

# CHEMISTRY-108L – General Chemistry for Chemistry Majors: Kinetics and Equilibrium

Spring 2021

**COURSE OVERVIEW** CHEM-108, *General Chemistry for Chemistry and Biochemistry Majors*, is the second semester of general chemistry, focusing on kinetics and equilibrium. CHEM-108 introduces the key chemical principles that underlie all the molecular sciences, from energy and environmental research to materials, nanotechnology, medicine and biochemistry. CHEM-108 formulates a rational molecular-level perspective of fundamental chemical phenomena. It emphasizes relationships between observables and theories. It introduces good laboratory practices and helps students make scientific decisions based on sound analysis and interpretation of data. At the end of this course, students will have acquired a firm understanding of the molecular principles behind many diverse chemical processes across all disciplines of science and engineering and should be well positioned for continuing more advanced studies in chemistry and biochemistry.

**FACULTY** Professor Chi H. Mak  
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**OFFICE HOURS** After lectures  
(Other times by appointment)

**LECTURE** MWF 12-1 SGM 101

**LABS** Tu 3:30-6:30 SGM 136C (Section 17214)  
SGM 136D (Section 17215)  
Tu 5-8 SGM 136D (Section 17216)  
Th 9-12 SGM 136D (Section 17212)  
Th 2-5 SGM 136D (Section 17213)

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**PREREQUISITE** Pre-requisite: CHEM-107, CHEM-105a or CHEM-115a

**TEXTBOOKS** Required:  
1. *Principles of Modern Chemistry*, 8<sup>th</sup> Edition, by Oxtoby, Gillis and Butler (2015, Cengage). **OGB8e**  
Recommended:  
1. *Chemical Principles*, 3<sup>rd</sup> Edition, by Dickerson, Gray, and Haight (1979, Benjamin/Cummings). **DGH3e**  
Available free online: <http://resolver.caltech.edu/CaltechBOOK:1979.001>

**COURSE  
CONTENT**

CHEM-108 will cover the following chapters in the textbook, approximately in the order listed. (This sequencing is the same as the order in which these materials are covered in the other second semester general chemistry courses at USC.)

<b>OGB8e</b>	<b>Topic</b>	<b>DGH3e</b>
Ch 3,6	Chemical Structures and Molecular Orbitals	Ch 11,12, 13
Ch 7	Organic Functional Groups	Ch 21
Ch 18	Chemical Kinetics	Ch 22
Ch 14	Chemical Equilibrium	Ch 17
Ch 15	Acid-Base Equilibrium	
Ch 16	Solubility and Precipitation Equilibrium	
Ch 13	Spontaneous Processes and Thermodynamic Equilibrium	Ch 16
Ch 17	Electrochemistry	Ch 19
Ch 8	Bonding in Transition Metal Compounds and Coordination Complexes	Ch 20
Ch 10	Solids, Liquids, and Phase Transitions	Ch 18
Ch 20	Molecular Spectroscopy and Photochemistry	
Ch 21	Structure and Bonding in Solids	Ch 14
Ch 22	Inorganic Materials	

Full attendance at all lectures is expected. You are responsible for any announcements made in lecture and all material presented whether or not it is in the textbook.

Reading and problems are assigned after every lecture.

**WEBSITE**

Blackboard will be used extensively in this course for instructions, homework, discussions and for distribution of materials. Make sure you have access.

**SLACK**

Slack, a collaboration app, will be used in this class to share data and information, host discussions, stream videos and address questions. Slack will be used for both the lectures and labs. Make sure you have Slack installed on your mobile device.

Subscribe to the CHEM-108 Slack channels at [uscchem-108spring2021.slack.com](https://uscchem-108spring2021.slack.com). **Use your personal email (i.e. non-USC) to sign up**, because USC places restrictions on their users on Slack.

**CLASS  
PARTICIPATION**

Class time will be used for lecture, discussion and problems. You are expected to participate in in-class discussions and problem-solving sessions. During the problem-solving sessions, you will be given the opportunity to demonstrate your approach to the class and earn extra credit points. Extra credit points are awarded for in-class participation but not for correctness, so you should feel free to actively engage in these opportunities.

CHEM-108 encourages active class participation. We do not use powerpoints. Please be sure to bring a notebook or paper, and pens or pencils to write with, as well as a calculator to every lecture, and be ready to do some work in class every time.

**READING  
ASSIGNMENTS**

The lectures will not revisit every section in the textbook, especially the basic ones. It is critical that you keep up with the reading assignments. Reading assignment for each lecture is posted on the Blackboard website. You should complete the reading assignment before you come to class.

## HOMEWORK AND VIDEOS

Short videos are sometimes used to supplement the lectures. These are considered part of your homework assignment. Materials presented in these videos will not be repeated in lectures.

Homework consists of weekly problem sets. Homework is assigned after every lecture. **Weekly homework is collected before lecture every Wednesday.**

## LABORATORY

**Lab begins with Check-In during the week of January 24<sup>th</sup> (Week 02 on the course calendar) at your scheduled lab time.** Your lab kit will be mailed out during the first week of class. Although the chemicals we will be using are safe for at-home use, if you have a lab coat and safety glasses, please do wear them for all the labs throughout the semester. This will protect you and your clothing from any spills.

**On the day you check in, there will be a lab orientation meeting with your TA over Zoom.** Please make sure to have your computer ready. For the rest of the semester, labs will also be done over Zoom and supervised by your TA.

**Safety glasses and a lab coat (100% cotton) are required for every person in the lab at all times.** All persons in the lab are required to wear long pants, shirt with sleeves, socks and covered/closed-toe shoes.

## LAB REPORTS

CHEM-108 lab reports will be graded using different rubrics from CHEM-105 or 107.

To help you develop good lab practice and learn how to present your data, CHEM-108 requires two types of lab reports:

1. ***Formal Lab Reports. (30 points each)***

During this semester, you will only have to write two full-length formal lab reports. You will be informed in advance which two labs require formal reports to be handed in. Each formal report is worth 30 points. The organization of a formal lab report should resemble a typical paper published in a chemistry journal. It should consist of these sections: Title and Author, Abstract, Introduction, Experimental Methods, Results, Discussion and Conclusions. If you work in teams, only data may be shared. Each student must produce his/her own report in its entirety, including all the data analysis, tables, graphs and every section in the report. Copying any portion of your report from another student will result in a zero for both students. Do not let anyone copy from you.

2. ***Short Lab Reports. (10 points each)***

The rest of the labs require only short lab reports. Each short report is worth 10 points. A short report is an abbreviated version of the formal report, consisting of these sections: Title and Author, Purpose, Experimental Procedure (in bullet points), Data, Analysis and Conclusion. If you work in teams, only data may be shared. Each student must produce his/her own report in its entirety, including all the data analysis, tables, graphs and every section in the report. Copying any portion of your report from another student will result in a zero for both students. Do not let anyone copy from you.

## QUIZZES

**Approximately ten short (~10 min) in-class closed-book quizzes will be given over the semester.** Quizzes will not be announced in advance. There will be no more than one quiz per week. Each quiz will focus on materials related to the homework and the lecture in the prior week. Two lowest quiz scores will be dropped. Absence on the day of a quiz will be treated as a zero.

## MIDTERM EXAMS

**There will be three midterm exams given during the semester.** These midterm exams will test you on each of the three major learning objectives of the course:

1. **Lab skills. (Cat I)**  
One of the three exams will test you on lab skills covered in the laboratory portion of the course. This exam will consist of a lab practical which you will complete during and within your lab period.
2. **Problem solving and analytical thinking. (Cat II)**  
One of the three exams will test you on your problem-solving and analytical skills. This will consist of a one-hour exam with several questions similar in style to the quizzes, but with emphasis on applications of the concepts.
3. **Data analysis and interpretation skills. (Cat III)**  
One of the three exams will test you on your data analysis and interpretation skills. For a Cat III exam, you will be given a problem with raw data and you will be asked to analyze the data and draw the proper conclusions from them to address the problem. For this exam, you will hand in a written report of your analysis similar to a formal lab report, consisting of the following required sections: Results, Discussion and Conclusion. You will be given 3 days for this exam. Each student must produce his/her own report in its entirety, including all the data analysis, tables, graphs and every section in the report. Copying any portion of your report from another student will result in a zero for both students. Do not let anyone copy from you.

### Midterm Exam Dates

Exam #1	Week 05 lab period (week of Feb 15 <sup>th</sup> )
Exam #2	Week 09 lab period (week of Mar 15 <sup>th</sup> )
Exam #3	Week 13 lab period (week of Apr 12 <sup>th</sup> )

For each of the three midterm exams, you will be tested on a different skill category (I, II or III). You will know which skill category you will be tested on in advance of the midterm.

## FINAL EXAM

**A comprehensive two-hour final exam will be given on May 7th, 2020 at 11:00 am to 1:00 pm.** This is the only time the final exam may be taken. No early or makeup final will be given.

## GRADING

Homework	13 @ 5 points	65
Laboratory	2 @ 30 points (formal reports)	140
	8 @ 10 points (short reports)	
Quizzes	8 @ 20 points each	160
Midterm Exams	3 @ 40 points each	120
Final Exam	1 @ 150 points	150
Total:		<u>635</u>

## ABSENCES

**All unexcused absences from labs or exams will result in a zero.** Individuals with excused absences will be given special consideration at the end of the semester. Absences will be excused on the basis of official university policy. To secure an excused absence, bring verification to Prof. Mak prior to the absence, or in case of illness, immediately upon your return. All excuses will be verified.

## COPYRIGHTED MATERIALS

All course materials, including notes, slides, exams, exam keys, in-class questions, homework, homework solutions, discussion questions, case studies and videos are considered copyrighted materials. Any student who transmits any of these materials to unauthorized users who are not registered in this course is in violation of USC student conduct code and will be reported to SJACS.