

PREPARATION FOR CHEMISTRY LAB: MOLECULAR GEOMETRY

Consider the PF_2^+ ion.

How many valence electrons does the ion have? _____

Draw the Lewis structure for the ion, use lines for shared pairs of electrons and dots for unshared electrons.

What is the electron geometry? _____

What is the molecular geometry? _____

Is the ion polar or is it nonpolar? _____

MOLECULAR GEOMETRY

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Molecular geometry describes the three-dimensional shape of a molecule or polyatomic ion. In turn, this shape determines whether the molecule or ion is polar or nonpolar. Molecular geometry and polarity play important roles in determining how molecules and ions interact with one another.

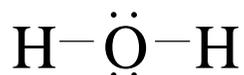
Review your class notes on Lewis structures and molecular geometry. Read Sections 10.5, 10.6, and 10.7 in your textbook. Be sure to download your own list of molecules/ions and bring the list to lab. Also bring the lecture supplement on molecular geometry names to lab with you.

BRIEF REVIEW

Consider H₂O, the water molecule.

The oxygen atom contributes six electrons to the valence electrons for the molecule and each hydrogen atom contributes one electron to the valence electrons for the molecule giving the molecule a total of eight valence electrons.

The following shows the Lewis structure for water. Lines are used for shared pairs of electrons and dots for unshared electrons.



The **electron (pair) geometry** is based on the distribution of electron regions, bonds and lone pairs, around the atom of interest. (The atom of interest is usually the central atom.) In water, there are four electron regions (two bonding regions + two lone pair regions) around the central oxygen atom leading to a **tetrahedral** electron (pair) geometry.

The **molecular geometry** is based on the locations of the atoms around the atom of interest. A water molecule has a **bent** molecular geometry.

A molecule is **polar** if the molecule has a center of positive charge and a center of negative charge which do not coincide or cancel. Water is a polar molecule, due to its geometry, distribution of lone electron pairs, and the polarity of the O-H bonds.

PROCEDURE

1. Obtain a model kit and report sheet from Lab Services.
2. Transfer the formulas for the molecules/ions that have been assigned to you, in order, to the report sheet. When you turn in your report sheet, be sure this list is attached.
3. Take your time. Learning this now, while you have the model kit, handout, and three hours of dedicated time will make life much easier for you when you are studying for the next exam.
4. For each individual molecule/ion:
 - a) Determine the number of valence electrons on the molecule/ion.
 - b) Draw the Lewis structure for the molecule/ion using lines for shared pairs of electrons and dots for unshared electrons.
 - c) Build the model. Have your TA initial that you have built the model. This (that you built a model) is the only thing your TA will be checking. Your TA is not responsible for making sure that you built the correct model.
 - d) Determine the electron geometry and molecular geometry of the molecule/ion. Use the appropriate terms to describe each.
 - e) Determine the polarity of the molecule/ion.
 - f) Again, take your time. Examine the shape of the model and see how the terms used to describe the electron and molecular geometry of the molecule/ion correspond with the model's shape. See how the shape helps you decide on the polarity of the molecule/ion.
5. Repeat for each assigned molecule/ion.
6. Review the names for all molecular geometries, including those for structures you were not assigned.
7. After you have completed all ten of the assigned molecules/ions and reviewed all molecular geometries: turn in your report sheet, put all your materials away, return your model kit to Lab Services, and pick up a quiz. Go directly to the center lab bench in your laboratory and, using only your brain and a pencil (no handouts, models, or human help), complete and turn in your quiz.