

# Chemistry 1A Fall 2015

Reading is from the class textbook (Chemical Principles, by Atkins et al)

## 1. A Reminder about Stoichiometry

8/26: Moles, molecular formulas and chemical equations.

8/28: Solutions, concentrations, Acid-base chemistry, redox reactions

Reading: Fundamentals

## 2. Quantum concepts & atomic structure

8/31: Waves, electromagnetic radiation, Planck & de Broglie relations

9/2: Quantization in atoms, the Bohr atom and atomic spectra

9/4: Particle in a 1-d box and the link between nodes and energy levels

Reading: Ch. 1

## 3. Atomic structure.

9/7: No lecture: Labor Day.

9/9: Energy levels of 1-electron atoms, nodes, and atomic orbitals

9/11: Energy levels of many-electron atoms, periodic table trends.

Reading: Ch. 2

## 4. Ionic and covalent bonding: the classical picture.

9/14: Ionic bonding, Coulomb's Law & the octet rule

9/16: Lewis structures for covalent bonding

9/18: Extensions for polar bonding, violations

Reading: Ch. 3

## 5. Molecules and giant molecules.

9/21: Organic functional groups and polymers

**Midterm 1: Monday Sept. 21 7-9PM**

9/23: Biopolymers

9/25: VSEPR model for molecular shape

Reading: Ch. 20, Ch. 4.1-4.3

## **6. Molecular orbital theory & computation**

9/28: MO's in diatomic molecules: node counting

9/30: MO's in polyatomics: more node counting!

10/2: Computing the energy and structure of molecules

Reading: Ch. 4.3-4.12

## **7. Experimentally probing molecules with radiation**

10/5: Electronic energy levels: Photoionization & UV-vis spectroscopy

10/7: Microwave, infrared, NMR spectroscopy, X-ray diffraction.

Reading: Major techniques 1,2,3,7

## **8. Gases, liquids and solids**

10/9: Macroscopic gas laws vs microscopic kinetic theory

10/12: Maxwell distribution, intermolecular forces & real gases

10/14: Liquids and phase transitions

10/16: Types of solids & their uses

Reading: Ch. 5,6,(7)

## **9. Thermodynamics and the 1<sup>st</sup> Law**

10/19: Introduction to thermodynamics and the 1<sup>st</sup> law

**Mid-term 2: Tuesday Oct. 20 7-9PM**

10/21: Enthalpy, thermochemistry & bond energies

10/23: Combustion and world energy usage

Reading: Ch. 8

## 10. Spontaneous processes, disorder and the 2<sup>nd</sup> Law

10/26: Disorder and entropy

10/28: Entropy, the 2<sup>nd</sup> Law, and spontaneous processes

10/30: Gibbs free energy: reformulating the 2<sup>nd</sup> law

Reading: Ch. 9.

## 11. Free energy and equilibrium

11/2: Phase changes, solubility, and physical equilibrium

11/4: Chemical equilibrium, mass action, equilibrium constants

11/6: Temperature dependence, homogeneous & heterogeneous equilibria

Reading: Ch. 10, 11

## 12. Acid-base equilibria

11/9: Acid/base classification, acid/base scales, weak acids

11/11: Veteran's Day (no class)

11/13 Acid-base titration curves

11/16: Weak acids, buffers, polyprotic acids

Reading: Ch. 12,13

## 13. Electrochemistry

**Mid-term 3: Tuesday Nov. 17 7-9PM**

11/18: Electrochemical cells, cell potentials & Gibbs free energy

11/20: Concentration effects, Nernst equation

11/23: Batteries, fuel cells, natural & artificial light harvesting

Reading: Ch. 14

11/25: No lecture

11/27: No lecture

## **14. Chemical kinetics**

11/30: Rates of reactions & elementary steps

12/2: Reaction mechanisms & steady state approximation

12/4: Temperature dependence and catalysis

Reading: Ch. 15

**Final Exam: MONDAY, DECEMBER 14, 2015 3-6P**