

Lab 2: Molecular Structure and VSEPR

Objectives:

- To systematically determine the shapes of molecules using VSEPR theory.
- To learn determination of molecular polarity based on shape and bond polarity

Pre-lab: (To be submitted at the beginning of lab)

Draw the Lewis dot structures for each molecule in the following list (first column of the table). Hand this in on a separate sheet at the beginning of lab, and also write it in the table.

Procedures:

1. Build a model of the first molecule. Use a stick with no ball on the end to represent a lone pair. Be sure to pick a ball with holes placed at the appropriate angles to match the bond angles. Build the molecule so that all "parts" (the lone pairs and atoms attached to the central atom) are as far away as possible from each other. Draw a picture of this model in column 2. (If the molecule has no lone pairs, leave column 2 blank.)
2. Now, take out any lone pairs (so that your model only has atoms and bonds). This shows the "molecular geometry" of the molecule. Draw a picture of this model in column 3. (There should be no blanks in column 3.)
3. In column 4, write the name of the geometry of the molecule (linear, bent, trigonal planar, pyramidal or tetrahedral). Refer to section 4.8 in your textbook.
4. In column 5, write the approximate angle between each bond/lone pair in the molecule. In column 6, write whether the molecule is polar or nonpolar.

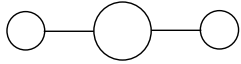
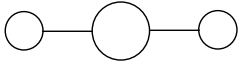
Lab Report Guide:

- **1. Results (5 pts)**
 - o Tables neatly filled out with data
- **2. Post Lab Questions (5 pts)**
 - o **Typed answers to the Post Lab questions. Note that single sentence answers will not suffice. State the answer to the question followed by a brief description of the evidence supporting that answer.**

Post Lab Questions:

1. Describe the underlying principle of VSEPR theory in your own words.
2. Explain why two compounds with the same generic formula, NH_3 and BH_3 , have different molecular geometries.
3. Why are the structures of H_2S and H_2O so similar? Why are the structures of CH_4 and SiH_4 so similar?
4. Although PH_3 and BH_3 both contain bonds of similar polarity, one molecule is polar while the other is nonpolar. Explain.
5. Write a detailed procedure in your own words for converting a chemical formula into a Lewis structure and how to determine the geometry and polarity from this Lewis structure.

Data Tables (to be attached to lab report)

Column 1 Lewis Dot Structure	Column 2 Sketch (with lone pairs)	Column 3 Sketch (no lone pairs)	Column 4 Molecular Geometry	Column 5 Bond Angles	Column 6 Polar or Nonpolar
BeH ₂ H:Be:H			Linear	180	Nonpolar
BH ₃					
H ₂ O					
PH ₃					
CH ₄					

Column 1 Lewis Dot Structure	Column 2 Sketch (with lone pairs)	Column 3 Sketch (no lone pairs)	Column 4 Molecular Geometry	Column 5 Bond Angles	Column 6 Polar or Nonpolar
CO ₂					
SiH ₄					
H ₂ S					
NH ₃					
NH ₄ ⁺ (cation)					