Activity: VSEPR Modeling

FOR THE TEACHER

Summary
In this activity, students construct physical models of molecular shapes. However, students are not told what the preferred arrangements of electron pair domains are. Instead, they derive the arrangements. Students are given the opportunity to conceptualize what is happening when one electron pair domain acts upon another, and to understand how those interactions result in the molecular geometries predicted by VSEPR theory.

Grade Level
High School

NGSS Alignment
This activity will help prepare your students to meet the performance expectations in the following standards:

- **Scientific and Engineering Practices:**
  - Developing and Using Models

AP Chemistry Curriculum Framework
This activity supports the following learning objectives:

- **Big Idea 2:** Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.
  - **2.21** The student is able to use Lewis diagrams and VSEPR to predict the geometry of molecules, identify hybridization, and make predictions about polarity.

Objectives
By the end of this activity, students should be able to

- Conceptualize the impact of one electron pair domain acting upon another, and understand how those interactions result in the molecular geometries predicted by VSEPR theory.
- Describe the implications of electron pair repulsions on molecular shape.
- Visualize the three-dimensional structure of the molecules, and provide clear and cogent answers when asked to explain or justify a structure using VSEPR theory.
- Understand that the molecular shape names are descriptions of the actual shape.
- Make the correlation between geometry, nonbonding pairs and molecular shape.

Chemistry Topics
This activity supports students’ understanding of

- Molecules & Bonding
- VSEPR Theory
- Molecular Geometry
- Molecular Structure

Time
**Teacher Preparation:** 10 minutes
**Lesson:** Parts 1 and 2: 45 minutes; Part 3: 20 minutes

Materials (per student)

- 20 Quilting Pins (or any other color ball pin)
- Modeling clay
Safety
- No specific safety precautions need to be observed for this activity.

Teacher Notes
- Find out more about this VSEPR Modeling Activity in the September 2017 issue of Chemistry Solutions.
- Before students come to class, divide clay into one “lump” for each student. One 2-ounce packet of clay is enough for 3 students. As class begins have students roll their clay into 5 equally-sized (approximately ½”) balls. As they are doing this, pass the pins around and have each student take 20 pins.
- If you would like to create permanent models, use oven bake clay such as Fimo or Sculpey. Bake models at the lowest oven temperature possible for approximately 30 minutes to harden the clay. The plastic on the pins will not melt at this temperature. Line the pan with wax paper before baking if it will be used for baking food afterwards.
- Before beginning the activity have students complete the first three columns on the VSEPR student handout (Lewis Structure, Electron Pair Domains, and Nonbonding Pairs). They can then complete the remaining columns as you move through this exercise.
- Teachers should follow the outline described in “Increasing Student Understanding VSEPR Theory” for implementing this activity with students. Directions as well as teacher prompts are included in the article.

FOR THE STUDENT
Lesson

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<tr>
<th>Lewis Structure</th>
<th># Electron pair domains</th>
<th># Nonbonding (lone) pairs</th>
<th>Shape</th>
<th>Bond Angles</th>
<th>Polar or Nonpolar</th>
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