

*BIG IDEA: interparticle forces (for liquids & solids) determine macroscopic physical properties (melting point, viscosity, electrical conductivity...) of substances*

## INTRODUCTION to ELECTRONS & BONDING

1. valence electrons & the Periodic Table of Elements .....7.11
  - a. representative elements (predicable)
  - b. transition metals (unpredictable until CHM103)
  
2. chemical bonds .....8.1
  - a. Noble Gas electron configuration; "Octet" rule
  - b. covalent bonds .....8.1
  - c. ionic bonds .....8.4
    - i. metals (lose valence electrons)
    - ii. non-metals (gain electrons to achieve noble gas configuration)
  - d. polar covalent bonds ..... 8.2 & 8.3
    - i. electronegativity ( $\chi$ ).....8.2
      1.  $\Delta\chi \leq 0.5$  = non-polar covalent bond
      2.  $\Delta\chi = \sim 0.6-1.9$ : polar (covalent) bond
      3.  $\Delta\chi \geq 2.0$ : ionic bond
  
3. introduction to Lewis Structures ..... 8.9-8.11
  - a. noble gas electron configuration & sharing electrons
  - b. Lewis Structures
    - i. definition
    - ii. rules for drawing simple Lewis Structures
  
4. molecular geometry & polarity .....8.13
  - a. electrons repel!
  - b. basic electron geometries:
    - i. linear
    - ii. trigonal planar
    - iii. tetrahedral
  - c. basic molecular geometries:
    - i. linear
    - ii. trigonal planar & bent ("V")
    - iii. tetrahedral, trigonal pyramidal & bent ("V")
  - d. determining overall molecular polarity
    - i. polar bonds and/or electrons "on one side" of molecule
    - ii. quantifying polarity of bonds

## PURE SOLIDS &amp; LIQUIDS

## 5. substances &amp; associated interparticle forces

- a. elements.....10.1, 10.3-10.5
  - i. metals
  - ii. diatomic non-metals
  - iii. other non-metals (excl. C or Si)
  - iv. C or Si
  
- b. compounds..... 10.1, 10.3, 10.5
  - i. ionic (cation-anion)
  - ii. molecular
    - 1. molecules w/ OH, NH or FH
    - 2. polar molecules: electronegative atom, polar bond(s), molecular geometry
    - 3. non-polar molecules
  - iii. network solids (containing C or Si)

## 6. interparticle forces, relative strengths

- a. bonds (strong) ..... ch. 8
  - i. ionic
  - ii. covalent (nonmetal-nonmetal)
  
- b. weak inter-particle forces .....10.1
  - i. hydrogen bonding (weak)
  - ii. dipole-dipole forces (weaker): electronegative atom(s), polar bond(s), molecular geometry
  - iii. London Dispersion Forces (weakest)

## 7. physical properties of liquids &amp; solids ..... 10.2, 10.4, 10.5, 10.8

- a. vapor pressure
- b. melting / freezing point
- c. boiling point
- d. surface tension
- e. viscosity
- f. enthalpy ("heat") of fusion
- g. enthalpy ("heat") of vaporization
- h. rates of evaporation
- i. volatility
- j. hardness
- k. malleability & ductility
- l. electrical conductivity

8. interparticle forces & physical properties .....10.2
- a. stronger interparticle forces INCREASE:
    - i. melting / freezing point
    - ii. boiling point
    - iii. surface tension
    - iv. viscosity
    - v. enthalpy (“heat”) of fusion
    - vi. enthalpy (“heat”) of vaporization
  - b. stronger interparticle forces DECREASE:
    - i. vapor pressure
    - ii. rates of evaporation
    - iii. volatility
  - c. types of covalent bonding affect:
    - i. hardness
    - ii. malleability & ductility
    - iii. electrical conductivity
  - d. dissimilar substance interactions
    - i. liquid in solid vessel: meniscus shapes
    - ii. polar liquid / non-polar solid (“beading”)
    - iii. polar liquid / non-polar liquid (“oil & water” separation)
9. vapor pressure & changes of state .....10.8
- a. vapor pressure & dynamic equilibrium
  - b. changes of state
    - i. melting / freezing; normal melting point
    - ii. boiling / evaporating / condensing; normal boiling point
    - iii. sublimation / deposition
  - c. enthalpies of state changes
    - i. heat of fusion
    - ii. heat of vaporization
  - d. heating curves
  - e. calculations involving changes of state
  - f. vapor pressure, temperature & heat of vaporization; mathematical relationship
10. phase diagrams .....10.9
- a. introduction
  - b. relative densities
  - c. normal melting & boiling points
  - d. triple points
  - e. critical point / critical pressure