

## Gen Chem I (CHEM1311) - Study Guide for Ch.4-6

### Ch. 4 Electronic Structure of the Atom

Periodicity (Relationship to atomic size & ionization energy)

Periodic Table

- Group Identifications (alkali metals, alkaline earth, halogens, noble gases, etc.)

Atomic models

- nature of light and the electromagnetic spectrum

Classical vs. Quantum Physics

Bohr Theory of atomic structure

- electron orbits
- principal quantum no.
- maximum electron capacity/shell ( $2n^2$ )
- energy level diagrams
- Group no. and valence shell electrons
- electron transitions b/w energy levels
- line spectra
- Failures of the Bohr model

Subshells & Electron Configuration

- Types of subshells (*s, p, d, f*)
- Subshell spacing (relative energy levels)
- Electron configuration
  - Full & Noble gas abbreviations

Modern Quantum Mechanical Model of the Atom

- Electron *orbitals* vs orbits
- Heisenberg uncertainty principle and electron location

### Ch 5: Covalent & Ionic Bonds

Molecules, Compounds & elements

Covalent Bonds

- Definition
- Role of Valence Electrons
- Octet Rule

Lewis Dot Structures

- Group No. & valence electrons
- Predicting no. bonds through group no.
- Predicting molecular formulas through group no.
- Lewis dot diagrams for elements
- Lewis dot diagrams for compounds
- Multiple bonds (double & triple bonds)
  - Resonance forms

## Ionic Bonding

- definition
- Electronegativity
  - definition
  - periodic trend in values
  - polar covalent bonds
  - predicting the bond *type* (covalent, ionic or polar covalent) from differences in electronegativity values

## Nomenclature

- binary ionic compounds
- polyatomic ionic compounds
- covalent compounds

## CH 6 Structure of Molecules

### Valence Shell Electron Pair Repulsion Theory (VSEPR)

- Electron group repulsion
- Molecular Geometry
  - bond angles & electron groups
  - Bonding pairs vs. lone pairs - effect on 3D structure
  - Common Arrangements:
    - 2 electron groups: linear
    - 3 electron groups: trigonal planar
    - 4 electron groups: tetrahedral, pyramidal, bent

### Valence Bond Theory

- describes electronic nature of covalent bonds
- bond strength ~ orbital overlap
- creation of hybrid orbitals b/w *s* and *p* orbitals to form bonding orbitals
  - $sp^3$ ,  $sp^2$ ,  $sp$

### Molecular Orbital Theory

- Another theory for why/how covalent bonds form
- Concerned with *molecular* vs. *atomic* orbitals
- Says only 2 ways for electrons in atomic orbitals to interact:
  1. Bonding orbitals
  2. Antibonding orbitals
- When equivalent no. of valence electrons in each orbital, antibonding orbital cancels bonding orbital and no bond forms
- When no. of valence electrons in bonding orbital > no. electrons in antibonding orbital, a covalent bond *can* form

### Polarity of molecules

- No. valence electrons → Lewis dot structure → shape (VSEPR) → bond type
  - En differences
  - partial (+) and (-) charges
  - dipole moments
    - associated *magnitude* and *direction*
    - *additive* and *negative* effects
- Polar interactions b/w molecules
  - phase consequences (solid, liquid, gaseous)
  - strength relative to ionic or covalent bonds

