**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.

**Background**: 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?

**2)** Name the five different electronic geometries, and the eleven different molecular geometries.

**3)** Explain why pairs of electrons around a central atom repel each other.

**Materials**:

- 3 different colors of Playdough - Laminated "lone pairs" - Protractor - Toothpicks - Color pencils/markers

**Procedure**: ***(Steps with a * should be completed before you get to class. Steps with a ** should be completed after class.)***

1. ***** Draw Lewis Structure
2. ***** Determine the following for each atom:
    a. Number of lone pairs and bond pairs around the central atom.
    b. AXE formula (A center atom, X bonded atoms, E lone pairs)
    c. Steric Number
3. ***** 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!)*
4. Construct a 3D model for each compound or ion with the provided materials.
    a. Use one color of playdough as the center atoms (A), the other colors of playdough for your outer atoms (X), and the laminated "lone pair" shapes as lone pairs (E).
    b. Use one toothpick for single bonds, two toothpicks for double bonds, and three toothpicks for triple bonds.
    c. Use your protractor to get the bond angles as close as possible – it's hard to do with playdough and toothpicks, that's ok!
    d. Have someone from your group take a photo of your models, use the index cards to label each model.
        i. ****** Add photos to a Google Doc that will be turned in as a GROUP assignment! Detailed instructions will be given in class.
5. ***** *or* ****** *depending on timing in class* - Sketch a 3D picture of your model.
    a. Needs to show effort, be neat, accurate representation of bond angles, etc.

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| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $NO_3^-$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $SiCl_4$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $CO_2$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

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| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $NClH_2$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $XeF_4$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $CH_2O$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

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| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $SF_6$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $BF_3$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $NO_2^-$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

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| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $SF_4$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $ClF_3$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $BrF_5$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

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| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $N_2$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

| Molecular Formula | AXE Formula | Lewis Structure | Electronic Geometry | Bond Angle | 3D Sketch |
|---|---|---|---|---|---|
| $NH_4^+$ | | # v.e- = | | | |
| # Bond Pairs | Steric Number | | Molecular Geometry | Hybridization | |
| # Lone Pairs | | | | | |

**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, $IOF_5$, $BrF_3$, $SO_4^{2-}$, $CO_3^{2-}$

*Please clean up!*

*Put the playdough away in the cans, close the lids tightly.*

*Put toothpicks and Styrofoam balls back in the correct weigh boats.*

*Put everything back on the tray.*