Dougherty Valley HS Chemistry
Bonding and Structure – Molecular Geometry Activity

Worksheet #10

Name: **Period:** **Seat#:**

Purpose: To construct a series of compounds using the VSEPR model and to use your model to determine the type of bonding and hybridization, and the geometry around each **central** atom.

Pre-Activity Questions: The VSEPR model is based on the premise that electron pairs around a central atom will position themselves to allow for maximum separation. Instead of writing an actual Background Paragraph, just answer these questions below.

1) What does VSEPR stand for?	**3)** Name the five different electronic geometries, and the eleven different molecular geometries.
2) Explain why pairs of electrons around a central atom repel each other.	

Materials:

- Computer/Laptop
- Color pencils/markers

Procedure:

1. Construct a 3D model for each compound using the online PhET simulation, and then sketch onto your paper.
    a. https://phet.colorado.edu/sims/html/molecule-shapes/latest/molecule-shapes_en.html
    b. Click to turn on the following:
        - Lone pairs
        - Bond angles
        - Electronic and Molecular Geometry
    c. Click in the bottom right corner where it says "PhET" and there are three vertical dots
2. Click options, then "projector mode" – it makes the background white so it is much easier to see things (I think so at least!).
3. Draw Lewis Structure
4. Determine the following for each atom:
    a. Number of bonded atoms on center atom, number of lone pairs on center atom.
    b. AXE formula (A center atom, X number of atoms bonded to the center atom, E number of lone pairs on the center atom)
    c. Steric Number
5. Using the information from Step 2 and a VSPER chart (which should be memorized!), determine the following:
    a. Electronic Geometry (*linear, trigonal planar, tetrahedral, trigonal bi-pyramidal, or octahedral*)
    b. Molecular Geometry (*linear, trigonal planar, bent, tetrahedral, trigonal pyramidal, trigonal bi-pyramidal, seesaw, T-shaped, octahedral, square planar*)
    c. Bond angle between the atoms attached to the central atom. *(Based on the molecular geometry)*
    d. Type of hybridization of the central atom in each molecule – if any *(sp, sp^2, sp^3, sp^3d, sp^3d^2 – remember, d hybridization may not be real!)*

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Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
NO_3^-	AX_3	# v.e- =			
# bonded atoms on A 3 *# of lone pairs on A* 0	Steric Number 3		Molecular Geometry	Hybridization	

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
$SiCl_4$		# v.e- =			
# bonded atoms on A *# of lone pairs on A*	Steric Number		Molecular Geometry	Hybridization	

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
CO_2		# v.e- =			
# bonded atoms on A *# of lone pairs on A*	Steric Number		Molecular Geometry	Hybridization	

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Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
$NClH_2$		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
XeF_4		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
CH_2O		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

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Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
SF_6		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
BF_3		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
NO_2^-		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

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Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
SF_4		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
ClF_3		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
BrF_5		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

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Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
N_2		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Molecular Formula	AXE Formula	Lewis Structure	Electronic Geometry	Bond Angle	3D Sketch
NH_4^+		# v.e- =			
# bonded atoms on A	Steric Number		Molecular Geometry	Hybridization	
# of lone pairs on A					

Done early? You can try doing these too!

CCl_4, NH_3, H_2O, SCl_2, I_3^-, SO_2, ICl_4^-, AsF_5, IF_4^+, H_3O^+, TeF_5^-, HCN, IOF_5, BrF_3, SO_4^{2-}, CO_3^{2-}

Another teacher made some online card making practices for VSEPR shapes! (please let me know if these links stop working)

- AXE Formulas and Geometry Names https://tinyurl.com/bku42kb6
- Shapes and 3D Models https://tinyurl.com/33357fmc
- AXE Formulas and 3D Shapes https://tinyurl.com/yjsa39xm