Chem 1A: General Chemistry

Fall 2018

Chem1AFall2018@gmail.com

Chemistry is the study of nature at the molecular scale. It is an ancient subject, as old as the first people to wonder why fire is hot and gold is shiny. But chemistry is also one of the most active areas of modern science, as new as the latest drug discovery, solar cell design, climate model, or gene editing technology.

Chem 1A surveys the subject of chemistry broadly, with an emphasis on the physical concepts that unify our understanding of molecular structure and reactivity. Once mastered, these concepts will allow you to pursue advanced studies in biology, materials, planetary science, and engineering with a sophisticated appreciation of how things work at the microscopic scale, where mysteries of life emerge and astonishing material properties originate.

Lectures are the heart of this course. Here, chemical questions will be posed, mulled, and answered in an interactive setting. They will include many eye-catching demonstrations of chemical properties and processes. They will also feature peer discussions and ChemQuizzes that probe your intuition and understanding in real time. Attendance of your assigned lecture is mandatory.

Discussion sections will explore how concepts developed in lecture translate into practical tools for analysis and prediction. Here you will learn how to perform calculations, recognize trends, and make informed estimates. These abilities, founded on your understanding of basic concepts, will be tested on homework assignments and exams. Attendance of your assigned discussion section is also mandatory.

Chem 1A will set high standards for learning difficult material, but it is also intended to be exploratory and fun. Your instructors are excited to share their passion for a subject that figures prominently not only in scientific headlines, but also in modern discussions of humanity's roots, capabilities, and responsibilities. We are here to spark your imagination, and to arm you with tools that will serve you throughout your studies and beyond.

For the quickest response to your questions, please email Chem1AFall2018@gmail.com .

Instructors

9am and 11am lectures:

Professor Phillip Geissler

207 Gilman Hall

geissler@berkeley.edu

Office Hours

Tuesdays 10-11:30am in Chemistry Library Room 100E

Thursdays 2-3:30pm in Chemistry Library Room 100F

1pm lecture:

Professor Eran Rabani

220 Gilman Hall

eran.rabani@berkeley.edu

Office Hours

Mondays 3-4pm in Chemistry Library Room 100F

Fridays 2-3pm in Chemistry Library Room 100F

Staff

Instructional Support Director:

Dr. Rose Beeler

rbeeler@berkeley.edu

Demonstrations/Projection Manager:

Karen Chan

kchan@cchem.berkeley.edu

Head GSIs

David Lunderberg

david_lunderberg@berkeley.edu

Office hours: M/W 10-11am in Bixby North

Kiera Wilhelm

wilhelmk@berkeley.edu

Office hours W/F 12-1pm in Bixby North

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Required Materials

Text:

Chemical Principles: The Quest for Insight

by Peter Atkins, Loretta Jones, and Leroy Laverman

(We have designed an electronic excerpt of this book that is much less expensive than the full hard copy. It can be obtained from the Cal Student Store or from the publisher.)

TI-30X Calculators or any other scientific calculator are necessary for exams (a smart phone calculator CANNOT be used).

Attendance Policy and iClickers

You will need to bring an *iClicker* device to each lecture. You can only get attendance credit by attending the lecture you are enrolled in (9 am, 11 am, or 1 pm) and participating in the ChemQuizzes, for which you need an activated iClicker. Your ChemQuiz participation in lectures will designate your attendance.

iClickers are available for purchase or rental at the Cal Student Store. It is your responsibility to properly register your iClicker remote in a timely fashion. It is also your responsibility to regularly check your iClicker grades for any discrepancies and bring them to our attention quickly.

For help with obtaining and setting up your iClicker, see www.ets.berkeley.edu/services-facilities/clickers/students-getting-started .

Your attendance score will be the sum of: 2 points for each lecture (up to a maximum of 64 points) and 1 point for each discussion (up to a maximum of 11 points).

Grading

This course is not graded on a curve, in order to encourage student interactions and peer learning. 1000 total course points are assigned as follows:

Midterm 1:	180
Midterm 2:	180
Midterm 3:	200
Final Exam (Cumulative):	300
Homework:	65
Attendance:	75

The grading scheme is as follows (cutoffs may be lowered but they will not be raised):

850 – 1000:	A
700 – 849:	B
550 – 699:	C
350 – 549:	D

0 – 349: F

Homework

Weekly homework will be assigned and submitted through the Sapling Learning system. Homework is meant to promote learning, so multiple attempts for each problem are possible. Each incorrect attempt deducts 5% of the total possible points for that specific problem. (e.g. 1 attempt = 100%, 2 attempts = 95%, 3 attempts = 90%, etc.)

Exams

Midterm exams will be held on Tuesday evenings: September 18 (8-10 pm), October 16 (7-9pm), and November 13 (7-9pm). The Final Exam is Monday, December 10, 3-6pm (Final Exam Group 3). No makeup exams will be given. If you miss any exam, you will receive a grade of zero, except in the case of a documented emergency. Exams will be administered to student-athletes who are traveling for University sanctioned events by appropriate proctor at the scheduled exam time. If you are a student with a documented disability, please visit the staff at the Disabled Students Program to arrange for testing accommodations.

Academic Integrity (http://teaching.berkeley.edu/berkeley-honor-code):

We support an environment of academic integrity and respect on campus that is embodied in the UC Berkeley Honor Code:

"As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."

and trust that you will follow this code in all your Chem 1A activities. Remember that, as a member of the campus community, you are expected to demonstrate integrity in all of your academic endeavors and will be evaluated on your own merits. The consequences of cheating and academic dishonesty—including a formal discipline file, possible loss of future internship, scholarship, or employment opportunities, and denial of admission to graduate school—are simply not worth it.

Course Material Schedule & Reading List:

Week	Date	Topic	Readings	Lecture #
1	W 8/22	Introduction to the molecular world	Fund. B, and 1A.1	1
	F 8/24	Stoichiometry at macroscopic and microscopic scales	Fund. E, L, M	2
	M 8/27	Quantum mechanics and the microscopic world		3
2	W 8/29	Quantum mechanics and light	1A.2-3	4
	F 8/31	Quantization and spectroscopy	1B	5
	M 9/3	**Academic holiday**		
3	W 9/5	Quantum mechanics and particles	1C	6
	F 9/7	Orbitals, energy levels, and quantum numbers of the H atom	1D	7
	M 9/10	Multi-electron atoms and screening	1E.1	8

4	W 9/12	Aufbau principles	1E.2	9
	F 9/14	Ionization energy and periodic trends	1F.1-4	10
	M 9/17	Electron affinity and ionic bonding	1F.5, 2A	11
		Mid-Term Exam 1	Tues. 9/18 8-10pm	
5	W 9/19	Covalent bonding and Lewis structures	2B	12
	F 9/21	Resonance and octet exceptions	2C, 2D	13
	M 9/24	Molecular structure and VSEPR	2E	14
6	W 9/26	Orbital hybridization	2F	15
	F 9/28	Molecular orbital theory	2G.1-2	16
	M 10/1	Diatomic and polyatomic molecules	2G.3-4	17
7	W 10/3	Fluctuations and the microscopic origin of pressure	3A	18

	F 10/5	Gas laws	3B, 3C	19
	M 10/8	Probability distribution of molecular speed	3D	20
8	W 10/10	Intermolecular forces	3E, 3F	21
	F 10/12	Hydrogen bonding and London dispersion	3G	22
	M 10/15	Thermal fluctuations and bond stability		23
		Mid-Term Exam 2	Tues. 10/16 7-9pm	
9	W 10/17	Phase transitions	5A, 5B	24
	F 10/29	Thermodynamics: heat, work, and the first law	4A, 4B	25
	M 10/22	Enthalpy and heat capacity	4C, 4D, 4E	26
10	W 10/24	Spontaneity and the second law	4F	27
	F 10/26	Entropy and Gibbs free energy	4G, 4H, 4I, 4J	28

	M 10/29	State functions and thermodynamic cycles		29
11	W 10/31	Standard states and the minimum work principle		30
	F 11/2	Surface tension and critical fluctuations		31
	M 11/6	Chemical equilibrium and the law of mass action	5G, 5H, 5I	32
12	W 11/7	Le Chatelier's principle	5J, 6I	33
	F 11/9	Acids and bases	6A	34
		Mid-Term Exam 3	Tues. 11/13 7-9pm	
	W 11/14	pH and pK_a	6B, 6C, 6D, 6E	35
	F 11/16	Neutralization and strong acid titration		36
	M 11/19	Weak acid titration and buffers	6G, 6H.2-4	37

14	W 11/21	**Academic Holiday**		
	F 11/23	**Academic Holiday**		
	M 11/26	Redox reactions	6K	38
15	W 11/29	Electrochemical cells and reduction potentials	6L, 6M, 6N, 6O	39
	F 12/1	Chemical kinetics	7A, 7D, 7E	40
		Final Exam		