



## 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.



- 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](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.



**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**

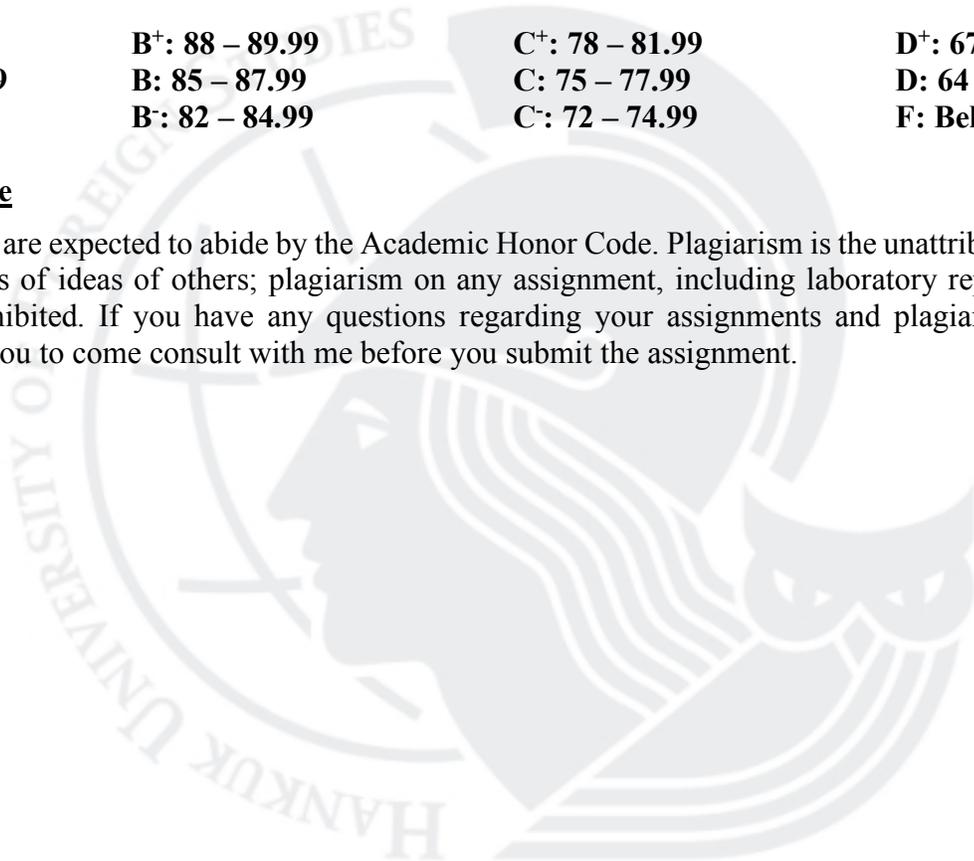
Your final grade will depend on the following combination of grades:

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

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

**Honor Code**

All students are expected to abide by the Academic Honor Code. Plagiarism is the unattributed use of the words or 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.





## 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 (7/31)**



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



Enzymes  
Metabolism

Lecture 12: Modern Concepts in Biochemistry

LAB 5: Analytical Chemistry/Lab Techniques (<http://chemcollective.org/vlabs>)

Review Session

**FINAL EXAM (8/14)**

Final Exam Q&A – Course Wrap-up

