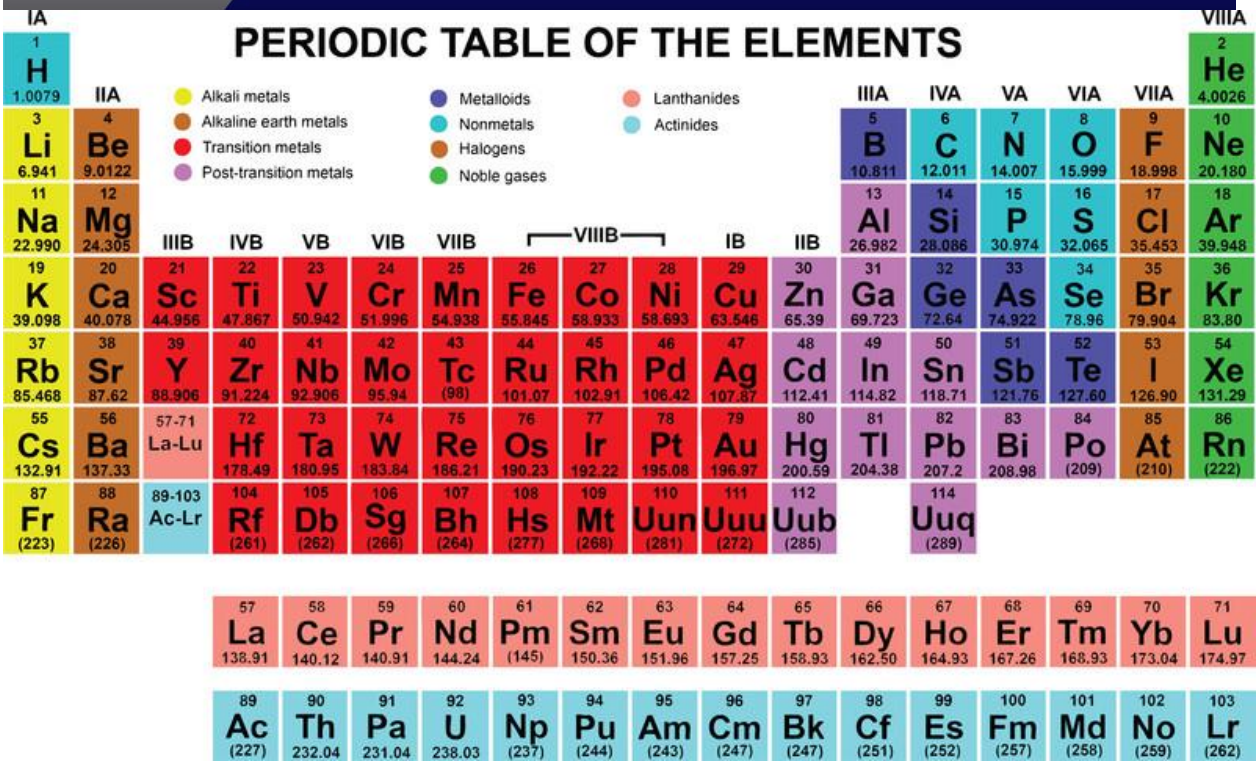

2. Use your colored pencils and the data in Table 1 to sketch the Lewis Structures for each of the elements in Table 1.

Procedures

Part 2: Construction of Molecules

1. Now, construct the three dimensional geometry for the molecules listed in Table 2. While you are constructing your molecules it will be useful to keep the following points in mind:
    - Nature “loves” symmetry which means equal bond lengths and angles.
    - Electrons prefer to be as far apart from each other as possible without disrupting the symmetry too drastically.
    - And, lone pairs take up more space because they are not confined by bonds.
2. Look at Table 2 and fill in the bond angles for each of the molecules that you will be building.

    Hint: Use the column in Table 2 labeled “Structure” to determine the molecular geometry.

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3. Using your colored pencils make a Lewis Dot Structure sketch for each of the molecules in Table 2 that you will be building.
4. Gather as many marshmallows and toothpicks you will need for your first molecule (carbon dioxide).

   Hint: You will need two marshmallows for the oxygen (O) and one marshmallow for the carbon (C).

5. Using your permanent marker label the miniature marshmallow with the elemental symbol for each atom in your molecule (Figure 6).

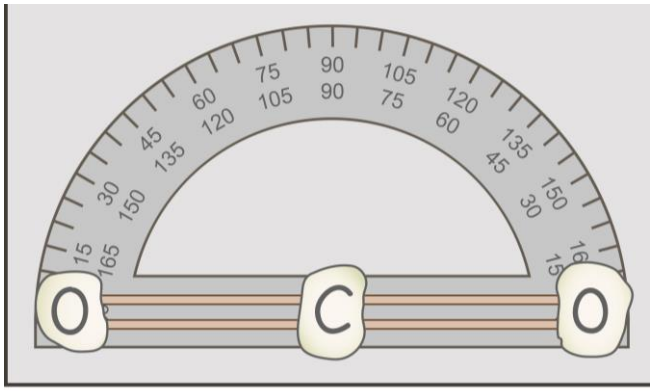

***Figure 6:** To satisfy the octet rule the linear carbon dioxide molecule has double bonds. Note, the bond angles should be 180 degrees.*

6. Refer to Table 2 to determine which atom will be the central atom in your molecule.
7. Connect the atoms together with toothpicks.
8. Compare your model with the diagram of the Linear molecular geometry in Table 2.
9. Use your protractor to verify that you have constructed your molecule with the correct bond angles.
10. To determine the angle between your atoms place the center of the protractor on the central atom, and a line the base with a bond (Figure 6). Then measure the angle. When in doubt think *"should this angle be bigger or smaller than 90°?"*
11. If your bond angles are incorrect, remove the toothpicks from the marshmallows, construct the molecule again, and use your protractor to verify that you have constructed

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your molecule with the correct bond angles.

12. Follow the above procedures for each of the molecules in Table 2.
13. When you are finished take a picture of the molecules and send the images to your instructor. Make sure you identify yourself, name of the lab, and any other necessary identifying information.

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