

Course Abstract

If you need accommodations due to a disability, contact Disability Services in Edison Hall Room 100, 732.906.2546.

To foster a productive learning environment, the College requires that all students adhere to the Code of Student Conduct which is published in the college catalog and website.

Course ID and Name: CHM 118 Chemistry II

Department: Natural Sciences

Chairperson: Dr. Donna Howell
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Prerequisites: CHM 117

COURSE DESCRIPTION:

A continuation of CHM 117. Topics include qualitative and quantitative solution chemistry, acid-base theory, chemical equilibria, oxidation-reductions and basic electrochemistry. Laboratory experiences cover qualitative analysis and volumetric methods of analysis. The volumetric techniques include acid-base and redox titrations and spectrophotometric analysis. The computer is used to analyze data.

General Education Status: Science

Credits: 4 **Lecture Hours:** 4 **Lab Hours:** 3

Learning Outcomes

Upon successful completion of this course, student will be able to:

1. Understand chemical principles, terminology and concepts.
2. Understand the relationship between the historical aspects of chemistry and modern day concepts and issues and the relationship between chemistry and the other sciences.
3. Understand the role of chemistry in our modern society and in our everyday lives.
4. Apply chemical concepts and principles to solving problems.
5. Use recommended library references to supplement the text and assist him in writing lab reports.
6. Use laboratory equipment properly and safely and how to apply the scientific method to chemical investigations.

COURSE REQUIREMENTS

Students must attend every lecture and laboratory session. Lecture performance is evaluated by exams, homework assignments, and quizzes. Laboratory performance is measured by practical examinations, laboratory reports, quizzes and observation of student laboratory technique.

Assessment tool	% of final grade
4 Lecture Exams	40%
Final Lecture Exam	20%
Quizzes	10%
Lab Exams	30%

FINAL EXAM

The final exam will be administered during the special exam days. The hourly exams will contain multiple choice and open-ended questions but the final exam will be multiple choice.

GRADING STANDARD:

Upon completion of the course, grades will be assigned as follows:

- A = 90 – 100%
- B+ = 86 - 89%
- B = 80 - 85%
- C+ = 76 - 79%
- C = 70 - 75%
- D = 60 - 69%
- F = <60%

Course Content:

1. Solutions
2. Ionization: Acids, Bases, and Salts
3. Chemical Equilibrium
4. Oxidation-Reduction Reactions
5. Mole-related concepts
6. Radioactivity and Nuclear Chemistry
7. Organic Chemistry
8. Biochemistry

Textbooks for Course:

<u>Author</u>	<u>Title</u>	<u>Publisher</u>	<u>Copyright</u>
Nivaldo J Tro	Introductory Chemistry, 5 th Edition	Person	2015

REQUIRED CALCULATOR

A non-programmable and non-graphical scientific calculator is required for this course. It is advisable to purchase a calculator which includes parenthesis functions, scientific notation capabilities, and logarithmic functions. No programmable / graphical calculators, cell phones, or similar devices are allowed during the quizzes or exams. The TI-83 and TI-84 calculators are examples of calculators that are not acceptable.

LECTURE OUTLINE

1. LIQUIDS, SOLIDS AND INTERMOLECULAR FORCES

- A. Interactions between Molecules
- B. Properties of Liquids and Solids
- C. Intermolecular Forces in Action: Surface Tension and Viscosity
- D. Evaporation and Condensation
- E. Melting, Freezing, and Sublimation
- F. Types of Intermolecular Forces: Dispersion, Dipole–Dipole, Hydrogen Bonding, and Ion-Dipole
- G. Types of Crystalline Solids: Molecular, Ionic, and Atomic
- H. Water: A Remarkable Molecule

2. SOLUTIONS

- A. Solutions: Homogeneous Mixtures
- B. Solutions of Solids Dissolved in Water: How to Make Rock Candy
- C. Solutions of Gases in Water: How Soda Pop Gets Its Fizz
- D. Specifying Solution Concentration: Mass Percent
- E. Specifying Solution Concentration: Molarity
- F. Solution Dilution
- G. Solution Stoichiometry
- H. Freezing Point Depression and Boiling Point Elevation
- I. Osmosis: Why Drinking Salt Water Causes Dehydration

3. ACIDS AND BASES

- A. Acids: Properties and Examples
- B. Bases: Properties and Examples
- C. Molecular Definitions of Acids and Bases
- D. Reactions of Acids and Bases
- E. Acid–Base Titration: A Way to Quantify the Amount of Acid or Base in a Solution
- F. Strong and Weak Acids and Bases
- G. Water: Acid and Base in One
- H. The pH and pOH Scales: Ways to Express Acidity and Basicity
- I. Buffers: Solutions That Resist pH Change

4. CHEMICAL EQUILIBRIUM

- A. The Rate of a Chemical Reaction
- B. The Idea of Dynamic Chemical Equilibrium
- C. The Equilibrium Constant: A Measure of How Far a Reaction Goes
- D. Heterogeneous Equilibria: The Equilibrium Expression for Reactions Involving a Solid or a Liquid
- E. Calculating and Using Equilibrium Constants
- F. Disturbing a Reaction at Equilibrium: Le Châtelier’s Principle
- G. The Effect of a Concentration Change on Equilibrium
- H. The Effect of a Volume Change on Equilibrium
- I. The Effect of a Temperature Change on Equilibrium
- J. The Solubility-Product Constant
- K. The Path of a Reaction and the Effect of a Catalyst

5. OXIDATION AND REDUCTION

- A. Oxidation and Reduction: Some Definitions
- B. Oxidation States: Electron Bookkeeping
- C. Balancing Redox Equations
- D. The Activity Series: Predicting Spontaneous Redox Reactions
- E. Batteries: Using Chemistry to Generate Electricity
- F. Electrolysis: Using Electricity to Do Chemistry
- G. Corrosion: Undesirable Redox Reactions

6. RADIOACTIVITY AND NUCLEAR CHEMISTRY

- A. The Discovery of Radioactivity
- B. Types of Radioactivity: Alpha, Beta, and Gamma Decay
- C. Detecting Radioactivity
- D. Natural Radioactivity and Half-Life
- E. Radiocarbon Dating: Using Radioactivity to Measure the Age of Fossils and Other Artifacts
- F. The Discovery of Fission and the Atomic Bomb
- G. Nuclear Power: Using Fission to Generate Electricity
- H. Nuclear Fusion: The Power of the Sun
- I. The Effects of Radiation on Life
- J. Radioactivity in Medicine

7. ORGANIC CHEMISTRY

- A. Carbon: A Versatile Atom
- B. Hydrocarbons: Compounds Containing Only Carbon and Hydrogen
- C. Alkanes: Saturated Hydrocarbons
- D. Isomers: Same Formula, Different Structure
- E. Naming Alkanes
- F. Alkenes and Alkynes
- G. Hydrocarbon Reactions
- H. Aromatic Hydrocarbons
- I. Functional Groups
- J. Alcohols
- K. Ethers
- L. Aldehydes and Ketones
- L. Carboxylic Acids and Esters
- M. Amines
- N. Polymers

8. BIOCHEMISTRY

- A. The Cell and Its Main Chemical Components
- B. Carbohydrates: Sugar, Starch, and Fiber
- C. Lipids
- D. Proteins
- E. Protein Structure
- F. Nucleic Acids: Molecular Blueprints
- G. DNA Structure, DNA Replication, and Protein Synthesis

LAB OUTLINE

LAB NO.	LABORATORY EXERCISE
1	Introduction to Qualitative Analysis Discussion of Grouping system of cations and anions for qualitative identification and separation
2	Qualitative Analysis of Group I Metal Ions Identification of Group I cations in an unknown solution
3	Qualitative Analysis of Anions Introduction and identification of simple or polyoxo-anions in an unknown solution
4	Introduction to Computer Graphing: Ionization- Conductivity and Ionic Equations Manipulation of data with scientific spreadsheets and plotting of data. Review the use of spreadsheets for calculation and graphing scientific data.
5	The Molecular Weight of Naphthalene by Freezing Point Depression Determination on the effect of increasing the number of solute particles on the freezing point of the solution, measure the freezing point depression of a solution as well as the molar mass of the solute, and draw a conclusion about the hypothesis.
6	Determination of Co^{2+} Concentration by Spectrophotometry Part 2 Beer's law, Utilizing Excel for data analysis, graphical analysis, conclusions
7	Lab Exam #1
8	Standardization of a NaOH Solution by Titration Precision measurement of molarities of unknown NaOH solution using Titration
9	Determination of the % Purity of Potassium Acid Phthalate by Titration. Determination of the acidity of Vinegar by Titration Applications of Techniques learn in experiment #8 to determine % of unknown weak acid salt and Vinegar
10	Chemical Equilibrium and LeChatelier's Principle Determination of the effect of changing concentrations, changing pH, and changing temperature of a chemical equilibrium, and draw a conclusion about the hypothesis.
11	Determination of the Ionization Constant (K_a) of a Weak Acid Determination of dissociation constant of weak acid using Governing principles of ionization and titrimetric method.
12	Review
13	Lab Exam #2 (Final exam)

