CHEM 1A PO, SECTION 2: General Chemistry

Instructor
Prof. Jane M. Liu (SN 216)
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Class
MWF, 9 – 9:50 am
Seaver North 202

Office Hours
Wednesdays 2-4pm; Thursdays, 8-11 am; or by appointment
Prof. Liu's Review Sessions: Fridays, 11:30-1:00 pm, SN 202 (see page 3 for more information)

Welcome to General Chemistry! I am so glad that you are here. This first foray into the field will provide a foundation for advanced study in the chemical sciences and related fields. I hope that through this course you will also gain a general appreciation for the molecular nature of our world. A major objective of this course is to learn about the general types of chemical reactions and how to understand these reactions both qualitatively and quantitatively. At the same time, true to the liberal arts mission of Pomona College, I want to humanize the subject (chemists are, after all, people too!) and I want you to be able to use what you experience in this course to be successful in other classes and endeavors – so not everything you will learn will be about chemistry! At the end of the day, I want to foster an environment that produces a cohort of active learners who are intentional about their educational choices. Along these lines: this course will aim to address the following two questions and twelve intended learning outcomes:

- **What is chemistry?**
- **Who are chemists?**

After successfully completing this course, students will be able to:

- Identify, from chemical equations or experimental observations, four main types of chemical reactions: precipitations, acid-base, complexation and reduction-oxidation (redox)
- Apply knowledge of the periodic table (i.e. the chemical properties of the elements) to predict chemical reactions
- Apply the mole concept and stoichiometry to solve quantitative problems (e.g. titrations, percent yields, solubility) involving the four types of chemical reactions
- Explain how energy plays a central role in molecular structure and chemical reactions
- Calculate equilibrium constants and use them to determine the extent of reactions for different types of chemical reactions
- Apply the concepts of enthalpy, entropy, free energy and temperature to determine whether a chemical reaction proceeds spontaneously
- Explain the relationship between the equilibrium constant and free energy for a chemical reaction
- Interpret mathematical equations, figures, tables and graphs correctly
- Develop conceptual models and hypotheses from observed chemical data and phenomena
- Synthesize knowledge to solve complex chemistry problems
- Increase process skills such as: communication of scientific concepts and experimental results, group dynamics and teamwork, management and self-assessment
- Explain to others the major learning outcomes of CHEM 1A

Note that many of the intended learning outcomes above are applicable outside of chemistry! Being able to apply knowledge, being able to grapple with tables and graphs – these are all foundational skills that will allow you to be creative, critical thinkers in any field you apply yourself to.

For each class period, a list of **specific learning outcomes** will be provided to you, so that you can gauge your mastery of the materials and skills covered in CHEM 1A.

COURSE MATERIALS

- Zumdahl and DeCoste's **Chemical Principles**, 8th ed. *with* OWLv2 (required).
- *Chemistry 1a Laboratory Manual (*required; available from the stockroom)
- In class activities, lecture slides, videos, problem sets and additional materials will be posted on **Sakai**. You should check this site *frequently* and be familiar with its contents.
- Calculator
- Active Pomona College email account. I email the class frequently. You are expected to check your Pomona email account for these emails and to read them.

COURSE OVERVIEW

Your Tasks

Before class: Do initial reading assignments as an individual before class. These assignments must be ready at the start of class – your preparation will form part of your participation grade.

In class: ***Engage content in class – through discussion and problem solving – to achieve learning gains.*** The in-class work aims to maximize your learning while also developing important skills such as communication, teamwork, management and self-assessment. During our class meeting time, you will function as a member of a Learning Team, examining chemistry concepts as a unit. Working as a team is also reflective of how science is actually done – in research groups, through collaboration, etc. Periodically, team responses to key questions on in-class activities will be evaluated for correctness and effective communication. The team may also strategize on ways to improve teamwork and team products. Your team effort and these responses is part of your participation grade.

After class: ***Actively*** work on questions stemming from the reading and in-class work. This will your learning full circle. "Actively working" means that you work out the problems yourself – you do not simply watch someone else tackle the problem. There are two sources of questions for you:

- ***Online Web Learning (OWLv2):*** This electronic resource is designed to enhance your learning in conjunction with the text; access is gained via the course Sakai site. There are three types of assignments:

  Quick Prep: Designed to check your understanding of the chemistry you may have learned in high school / secondary school, and /or to bolster your understanding of beginning topics if this if your first time taking chemistry. Your Quick Prep score will not count toward your final grade.

  Mastery Questions: These test your understanding of the concepts as we proceed through the material and give you practice in expanding your toolset. **A set of Mastery Questions, related to material recently covered in class, is due every Sunday at noon**. Late assignments will be accepted, but a 10% penalty will be enforced. You may retake any mastery assignment as many times as you wish before the due date to improve your score; you may also redo mastery questions after you've turned them in for further practice.

  Optional Help: These are tutorials and other exercises aimed to help you better understand concepts you might be struggling with. These are entirely optional.

- ***Problem Sets:*** For each topic, additional problems (from the text and beyond) will be suggested. **A set of these will be provided as Problem Sets each week.** These problem sets will not be graded and do not count toward your final grade. However, they will allow you to practice using your expanded toolset, prepare you for the exams, and are important for your success in the course.

Additional Resources

Mentor Sessions: One of the most crucial elements of a positive General Chemistry experience is developing efficient, effective study habits and spending dedicated time in problem-solving sessions throughout the week. To help you develop these habits and also complete homework problems, **attendance to your assigned, weekly mentor session is highly recommended**:

- **One session per week:** Mentor Groups will be created based on student and mentor availabilities, and will focus on working on problems in a small-group setting, allowing you to solidify concepts covered in class. A Mentor who can help you with the problems and with study strategies will lead each session. Mentors are handpicked peers who are committed to helping you succeed in this course. The Mentor's role is to serve as a guide for the study session and also as a liaison to Prof. Liu as needed.
- **Expectations for working in groups:** Form a positive working relationship with your Mentor Group by being inclusive, respectful, and supportive of all members of the group. Encourage members to participate in discussions and listen to them speak when they do. Maintain active communication with each other outside of the Mentor Group sessions.

Review Sessions: Two types of faculty-led review sessions will be provided as additional, optional resources:

- I lead a weekly session, Q&A style, where you ask me questions and I provide guidance as to how to effectively approach the question to reach the answer.
- Prof. Wellman will lead problem-solving sessions (PSSs) focused on specific topics with the aim of helping you master these concepts. 6 sessions will be held throughout the semester. Each session will be offered twice (T, 9:30-10:30; W, 12-1 pm), to accommodate varying schedules, and are indicated on the calendar below.

Assessments

Final Grade Calculation		Grading Scale			
OWL:	5%	A	93-100	C	73-76
Mid-term exams:	36% (12% each)	A-	90-92	C-	70-72
Final exam:	24%	B+	87-89	D+	67-69
Project:	5%	B	83-86	D	63-66
Participation:	5%	B-	80-82	D-	60-62
Laboratory work:	25%	C+	77-79	F	≤59

There is no curve for this course – you need only worry about your own performance. Please note that an "A" grade represents excellent mastery and astute discussion of concepts covered in this course.

A passing grade (D- or above) is required for both the lecture and lab portions of the course in order to pass the class.

Exams: Three in-class mid-term exams will be given throughout the semester. The exams will be comprised of short answer questions. The questions will be drawn from lectures, in-class activities, assigned homework and problem sets. The exams will focus on testing your ability to apply what you have learned and not rote memorization. No make-up exams will be given. If you know in advance that you will miss an exam, please notify me at least one week ahead of time so that alternative arrangements can be made. If you miss an exam due to a documented health or family-related emergency, your other two exams will each count 18% of your total grade. **The final exam will be cumulative.** The final exam is worth more than the individual mid-terms to allow you to learn and grow from those formative assessments, and to receive recognition of those efforts.

Project: To help you meet the goal of learning *who* chemists are and *what* chemistry is, you will complete a small project, individually. Details will be provided and can be found on Sakai.

Participation: Attendance in class is mandatory in an active learning environment. In addition to mastering the material yourself, you are responsible for assisting the other members of your team in their understanding of the material. You must not miss class. Please be respectful of me and your fellow classmates and show up to class on time. You can expect your grade to drop substantially with 3 or more absences. Valid reasons for missing class are serious illness, religious observations or family emergencies. **You are responsible for handing in all assignments on time and obtaining all activities, regardless of missed classes.**

Throughout the semester, you will be asked to assess yourself and your teammates. Evaluations will be based on the Team Performance Rubric, which can be found on the course Sakai site. You should refer to this rubric *frequently* throughout the semester to make sure you are fulfilling the criteria of being a productive team

Laboratory: The laboratory work begins Wednesday of the first week of classes. The lab begins promptly at 1:15 p.m. in room SN 111. Please obtain the laboratory manual and lab notebook prior to the first week of lab and bring it to the first laboratory session. For all labs, please wear clothes that completely cover your legs and closed-toed shoes, and bring your safety glasses, lab coat, notebook, and a calculator. If you must change your section in a particular week, see Professor Wellman **beforehand**. All permanent laboratory section changes must occur during the first week of classes.

Grading Policy: Any query regarding scores on graded assignments or exams should be presented within three days of return of the assignment/exam. It is the student's responsibility to meet with the professor to make any adjustments. Please note that I reserve the right to regrade the entire submission, and as a result, I may raise or lower your entire score. After three days, all scores become final and unalterable.

Late policy: For all assignments, late work will be accepted. However, for every 24 hours that the assignment is tardy, a 10% deduction will be applied to your grade on that assignment. For OWL questions, there will be a 10% deduction after the due date – regardless of how tardy the submission.

Special circumstances: If there are special circumstances, such as illness of other form of emergency, which should be taken into account with regard to any of the stated class policies, please inform me as soon as possible so that alternative arrangements can be made.

Accommodations: Pomona College is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations may be made by contacting the Dean of Students Office. It is up to the student to contact the professor **within the first three weeks of classes** to fulfill the accommodations.

Academic ethics and integrity policy: You are expected to abide by the Pomona College Standards of Academic Integrity. For the official policy go to:
http://catalog.pomona.edu/content.php?catoid=7&navoid=394. Plagiarism, whether deliberate or unintentional, and cheating on examinations is not acceptable.

Detailed information on Pomona College's policy on academic honesty is presented in your "Critical Inquiry" course (ID 1); you are expected to follow the policy in Chemistry 1A. An especially important academic honesty standard for Chemistry 1A concerns laboratory work - "In laboratory or research projects involving the collection of data, students accurately report data observed and do not alter these data for any reason." One purpose of college laboratory courses is to develop the proper ethical conduct in scientific work. Unethical professional practices and research fraud have ruined the careers of practicing scientists not to mention the problems caused using faulty data that is believed to be correct. Hence, one purpose of having you turn in a copy of your laboratory data each day when you leave the laboratory is to help remove the temptation of altering your data when preparing your final report. All of your work on examinations and in laboratory reports must be your own. You are encouraged to work together on homework, laboratories, and in study of course material. However, any work that you turn in for a grade must be your own. Working together on homework is a good

idea, but you should not simply copy another student's work. Academic dishonesty cases will be reported to the Dean of Students Office in accordance with college policy.

Calendar (Subject to Change)

FALL 2018

SUNDAY	MONDAY	TUESDAY	WEDNES.	THURS.	FRIDAY	SAT.
AUG 26 QSE EXAM	27	28	29	30	31	SEPT 1
2 1ST YEAR REGISTRATION	3	4 CLASSES START	5	6	7	8
9 OWL DUE, NOON	10	11 *PROBLEM SOLVING SESSION*	12 *PROBLEM SOLVING SESSION*	13	14	15
16 OWL DUE, NOON	17	18 *PROBLEM SOLVING SESSION*	19 *PROBLEM SOLVING SESSION*	20	21	22
23 OWL DUE, NOON	24 BIOL40 EXAM	25 *PROBLEM SOLVING SESSION*	26 *PROBLEM SOLVING SESSION*	27	28	29
30 OWL DUE, NOON	OCT 1	2	3 EXAM 1	4	5	6
7 OWL DUE, NOON	8	9 *PROBLEM SOLVING SESSION*	10 PROJECT *PROBLEM SOLVING SESSION*	11	12	13
14 OWL DUE, NOON	15 BIOL40 EXAM	16	17	18	19	20
21 OWL DUE, NOON	22 *PS 7 DUE* FALL RECESS	23 FALL RECESS	24	25 LAST DAY TO DROP	26 EXAM 2	27
28	29	30	31	NOV 1	2 PROJECT	3
4 OWL DUE, NOON	5 BIOL40 EXAM	6 *PROBLEM SOLVING SESSION*	7 *PROBLEM SOLVING SESSION*	8	9	10
11 OWL DUE, NOON	12	13	14	15	16	17
18	19 EXAM 3	20	21	22 THANKSGIVING	23	24
25 OWL DUE, NOON	26	27	28	29	30 BIOL40 EXAM	DEC 1
2 OWL DUE, NOON	3	4 *PROBLEM SOLVING SESSION*	5 *PROBLEM SOLVING SESSION*	6	7 PROJECT	8
9 OWL DUE, NOON	10	11	12	13 READING DAY	14 READING DAY	15
16	17 1A FINAL 9 AM - NOON	18 FINALS	19 FINALS	20 FINALS	21 FINALS	22 FINALS
23	24	25	26	27	28	29

Schedule (Subject to Change):

Wk	(Lecture)Date	Topic	Assigned Reading*	PSS**
1	(1) 9/5	Introduction		
	(2) 9/7	Composition of Matter	Ch 1, Ch 2 (1-3), Mini-Lecture, App 1	
2	(3) 9/10	Atomic Theory	Ch 2 (4-7), Mini-Lecture, Appendix 2	*Sig Figs and Dimensional Analysis*
	(4) 9/12	The Mole Concept	Ch 3 (1-4)	
	(5) 9/14	Empirical and Molecular Formulas	Ch 3 (5-7)	
3	(6) 9/17	Stoichiometry	Ch 3 (8-11)	*Moles and Stoichiometry*
	(7) 9/19	Introduction to Aqueous Solutions	Ch 4 (1-3, 8)	
	(8) 9/21	The Periodic Table	Ch 2 (8,9) and Ch 13 (1-3)	
4	(9) 9/24	Bonding; Lewis Dot Structures	Ch 13 (1-3, 9-10)	*Lewis Structures*
	(10) 9/26	Lewis Dot Structures (continued)	Ch 13 (11-12)	
	(11) 9/28	Molecular Geometry	Ch 13 (11-13)	
5	(12) 10/1	Precipitation Reactions	Ch 4 (4-8)	
	(13) 10/3	**EXAM 1**		
	(14) 10/5	Acid Base Reactions	Ch 4 (9) and Ch 7 (1-2)	
6	(15) 10/8	Complexation and Redox Reactions	Ch 4 (10) and Ch 8 (10)	*Ppt and Acid/Base Reactions*
	(16) 10/10	Redox Reactions (continued)	Ch 4 (11)	
	(17) 10/12	Redox Titrations	Ch 4 (12)	
7	(18) 10/15	Ideal Gas Law	Ch 5 (1-5)	
	(19) 10/17	Kinetic Theory of Gases	Ch 5 (6)	
	(20) 10/19	Real vs Ideal Gases	Ch 5 (10)	
8		**Fall Recess**		
	(21) 10/24	Chemical Equilibria	Ch 6 (1-4)	
	(22) 10/26	**EXAM 2**		
9	(23) 10/29	Chemical Equilibria (continued)	Ch 6 (5-8)	
	(24) 10/31	Strong and Weak Acids	Ch 7 (1-2)	
	(25) 11/2	pH of Acid/Base Solutions	Ch 7 (3-6)	
10	(26) 11/5	Buffers	Ch 8 (1-4)	*Equilibrium Problems*
	(27) 11/7	Acid/Base Titrations	Ch 8 (5-7)	
	(28) 11/9	Solubility Product	Ch 8 (8-9)	
11	(29) 11/12	Energy	Ch 9 (1-2)	
	(30) 11/14	Specific Heat	Ch 9 (3-4)	
	(31) 11/16	Calorimetry	Ch 9 (3-4)	
12	(32) 11/19	**EXAM 3**		
		Thanksgiving		
13	(33) 11/26	Heat of Reactions	Ch 9 (5-6)	
	(34) 11/28	Spontaneous Change and Entropy		
	(35) 11/30	Guest Lecture on Research	Ch 10 (1-4)	
14	(36) 12/3	Entropy and Free Energy	Ch 10 (5-8)	*Thermo.*
	(37) 12/5	Free Energy and Equilibrium	Ch 10 (9-11)	
	(38) 12/7	Electrochemistry	Ch 11 (1-4)	
15	(39) 12/10	Electrochemistry (continued)	Ch 11 (5-8)	
	(40) 12/12	**Last Day!**		
16	**12/17 9-noon**	**FINAL EXAM – Millikan 1051**		

*Assigned reading indicates book chapter (sections) that should be read prior to that day's lecture.
**Problem Solving Sessions (PSS) are on indicated weeks: Tues (9:30-10:30 am) and Wed (12-1 pm) in Millikan 1051