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81, Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 17035, Korea

Hankuk University of Foreign Studies

2019 Summer Session

CHEM 101 Introduction to Chemistry with Lab

Course Outline

Course Code: CHEM 101

Instructor: Young Charles Jang, Ph.D.

Home Institution: Georgia Institute of Technology (Georgia Tech)

Office Hours: TBA & By Appointment

Email: young.jang@gatech.edu

Credit: 4

Class Hours: This course will have 72 class hours, including 40 lecture hours, 10 lecturer office hours, 10-hour TA discussion sessions, 2-hour review sessions, 10 laboratory hours.

Course Description

This is an **active-learning** class that introduces students to general chemistry fundamental laws and theories of chemical reactions. Topics include atomic structure; bonding theory; stoichiometry; properties of solids, liquids and gases; chemical thermodynamics; electrochemistry; and kinetics. This course will foster the development of critical scientific skills including hypothesis testing, experimental design, data analysis and interpretation, and scientific communication. Class time will consist of a variety of **team-based activities** designed to discuss, clarify, and apply new ideas by answering questions, drawing diagrams, analyzing primary literature, and explaining medical phenomenon in the context of chemical and biochemical principles.

Course Objectives

- Identify steps in the scientific method.
- Apply concepts of measurement and significant figures to laboratory practices and chemical problems.
- Correlate position on the periodic table to properties of elements and bonds.
- Calculate amounts of chemical species using information from chemical formulas and chemical equations.
- Correlate information from balanced chemical equations to the microscopic scale.
- Explain atomic structure using the quantum mechanical model of the atom.

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- Explain periodic trends using theories of electronic structure.
- Interpret thermochemical equations and data and evaluate energies of systems.
- Summarize the behaviors of gases and explain them using the kinetic-molecular theory.
- Correlate the molecular level process that occur during heating, cooling, and phase changes to the amount of energy removed or added to a system during each process.
- Interpret equilibrium data regarding gaseous and aqueous reactions.
- Compare/contrast the concepts of the three theories of acids and bases and apply them to inorganic and biological systems.
- Integrate the concepts of equilibrium, Gibbs free energy, and cell potential
- Use reaction mechanisms to infer the kinetics of a chemical reaction.
- Compare/contrast the relationships between rate and concentration, concentration and time, and rate and time. Apply these principles to kinetic data.
- Apply chemical concepts to everyday life.

Required Textbooks

CHEM 101 is taught on the flipped classroom model, meaning that you will need to complete your assigned readings before each lecture. **CHEM 101** will be taught without a textbook. All course readings and videos are available on the course website (TBD) or will be handed out before lectures. We will also use an online textbook found at **OpenStax Chemistry** (open source e-book): https://openstax.org/details/books/chemistry

Learning Catalytics for Participation and Homework

To complete your team in class activities and your homework assignments, students are required to have a **Learning Catalytics** account. Learning Catalytics can be purchased directly at: https://learningcatalytics.com/users/sign_up
To participate in class, you will need to bring an internet-ready smartphone, tablet, or laptop to class to earn participation points. Phone and computer use is restricted to class-related material, and off-task use may result in loss of participation points for that day.

Homework

Homework assignments will be made available each week in Learning Catalytics and are always due on Sundays at midnight. Homeworks close on Sunday at midnight, with few exceptions, and will not be reopened for credit, but you can review closed sessions for study purposes. In the week of Midterm and Final Exam, all homeworks for that module will be reopened for practice, not for credit. We will drop the lowest Homework from your participation grade.

Exams (Mid-term and Final)

This course has a midterm exam and the cumulative final exam. The midterm exams will be held as “closed-book,” and will be made up of multiple-choice questions based on topics, materials, and discussions presented in class, assigned readings, and homeworks.

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Laboratory

A 100% cotton lab coat, and you must wear closed-toe shoes that cover your entire foot as well as long pants. Laboratory attendance is mandatory and each unexcused absence will lower your final course grade (not just your lab grade) by 5%.

Grading & Evaluation

Your final grade will depend on the following combination of grades:

1) Mid-term exam 35%
2) Final exam - 35%
3) Homeworks 10%
4) Laboratory reports 20%

A: 94-100	**B^+: 88 – 89.99**	**C^+: 78 – 81.99**	**D^+: 67 – 71.99**
A^-: 90-93.99	**B: 85 – 87.99**	**C: 75 – 77.99**	**D: 64 – 66.99**
	B^-: 82 – 84.99	**C^-: 72 – 74.99**	**F: Below 64**

Honor Code

All students are expected to abide by the Academic Honor Code. Plagiarism is the unattributed use of the words of ideas of others; plagiarism on any assignment, including laboratory reports are strictly prohibited. If you have any questions regarding your assignments and plagiarism, we encourage you to come consult with me before you submit the assignment.

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Course Schedule:

Week 1: CHAPTER 1
Lecture 1: Course Introduction
- The way science works
- What is chemistry? Some fundamental concepts
- The importance of chemical principles

Lecture 2: Chemistry: Methods and Measurements
- Matter and Measurement
- The modern metric system
- Measuring energy
- Density
- Unit Conversions

LAB 1: Experimental designs using chemical principles

Week 2:
Lecture 3: Atom, Molecules, and Ions (Chapter 2)
- The modern view of Atomic structures
- Molecules and Molecular Compounds
- Ions and Ionic Compounds

Lecture 4: Composition of substances and solutions (Chapter 3)
- Formula Mass and Mole Concept
- Determining Empirical and Molecular Formulas
- Molarity
- Other units of solution concentration

Lecture 5: Stoichiometry of Chemical Reactions (Chapter 4)
- Writing and balancing chemical equations
- Classifying chemical reactions
- Reaction stoichiometry
- Reaction yields
- Quantitative chemical analysis

LAB 2: Stoichiometry (http://chemcollective.org/vlabs)

Week 3:
Review Session
MIDTERM (7/15)

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Lecture 6: Thermochemistry (Chapter 5)
- Energy Basics
- Calorimetry
- Enthalpy

Lecture 7: Electronic Structure and Periodic Properties of Elements (Chapter 6)
- Electromagnetic Energy
- The Bohr Model
- Development of Quantum Theory
- Electronic Structure of Atoms (Electron Configurations)
- Periodic Variations in Element Properties

Lecture 8: Chemical Bonding and Molecular Geometry (Chapter 7)
- Ionic Bonding
- Covalent Bonding
- Lewis Symbols and Structures
- Formal Charges and Resonance
- Strengths of Ionic and Covalent Bonds
- Molecular Structure and Polarity

LAB 3: Thermochemistry (http://chemcollective.org/vlabs)

Week 4:

Lecture 9: Acids and Bases and Oxidation-Reduction
- pH scales
- Chemical and biological buffers
- Acid-base titrations
- Balancing oxidation/reduction equations

Lecture 10: Organic Chemistry
- Electrolytes
- Hydrocarbons
- Alcohols, Phenols, and Ethers
- Aldehydes and Ketones

LAB 4: Acid-Base Chemistry (http://chemcollective.org/vlabs)

Week 5:

Lecture 11: Biological Chemistry
- Proteins

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Enzymes
Metabolism

Lecture 12: Modern Concepts in Biochemistry
LAB 5: Analytical Chemistry/Lab Techniques (http://chemcollective.org/vlabs)

Review Session
FINAL EXAM (8/1)
Final Exam Q&A – Course Wrap-up