

**Course Code:** CHE 142 (IAI CHM 912)

**Course Title:** General Chemistry II

**Department:** Natural Sciences

**Effective Date:** Summer 2026

**PCS Code:** 1.1 - Baccalaureate/Transfer

**CIP Code:** 40.0501

**Repeatability:** 0

---

## Credit Hours

**Catalog Notation:** 4-3-5

**Credit Hour Distribution:**

Lecture: 4

Lab: 3

Clinical: 0

**Total: 5**

---

## General Course Information

### Catalog Description

Equilibrium reactions (gas, acid/base, solution); nuclear chemistry; electrochemistry; redox reactions, transition metal complexes; properties of metals and nonmetals; rates and mechanisms of reaction. Introduction to organic chemistry and biochemistry.

### General Course Objectives

- To provide a background in chemistry which will enable students to take the organic chemistry sequence or transfer to a senior institution and to apply this information to life experiences.
- To provide practice in logical thinking and problem solving.

### Minimum Placement Levels

English	Reading	Math
None	Placement out of CCS 098	None

### Prerequisites

Credit in CHE 141 with a grade of C or higher

### Methods of Evaluation

- Lecture Assignments (homework, participation) = 5%
- Laboratory (pre/in/post lab assignments, formal lab report, etc.) = 32.5%
- Special Assignments (research articles, applications, presentation) = 7.5%
- Content Assessment (exams, etc.) = 35%
- Final Exam = 20%

## Instructional Materials and Additional Supplies

- [Aleks 360 Immediate Access for Chemistry](#)
- [Chemistry: Atoms First 2e, OpenStax UCONN. https://openstax.org/details/books/chemistry-atoms-first-2e](https://openstax.org/details/books/chemistry-atoms-first-2e)
- Lab goggles: \$15.00
- Scientific calculator: \$20.00
- Two permanently bound composition notebooks: \$4.00

## Course Content

### General Learning Outcomes (GLOs)

- Communication: Students will demonstrate the ability to read, write, listen, and speak effectively.
- Critical Thinking and Information Literacy: Students will demonstrate the ability to evaluate perspectives, evidence, and implications, and to locate, assess, and use information effectively.
- Reasoning and Inquiry: Students will demonstrate the ability to solve problems using deductive reasoning and logic, quantitative reasoning, or the scientific method.

### Course Segments and Student Learning Outcomes

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Thermodynamics, Equilibrium, and Chemical Reactions Review	<ol style="list-style-type: none"><li>1. Review basic concepts presented in the first semester of chemistry.</li><li>2. Relate numerical thermodynamic values such as Enthalpy, Entropy, Gibbs Free Energy, and Equilibrium Constant to the spontaneity of a reaction.</li><li>3. Apply thermodynamic concepts and calculations to real life scenarios.</li><li>4. Classify chemical reactions by class of chemical reaction.</li><li>5. Review the usage of basic laboratory equipment and laboratory calculations.</li><li>6. Name and recognize the function of basic glassware used in chemistry labs.</li><li>7. Construct a laboratory record.</li></ol>	4	3	0
Acids and Bases and Aqueous Equilibria	<ol style="list-style-type: none"><li>1. Identify common acids and bases by name and chemical structure/formula.</li><li>2. Perform equilibrium calculations to determine the pH of solutions containing a strong acid, strong base, weak acid, or weak base.</li><li>3. Perform calculations to determine the pH of a solution prepared by mixing an acid with a base, or vice-versa.</li><li>4. Apply Le Chatelier's principle and the common ion effect to solutions containing weak acids or weak bases.</li><li>5. Describe the function of a buffer and explain how it works. Perform calculations associated with buffer preparation.</li><li>6. Gather information about an acid or a base (concentration, pKa, etc.) by creating and analyzing titration graphs. Perform calculations associated with titrations using an indicator. Write and perform calculations associated with solid solubility (Ksp), and apply common ion effect and Le Chatelier's principle to these reactions.</li><li>7. Prepare solutions containing an acid and a base with a specific pH.</li><li>8. Prepare buffer solutions.</li><li>9. Perform titrations using an indicator and complete calculations associated to titrations.</li><li>10. Construct a titration graph. Recognize specific areas of a titration graph such as equivalence point, buffer region, etc. and retrieve information such as pKa and concentration values.</li><li>11. Perform calculations associated with titration.</li></ol>	12	9	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Redox Reactions and Electrochemistry	<ol style="list-style-type: none"> <li>1. Assign oxidation states and charges to individual atoms and compounds.</li> <li>2. Explain oxidation state and charge in terms of electron configuration.</li> <li>3. Break down redox reactions into half reactions; identify the oxidation reaction, reduction reaction, oxidizing agent, and reducing agent; and balance redox reactions in acidic and basic conditions.</li> <li>4. Calculate cell potentials of standard and nonstandard electrochemical cells.</li> <li>5. Mathematically and conceptually relate cell potentials to spontaneity (<math>\Delta G</math>) and equilibrium constant.</li> <li>6. Explain and perform calculations associated with electroplating and electrodeposition.</li> <li>7. Create galvanic cells in the lab by using various common metals and salt solutions.</li> <li>8. Determine the cell potentials for each cell created by using a voltmeter, and use the cell potential values to determine the standard reduction potential.</li> <li>9. Use the cell potential values to determine the change in Gibbs free energy of the reaction.</li> <li>10. Explain the principle of electroplating.</li> <li>11. Use redox reactions to perform electroplating.</li> </ol>	8	6	0
Chemical Kinetics and Nuclear Chemistry	<ol style="list-style-type: none"> <li>1. Apply the kinetic molecular theory and collision theory to reaction rates.</li> <li>2. Propose a rate law for a reaction based on experimental kinetic values.</li> <li>3. Propose or evaluate reaction mechanisms by using experimental values. Relate rate laws to integrated rate laws. Use integrated rate laws to perform mathematical calculations.</li> <li>4. Apply kinetic concepts and calculations to nuclear chemistry and other real-life applications.</li> <li>5. Use experimental values to determine the rate of a given reaction.</li> <li>6. Identify how external factors such as temperature affect the reaction's rate and rate constant.</li> <li>7. Use graphical analysis to determine the rate orders for given chemical reactions.</li> <li>8. Identify the properties of different nuclear decays and identify materials capable of blocking different nuclear emissions.</li> <li>9. Use integrated laws and radioactivity content to determine the age of a material or item.</li> </ol>	8	6	0
Bonding and Hybridization Review	<ol style="list-style-type: none"> <li>1. Review basic concepts presented in the first semester of chemistry involving bonding, electron configuration, and molecular structure.</li> <li>2. Classify bonds as ionic, polar covalent, and non-polar covalent, and be able to explain the difference between them.</li> <li>3. Write the electron configuration of elements and ions.</li> <li>4. Arrange chemical bonds based on strength and reactivity.</li> <li>5. Discuss how bond strength affects the chemical and physical properties of compounds.</li> <li>6. Explain how chemical bonds contained in a compound affect the reactivity of the compound.</li> </ol>	4	3	0

Course Segment	Learning Outcomes	Lecture Hours	Lab Hours	Clinical Hours
Coordination Chemistry	<ol style="list-style-type: none"> <li>1. Explain and illustrate the difference between ionic, covalent, and coordinate covalent bonds in terms of electronegativity, polarity, and strength.</li> <li>2. Identify the oxidation state of transition metals in a coordination complex.</li> <li>3. Determine the electron configuration of transition metals.</li> <li>4. Identify compounds as ligands and classify them as monodentate, bidentate, and polydentate.</li> <li>5. Identify the coordination number of coordination complexes and predict their molecular geometries of coordination complexes based on the coordination number and electron configuration.</li> <li>6. Define crystal field theory. Explain the factors affecting the d orbital splitting by using crystal field theory.</li> <li>7. Illustrate orbital splitting and mathematically relate gap energy to color and wavelength absorption and emitted and magnetic properties of coordination complexes.</li> <li>8. Explain the effect of a ligand and the oxidation state of a metal ion on the magnitude of d orbital splitting of the coordination complex.</li> <li>9. Relate d orbital splitting to complex magnetic properties and color.</li> <li>10. Describe the applications of coordination bonds to everyday life.</li> </ol>	8	6	0
Organic Chemistry	<ol style="list-style-type: none"> <li>1. Name basic organic molecules (alkanes, alkenes, alkynes, haloalkenes) by using IUPAC nomenclature.</li> <li>2. Identify and name common organic functional groups.</li> <li>3. Illustrate organic structures by using different representations or projections.</li> <li>4. Recognize constitutional isomers, geometric isomers, and enantiomers.</li> <li>5. Recognize nucleophiles and electrophiles.</li> <li>6. Explain and illustrate a mechanism of reaction by using arrow pushing.</li> <li>7. Categorize simple organic reactions as elimination, addition, or substitution.</li> <li>8. Arrange nucleophiles by strength as a base.</li> <li>9. Predict the product of elimination, addition, and substitution reactions.</li> <li>10. Construct relationships between chemical structures and physical and chemical properties.</li> <li>11. Predict the product of basic organic reactions.</li> </ol>	12	9	0
Organic Chemistry: Reactions and Polymers	<ol style="list-style-type: none"> <li>1. Explain the effects of functional groups on the pKa and reactivity of the molecules.</li> <li>2. Describe and illustrate by using dipole moments the polarity of different organic functional groups.</li> <li>3. Illustrate by using arrow pushing the mechanism of reaction for the formation of ester and amide bonds.</li> <li>4. Describe the reactivity of double bonds.</li> <li>5. Describe the principles of polymer synthesis.</li> <li>6. Identify monomers in a polymer.</li> <li>7. Recognize biopolymers such as peptides, lipids, polysaccharides, and nucleic acids.</li> <li>8. Identify the monomers constituting the four main classes of biopolymers.</li> <li>9. Illustrate by using arrow pushing the mechanism of formation of amide, phosphodiester, ester, and glycosidic bonds.</li> <li>10. Recognize organic functional groups.</li> <li>11. Predict the reaction and products formed based on the functional groups of the reactants.</li> <li>12. Relate organic functional groups to chemical and physical properties of compounds.</li> <li>13. Relate functional groups present in monomers to the function of the polymers.</li> </ol>	4	3	0

**Total Contact Hours**

Lecture Hours	Lab Hours	Clinical Hours
60	45	0