Lesson Title	Molecular geometry
Length of Lesson	90 minutes
Created By	Cheryl McLaurin
Subject	Chemistry
Grade Level	10-12
State Standards	2.e., 2.g.
DOK Level	2 &3
DOK Application	Cause/effect, Compare, Construct
National Standards	B: Physical Science
Graduate Research Element	Soil structure, water movement within soil

Student Learning Goal:
Students will learn the basics of the Valence Shell Electron Pair Repulsion theory. Bond types and geometries will be introduced and explained.

<u>State Standards:</u>
2. Demonstrate an understanding of the atomic model of matter by explaining atomic structure and chemical bonding.

e. Compare the properties of compounds according to their type of bonding.
- Covalent, ionic, and metallic bonding
- Polar and non-polar covalent bonding
- Valence electrons and bonding atoms

g. Develop a three-dimensional model of molecular structure.
- Lewis dot structures for simple molecules and ionic compounds
- Valence shell electron pair repulsion theory (VSEPR)

<u>National Standards:</u>

B: Physical Science: Structure and Properties of Matter:

- Atoms interact with one another by transferring or sharing electrons that are furthest from the nucleus. These outer electrons govern the chemical properties of the element.
- Bonds between atoms are created when electrons are paired up by being transferred or shared. A substance composed of a single kind of atom is called an element. The atoms may be bonded together into molecules or crystalline solids. A compound is formed when two or more kinds of atoms bind together chemically.
- The physical properties of compounds reflect the nature of the interactions among its molecules. These interactions are determined by the structure of the molecule, including the constituent atoms and the distances and angles between them.

Materials Needed (supplies, hand-outs, resources):
Index cards, molecular structure kit, powerpoint (see Teacher Notes).

Lesson Performance Task/Assessment:
Students will be assigned an element and will draw the assigned element's Lewis Dot structure on their card which will be affixed to their shirt. They will have to find other elements with which to bond and form compounds. Each student will fill out a work sheet with the compound created, the bond type, the Lewis Dot structure of that bond, and the molecular geometry of that structure.

Lesson Relevance to Performance Task and Students:
Recall and application of the lecture.

Anticipatory Set/Capture Interest:
Pictures from around Starkville showing clay cracks and foundation issues will be shown, and the reason behind the shrink/swell clay phenomenon will be explained. The rigid mineral sheet structure of clays will be explained, as well as the ionic exchange of cations for water molecules, which is what creates clay swelling.

Guided Practice:
Students will receive a lecture on bond types and geometry. They will be shown 3-D models of the different types of bonds.

Independent Practice:
Students will work together to create bonds and decide which type of geometry will be created with that bond. They will fill out the handout "Bond With Your Classmates."

Remediation and/or Enrichment:
IEP's will be supported. Students can work hands-on with the models if they need more practice. For enrichment, examples of more complex molecules can be shown and described.

Check(s) for Understanding:

- What types of bonds form double bonds?
- What are the differences between ionic and covalent bonds?
- Do certain elements prefer to form one type of bond over another? A particular geometry over others?

Closure:
Examples of the bonds formed between students will be reviewed and the structure evaluated.

Possible Alternate Subject Integrations:

Teacher Notes:

- There are multiple resources online for molecular geometry models.
- An excellent breakdown of clay structure can be found here: http://classes.css.wsu.edu/soils201/Presentations/Lab%204%20Clay%20Minerals.pdf