VSEPR

- Valence Shell Electron Pair Repulsion theory.

- Most important factor in determining geometry is the relative repulsion between electron pairs.

A molecule adopts the shape that minimizes electron pair repulsions around an atom.

Structure Determination by VSEPR

Ammonia, NH₃
1. Draw electron dot structure
2. Count σ BP’s and LP’s = 4
3. The 4 electron pairs are at the corners of a tetrahedron.
Structure Determination by VSEPR

Water, $\text{H}_2\text{O}$
1. Draw electron dot structure
2. Count $\sigma$ BP’s and LP’s = 4
3. The 4 electron pairs are at the corners of a tetrahedron.

Structure Determination by VSEPR

Formaldehyde, $\text{CH}_2\text{O}$
1. Draw electron dot structure
2. Count $\sigma$ BP’s and LP’s = 3
3. There are 3 electron pairs at the corners of a planar triangle.
Phenylalanine, an amino acid

Phenylalanine

STRUCTURES WITH CENTRAL ATOMS THAT DO NOT OBEY THE OCTET RULE

Violations of the Octet Rule

Usually occurs with Group 3A elements and with those of 3rd period and higher.
Consider boron trifluoride, BF₃
The B atom is surrounded by only 3 electron pairs.
Bond angles are 120°

This geometry is described as planar trigonal
Compounds with 5 or More Pairs Around the Central Atom

- **Trigonal bipyramid**
  - 5 electron pairs
  - $90^\circ$ and $120^\circ$

- **Octahedron**
  - 6 electron pairs
  - $90^\circ$ and $120^\circ$

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**Sulfur Tetrafluoride, SF$_4$**

- **Number of valence electrons = 34**
- **Central atom = S**
- **Dot structure has 5 e\textsuperscript{-} pairs around S**

Electron pair geometry = trigonal bipyramid (because there are 5 pairs around the S)

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**Sulfur Tetrafluoride, SF$_4$**

- The lone pair is in the equator because it requires more room.
- The molecular geometry is called *seesaw.*

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