

COURSE SYLLABUS

LAST REVIEW	Fall 2022
COURSE TITLE	General Chemistry
COURSE NUMBER	CHEM-0109
DIVISION	Math, Science, Business & Technology
DEPARTMENT	Chemistry
CIP CODE	24.0101
CREDIT HOURS	5
CONTACT HOURS/WEEK	Class: 3 Lab: 4
PREREQUISITES	MATH-0104
COURSE PLACEMENT	Students must meet the correct placement measure for this course. Information may be found at: https://www.kckcc.edu/admissions/information/mandatory-evaluation-placement.html

COURSE DESCRIPTION

Primarily for the liberal arts, allied health, and non-science majors, General Chemistry develops the principles of inorganic, organic, and biochemistry. Three lecture periods and two 2-hour laboratory/discussion periods are required weekly. Students may not receive credit for both CHEM-0109 and CHEM 111. This course may not be used as a prerequisite for CHEM-0112.

KANSAS SYSTEMWIDE TRANSFER: CHM 1030

The learning outcomes and competencies detailed in this course outline or syllabus meet or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Groups project for this course as approved by the Kansas Board of Regents.

General Education Learning Outcome

- ☐ Basic Skills for Communication
- ☐ Mathematics
- ☐ Humanities
- ☒ Natural and Physical Sciences
- ☐ Social and Behavioral Sciences

Institutional Learning Outcomes

- ☒ Communication
- ☒ Computation and Financial Literacy
- ☐ Critical Reasoning
- ☐ Technology and Information Literacy

- ☐ Community and Civic Responsibility
- ☒ Personal and Interpersonal Skills

TEXTBOOKS

<http://kckccbookstore.com/>

METHODS OF INSTRUCTION

A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE:

- I. Atoms and the Periodic Table
 - A. Subatomic particles and their general arrangement in the atom
 - B. Element symbols
 - C. Properties of the elements to their relative positions in the periodic table
- II. The Structure of Compounds
 - A. Ionic, covalent and polar covalent compounds
 - B. Lewis electron-dot symbols/formulas for various elements and simple molecules
 - C. Shape and polarity for simple molecules
- III. Chemical Nomenclature of Inorganic Compounds
 - A. Name of a substance given the formula
 - B. Write the formula of a substance given the name
- IV. Measurements
 - A. Significant digits in a number
 - B. Basic calculations on numbers and correct number of significant digits
 - C. Conversions between the English and metric system
- V. Matter and Energy
 - A. Classification of matter
 - B. Physical and chemical properties and changes
 - C. Calculate the energy involved in reactions
- VI. Calculations Involving Elements and Compounds
 - A. Calculate the formula or molar mass of a compound
 - B. Convert between mass, moles, and number of molecules of a substance
 - C. Perform simple stoichiometric calculations
 - D. Percent composition of compound and empirical formula
 - E. Stoichiometry problems
- VII. Chemical Equations
 - A. Write balanced equations for chemical reactions
 - B. Predict the products of simple chemical reactions

- VIII. Gases
 - A. Relationships between volume, temperature, and pressure
 - B. Gas laws
- IX. Liquids, Solids, and Solutions
 - A. Intermolecular forces
 - B. Solution concentration
 - C. Colligative properties
- X. Acids, Bases, and Ionic Equations
 - A. Acids and bases--Weak and strong
 - B. Reactions of acids and bases
 - C. Acidity and basicity on the pH scale
 - D. Perform simple pH calculations
 - E. Buffers and their function
- XI. Access Chemical Literature
- XII. Laboratory Skills
 - A. Observations and measurements
 - B. Communicate results through written reports
 - C. Safe work habits in the lab
 - D. Construct a graph
 - E. Use titration data
- XIII. Organic
 - A. Aliphatic and aromatic chemistry
 - B. Alkanes, alkenes, alkynes, and cyclic hydrocarbons
 - C. Organic functional groups: halogens, aldehydes, ketones, carboxylic acids, esters, amines, amides, and thiols
 - D. Name and illustrate the structure of aliphatic and aromatic compounds
 - E. Geometry around the carbon atoms
 - F. Write and classify simple organic reactions
- XIV. Biochemistry
 - A. Roles of carbohydrates, proteins, lipids, and nucleic acids in living systems
 - B. Buffers and the requirements of a buffer system
 - C. Chemistry involved in a metabolic pathway
 - D. Nucleic acids
- XV. Nuclear Chemistry
 - A. Classify nuclear reactions
 - B. Identify different types of ionizing radiation
 - C. Describe uses of radioactivity
- XVI. Discuss how chemistry applies in personal lives, economy, energy, and environment

COURSE LEARNING OUTCOMES AND COMPETENCIES

Upon completion of this course, students will be able to:

- A. Explain the chemical context of topics as they relate to the natural sciences and society.

- B. Demonstrate knowledge of atoms, the periodic table, molecular structure, and bonding.
- C. Recognize differences between phase of matter
- D. Identify and analyze different types of chemical reactions, including energetics and stoichiometry.
- E. Solve problems involving solutions, gases, and acids and bases.
- F. Record quantitative and qualitative data accurately. Critically analyze data and chemical information from various sources responsibly and accurately.
- G. Demonstrate a broad knowledge of Inorganic Chemistry.
 - 1. The student will be able to recognize the three major subatomic particles and their general arrangement in the atom.
 - 2. The student will be able to identify an element from its symbol and/or provide a symbol for a given element.
 - 3. The student will be able to relate the properties of the elements to their relative positions in the periodic table.
 - 4. The student will be able to distinguish between ionic, covalent and polar covalent compounds.
 - 5. The student will be able to create Lewis electron-dot symbols/formulas for various elements and simple molecules.
 - 6. The student will be able to recognize shape and determine polarity for simple molecules.
 - 7. The student will be able to determine the name of a substance given the formula and the formula of a substance given the name.
 - 8. The student will be able to determine the significant digits in a number, including numbers written in scientific notation.
 - 9. The student will be able to perform basic calculations on numbers and round off the answers to the correct number of significant digits.
 - 10. The student will be able to make conversions between the English and metric system as well as within the metric system.
 - 11. The student will be able to distinguish between the various classes of matter and differentiate between physical and chemical properties and changes.
 - 12. The student will be able to calculate the energy involved when a substance undergoes a phase and temperature change.
 - 13. The student will be able to calculate the formula or molecular mass of a compound.
 - 14. The student will be able to convert between mass, moles, and number of molecules of a substance
 - 15. The student will be able to perform simple stoichiometric calculations.
 - 16. The student will be able to calculate the percent composition of a compound from its formula or determine the empirical formula from percent composition.
 - 17. The student will be able to solve stoichiometry problems involving mass-mass, mass-volume, and volume-volume relationships, including limited reagent problems.

18. The student will be able to identify and balance simple chemical reaction equations.
19. The student will be able to predict the products of simple reactions.
20. The student will be able to know and solve problems involving the relationships between volume, temperature, and pressure.
21. The student will be able to use the gas laws to solve molecular mass, density, and stoichiometry problems
22. The student will be able to identify various intermolecular forces.
23. The student will be able to calculate the various ways of expressing solution concentration.
24. The student will be able to describe the boiling point elevation or freezing point depression of a solution and use them to calculate the molecular mass of an unknown solute.
25. The student will be able to identify acids and bases and describe the difference between a strong and weak acid and base and recognize reactions of acids and bases.
26. The student will be able to distinguish between acidity and basicity on the pH scale.
27. The student will be able to perform simple pH calculations.
28. The student will be able to identify buffers and describe their function.
29. The student will be able to classify nuclear reactions.
30. The student will be able to identify different types of ionizing radiation.
31. The student will be able to describe uses of radioactivity.
32. The student will be able to reference literature sources to gather and summarize information in a scientific research paper.
- H. Demonstrate a broad knowledge of Organic Chemistry.
 33. The student will be able to define and distinguish between aliphatic and aromatic chemistry.
 34. The student will be able to define and identify alkanes, alkenes, alkynes, and cyclic hydrocarbons.
 35. The student will be able to define, identify, and illustrate the various organic functional groups: halogens, aldehydes, ketones, carboxylic acids, esters, amines, amides, thiols.
 36. The student will be able to demonstrate the ability to name and illustrate the structure of aliphatic and aromatic compounds.
 37. The student will be able to recognize the geometry around the carbon atoms and the existence of isomers, including stereoisomers.
 38. The student will be able to demonstrate the ability to write and name simple organic reactions.
- Demonstrate a broad knowledge of Biochemistry.
 39. The student will be able to describe the roles of carbohydrates, proteins, lipids, and nucleic acids in living systems.
 40. The student will be able to describe the importance of buffers and the requirements of a buffer system

41. The student will be able to describe the chemistry involved in a metabolic pathway.
42. The student will be able to define, demonstrate, and distinguish between various nucleic acids, especially DNA and RNA.
43. The student will be able to discuss how chemistry applies in personal lives, economy, energy, and environment.
- I. Apply knowledge of good laboratory practices.
 44. The student will be able to make observations and measurements, handle data, calculate results, and draw conclusions from observations and/or experimental data.
 45. The student will be able to communicate results through written reports.
 46. The student will be able to demonstrate safe work habits in the lab.
 47. The student will be able to construct a graph and interpret graphical data.
 48. The student will be able to use titration data to solve stoichiometric problems.

ASSESSMENT OF COURSE LEARNING OUTCOMES

Student progress is evaluated through both formative and summative assessment methods. Specific details may be found in the instructor's course information document.

COLLEGE POLICIES AND PROCEDURES

Student Handbook

<https://www.kckcc.edu/files/docs/student-resources/student-handbook-and-code-of-conduct.pdf>

College Catalog

<https://www.kckcc.edu/academics/catalog/index.html>

College Policies and Statements

<https://www.kckcc.edu/about/policies-statements/index.html>

Accessibility and Accommodations

<https://www.kckcc.edu/academics/resources/student-accessibility-support-services/index.html>.