

## Objectives for CHEM 1312 General Chemistry II

This is a list of topics to be taught in General Chemistry II. It does not reflect the order in which the topics need be taught. The required text is Chemistry, 8<sup>th</sup> edition, by Whitten, Davis, Peck, & Stanley.

### Unit 1

#### Review of General Chemistry 1

#### **Thermodynamics: Chapter 15**

The First Law of Thermodynamics  
Enthalpy,  $\Delta H$   
Calorimetry (constant-pressure and constant volume)  
Thermochemical equations  
Internal energy,  $\Delta E$   
Relationship between  $\Delta E$  and  $\Delta H$   
Hess' Law  
Standard enthalpies of formation and reaction  
Bond energy and  $\Delta H$   
The Second Law of Thermodynamics & Spontaneity  
Entropy and Third Laws of Thermodynamics  
Gibb's free energy  
Relationship between  $\Delta G$  and  $K$  1

### Unit 2

#### **Chemical Kinetics: Chapter 16**

Rate of a reaction  
Factors that affect reaction rates  
a. Nature of reactants  
b. Concentration of reactants: Rate-law expressions & Reaction order  
c. Concentration vs. time: Integrated rate equations and half-life  
Collision theory, activation energy  
Transition state theory  
Mechanisms and Rate-law expressions  
Arrhenius equation: temperature and rate  
Catalysts

#### **Chemical Equilibria: Chapter 17**

Dynamic equilibria  
Equilibrium constant  $K_c$   
Reaction quotients  
Calculations with  $K_c$   
Heterogeneous equilibria  
 $K_p$  and  $K_c$   
Le Chatelier's Principle: factors affecting equilibria

### **Unit 3**

#### **Acid-Base Theories: Chapter 10**

Arrhenius Acid-base theories  
Bronsted-Lowry Acid-base theories  
Strength of acids: binary and ternary acids  
Lewis Acid-base theories

#### **Acid-Base Equilibria: Ch. 10, 18, 19**

Ionization of water  
pH and pOH  
K<sub>a</sub> and K<sub>b</sub> for weak acids and bases, % ionization  
Polyprotic acids  
Hydrolysis of salts: Relationship between K<sub>a</sub> and K<sub>b</sub>  
Hydrolysis of metal ions  
Common ion effect and Buffer solutions, Henderson-Hasselbalch equation  
Buffering action and preparation of buffer solutions  
Acid-base indicators  
Acid-base titrations

#### **Ionic equilibria: Solubility: Chapter 20**

K<sub>sp</sub> and solubility  
Common ion effect of solubility Reaction quotients  
Predicting precipitate formation  
Fractional precipitation  
Simultaneous Equilibria: K<sub>sp</sub> & K<sub>b</sub>/K<sub>a</sub>  
Dissolving precipitate, complex formation

### **Unit 4**

#### **7 Electrochemistry: Chapter 21**

Balancing redox reactions  
Electrical conduction & electrodes  
Electrolysis  
Faraday's law of Electrolysis  
Voltaic cells  
Standard electrode potentials  
Nernst equation  
Concentration cells  
Relationship of  $\epsilon^\circ$ ,  $\Delta G^\circ$  and K

#### **9 Nuclear Chemistry: Chapter 26**

n/p ratio and nuclear stability  
Nuclear binding energy & nuclear stability  
Radioactive decay  
Nuclear equations  
Kinetics  
Nuclear fission, fusion and reactors

## **Possible Additions**

### **Coordination Compounds: Chapter 25**

Basics: ligands, coordination number

Nomenclature

Structural Isomers

Stereoisomers: geometric & optical isomers

\*\*\* Crystal field theory: high spin, low spin

\*\*\* Color & spectrochemical series

### **Introduction to Organic Chemistry: Chapter 27**

Types of hydrocarbons

Functional groups: halides, alcohols, ethers, aldehydes, ketones, amines,  
carboxylic acids & derivatives

Nomenclature

Typical reactions: substitution, addition, elimination & polymerization

Isomers