For ions we must adjust the number of electrons available, \( A \):
- Add one e\(^-\) to \( A \) for each negative charge
- Subtract one e\(^-\) from \( A \) for each positive charge

- \( \text{NH}_4^+ \)
- \( \text{BF}_4^- \)
Example: $CO_3^{2-}$
Resonance

- There are three possible structures for $CO_3^{2-}$
  - The double bond can be placed in one of three places

These are called equivalent resonance structures

- The real structure of the $CO_3^{2-}$ anion is an average of these three resonance structures
Resonance

- There are no single or double bonds in CO$_3^{2-}$
- All three bonds are equivalent
- They are intermediate between the single and double bond
Resonance: Other Examples

- $SO_3$
Resonance: Other Examples

- $\text{NO}_3^-$
Resonance: Other Examples

- $\text{SO}_4^{2-}$
Exceptions to the Octet Rule

- In those cases where the octet rule does not apply, the substituents attached to the central atom nearly always attain noble gas configurations.

- The central atom does not have a noble gas configuration but may have fewer than 8 or more than 8 electrons.
Examples

- $\text{BBr}_3$
- $\text{AsF}_5$
Assignments & Reminders

- Go through the recent lecture notes
- Read Chapter 7 completely, except for Sections 7-7 & 7-8
- Homework #4 due by Oct. 16 @ 3 p.m.
- Review Session @ 5:15 p.m. on Sunday
CHAPTER 8

Molecular Structure & Covalent Bonding Theories
Stereochemistry

- The study of the three-dimensional shapes of molecules

- With the knowledge acquired so far we will be able to predict the shapes of molecules and ions

- Our instrument - Valence Shell Electron Pair Repulsion theory (VSEPR theory - R. J. Gillespie)
VSEPR Theory

- In any molecule or ion there are regions of high electron density:
  - Bonds (shared electron pairs)
  - Lone pairs (unshared electrons)
- Due to electron-electron repulsion, these regions are arranged as far apart as possible
- Such arrangement results in the minimum energy for the system
BeCl₂
BBr$_3$
$CH_4$
$\text{PCl}_5$
$\text{SF}_6$
Five Basic Geometries

- Linear
- Trigonal
- Tetrahedral
- Octahedral
- Trigonal bipyramidal
$\text{SiF}_4$
NH₃
Electronic Geometry and Molecular Geometry

- **Electronic geometry**
  - Distribution of regions of high electron density around the central atom

- **Molecular geometry**
  - Arrangement of atoms around the central atom
H₂O