# Syllabus

## CHM 122 General Chemistry II

## General Information

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**Department** Science and Technology

**Course Prefix** CHM

**Course Number** 122

**Course Title** General Chemistry II

## Course Information

**Catalog Description** Continuation of General Chemistry I. Topics covered include electronic structure and bonding theories, solutions, kinetics, equilibrium, acid-base chemistry, thermochemistry, thermodynamics, solids, organic and biochemistry, electrochemistry, coordination chemistry, descriptive chemistry of main-group elements, and nuclear chemistry

**Credit Hours** 4

**Lecture Contact Hours** 3

**Lab Contact Hours** 3

**Other Contact Hours** 0

**Grading Scheme** Letter

## Prerequisites

CHM 121 with a C or higher

## Co-requisites

None

## First Year Experience/Capstone Designation

**This course DOES NOT satisfy the outcomes applicable for status as a FYE or Capstone.**

# SUNY General Education

**This course is designated as satisfying a requirement in the following SUNY Gen Ed category**
Natural Sciences (and Scientific Reasoning)

# FLCC Values

**Institutional Learning Outcomes Addressed by the Course**
Inquiry and Interconnectedness

# Course Learning Outcomes

**Course Learning Outcomes**

1. Evaluate relationships between bonding, shape and reactivity
2. Apply concepts of kinetics and thermodynamics to predict reaction rates and spontaneity
3. Describe the difference between organic and inorganic compounds and identify functional groups and their properties
4. Conduct a chemistry experiment using proper safety procedures, recognize potentially hazardous situations and demonstrate an understanding for the necessity of safe laboratory procedures

# Outline of Topics Covered

**Electronic Structure and Bonding – VBT & MOT**

- The student should be able to demonstrate an understanding of Valence Bond Theory and Molecular Orbital Theory and apply them to diatomic molecules from Periods 1 and 2
- Write MO configurations for molecules, to calculate bond order, and to explain case such as the magnetic properties of O2 molecule

**Solutions**

- The student should be able to demonstrate an understanding of saturated, unsaturated, and supersaturated solutions
- Use and convert between units for concentration (molarity and molality)
- Determination of Molar Mass in Solution. Effect of Ionization and Aggregation
- Change of Solubility with Temperature

**Kinetics**

- The student should be able to demonstrate an understanding of the terms and concepts of chemical kinetics and solve related problems
- List the factors that affect reaction rates and discuss in terms of collision theory
- Use experimental data to determine the rate law expression and use the data to calculate rate constants and reaction orders
- Define and use terms such as reaction intermediate, activation energy, effective collision, rate-determining step and reaction mechanism
- Interpret energy diagrams related to kinetics

**Chemical Equilibrium**

- The student should be able to demonstrate an understanding of the fundamental principles of chemical equilibrium
- Write the equilibrium expression “K” from a balanced equation
- Relate the magnitude of the equilibrium constant “K” to the relative amounts of products and reactants present at equilibrium
- Apply Le Chatelier’s Principle to describe the qualitative changes caused by various stresses on a system at equilibrium
- Use data to calculate the value of K and use the value of K to determine quantities present at equilibrium

**Acids & Bases**

- The student should be able to demonstrate an understanding of the principles of chemical equilibrium as applied specifically to aqueous solutions
- Know the relationships among [H+], [OH-1], pH and pOH and perform calculations involving these
- Be able to distinguish between strong and weak acids and bases
- Calculate ionization constants for weak acids and bases
- Use Ka or Kb to calculate equilibrium concentrations of species present in solutions of weak acids and bases
- Calculate pKa or pKb from ionization constants
- Describe the common ion effect
- Define and recognize a buffer system
- Interpret acid-base titration curves and differentiate between equivalence point and endpoint

**Thermochemistry & Thermodynamics**

- The student should be able to demonstrate an understanding of spontaneous, reversible, and irreversible processes
- State the first and second law of thermodynamics
- Describe the kinds of molecular motion that a molecule can possess
- Use free energy changes to predict whether reactions are spontaneous
- Predict the sign of ?S for physical and chemical processes
- Calculate the Gibbs free energy from changes in enthalpy and entropy at a given temperature

- Calculate energy of a reaction using standard free energies of formation, Hess's law, and Bond Dissociation Energies
- Predict the effect of temperature on spontaneity given ?H and ?S

**Introduction to the Solid State**

- The student should be able to state the differences between amorphous and crystallin solids
- List the characteristics of molecular, covalent, ionic and metallic solids
- Interpret phase diagrams

**Introduction to Organic & Biochemistry**

- The student should be able to demonstrate an understanding of the fundamental aspects of organic chemistry, including functional groups, and important classes of organic reactions
- Recognize and describe the common functional groups in organic compounds
- Name simple compounds containing the common functional groups
- Recognize and predict the existence of structural isomerism in organic compounds
- Recognize the structure of amino acids, proteins, carbohydrates, nucleic acids, and lipids
- Define primary, secondary, tertiary and quaternary structure in proteins
- Describe the chemical nature of enzymes and their function in biochemical reactions

**Electrochemistry**

- The student should be able to demonstrate an understanding of the terms and concepts related to electrochemical systems
- Describe the components and processes occurring in electrolytic cells
- Apply Faraday's Law of Electrolysis to specific electrolytic systems
- Describe the components and processes present in voltaic cells
- Use the information contained in a standard electrode potential table for calculating Eo for a voltaic cell and for making predictions about reaction spontaneity
- Define the Nernst equation and apply it to electrochemical systems
- Use the relationship of Eo cell to the Gibbs free energy change, ?Go and the thermodynamic equilibrium constant K in problem solving

**Coordination Chemistry**

- The student should be able to demonstrate an understanding of the nature, properties and importance of complex ions and coordination compounds
- Define coordinate covalent bond, central metal, ligand, coordination sphere, coordination number, donor atom, chelate and isomer
- State the geometries associated with the specific coordination numbers in coordination compounds
- Recognize the types of isomerism in coordination compounds and give examples of each

## Descriptive Chemistry of Main-Group Elements

- Student should be able to demonstrate an understanding of some of the common main-group elements and their chemistry
- Identify elements which are classified as metals, non-metals, and metalloids
- List the general properties of metals
- Discuss the general properties and reactions for the most important main-group elements

## Nuclear Chemistry

- The student should be able to demonstrate an understanding of the fundamental principles of nuclear structure and nuclear changes
- Distinguish between nuclear changes and ordinary chemical changes
- Describe the factors that contribute to nuclear stability
- Define radiation, radioactivity, nuclide, isotope, naturally-occurring, artificial transmutation
- Define and write nuclide symbols for common types of subatomic particles
- Complete and balance nuclear equations
- List the methods used to detect and measure radiation
- Define half-life and perform calculations involving half-life
- Define and recognize equations that represent nuclear fission and fusion, and discuss some applications of these processes