



Chemistry I

Course Overview and Goals

This course provides a foundational understanding of general chemistry principles, covering topics such as atomic structure, chemical bonding, and stoichiometry. Through theoretical learning and practical experimentation, students develop critical thinking, problem-solving, and quantitative analysis skills. The course aims to equip students with the knowledge and skills necessary for further studies in chemistry and practical applications in various scientific fields.

Credit Recommendation

[American Council on Education](#)

Level: Lower-Division Baccalaureate

Credits (SH): 3 | Subject: Chemistry I | ACE ID: UPIS-0008

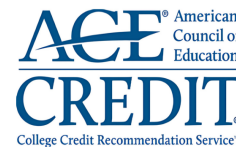
[National College Credit Recommendation Service \(NCCRS\)](#)

In the associate/certificate degree category OR the lower division baccalaureate/associate degree category, 3 semester hours in Chemistry, Earth Science, or Physical Science.

Learning Outcomes:

Upon successful completion of the course, students will be able to:

- Analyze and interpret trends in the periodic table, such as ionization energy, electronegativity, and atomic radius, to predict chemical behavior.
- Utilize stoichiometry principles to balance chemical equations, calculate reaction yields, and determine the composition of compounds.
- Apply dimensional analysis and unit conversion techniques to solve problems and accurately interpret experimental data.



- Demonstrate proficiency in laboratory techniques and the proper use of laboratory equipment for scientific experimentation.
 - Understand the fundamental concepts of general chemistry, including atomic structure, chemical reactions, and the properties of matter.
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Instructor Information for Course:

For any course-related inquiries or assistance, please do not hesitate to contact our dedicated instructors at the provided email address: team@upistudy.com. Your academic success is our top priority, and our instructors are here to support you throughout the course.

Course Information

Self-study: Online course: To be completed on the UPI Study platform

Grading

For each course module, the aim is to assess a student's competence in a range of business management skills relevant to the course content and learning outcomes. Students are required to demonstrate an understanding of key business concepts, apply skills to real-world work environments, and conduct independent research and analysis. Here are the following assessment tools utilized by UPI STUDY:

Attendance

Requirement of a minimum of study of 60 hours of study on the UPI study portal.

Quizzes

Quizzes are meant to test a student's comprehension of all lessons as they progress through the course.

Assignments

Assignments are intended to assess the student's application, analysis, and critical thinking skills about the concepts you learn in the course. One assignment is required for this course.

Final Exam

The final exam is a cumulative test designed to ensure that students have mastered the material in the course.

ACTIVITY	DESCRIPTION	WEIGHTAGE ON OVERALL GRADE
QUIZ	5-QUESTION QUIZ PER SUBCHAPTER	20%
ASSIGNMENT	COMPLETING AND SCORING WELL ON THE PROVIDED FINAL ASSIGNMENT/PROJECT	30%
FINAL EXAM	FINAL EXAM MADE OF 100 MULTIPLE-CHOICE QUESTIONS	50%

Note: Failure To Submit Or Fulfill Any Required Course Component May Result In Failure Of The Class

The grading standards are detailed in the charts below and apply to all courses unless specified differently in the course outline. According to the requirements set by the American Council on Education (ACE) and National College Credit Recommendation Service (NCCRS), a score of 70 or above is required to pass any course.

ALPHA GRADE	GRADE POINT	LOW RANGE	HIGH RANGE	DESCRIPTION	GUIDELINE
A	4.00	90	100	ACHIEVEMENT IN COURSE OUTCOMES IS OUTSTANDING AND WARRANTS UNIQUE AND DISTINGUISHED RECOGNITION.	CONSIDERABLE EVIDENCE OF ORIGINAL THINKING; DEMONSTRATED CAPACITY TO ANALYZE, INTEGRATE AND EXTEND CONCEPTS; OUTSTANDING GRASP OF SUBJECT MATTER; CONSISTENT DEMONSTRATION OF PRACTICE WITH NO SUPERVISION AND GUIDANCE.
B	3.50	80	89	ACHIEVEMENT IN COURSE OUTCOMES IS ACCEPTABLE AND MEETS ABOVE-AVERAGE STANDARDS.	EVIDENCE OF SOLID GRASP OF SUBJECT MATTER; REASONABLE UNDERSTANDING OF RELEVANT IDEAS; SOME EVIDENCE OF CRITICAL CAPACITY AND ANALYSIS; CLEAR CONNECTIONS OF IDEAS AND NUMEROUS EXTENSIONS; REASONABLE DEMONSTRATION

					OF PRACTICE WITH MINIMAL SUPERVISION AND GUIDANCE.
C	3.00	70	79	ACHIEVEMENT IN COURSE OUTCOMES MEETS AVERAGE STANDARDS.	EVIDENCE OF SOME UNDERSTANDING OF SUBJECT MATTER AND RELEVANT IDEAS; ABILITY TO DEVELOP/APPLY SOLUTIONS TO SIMPLE PROBLEMS; MINIMAL CONNECTIONS OF IDEAS AND EXTENSIONS; DEMONSTRATION OF PRACTICE WITH PERIODIC SUPERVISION AND GUIDANCE.
PASS = A SCORE OF 70 OR HIGHER IS REQUIRED TO PASS.					
D	1.00	60	69	ACHIEVEMENT IN COURSE OUTCOMES IS MARGINAL AND MEETS MINIMAL STANDARDS.	EVIDENCE OF A MINIMAL UNDERSTANDING OF SUBJECT MATTER AND RELEVANT IDEAS; MINIMAL CONNECTIONS OF IDEAS; DEMONSTRATION OF PRACTICE WITH CONSTANT SUPERVISION AND GUIDANCE.
F	0.00	0.00	59	ACHIEVEMENT IN COURSE OUTCOMES IS INADEQUATE AND FAILS TO MEET MINIMAL STANDARDS.	INSUFFICIENT EVIDENCE OF UNDERSTANDING SUBJECT MATTER AND RELEVANT IDEAS; INABILITY TO CONNECT AND EXTEND IDEAS; INABILITY TO DEMONSTRATE PRACTICE.

Course Materials

Textbooks & Materials

Notes and content provided on the UPI study's platform

1. Flowers, Paul, et al. *Chemistry 2e*. OpenStax, 14 Feb. 2019. Web version last updated 3 June 2024. ISBN-13: 978-1-947172-62-3 (hardcover), 978-1-59399-578-2 (paperback), 978-1-947172-61-6 (digital). Licensed under Creative Commons Attribution License v4.0.
2. Oxtoby, David W., H. Pat Gillis, and Laurie J. Butler. *Principles of Modern Chemistry*. 8th ed., Cengage Learning, 2016. ISBN 9781305079113.

Detailed Curriculum

CHAPTER NUMBER	CHAPTER TITLE	CHAPTER OBJECTIVES	READING & ASSIGNMENTS	INSTRUCTIONAL HOURS
Chapter 1	Essential Ideas	Understand the role and significance of chemistry in real-world contexts, emphasizing its application in solving everyday problems. Differentiate between physical and chemical properties and phases of matter, recognizing how these properties influence the selection and application of materials. Master measurement techniques in chemistry, including the importance of precision and accuracy, and develop proficiency in mathematical treatments of measurement results.	1.1 Chemistry in Context 1.2 Phases and Classification of Matter 1.3 Physical and Chemical Properties 1.4 Measurements 1.5 Measurement Uncertainty, Accuracy, and Precision 1.6 Mathematical Treatment of Measurement Results	4
Chapter 2	Atoms, Molecules, and Ions	Explore the historical development of atomic theory, appreciating how modern theories are built upon early ideas of atomic structure. Analyze the structure and properties of atoms, understanding the role of isotopes, ions, and symbolism in chemical formulas.	2.1 Early Ideas in Atomic Theory 2.2 Evolution of Atomic Theory 2.3 Atomic Structure and Symbolism 2.4 Chemical Formulas 2.5 The Periodic Table	6

		Describe the organization of the periodic table and recognize patterns in electron configuration and element properties.	2.6 Ionic and Molecular Compounds 2.7 Chemical Nomenclature	
Chapter 3	Composition of Substances and Solutions	Grasp the concept of the mole and its use in determining formula mass, essential for quantifying substances chemically. Calculate empirical and molecular formulas from experimental data, interpreting the quantitative composition of compounds. Understand solution concentration measures, including molarity and other units, and apply these concepts in various solution preparation and analysis scenarios.	3.1 Formula Mass and the Mole Concept 3.2 Determining Empirical and Molecular Formulas 3.3 Molarity 3.4 Other Units for Solution Concentrations	4
Chapter 4	Stoichiometry of Chemical Reactions	Develop the ability to write and balance chemical equations, applying this skill to analyze and predict reaction products and reactants. Classify chemical reactions and explore reaction stoichiometry to understand the quantitative	4.1 Writing and Balancing Chemical Equations 4.2 Classifying Chemical Reactions 4.3 Reaction Stoichiometry 4.4 Reaction Yields 4.5 Quantitative Chemical Analysis	4

		relationships in reactions. Examine the theoretical and actual yields of reactions, understanding the significance of these concepts in practical chemical analysis and industrial applications.		
Chapter 5	Thermochemistry	Understand basic concepts of energy in chemical reactions, including the laws of thermodynamics and the concept of enthalpy. Perform calorimetry experiments to measure heat transfer and calculate energy changes in chemical processes. Analyze the enthalpy changes in reactions, understanding their implications for spontaneity and energy efficiency.	5.1 Energy Basics 5.2 Calorimetry 5.3 Enthalpy	4
Chapter 6	Electronic Structure and Periodic Properties of Elements	Explain the quantum mechanical model of an atom, understanding how it describes the behavior of electrons in atoms. Explore the Bohr model and the development of quantum theory, including their	6.1 Electromagnetic Energy 6.2 The Bohr Model 6.3 Development of Quantum Theory	3

		implications for the electronic structure of elements. Relate periodic properties such as atomic size and ionization energy to element position in the periodic table, predicting element behavior based on these properties.		
Chapter 7	Chemical Bonding and Molecular Geometry	Discuss ionic and covalent bonding, predicting compound types based on differences in electronegativity and bond formation. Use Lewis symbols and structures to represent molecules, determining molecular shape and stability through concepts like resonance and formal charges. Analyze molecular geometry and its influence on compound properties using VSEPR theory and hybridization concepts.	7.1 Ionic Bonding 7.2 Covalent Bonding 7.3 Lewis Symbols and Structures 7.4 Formal Charges and Resonance	4

Chapter 8	Advanced Theories of Covalent Bonding	Explore valence bond theory and hybridization to understand molecular structure and bonding characteristics. Examine the formation and importance of pi and sigma bonds in determining molecular shape and reactivity. Utilize molecular orbital theory to predict electronic distribution in molecules, understanding its role in bond strength and chemical properties.	8.1 Valence Bond Theory 8.2 Hybrid Atomic Orbitals 8.3 Multiple Bonds 8.4 Molecular Orbital Theory	4
Chapter 9	Gasses	Understand the fundamental properties of gases, including gas pressure and the relationships described by the ideal gas law. Apply the ideal gas law to solve problems involving changes in pressure, volume, temperature, and the amount of gas. Analyze the behavior of gases through stoichiometric calculations involving gaseous substances, mixtures, and reactions, as well as the principles of effusion and diffusion.	9.1 Gas Pressure 9.2 Relating Pressure, Volume, Amount, and Temperature: The Ideal Gas Law 9.3 Stoichiometry of Gaseous Substances, Mixtures, and Reactions 9.4 Effusion and Diffusion of Gases	4

Chapter 10	Understanding Chemical Reactions	Explore the nature of intermolecular forces and their impact on the physical properties of liquids and solids. Understand phase transitions and phase diagrams, recognizing how changes in temperature and pressure affect the state of matter. Investigate the crystalline structure of solids and the factors influencing the properties of materials, such as lattice structures in crystalline solids.	10.1 Intermolecular Forces 10.2 Properties of Liquids 10.3 Phase Transitions 10.4 Phase Diagrams 10.5 The Solid State of Matter 10.6 Lattice Structures in Crystalline Solids	6
Chapter 11	Solutions and Colloids	Examine the process of dissolution, the factors that affect solubility, and the properties of solutions. Identify and differentiate between electrolytes and non-electrolytes, understanding their role in conducting electrical current in solutions. Explore the colligative properties of solutions, such as boiling point elevation and freezing point depression, and their practical applications.	11.1 The Dissolution Process 11.2 Electrolytes 11.3 Solubility 11.4 Colligative Properties 11.5 Colloids	4

Chapter 12	Understanding Kinetics	Describe the factors that affect reaction rates and understand the methods used to measure and express these rates. Develop an understanding of rate laws and how they are determined from experimental data, applying integrated rate laws to chemical reaction data. Explore complex reaction mechanisms and the role of catalysts in affecting the rate of chemical reactions.	12.1 Chemical Reaction Rates 12.2 Factors Affecting Reaction Rates 12.3 Rate Laws 12.4 Integrated Rate Laws 12.5 Collision Theory 12.6 Reaction Mechanisms 12.7 Catalysis	5
Chapter 13	Fundamental Equilibrium Concepts	Understand the dynamic nature of chemical equilibria and the factors that influence equilibrium positions, such as concentration, temperature, and pressure. Calculate equilibrium constants and use them to predict the direction of reaction and the concentrations of reactants and products at equilibrium. Apply Le Châtelier's Principle to predict the effect of external stresses on the position of equilibrium.	13.1 Chemical Equilibria 13.2 Equilibrium Constants 13.3 Shifting Equilibria: Le Châtelier's Principle 13.4 Equilibrium Calculations	4

Chapter 14	Acid-Base Equilibria	Explain acid-base theories (Brønsted-Lowry), defining acids and bases in terms of proton donors and acceptors. Calculate and interpret pH and pOH of solutions, understanding the scale of acidity and basicity. Analyze the behavior of polyprotic acids, buffer solutions, and the process of acid-base titrations in chemical analysis.	14.1 Brønsted-Lowry Acids and Bases 14.2 pH and pOH 14.3 Relative Strengths of Acids and Bases 14.4 Hydrolysis of Salts 14.5 Polyprotic Acids 14.6 Buffers 14.7 Acid-Base Titrations	3
Chapter 15	Equilibria of Other Reaction Classes	Discuss the concepts of precipitation and dissolution reactions and their role in forming and breaking down ionic compounds. Explore the role of Lewis acids and bases in forming coordinate covalent bonds and their applications in various chemical contexts. Understand coupled equilibria, exploring how the equilibria involved in one reaction can affect the position and rate of another.	15.1 Precipitation and Dissolution 15.2 Lewis Acids and Bases 15.3 Coupled Equilibria	2

Chapter 16	Thermodynamics	Study the concepts of spontaneity and entropy to understand how these factors determine the feasibility and extent of chemical reactions. Explore the Second and Third Laws of Thermodynamics and their implications for predicting the direction and equilibrium position of chemical processes. Analyze the relationship between free energy changes and the spontaneity of reactions, applying these concepts to biological and environmental systems.	16.1 Spontaneity 16.2 Entropy 16.3 The Second and Third Laws of Thermodynamics 16.4 Free Energy	3
Chapter 17	Electrochemistry	Review foundational concepts in redox chemistry and explore the setup and function of galvanic cells. Understand the measurement and significance of electrode potentials, including the standard reduction potentials of different elements. Explore the practical applications of electrochemistry in developing batteries, fuel cells, and corrosion prevention methods, as well as the	17.1 Review of Redox Chemistry 17.2 Galvanic Cells 17.3 Electrode and Cell Potentials 17.4 Potential, Free Energy, and Equilibrium 17.5 Batteries and Fuel Cells 17.6 Corrosion 17.7 Electrolysis	5

		principles behind electrolysis.		
	ASSIGNMENT	ASSIGNMENT & FINAL LAB PROJECT	Investigating Chemical Properties and Reactions	5
	FINAL EXAM	FINAL EXAM		2
				76 hours

Online Study Etiquette

Time Management:

While lectures are available for viewing at any time, it is recommended to establish a consistent study schedule to ensure steady progress through the course materials.

Distraction Management:

Keep phones in silent mode or away during study sessions to minimize distractions. Designated breaks are encouraged for checking phones and attending to personal tasks.

Device Usage:

Use laptops, tablets, or other devices primarily for accessing course materials and taking notes. Avoid unrelated activities on these devices during study sessions to maintain focus.

Academic Policies

Student Code of Conduct

Introduction

UPI's Code of Conduct establishes the standards of acceptable behavior for all students. This code aims to uphold UPI's reputation and integrity and foster a safe, inclusive, and productive study environment.

Integrity of Academic Work:



UPI students are expected to:

Policy Compliance:

- Conduct themselves in accordance with UPI's published policies.
- Submit academic work free of plagiarism of any kind, including use of artificial intelligence or collusion.
- Actively participate in the learning process.

Resource Awareness:

Be familiar with resources available for academic assistance and avoid plagiarism.

Copyright Compliance:

Comply with the proper use of copyright materials.

Attendance and Timeliness:

Attend scheduled course activities and submit assessment tasks on time, barring unforeseen or exceptional circumstances.

Equity and Respect

UPI students are expected to:

Interpersonal Conduct:

Treat all staff and students with courtesy, tolerance, and respect.

Non-discrimination:

Respect the rights of others to be treated equitably, free of unlawful discrimination and harassment, including sexual harassment.

Freedom of Expression:

Respect the rights of others to express views and opinions without engaging in offensive behavior.

Lawful and Non-discriminatory Behavior:

Avoid engaging in behavior that is unlawful, discriminatory, or offensive.

Non-threatening Behavior:

Avoid engaging in behavior perceived as threatening or intimidating.

Conduct in a Support Centre (Study Centre)

In the event of blended learning activities, students are expected to:

Respectful Behavior:

- Demonstrate respect for staff and students in support Centers.
- Turn off mobile phones during class times and assessments.

Language and Environment:

- Speak in English at all times.
- Refrain from eating and drinking in classrooms.

Preparation and Sobriety:

- Undertake all required preparation for classes.
- Do not participate in any learning activity under the influence of alcohol or other drugs.

Investigation of Misconduct

Any breaches of the code of conduct may be considered misconduct. The institution reserves the right to investigate and determine the seriousness of reported breaches. Serious breaches may result in the cancellation of a student's enrollment.

Other student obligations

Guide to Referencing

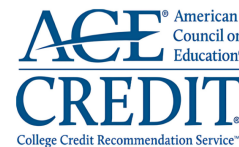
When writing assignments, referencing is crucial for various reasons:

1. Acknowledgment and Credit:

Give credit to authors for their work, words, and ideas. Acknowledge the intellectual contributions of others.

2. Locating References:

Allow readers and markers to easily locate your references.



3. Avoid Plagiarism:

Prevent plagiarism by clearly attributing sources.

4. Demonstrate Skills:

Showcase research, reading, and evaluative skills. Provide evidence of the depth and breadth of your knowledge.

5. Academic Integrity:

Avoid losing marks due to improper citation.

6. Consistency:

Maintain consistency in your referencing style.

Course Retake Policy

Students who earn grades below 70% and fail a course may submit a petition to the administrative team for a repeat attempt. This process ensures students understand the importance of mastering course content and the procedures required for course repetition. The administrative team will evaluate the petition, and this may involve seeking the consent of the course instructor, highlighting the application of institutional policies and protocols. Upon approval, students may repeat the course once to demonstrate a higher level of mastery, encouraging them to analyze their previous performance, identify areas for improvement, and apply enhanced learning strategies in their second attempt.

The grade from the repeated course will be included in the student's transcript, regardless of whether it is higher or lower than the original grade, ensuring a fair assessment of the student's current level of understanding and mastery of the subject matter. If the student achieves a passing grade in the repeated course, they will earn credit for the course, with the original course grade being excluded from the final credit consideration. This demonstrates the student's ability to create a successful learning outcome through perseverance and improved comprehension.

Referencing System

The Harvard referencing system is commonly used and involves a two-stage process:



In-text Reference:

Reference sources within the text of your report or assignment.

Reference List:

Provide a comprehensive list of all references at the end of your report or assignment.

Online Resources for Referencing:

Utilize the following websites to assist you in implementing the Harvard referencing system:

- Cite This For Me - Harvard Referencing
- Harvard Generator
- Purdue Owl