AP CHEMISTRY CHAPTER 8 AND 9 OUTLINE

BONDING: GENERAL CONCEPTS

COVALENT BONDING: ORBITALS

8.1: TYPES OF CHEMICAL BONDS

Chemical Bond

Bond Energy

Ionic Bonding

Ionic Compound

Coulomb’s Law and energy of interaction

Hydrogen-Hydrogen Bonding: An example (See page 344, fig. 8.1)

Bond Length

Covalent Bonding

Polar Covalent Bonding

8.2: ELECTRONEGATIVITY

8.3: BOND POLARITY AND DIPOLE MOMENTS

Dipolar (Dipole Moments)

Note: the presence of a polar bond does not always yield a polar molecule

8.4: IONS: ELECTRON CONFIGURATIONS AND SIZES

Generalizations that apply to electron configurations in stable compounds

1.

2.

Predicting formulas of ionic compounds

Sizes of Ions

Isoelectronic Ions

8.5: FORMATION OF BINARY IONIC COMPOUNDS

Lattice Energy

Example of calculating Lattice Energy

Li(s) + 1/2F2(g) → LiF(s)

Step 1: Sublimation of Lithium

Step 2: Ionization of gaseous Lithium atoms

Step 3: Dissociation of fluorine molecules

Step 4: Formation of fluoride ions in the gas phases

Step 5: Formation of solid Lithium fluoride from the gaseous ions

Lattice Energy Calculations

8.6: PARTIAL IONIC CHARACTER OF COVALENT BONDS

8.7: THE COVALENT CHEMICAL BOND: A MODEL

Delocalization

Fundamental Properties of Models

1.

2.

3.

4.

5.

8.8: COVALENT BOND ENERGIES AND CHEMICAL REACTIONS

Single bond

Double bond

Triple bond

See Table 8.4 and 8.5

Bond Energy and Enthalpy

H2(g) + F2(g) → 2HF(g)

8.9: THE LOCALIZED ELECTRON BONDING MODEL

LE Model

Lone Pairs

Bonding Pairs

Three parts of the LE Model

1.

2.

3.

8.10: LEWIS STRUCTURES

Steps for Writing Lewis Structures

1.

2.

3.

Examples: Water and Carbon dioxide

8.11: EXCEPTIONS TO THE OCTET RULE

Examples: BF3 and SF6

Lewis Structures: Comments About the Octet Rule

1.

2.

3.

4.

5.

8.12: RESONANCE

Odd Electron Molecules

Formal Charge

Formal Charge = (number of valence electrons on free atom) – (number of valence electrons assigned to the atom in the molecule)

Valence electrons assigned = (number of lone pair electrons) + 1/2(number of shared electrons)

Example- SO42-

Rules Governing Formal Charge

1. Use Above formulas to calculate the formal charge
2. The sum of the formal charges of all atoms in a give molecule or ion must equal the overall charge of that species
3. If nonequivalent Lewis structures exist for a species, those with formal charges closest to zero and with any negative formal charges on the most electronegative atoms are considered to best describe the bonding in the molecule or ion

8.13: MOLECULAR STRUCTURE: VSEPR MODEL

Molecular Structure

Using the AXnEY method to determine molecular geometry

1. Draw the Lewis structure for the molecule

2. “A” represents the central atom

3. “X” represents the number of atoms bonded to the central atom, bond type does not matter

1. “E” represents lone pairs on the Central Atom Only

IF THERE IS NO CENTRAL ATOM, THE MOLECULE IS LINEAR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EXAMPLE | AXnEy NOTATION | MOLECULAR GEOMETRY | DIPOLE MOMENT | Hybridization |
| CO2 | AX2 | Linear | No | sp |
| BF3 | AX3 | Trigonal Planar | No | sp2 |
| NO2- | AX2E | Bent | Yes | sp2 |
| CH4 | AX4 | Tetrahedral | No | sp3 |
| NH3 | AX3E | Trigonal pyramidal | Yes | sp3 |
| H2O | AX2E2  | Bent | Yes | sp3 |
| PCl5 | AX5 | Trigonal bipyramidal | No | sp3d |
| SF4 | AX4E | See Saw | Yes | sp3d |
| ClF3 | AX3E2 | T-Shaped | Yes | sp3d |
| XeF2 | AX2E3 | Linear | No | sp3d |
| SF6 | AX6 | Octahedral | No | sp3d2 |
| ClF5 | AX5E | Square Pyramidal | Yes | sp3d2 |
| XeF4 | AX4E2 | Square Planar | No | sp3d2 |