**Name: Period: Seat#:**

**Worksheet #10**

**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? | 1. Name the five different electronic geometries, and the eleven different molecular geometries. |
| 1. 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.
   1. <https://phet.colorado.edu/sims/html/molecule-shapes/latest/molecule-shapes_en.html>
   2. Click to turn on the following:
      * Lone pairs
      * Bond angles
      * Electronic and Molecular Geometry
   3. 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:
   1. Number of bonded atoms on center atom, number of lone pairs on center atom.
   2. AXE formula (A center atom, X number of atoms bonded to the center atom, E number of lone pairs on the center atom)
   3. Steric Number
5. Using the information from Step 2 and a VSPER chart (which should be memorized!), determine the following:
   1. Electronic Geometry (*linear, trigonal planar, tetrahedral, trigonal bi-pyramidal, or octahedral*)
   2. Molecular Geometry (*linear, trigonal planar, bent, tetrahedral, trigonal pyramidal, trigonal bi-pyramidal, seesaw, T-shaped, octahedral, square planar*)
   3. Bond angle between the atoms attached to the central atom. *(Based on the molecular geometry)*
   4. Type of hybridization of the central atom in each molecule – if any *(sp, sp2, sp3, sp3d, sp3d2 – remember, d hybridization may not be real!)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Molecular Formula** | **AXE Formula** | **Lewis Structure** | **Electronic Geometry** | **Bond Angle** | **3D Sketch** |
| NO3— | AX3 | **# v.e- =** |  |  |  |
| **# bonded atoms on A**  3  ***# of lone pairs on A***  0 | **Steric Number** | **Molecular Geometry** | **Hybridization** |
| 3 |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Molecular Formula** | **AXE Formula** | **Lewis Structure** | **Electronic Geometry** | **Bond Angle** | **3D Sketch** |
| SiC*l*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** |
| CO2 |  | **# 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** |
| NClH2 |  | **# 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** |
| XeF4 |  | **# 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** |
| CH2O |  | **# 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** |
| SF6 |  | **# 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** |
| BF3 |  | **# 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** |
| NO2— |  | **# 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** |
| SF4 |  | **# 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** |
| C*l*F3 |  | **# 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** |
| BrF5 |  | **# 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** |
| N2 |  | **# 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** |
| NH4+ |  | **# v.e- =** |  |  |  |
| **# bonded atoms on A**  ***# of lone pairs on A*** | **Steric Number** | **Molecular Geometry** | **Hybridization** |
|  |  |  |

**Done early? You can try doing these too!**

|  |
| --- |
| CCl4, NH3, H2O, SCl2, I3-, SO2, ICl4-, AsF5, IF4+, H3O+, TeF5-, HCN, IOF5, BrF3, SO42-, CO32- |

**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>