# CHEM 1212K

**Georgia Tech | Summer 2026**

## Chemical Principles II

Section **A** (4.0 credit hours)

Welcome to Chemical Principles II! In this course, you'll learn the fundamental principles of chemical kinetics, chemical equilibrium, electrochemistry, coordination chemistry, and main-group chemistry to propel you to success in future chemistry courses and any career touching on chemistry (and there are *many!*). Like Chemical Principles I, this course is designed to promote daily engagement with the course material and to reward mastery of the material by the final exam via Grade Improvement.

## Instructor Information

*Lecture*
Dr. Deborah Santos (deborah.santos@chemistry.gatech.edu)
*Office Hours:* See Canvas for Time and Location

## Laboratory Coordinator

Dr. Michael Evans (michael.evans@chemistry.gatech.edu)
*Office Hours:* See Canvas for Time and Location

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## Contacting Instructors

| Topic | Contacts | Information |
|---|---|---|
| Lecture Content | Ed Discussion | Access via Canvas |
| | Teaching Assistants | Email or Office Hours |
| | Dr. Santos | Email or Office Hours |
| Lab Content | Ed Discussion | Access via Canvas |
| | Teaching Assistants | Email or Office Hours |
| | Dr. Evans | Email or Office Hours |
| Lecture Logistics | Dr. Santos | Email or Office Hours |
| Lab Logistics | Dr. Evans | Email or Office Hours |

**This is a Core IMPACTS course that is part of the STEM area.**

Core IMPACTS refers to the core curriculum, which provides students with essential knowledge in foundational academic areas. This course will help master course content, and support students' broad academic and career goals.

This course should direct students toward a broad Orienting Question:

- How do I ask scientific questions or use data, mathematics, or technology to understand the universe?

Completion of this course should enable students to meet the following Learning Outcome:

- Students will use the scientific method and laboratory procedures or mathematical and computational methods to analyze data, solve problems, and explain natural phenomena.

Course content, activities and exercises in this course should help students develop the following Career-Ready Competencies:

- Inquiry and Analysis
- Problem-Solving
- Teamwork

## Course Overview

This course is the second of a two-semester sequence that introduces the foundational concepts of chemistry. General topics covered in lecture include chemical kinetics, chemical equilibrium, acids and bases, buffers and titrations, electrochemistry, coordination chemistry, and fundamental principles of main-group chemistry. Laboratory focuses on fundamental lab skills as well as analytical and synthetic chemistry. The laboratory component is designed to develop your experimental skills as you collect and evaluate evidence for the concepts, principles, and theoretical models discussed in lecture.

### *Pre- and Co-requisites*

Chemical Principles I or equivalent is a pre-requisite for this course.

### *Learning Goals and Outcomes | Lecture*

- **Apply and analyze** principles of chemical kinetics, temperature effects, and chemical equilibrium to predict reaction rates, extents, and equilibrium behavior.
- **Interpret and predict** chemical system responses using Le Chatelier's principle, equilibrium data, and Gibbs free energy relationships in chemical and biological contexts.
- **Compare and apply** acid-base theories, buffers, and titration methods to characterize inorganic and biological chemical systems.
- **Integrate and apply** electrochemical concepts, including cell potential, equilibrium, and thermodynamics, to explain energy generation and redox processes.
- **Explain and predict** structure-property-reactivity relationships in inorganic systems, including coordination compounds, electrophilic/nucleophilic behavior, carbon allotropes, and reactions of hydrides and oxides.

### *Learning Goals and Outcomes | Laboratory*

- See laboratory syllabus.

## In-Class Experience

This is a residential course involving in-person class meetings at the times and location listed in OSCAR. Being physically present will help you learn from us, learning

assistants, and your classmates; as such, class meetings will be neither streamed nor recorded. If you are ill, then please do *NOT* attend class. Instead, contact us so that we can discuss

the best way for you to stay current with the material while prioritizing your health and that of others.

Our goal is for class meetings to provide opportunities for you to engage with us, with your classmates, and with the material as all these interactions enhance learning. During class, you will be prompted to work with other students and to engage in dialogue with both other students and us about the course material. You also are strongly encouraged to ask questions!

Taking notes is an essential academic skill that does not come naturally to some. To facilitate the development of this skill, we provide what we refer to as *skeletal* lecture notes. These are slides or notes pages that will be posted to Canvas that have a framework of information. The slides will be completed in class or in lecture videos to be watched before each class meeting. This means that you don't have to write *all* the notes while watching videos; however, we do expect you to follow along by taking notes on the skeletal notes. You do not need to focus on writing down everything verbatim; indeed, part of the skill development is learning to paraphrase and condense key information! We encourage you to compare notes with classmates regularly to ensure you have recorded all key points.

## Course Requirements and Grading

| | |
|---|---|
| Daily Work* | 255 pts. |
| Laboratory† | 225 pts. |
| Exam 1 | 100 pts. |
| Exam 2 | 100 pts. |
| Quizzes | 120 pts. |
| Final Exam | 200 pts. |

* Daily work consists of in-class problem sets, preparation quizzes, and learning reflections. See below for additional details.

† Students earning below 60% in the laboratory component of the course (less than 135 of 225 points) will receive a grade of F and will be required to repeat both the lecture and the laboratory components. See the lab syllabus for laboratory requirements.

Letter grades will be assigned using the following ranges. To encourage mastery of concepts and skills the course will not be curved.

| | |
|---|---|
| A | 1000 – 900 pts. |
| B | 899 – 800 pts. |
| C | 799 – 700 pts. |
| D | 699 – 600 pts. |
| F | 599 – 0 pts. |

Students earning below 60% in the lecture component of the course (less than 465 of 775 points) will receive a grade of F and will be required to repeat both the lecture and the laboratory components.

## Descriptions of Graded Components

### *Exams*

Examinations will be held on June 18th and July 23rd. The exams will be administered on Canvas and take place in the scheduled class period and location. Bring your laptop computer to the room, connect to the Internet, and access Canvas prior to the official start time. Smartphones, tablets, and headphones *are not permitted* for use during exams. Approximately one week before each exam is administered, we will perform a "test run" during class to identify any issues with connectivity or access.

When the exam opens, you will receive a unique subset of 15 – 20 questions from a question bank. Possible question types are multiple choice, multiple answer, fill in the blank, numeric entry, and dropdown menus. Only one attempt is permitted, and responses should be submitted when you have completed the exam (however, responses will submit automatically at the end of the exam period). Although exams will be graded immediately, exam scores will only be released after instructors have had an opportunity to review them.

One 8.5" × 11" crib sheet will be permitted for use on each of the three midterm exams. Only one side of the crib sheet may be used, and ***all content must be handwritten. No photocopied material is permitted***. The inclusion of photocopied or printed material on a crib sheet is a violation of the academic integrity policy of the course. Exams will otherwise be closed book, closed note, and closed Internet.

Use of a scientific or graphing calculator without Internet connectivity is permitted (and strongly encouraged!).

### *Final Exam*

The final exam will be held in **the assigned classroom on a date TBD**. The exam will be administered on Canvas in a manner like the midterms. You will receive a unique set of 50 – 55 questions from a question bank.

Four single-sided crib sheets may be used for the final exam; the policies above for midterm crib sheets also apply for the final exam. Use of a scientific or graphing calculator without Internet connectivity is permitted (and strongly encouraged!).

### *Grade Improvement Plan*

The final exam will include two sections, with each section representing material from exams 1 & 2. If you earn a higher score on a given section than you did on the corresponding midterm exam, that score will replace the original score. For example, if a student earns 75 points on exam 1 and 95% on section 1 of the final exam, 95 points will be used in the calculation of the exam 1 score. It is possible for both original exam scores to be replaced. ***You must have attempted the original individual exam or have an excused absence communicated to the course instructor to be eligible for the Grade Improvement Plan.***

### *Daily Work*

Daily Work consists of work that is designed to be completed regularly (daily) to help you stay on track with course material. These assignments are designed to aid your understanding of material and should be viewed as part of your study and learning process rather than tasks simply to be completed.

To emphasize this philosophy, we offer you about 30% more points of opportunity than are required for full credit. As outlined below, there are 321 points available; of these, you need 255 for full credit. This means that individual due date extensions and make-up assignments will be available only for those with excused absences, institute approved absences, or accommodations. Each of these circumstances should be discussed with us as soon as you know of an issue.

Though you need only 255, we encourage you to work through as many of the assignments as possible to facilitate success in the course.

| Assignment | Count | Points per Assignment | Total Points for Assignment Type |
|---|---|---|---|
| Preparation Quizzes | 18 | 4 | 72 |
| Real Data Analysis Tasks | 5 | 15 | 75 |
| In-class Activities | 18 | 8 | 144 |
| Learning Reflections | 3 | 10 | 30 |

- *Preparation Quizzes.* These are brief assignments designed to help you check your understanding of the pre-lecture videos and/or readings. Assignments will be posted and submitted on Canvas via Quizzes. Preparation Quizzes are due at the start of each class meeting. Late submissions will not be accepted—*do not submit after the due date.*

- *Real Data Analysis Tasks.* Five times throughout the semester, we will examine sets of data from the most recent lab experiment. Groups will work together to conduct the analysis of this data and relate the concepts of the course to the experiment. The tasks will be submitted as a group at the end of class.
- *In-class Activities.* Each class meeting will include a series of questions or problems worked during class and submitted on Canvas via quizzes. In-class quizzes in Canvas will open immediately after class and are due at 1:00 pm on the day of the following class meeting. Late submissions will not be accepted—*do not submit after the due date.*
- *In-class Quizzes*. Each week, there will be a quiz to serve as a learning outcome checkpoint. These are low stakes based on a smaller number of points but will provide useful feedback to the student and the instructor prior to exams.
- *Learning Reflections.* Periodically throughout the semester and after each exam, a learning reflection assignment will be posted on Canvas. These assignments will be graded for completion and are designed to help you consider your approach to learning in the course and how it facilitates your goals associated with CHEM 1212K.

To make the most of the course structure we have developed, it is important to consider your mindset toward Daily Work assignments. It is easy to consider these as just items to be crossed off a to-do list, and there are many shortcuts and hacks students can use to complete them quickly and with high scores. However, that "efficiency" often is counter-productive in the long-term. We encourage you to view these assignments as they were designed—as tools to aid your mastery of the material. We encourage you to approach each question as an opportunity to test your understanding. The best way to do this is to try each question using only materials you'd have on an exam. It's okay if you can't work them all this way, and if you are stuck then you certainly should refer to your lecture materials or textbook. However, giving each question a solid 30 – 60 seconds of consideration before you refer to other resources will help forge mental connections as well as the skill of starting to work a problem even when you are unsure of the exact route you should take (the latter is a skill that will serve you well in life!).

### *Laboratory*

Laboratory assignments will include pre-labs, notebook pages, post-labs, certified reagent operations, and other miscellaneous assignments. *You must pass the laboratory component of the course with a score greater than 60% to pass the course as a whole.* Although you will work with a lab partner and a small degree of collaboration is acceptable, all laboratory work should be completed and submitted individually. Please consult the lab syllabus for more details.

## Course Materials and Websites

### *Textbook*

- *Chemistry 2e* by OpenStax. This is a free online textbook that will be mapped to the course slides. The preparation readings will be assigned from this book to prepare for preparation quizzes.

### *Additional Materials*

- *Laboratory notebook.* You should have a dedicated notebook for recording data and observations during lab demonstrations and simulations. It does not need to make duplicate pages as you write.
- *Microsoft Office suite.* You will need access to Word, Excel, and PowerPoint for this course. All can be downloaded free of charge for GT students through OIT.
- *LabFlow subscription.* You will need to purchase a subscription to LabFlow for the laboratory portion of the course.

### *Websites*

- *Canvas.* All course materials and announcements will be posted on the CHEM 1212K Canvas sites. Make sure to check them *daily!* Note that there are separate sites for the Lecture and Laboratory components of the course.
- *Ed Discussion.* Use Ed Discussion as an opportunity to ask and *answer* questions about anything related to CHEM 1212K. Keep in mind that teaching others is a great way to develop a deeper understanding of the concepts of the course. Please observe general guidelines for civility as you post questions and responses. We intend the site to help build community and we are determined to make it a safe and inclusive space for all students.
- *LabFlow.* This site is used for the lab portion of the course and will be the location of all lab related assignments and documents. It is linked on the lab Canvas page.

## Expectations and Guidelines

### *Academic Integrity*

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit this page or this page.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for a violation.

If at any time throughout the semester you have a question involving academic integrity or the Honor Code, please do not hesitate to reach out to your instructor or a First-year Chemistry faculty member.

### *Accommodations for Student with Disabilities*

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/ as soon as possible to make an appointment to discuss your special needs and to obtain

an accommodations letter. Please inform Dr. Evans ***within the first week of the course or as soon as possible after registering with ODS.***

*Collaboration and Group Work*

You are encouraged to work with classmates on in-class problem solving and to study with others outside of class. Collaboration on homework assignments is acceptable, and you should keep in mind that the effort you put into these assignments will be reflected in what you gain from them. Discussion of the material in laboratory assignments is appropriate; however, all work submitted in reports must be prepared independently.

*Extensions, Late Assignments, and Missed Exams*

Comprehensive guidelines regarding class attendance and excused absences can be found in the Georgia Tech catalog. Please read through the policies in their entirety.

Rules and Regulations Section IV
Student Absence Regulations

Due to the structure of Daily Work, late homework submissions and in-class work are not accepted except in the case of excused absences. Lab assignments are penalized at 10% of the total assignment value for each day they are late following the precise due time.

*Student-Faculty Expectations Agreement*

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See Student-Faculty Expectations in the Catalog for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, we encourage you to remain committed to the ideals of Georgia Tech while in this class.

We expect students to arrive prepared for class, to participate in class activities and discussions, and to utilize office hours for additional help when needed.

In return, students should expect instructors to arrive prepared for class, to engage them in activities and discussions that further their understanding of course material, and to be available during office hours.

Students should expect to spend, on average, 6 – 8 hours per week outside of the classroom and laboratory to excel in this course. This includes time spent reading the textbook and watching lecture videos, taking and reviewing notes, working problems, and writing laboratory reports. To succeed in this course, students *must* develop a

pattern of preparing for class, attending class, and then reviewing after each class period.

## Schedule of Topics

| Week of | Tuesday | Thursday | Lab Experiment |
|---|---|---|---|
| May 18 | Course Introduction<br>Kinetics I | Kinetics II<br>Kinetics Quiz A | Iodine Clock Lab |
| May 25 | Kinetics III<br>Real Data (Iodine Clock) | Equilibrium I<br>Kinetics Quiz B | Measurement of K Lab |
| Jun 1 | Equilibrium II<br>Real Data (Measurement of K) | Acids and Bases I<br>Equilibrium Quiz | Acid Base Equilibrium Lab |
| Jun 8 | Acids and Bases II<br>Real Data (Acid Base Equilibrium) | Acids and Bases III<br>Acids and Bases Quiz | Water Quality Lab |
| Jun 15 | Acids and Bases IV | **Exam I** | Buffers Lab |
| Jun 22 | Aqueous Equilibria I<br>Real Data (Buffers) | Aqueous Equilibria II<br>Aqueous Equilibria Quiz A | Titration Lab |
| Jun 29 | Aqueous Equilibria III<br>Real Data (Titration) | Aqueous Equilibria IV<br>Aqueous Equilibria Quiz B | Solubility Equilibria Lab |
| Jul 6 | Electrochemistry I | Electrochemistry II<br>Electrochemistry Quiz | Redox Potential Lab |
| Jul 13 | Coordination Chemistry I | Coordination Chemistry II | Metal Oxalate Lab |
| Jul 20 | Coordination Chemistry III | **Exam II** | **No Lab** |
| Jul 27 | Content Review | **No Class – Reading Period** | **No Lab** |
| Aug 3 | **Final Exams** | | |