**BARTON COMMUNITY COLLEGE**

##### **COURSE SYLLABUS**

1. **GENERAL COURSE INFORMATION**

Course Number: CHEM 1808

Course Title: College Chemistry II

Credit Hours: 5 Credit Hours

Prerequisites: 1806 College Chemistry I or equivalent with a C or better.

Division/Discipline: Academic Division/Chemistry

Course Description: This course is the second semester of the College Chemistry series. This course stresses the conceptual and mathematical approach to understanding general chemistry and prepares the student to follow a science oriented four-year program. It provides students with the necessary tools to handle problems of both a theoretical and practical nature. The students taking this course are usually declared Chemistry, Physics, Engineering, Pre-Med, etc., majors. This course is a continuation of College Chemistry I.

1. **INSTRUCTOR INFORMATION**

## **COLLEGE POLICIES**

Students and faculty of Barton Community College constitute a special community engaged in the process of education. The College assumes that its students and faculty will demonstrate a code of personal honor that is based upon courtesy, integrity, common sense, and respect for others both within and outside the classroom.

Plagiarism on any academic endeavors at Barton Community College will not be tolerated. The student is responsible for learning the rules of, and avoiding instances of, intentional or unintentional plagiarism. Information about academic integrity is located in the Student Handbook.

The College reserves the right to suspend a student for conduct that is detrimental to the College's educational endeavors as outlined in the College catalog, Student Handbook, and College Policy & Procedure Manual. (Most up-to-date documents are available on the College webpage.)

Anyone seeking an accommodation under provisions of the Americans with Disabilities Act should notify Student Support Services via email at [disabilityservices@bartonccc.edu](mailto:disabilityservices@bartonccc.edu).

## **COURSE AS VIEWED IN THE TOTAL CURRICULUM**

College Chemistry II is an approved general education course at BCC, which can be used to fulfill degree requirements as a breadth laboratory science course in the natural/physical science. In addition, it is required (or recommended) to be taken by students enrolled in Chemistry, Physical Science, Biological Sciences, Medical Lab Technician, and pre-professional programs (e.g. Pre Dentistry, Pre-Forestry, Pre-Medicine, Pre-Pharmacy, Pre-Wildlife, Pre-Chiropractic, Pre-Veterinarian, Pre-Engineering, etc.)

The learning outcomes and competencies detailed in this course syllabus meet or exceed those specified for this course by the Kansas Core Outcomes Groups project, and as approved by the Kansas Board of Regents –[http://kansasregents.org/transfer\_articulation](https://mail.bartonccc.edu/owa/redir.aspx?C=qVD-LBvN0kGqrR1qYRD1DhVzTst039IIQPv6y5zBJIs2AFzqxzQ44MHNcN2AIt8qr6rQMioa1FI.&URL=http%3a%2f%2fkansasregents.org%2ftransfer_articulation).

This course transfers well and may be used to help fulfill credit and course requirements for general education at all Kansas Regents institutions. However, general education requirements vary among institutions, and perhaps even among departments, colleges, and programs within an institution. Also, these requirements may change from time to time and without notification. **Therefore it shall be the student’s responsibility to obtain relevant information from intended transfer institution during his/her tenure at BCC to insure that he/she enrolls in the most appropriate set of courses for the transfer program.**

## **ASSESSMENT OF STUDENT LEARNING/COURSE OUTCOMES**

Barton Community College is committed to the assessment of student learning and to quality education. Assessment activities provide a means to develop an understanding of how students learn, what they know, and what they can do with their knowledge. Results from these various activities guide Barton, as a learning college, in finding ways to improve student learning.

Course Outcomes, Competencies, and Supplemental Competencies:

* 1. Define and describe solutions in terms of Colligative Properties.
     1. Describe the origins and relative magnitudes of intermolecular forces.
     2. Relate phase behavior to nature of intermolecular forces.
     3. Define saturated solution, unsaturated solution, supersaturated solution, solubility, solute, and solvent.
     4. Perform calculations using Henry's Law
     5. Calculate concentration in molality, molarity, mole fraction, and percent composition, and interconvert between these units.
     6. Explain and calculate vapor pressure using Raoult's Law.
     7. Explain other colligative properties, including freezing point depression, boiling, point elevation, and osmotic pressure.
     8. Perform calculations using colligative properties, including molecular weight, freezing point depression, boiling point elevation and osmotic pressure.
     9. Differentiate between the behaviors of non-ionizing and ionizing compounds in solution.
  2. Express the kinetics of chemical reactions by analyzing reaction rates.
     1. Define the rate of a reaction and the factors that affect them.
     2. Using experimental data, determine the rate law and use the initial rate method to determine reaction order.
     3. Determine orders of reaction for reactants from data expressing changes in concentration as a function of longer times.
     4. Use the rate law to determine the overall order of a reaction.
     5. Determine a reaction rate law from initial rate data.
     6. Describe the relationship between order of reaction and molecularity.
     7. Use an integrated form of the rate expression to perform calculations relating reactant or product concentration with reaction time.
     8. Compare zero, first and second order rate reactions.
     9. Define the collision theory of a reaction rate.
     10. Use the Arrhenius equation to illustrate the relationship between energy of activation and rate law constant.
     11. Describe the relationships among the mechanism, the overall reaction and elementary steps.
     12. Identify reaction intermediates and catalysts in reaction mechanisms.
     13. Draw and interpret energy diagrams and illustrate the affect of a catalyst on the energy diagram.
  3. Describe and apply equilibrium principles to reversible reaction pairs.
     1. Explain the relationship between the terms reversible reaction and dynamic equilibrium.
     2. Write the general equilibrium constant expression and explain its significance.
     3. Calculate Keq given equilibrium concentrations of reactants and products.
     4. Calculate equilibrium concentrations of reactants and products given the equilibrium concentration of other reactants and products.
     5. Calculate new equilibrium concentrations of reactants and products after an increase or decrease in the concentration of one of the reactants or products.
     6. Explain why the concentrations of pure liquids and solids are never used in equilibrium constant expressions.
     7. Show how the numerical value of the equilibrium constant changes when the stoichiometric coefficients are changed or the reaction is reversed.
     8. Explain the differences between the terms Kc and Kp and the relation of either to Qc.
     9. Explain the difference between an equilibrium position and an equilibrium constant.
     10. Given Keq and initial concentration of reactants and/or products, calculate the final concentrations of reactants and/or products.
     11. List and explain the external factors that can affect equilibria.
     12. Using Le Chatelier’s Principle, explain how changes in temperature, pressure, volume, or concentration affect the equilibrium position for a chemical reaction.
  4. Evaluate the equilibrium of aqueous solutions by defining, describing, and calculating associated solution properties.
     1. Use the definition of acids and bases to distinguish between strong and weak acids and bases, equilibrium relationships among them, and the aqueous properties of their salts.
     2. Use the concepts of pH, pOH, Ka, and Kb to calculate the pH of aqueous solutions of acids, bases, and their salts.
     3. Determine the specific species present in an aqueous solution and the concentrations of those species.
     4. Describe the shape of acid-base titration curves for strong acid-strong base, weak acid-strong base, strong acid-weak base and weak acid-weak base titrations.
     5. Describe the effect of common ions and calculate concentrations of all species present in solutions of weak acids and bases.
     6. Describe the ionization of polyprotic acid in aqueous solution.
     7. Explain the buffer effect, predict the influence of added acids and bases on buffers, and calculate the concentrations of species in solution (using acid or base dissociation constant expressions, or Henderson-Hasselbach equation).
     8. Calculate the pH of a buffer solution outside of the buffer region.
        1. Identify titration curves for strong, weak, and polyfunctional acids and bases.
     9. Display the use of volumetric methods to determine the concentrations of species in solution.
     10. Utilize the application of indicators in titration.
     11. Write an equation to express the relationship between a solid solute and its constituent ions in a saturated solution.
     12. Calculate the Ksp from molar solubility and molar solubility from Ksp.
     13. Calculate the effect of a common ion on the molar solubility of a salt.
     14. Predict whether precipitation will occur when salt solutions are mixed and determine the concentration of ions remaining in solution after precipitation.
  5. Evaluate a chemical reaction in terms of its thermodynamic properties.
     1. Explain the similarities and differences between such terms as enthalpy, entropy, and free energy.
     2. Explain how the First, Second, and Third Laws of Thermodynamics apply chemical and physical processes.
     3. Predict whether the entropy change in a given process is positive, negative, or near zero.
     4. Use data tables to determine enthalpy, entropy, and free energy changes.
     5. Explain how ∆H˚, ∆S˚, and ∆G˚ are related to reaction spontaneity.
     6. Explain how knowledge of ∆H˚, ∆S˚, and ∆G˚ allows one to predict the conditions under which a reaction will occur.
     7. Describe and calculate the relationship between the standard free energy of reaction and the equilibrium constant.
     8. Calculate ∆G for a chemical reaction that occurs under nonstandard conditions.
  6. Evaluate the redox chemistry of, and describe electrochemical cells.
     1. Describe galvanic and electrolytic cells and their operation, including the identification of half reactions at the anode and cathode.
     2. Write half reactions given a balanced redox reaction, and generate a balanced redox reaction given redox half reactions.
     3. Calculate cell potentials and determine spontaneity of oxidation/ reduction reactions.
     4. Apply Faraday's Law in calculations.
     5. Apply the relationship of thermodynamics to electrochemistry.
     6. Use the Nernst Equation in calculations.
     7. Use the relationship between the cell potential E and ∆G in problem solving.
     8. Give examples of natural and/or commercial applications of electrochemical processes
     9. Use the activity series of metals (optional).
  7. Optional or Supplemental Topics as identified by KBOR
     1. Biochemistry.
     2. Coordination chemistry.
     3. Descriptive chemistry.
     4. Nuclear and radiochemistry.
     5. Organic chemistry.
     6. Solid state chemistry.

1. Work in the laboratory in accordance with good laboratory practices
   * 1. Dress in an appropriate manner as to promote safety in the laboratory, wearing appropriate laboratory attire and goggles when anyone is working with chemicals in the laboratory.
     2. Follow written directions accurately.
     3. Work safely and effectively, using equipment and chemical carefully and correctly.
     4. Demonstrate use of required techniques.
     5. Dispose of waste products in a proper manner.
     6. Know how to find and interpret MSDS's for the chemicals used in a particular laboratory.
   1. Gather and record qualitative and quantitative data accurately
      1. Acquire data using balances and volumetric glassware.
      2. Make and record visual observations.
      3. Use computers, when appropriate, as data acquisition tools.
      4. List or describe experimental assumptions made and any deviations from the written experimental procedures.
   2. Handle and evaluate data in logical, productive, and meaningful ways
      1. Create notebooks and laboratory reports that are clear, understandable, and accurately represent the data collected.
      2. Display computer data in a spreadsheet or graphically, as appropriate
      3. Correlate observations with chemical or physical processes.
      4. Carry out suitable calculations with quantitative data, recognizing when data and calculations are within a reasonable range.
      5. Use observations of experimental data to present relevant conclusions pertaining to the experimental procedure.
      6. Correlate laboratory work with principal topics in College Chemistry II lecture by discussing the results obtained in the context of the competencies identified above in outcomes A-G.

1. **INSTRUCTOR'S EXPECTATIONS OF STUDENTS IN CLASS**

1. **TEXTBOOKS AND OTHER REQUIRED MATERIALS**

## **REFERENCES**

### **METHODS OF INSTRUCTION AND EVALUATION**

### Since laboratory activities are integral to the learning outcomes of this lab science course, students must pass the laboratory portion of the class in order to successfully complete (“pass”) the course.

### **ATTENDANCE REQUIREMENTS**

## **COURSE OUTLINE**