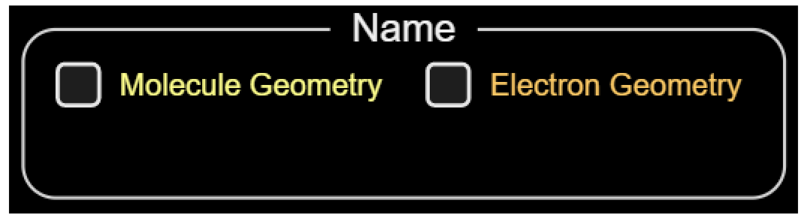
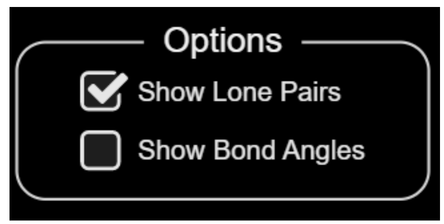
Unit 7: Bonding, Chemical Bonding

#9 Lewis Dot Structures and VSEPR Topic Inquiry

Chemist: ______________________________

Directions:

1. You will begin to explore the V.S.E.P.R. Theory by building simple molecules modeled after drawn lewis dot structures.
    a. Simulation: Building Molecules
2. Click on MODEL, explore the tools used in the simulation to get familiar with how to use the simulation.
3. You should see the following in the lower left corner: 

4. You should also see the following in the lower right corner: 

Inquiry Task:

1. Using the simulation, build a simple molecule with the following conditions:

Single Covalent Bonds	Lone Pairs	Molecule Geometry	Electron Geometry
1	3		
2	2		
3	1		
4	0		

2. According to the identified information, in your own words, how does a molecule geometry differ from an electron geometry?

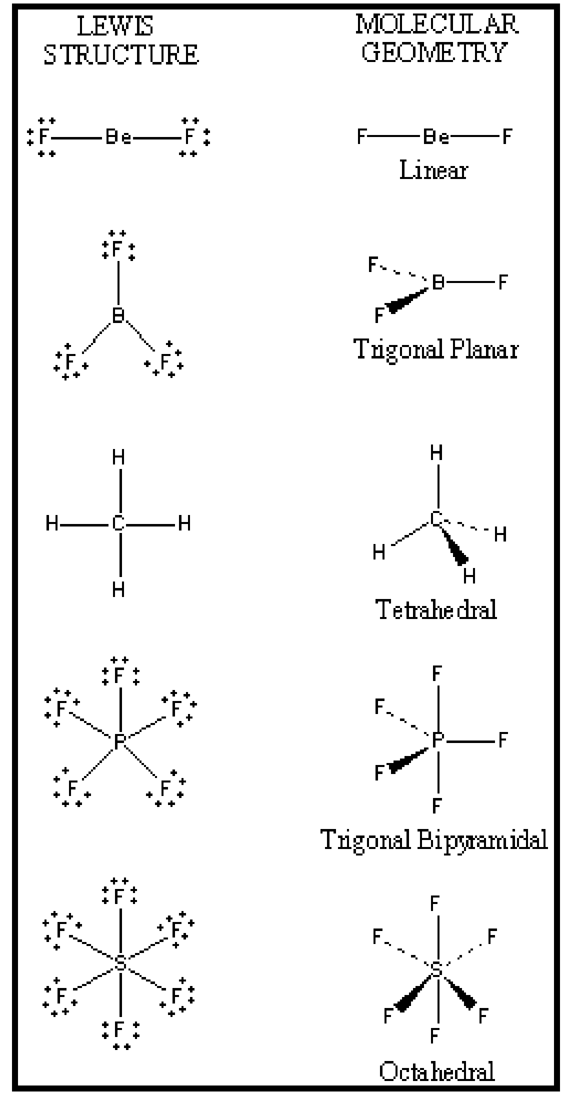
   a. In what way are they similar?

3. Geometry allows you to represent properties and relations between various points within a 3-Dimensional space. The Valence Shell Electron Pair Repulsion (VSEPR) Theory similarly represents molecules within a 3D space by viewing the location and orientation of what two components of a molecule?

   a. ____________

   b. ____________

4. Why is this theory called the *Valence Shell Electron Pair Repulsion* Theory? Put this in your own words. To help answer this question, consider building a few more molecules in the MODEL simulation to determine a general reasoning behind the given name of the theory.



5. To better understand the possible molecular and electron geometries, you will need to complete the following table outlining all potential VSEPR Shapes. Your task is to build molecules with varying numbers of DOMAINS. A DOMAIN is a group of electrons attached to a central atom. Single bonds, double bonds and triple bonds are each considered a single domain. Lone pairs of electrons are also considered a domain under this lens of thinking according to the directions supplied. For each molecule, note its ELECTRON GEOMETRY, MOLECULAR GEOMETRY, and its BOND ANGLE. Also provide a screenshot of the molecule you built in the simulation. The molecule can be rotated for easier viewing. Once you've completed each section, you'll be asked to draw some additional conclusions on this subject.

TABLE 1:

Total Domains	**Bonds on Central Atom**	**Lone Pairs on Central Atom**	**Electron Geometry**	**Molecule Geometry**	**Bond Angle**	**Screenshot or Sketch of Molecule Built in Simulation**
1	1	0				
2	2	0				
	1	1				
3	3	0				
	2	1				
	1	2				

4	4	0				
	3	1				
	2					
	1					

Total Domains	**Bonds on Central Atom**	**Lone Pairs on Central Atom**	**Electron Geometry**	**Molecule Geometry**	**Image or Sketch**
5	5	0			
	4	1			

Total Domains	Bonds on Central Atom	Lone Pairs on Central Atom	Electron Geometry	Molecule Geometry	Image or Sketch
6					

Real Molecules Model

Directions:
1. Click on Real Molecules.
2. Select from the dropdown menu the provided real molecule and note the electron geometry, molecule geometry, and bond angles.

Molecule	Electron Geometry	Molecule Geometry (Shape)	Bond Angles	Image or Sketch
H_2O				

Molecule	Electron Geometry	Molecule Geometry (Shape)	Bond Angles	Image or Sketch
NH_3				
CO_2				
SO_2				
SF_4				
ClF_3				
XeF_2				
PCl_5				
XeF_4				
BrF_5				
SF_6				

1. Which molecules and their associated bond angles differ from the VSEPR Theory predictions in TABLE 1?

2. What does this new information imply about the true nature of electron repulsions between lone pairs of electrons and bonding pairs of electrons?