CHEM 1A – General Chemistry
De Anza College

Instructor	Email	Office Hour Location	Office Hours
Rachel Snelling, Ph.D.	snellingrachel@fhda.edu	SC 1200 (second floor)	M-Th 10:30a-11:20a

Course Description: An introduction to the structure and reactivity of matter at the molecular level. Application of critical reasoning to modern chemical theory and structured numerical problem solving. Development of molecular structure from rudimentary quantum mechanics, including an introduction to ionic and covalent bonding. Chemical problem solving involving both formula and reaction stoichiometry employing the unit analysis method. An introduction to thermochemistry and a discussion of the first law of thermodynamics.

Required Materials:

- Textbook: ***Chemistry: The Molecular Nature of Matter and Change, 8th edition*** by *Silberberg and Amateis* (McGraw-Hill: 2015; ISBN 978-1-259-63175-7
- Lab Notebook: a plain composition notebook is sufficient
- Safety Goggles: can be purchased at the bookstore

Enrollment Policies

- **Attendance** to lab lecture is mandatory. You are responsible for getting the notes from another student if you miss lecture. I do not give out lecture notes. ***Please do not email me to ask if I went over anything important in lecture; it's all important!!***
- **Enrolled** students must be present and prepared at the first lab meeting. If you are more than ***15 minutes*** late for the first lab, ***you may be dropped from the course***.
- There will be ***no section switching*** outside of the registration systems in place online.
- The last day to enroll is Saturday 4/20.
- There will be ***no lab make-ups***.
- If you miss or come to lab late, unprepared, or are asked to leave the lab for violating safety rules, you are ***not eligible for a make-up***. You can get credit for what you have prepared that day, but nothing more. You are also responsible for turning in the lab report due that day, if applicable.
- If you are sick, it may not be safe for you to attend lab. Email your Rachel **before** your lab starts and follow the *meeting half-way policy*, otherwise your situation will be treated as an unexcused absence.
- Consult the schedule for experiment due dates. Assume ***no late lab reports*** will be accepted unless ***prior permission*** in writing/e-mail before the due date. *Missing one full report means you drop one letter grade (ex. A to B).*
- *If you do not turn in two reports or if you miss two labs, you cannot pass the course.*
- **Enrollment limits** Due to safety considerations and space limitations, enrollment in each section of general chemistry is strictly limited to 30 students. ***There are absolutely no exceptions to this policy, regardless of circumstances.***
- **Wait list** If a particular section has already been filled at the time you register for the course, you may be automatically added instead to the wait list (space permitting). Open spaces in each section will be filled in order according to the official wait list up until the add deadline. Any open spaces remaining after all students on the wait list have been added will be filled on a **first-come, first-serve** basis. If you are added to a section from the wait list, you will not be assigned a laboratory locker until you verify that you have officially enrolled in the class. Any assessments that you may have missed while attempting to add the class will be addressed on an individual basis once you are successfully added to the course.
- **Registration errors** Official class rosters are generated prior to the beginning of the quarter by Admissions and Records (A & R), located in the Student and Community Services (SCS) building. Problems related to the registration system itself, your registration status, or your position on the wait list must be addressed directly to A & R, as before the quarter begins I ***do not*** have the ability to manage class registration. I am only able to add students to the course or wait list once the quarter begins.

- **Dropping** If, for whatever reason, you choose to drop or withdraw from this course, it is ***your responsibility alone*** to initiate the drop or withdraw by the appropriate deadline, either online or in person. However, prior to the drop deadline, if you stop attending class, I am ***required*** to drop you from the course so as to ensure an accurate census count, which in turn determines the level of funding provided to De Anza by the State of California. Additionally, due to federal restrictions related to financial aid, after the drop deadline but before the withdrawal deadline, if you stop attending class I am also ***required*** to drop you from the course. If you stop attending class for whatever reason, especially before the drop deadline, you **must** contact me to ensure you are not removed from the course.

Disability Accommodation

If you have some form of disability, many accommodations and services are available through Disability Support Programs & Services (DSPS), located in the Advanced Technology Center (ATC 209). If you require some form of academic accommodation on assessments – such as additional time, a reduced-distraction environment, or the use of alternative media or assistive technology – you must be evaluated by the Educational Diagnostic Center (EDC), located in Learning Center West (LCW 110), and receive a Test Accommodation Verification (TAV) form. ***Absolutely no accommodations can be given without a completed TAV form.***

Academic Integrity

Academic integrity is one of the most important qualities a student, instructor, or researcher can possess. Once that integrity is lost, it is virtually impossible to recover, and its loss represents a severe lapse in ethics. Cheating and plagiarism are two of the most serious violations of academic integrity in an educational environment. Having been a student, I fully understand the pressure to succeed. However, **I do not consider cheating to be excusable in any form or under any circumstances**, as I personally believe that a lack of ethics in this phase of your academic career is indicative of how you will behave in your future occupation. **Any student caught cheating or plagiarizing on any assignment will automatically receive zero credit for that assignment**. If collusion between multiple students can be unequivocally demonstrated, each student will receive this same penalty. All instances of cheating and plagiarism will be reported to both the dean of Physical Sciences, Math, and Engineering (PSME) and the dean Student Development for possible further disciplinary action.

Code of Conduct

All De Anza students and staff are expected to abide by the Code of Conduct, which is based on the following four principles:
1) Mutual respect between students, faculty, and staff.
2) Pursuit of studies with honesty and integrity.
3) Respect for College and personal property.
4) Compliance with all rules and regulations.
It is fortunate that only occasionally am I prompted to take action against violations of the code of conduct, as the majority of students are respectful of each other and of course policies. However, be aware that **disruptive or abusive behavior towards myself or any student in the class will not be tolerated. Depending on the seriousness of the incident, violations of the code of conduct may be reported to the dean of Student Development for potential disciplinary action. Additionally, I am authorized to dismiss a student from class, without prior authorization, for disruptive behavior for two class periods. ***Note:* Cheating and other lapses of academic integrity constitute violations of code of conduct.**

Lecture

- **Textbook** The official text for this course is ***Chemistry: The Molecular Nature of Matter and Change, 8th edition*** by ***Silberberg and Amateis*** (McGraw-Hill: 2015; ISBN 978-1-259-63175-7). ***Note:*** Due to the high cost of textbooks, if you have already purchased a previous edition of this text or a text written by another author, it is your decision whether or not to purchase the official text;

however, all problems, section numbers, diagrams, or tables referred to in class will come directly from the official text. There are other excellent texts available which may be useful if you are seeking addition problems or an alternate presentation of the course material. If you wish to use an alternate text, please consult with me so that I can determine whether the text you intend to use is appropriate for the level of this course.

- **Suggested problems** It is recommended that you work all of the in-chapter problems from the sections listed below for fundamental skill development; the additional problems listed below are suggested for further practice.
- **Homework** Working problems at the end of each chapter is one absolutely assured way to increase your understanding of the course material. Recommended problems can found abve. As this is a college-level course, homework will not be collected or graded; ***it is entirely up to you*** to discipline yourself to do as many problems as may be necessary for you.
- **Exams** are comprehensive assessments that review in detail topics covered in lecture. Although not explicitly cumulative, each successive exam naturally builds on material found on previous exams. Exams will last the entire class period and consist of fill-in-the blank, short essay, mechanism, or synthesis questions. ***No multiple-choice tests will be given in this class***.
- **Final exam** is identical in format to the regular exams, except the final it is ***cumulative and comprehensive***, covering material from the entire quarter. Do not fall into the trap of cramming for each test only to forget everything before the final! Reviewing the quizzes and tests from the quarter is one of the best ways to prepare for the final. Be aware that material presented after the last exam will also be included on the final. ***Note: The final does not include any lab-related material.***
- **Suggested problems** It is recommended that you work all of the in-chapter problems from the sections listed below for fundamental skill development; the additional problems listed below are suggested for further practice. ***Note:*** Homework problems are **not** necessarily an indicator of the types of problems that will be found on quizzes or exams. In fact, you may encounter problems on quizzes or exams that have not been directly addressed either in class or in the suggested problems. I believe it is important to not simply regurgitate material, but to extend the skills you have mastered – in a reasonable way – to the unfamiliar, as you will undoubtedly encounter such challenges in your future studies or careers.

	LECTURE SCHEDULE MWF			
WEEK	**DAY**	**SECTIONS**	**TOPIC**	**PROBLEMS**
1	4/8	1.1-1.5	Numbers and Units	1: 2, 4, 6, 8, 23, 24, 28, 34, 38, 40
	4/10	2.1-2.5	Atomic Structure	2: 12, 20, 22, 26, 39, 41, 52, 60, 63
	4/12	2.6-2.8	Nomenclature	2: 84, 88, 90, 92, 94, 98, 100, 102, 106
2	4/15	2.8-2.9	Molecules and Compounds	2: 112, 115
	4/17	3.1-3.2	The Mole	3: 2. 8. 12, 16, 20, 22, 27, 36, 42, 44, 46, 48
	4/19	3.3-3.4	Stiochiometry	3: 58, 60, 62, 69, 73, 89, 91, 93
3	4/22	**EXAM 1**		
	4/24	4.1-4.3	Precipitation Reactions	4: 2, 3, 13, 14 – 22 (*even*), 26, 28, 30, 36, 41, 43 – 49 (*odd*)
	4/26	4.4	Acids and Bases	4: 57, 61, 63. 65. 67, 69, 71
4	4/29	4.5-4.6	Oxidation-Reduction Reactions	4: 82 – 96 (*even*), 103 – 111 (*odd*), 115
	5/1	6.1-6.2	Thermodynamics	6: 9, 11, 15, 19, 21, 24, 26, 28
	5/3	6.3-6.4	Calorimetry	6: 33, 35, 37, 39, 43, 45, 47, 49, 55-57, 65
5	5/6	6.5	State Functions	6: 70, 72, 74
	5/8	6.6	Heat of Reaction	6: 77, 79, 84
	5/10	**EXAM 2**		
6	5/13	7.1-7.2	Quantum Mechanics	7: 2, 7, 9, 11, 18, 20, 22, 31
	5/15	7.3-7.4	Wave Functions	7: 35 – 38, 47, 48
	5/17	7.4	Atomic Orbitals	7: 49, 51, 53, 55, 57, 59, 62, 63
7	5/20	8.1-8.2	Electron Configurations	8: 6, 9, 11, 13, 16
	5/22	8.2	Periodic Table	8: 18, 21, 23, 25, 29, 31, 33, 39, 41
	5/24	8.3-8.4	Periodic Trends	8: 46, 50, 53, 55, 57, 59, 61, 62, 69, 71, 75, 81
8	5/27		**Memorial Day-No Class**	
	5/29	**EXAM 3**		
	5/31	9.1-9.2	Ionic Bonding	9: 1, 4, 6, 8, 17, 20 – 30 (*even*), 33
9	6/3	9.3-9.4	Covalent Bonding	9: 34, 35, 39, 41, 43, 45, 47
	6/5	9.5-9.6	Polarity	9: 51, 53, 56, 58, 60, 64, 66
	6/7	10.1	Molecular Structures	10: 1 – 21 (*odd*)
10	6/10	10.2-10.3	Molecular Shapes	10: 28 – 48 (*even*), 52, 56, 57
	6/12	**EXAM 4**		
	6/14	11.1	Hybridization	11: 1 – 11 (*odd*)
11	6/17	11.2-11.3	Molecular Orbital Theory	11: 20, 21, 23, 25, 26, 28, 30, 34, 36
	6/19	11.3	Resonance and Delocalization	-
	6/21		Q and A for Final	
FINAL	6/24		**FINAL 11:30a-1:30p**	

	LECTURE SCHEDULE T/Th			
WEEK	**DAY**	**SECTIONS**	**TOPIC**	**PROBLEMS**
1	4/9 to 4/11	1.1-1.5	Numbers and Units	1: 2, 4, 6, 8, 23, 24, 28, 34, 38, 40
		2.1-2.5	Atomic Structure	2: 12, 20, 22, 26, 39, 41, 52, 60, 63
		2.6-2.8	Nomenclature	2: 84, 88, 90, 92, 94, 98, 100, 102, 106
2	4/16 to 4/18	2.8-2.9	Molecules and Compounds	2: 112, 115
		3.1-3.2	The Mole	3: 2. 8. 12, 16, 20, 22, 27, 36, 42, 44, 46, 48
		3.3-3.4	Stiochiometry	3: 58, 60, 62, 69, 73, 89, 91, 93
3	4/23	**EXAM 1**		
	4/25	4.1-4.3	Precipitation Reactions	4: 2, 3, 13, 14 – 22 (*even*), 26, 28, 30, 36, 41, 43 – 49 (*odd*)
		4.4	Acids and Bases	4: 57, 61, 63. 65. 67, 69, 71
4	4/30 to 5/2	4.5-4.6	Oxidation-Reduction Reactions	4: 82 – 96 (*even*), 103 – 111 (*odd*), 115
		6.1-6.2	Thermodynamics	6: 9, 11, 15, 19, 21, 24, 26, 28
		6.3-6.4	Calorimetry	6: 33, 35, 37, 39, 43, 45, 47, 49, 55-57, 65
5	5/7	6.5	State Functions	6: 70, 72, 74
		6.6	Heat of Reaction	6: 77, 79, 84
	5/9	**EXAM 2**		
6	5/14 to 5/16	7.1-7.2	Quantum Mechanics	7: 2, 7, 9, 11, 18, 20, 22, 31
		7.3-7.4	Wave Functions	7: 35 – 38, 47, 48
		7.4	Atomic Orbitals	7: 49, 51, 53, 55, 57, 59, 62, 63
7/8	5/21 to 5/28	8.1-8.2	Electron Configurations	8: 6, 9, 11, 13, 16
		8.2	Periodic Table	8: 18, 21, 23, 25, 29, 31, 33, 39, 41
		8.3-8.4	Periodic Trends	8: 46, 50, 53, 55, 57, 59, 61, 62, 69, 71, 75, 81
8	5/30	**EXAM 3**		
9	6/4 to 6/6	9.1-9.2	Ionic Bonding	9: 1, 4, 6, 8, 17, 20 – 30 (*even*), 33
		9.3-9.4	Covalent Bonding	9: 34, 35, 39, 41, 43, 45, 47
		9.5-9.6	Polarity	9: 51, 53, 56, 58, 60, 64, 66
		10.1	Molecular Structures	10: 1 – 21 (*odd*)
10	6/11 to 6/13	10.2-10.3	Molecular Shapes	10: 28 – 48 (*even*), 52, 56, 57
		EXAM 4		
		11.1	Hybridization	11: 1 – 11 (*odd*)
11	6/17 to 6/19	11.2-11.3	Molecular Orbital Theory	11: 20, 21, 23, 25, 26, 28, 30, 34, 36
		11.3	Resonance and Delocalization	-
FINAL	6/27		**FINAL 11:30a-1:30p**	

Laboratory Information

- **Textbook** The official lab text for this course has been prepared by the chemistry department is available for free. Individual experiments can be downloaded using the following link: **http://deanza.edu/chemistry/Chem1A.html**
- **Prelabs** Before beginning a new experiment, you are required to complete a pre- lab for that experiment. Most experiments include procedures for both miniscale and microscale quantities. By default, you should prepare a pre-lab only for the miniscale procedure. However, reduced quantities of reagents will often be used, and occasionally slight modifications to the procedure may be made; any such changes to the procedure will be announced in advance. Also, some experiments are comprised of multiple parts; in those cases, a pre-lab only needs to be prepared for the parts indicated in the schedule below, unless otherwise announced.
- Student Learning Objectives:
  1. Identify and explain trends in the periodic table.
  2. Construct balanced reaction equations and illustrate principles of stoichiometry.

3. Apply the first law of thermodynamics to chemical reactions.

LABORATORY SCHEDULE			
WEEK	**DAY**	**REPORT**	**TOPIC**
1	4/8 or 4/9		Introduction and Check-In
	4/10 or 4/11		Lab A1-Measurement
2	4/15 or 4/16		Lab A2-Nomenclature
	4/17 or 4/18	Lab 1	Lab A3-Gravimetric analysis of a hydrate
3	4/22 or 4/23		Lab A3-Gravimetric analysis of a hydrate
	4/24 or 4/25		Lab A4-Precipitation
4	4/29 or 4/30	Lab 3	Lab A4-Precipitation
	5/1 or 5/2		Lab A4-Precipitation
5	5/6 or 5/7		Lab A5-Types of Reactions
	5/8 or 5.9	Lab 4	Lab A5-Types of Reactions
6	5/13 or 5/14		Lab A6-Conductivity of Solutions
	5/15 or 5/16	Lab 5	Lab A6-Conductivity of Solutions
7	5/20 or 5/21		Lab A7-Acid/Base Titration of Vinegar
	5/22 or 5/23	Lab 6	Lab A7-Acid/Base Titration of Vinegar
8	5/27 or 5/28		**No Lab-Memorial Day**
	5/29 or 5/30		Lab A8-Calorimetry and Thermochemistry
9	6/3 or 6/4	Lab 7	Lab A8-Calorimetry and Thermochemistry
	6/5 or 6/6		Lab A9-Redox Titration of Bleach
10	6/10 or 6/11	Lab 8	Lab A9-Redox Titration of Bleach
	6/12 or 6/13		Lab A10-Line Spectra
11	6/17 or 6/18	Lab 9	Lab A11-Molecular Modeling
	6/19 or 6/20	Lab 10	Check-Out
NOTE: The Report of Lab 11 is due the day of the lecture final			

Absences

- Almost everyone is absent from class occasionally due to legitimate reasons – such as sudden or unexpected work conflicts, illness of self or a close relative, accidents, births, deaths, court cases; sometimes the reasons are not so lofty – such as sleeping through an alarm or grappling with the after-effects of a particularly enthralling party. If you have missed class, or you are aware ahead of time that you will be absent for class, please contact me by e-mail (or by phone if you do not have e-mail access) and provide a brief explanation for your absence. Without proper advance or reasonable notice, no opportunity to make up any missed work will be given. Depending on the reason for your absence, you may be required to provide verification of the circumstances surrounding your absence – for example, a doctor's note confirming your illness.
- Due to the perpetually impacted wait lists for this class, if you are absent for any reason before the add deadline passes without justification or notification ***you may be automatically dropped from the class***. During this time period, it is especially important that you contact me regarding any absences right away to preserve your spot in the class.

Make-up policies

- **Lecture and lab lecture** If you are absent from lecture or the lecture portion of lab and if no quiz or exam was given that day, there is no work for you to make up. Audio recordings and written notes of all lectures and lab lectures can be found online at the class website. If you were absent from the lecture portion of lab on a day a pre-lab was due, you must show me that pre-lab on the ***very next day*** that you are in class.

- **M*issed labs cannot be made up.*** Our lab program operates under tight constraints on both resources and space; as such, the chemicals for any one experiment are only available for a limited number of lab periods. If the chemicals happen to be available the next lab you attend, you must be prepared to complete the missed work in parallel with whatever other experiment you are supposed to be conducting that day. If you are unable to complete an experiment due to one or more ***legitimate***

absences, the grade for the missing lab will be based on an alternate assignment related to the lab. Other than under rare circumstances, you may ***not*** attend another lab section to make up a missed lab, especially if the section already has a full compliment of students. ***Note: If you miss lab on the same day you have a lecture exam, you will not be allowed to take or receive a score for the exam.***

- **Lab exams** Missed lecture quizzes and lab exams can be made up only in the event of an excused absence and must be taken by ***the very next time that you attend class***, regardless of whether it is for lecture or for lab; otherwise, you will receive a score of zero on that assessment. If you wish to make up the assessment before your next regular class session, you may make arrangements to come during office hours or some other mutually agreed-upon time. Due to problems with academic integrity, make-up quizzes and lab exams differ from the original versions given in class, although they are of comparable difficulty.

- **Exams** Due to problems with academic integrity, ***missed exams normally cannot be made up***. If you missed class due to a truly severe event – such as a debilitating accident or the death of a close relative – then the opportunity to make up an exam may be given, although the exam will differ from the original version.

- **Final** The final exam time and date is scheduled by the college and cannot be changed unless every student in the class agrees and the time change is approved by the dean. Be sure to schedule any travel around your final exam time. If a true, verifiable emergency arises, contact me ***immediately*** to make alternate arrangements. When such an emergency occurs, the exam will be given at another time when possible. If no alternate time is available, a grade of 'incomplete' may be given for the quarter; the final must then be taken within a mutually established time frame. An official contract must be submitted to A & R to receive an 'incomplete'; if the incomplete is not resolved according to that contract, you will receive a grade based on the work completed.

Grading Options

- **Pass/No Pass-**If you are taking this class out of general scientific interest or for pleasure and would like to receive credit for the course – but do not need a letter grade – this course may be taken on a pass/no-pass basis. A grade of 'C' or higher is considered passing, while a grade of 'D+' or lower is considered failing. You must elect to take the course on a pass/no-pass basis by the official registration deadline. ***Note:*** Once the deadline for designating the course as pass/no-pass has elapsed, you ***cannot*** convert a passing grade into a letter grade or convert a letter grade into a passing grade.

- **Auditing**-If you have previously taken this course ***at De Anza*** and want to repeat this course for review, you may take this course on an audit basis. If you have **not** taken this course ***at De Anza*** before, you must officially register for the course. Due to liability and equanimity concerns, ***you may not attend this class if you are not officially registered***. Auditing students may not participate in lab experiments and will not receive credit for the course.

- **Plus/Minus Grades**-Grades in this course are constituted according to a plus/minus grading scale. According to the California state education code, the maximum grade point possible for a course is 4.0, meaning that a grade of 'A+' is equivalent to a grade of 'A' for the purposes of calculating grade point average. Additionally, since a grade of 'C' is considered the minimum grade for passing a course within the California community college system, there is no such grade as 'C–' at De Anza.

Grade Distribution

A+ 98 – 100%	A 93 - 97	A- 90 - 92
B+ 88 - 89%	B 83 - 87	B- 80 - 82
C+ 78 – 79%	C 70 - 76	
D 55 - 69	F < 55	

Laboratory Safety
The chemistry department has adopted the following safety rules from the American Chemical Society Safety In Academic Laboratories Guidelines, 7th Ed. for all chemistry lab classes:

- Department-approved safety goggles must be worn at all times once laboratory work begins, including when obtaining equipment from the stockroom or removing equipment from locker drawers, and may not be removed until all laboratory work has ended and all glassware has been stored.
- Shoes that completely enclose the foot are to be worn at all times; NO sandals, open-toed, or open-topped shoes, or slippers, even with socks on, are to be worn in the lab.
- Shorts, cut-offs, skirts, or pants exposing skin above the ankle, and sleeveless tops may not be worn in the lab.
- Hair reaching the top of the shoulders must be tied back securely.
- Loose clothing must be constrained.
- Wearing jewelry (rings, bracelets, watches, etc.) is discouraged due to chemical between jewelry and skin.
- Eating, drinking, or applying cosmetics in the laboratory is forbidden at ALL times, including during lab lecture.
- Use of electronic devices requiring headphones in the laboratory is prohibited at ALL times, including during lab lecture.
- Students are required to know the locations of the eyewash stations, emergency shower, and all exit.
- You may not be in the laboratory unless an instructor is present to supervise.
- Students not enrolled in the laboratory class may not be in the lab at any time after the first lab period of each quarter. 12 • If for any reason you feel faint during lab, notify an instructor before stepping out for air so you can be supervised.
- Never point a heated system towards any person, including yourself (or me).
- Glass and needles must only be disposed of in the appropriate container in the regular trash.
- Never use chemical refrigerators to store food or any other personal items.

Eye Safety

- **Eye hazards:** Many students incorrectly assume that chemicals are the prime eye hazard in the laboratory, when in fact it is often glassware that is more hazardous. If a test tube is dropped unexpectedly, regardless of whether the compound inside that tube is hazardous or not, the flying pieces of glass certainly have the potential to cause injury. In fact, it is often bystanders that are injured in such accidents, since they may not be immediately aware of what the person next to them is doing. As such, you must wear your goggles the entire time you are in the lab or in front of the stockroom window – even if you are finished with your experiment and you are “just” chatting with your friends, even if you are “just” in the balance room, even if other students are (foolishly) not wearing theirs.

- **Types of goggles:** Your safety goggles must make a seal around your eyes to prevent objects or chemicals striking from the sides as well as directly towards your eyes. If you wear prescription glasses, you must still wear safety goggles over your regular glasses, as most regular glasses are not shatter-proof and do not have appropriate side shielding. If you are certain that you will be taking many laboratory classes and you wear prescription glasses, you may want to purchase a pair of prescription safety glasses. My current favorite type of safety goggles is the Uvex Stealth, since it has a comfortable cushioning pad around the goggles.

- **Contacts:** If you wear contacts, be aware there is some concern that certain types of contact lenses (particularly soft lenses) may be potentially hazardous to wear in the presence of some chemicals. Although at De Anza there is no prohibition against wearing contact lenses (as long as safety goggles are also worn), you may want to make your own informed decision.

Accidents

- Accidents in the laboratory can and inevitably do occur, regardless of the level of training a person has or the extent of precautions taken. I will not be mad if an accident occurs, since you are students learning how to operate in the laboratory and not trained chemists; in particular, I fully expect glassware to be broken in the lab (by accident, of course). However, since chemicals are present as well, you must inform me. If an accident does occur so that I can ensure your safety, the safety of the laboratory environment, and the safety of your fellow students.

Emergency Procedures

• Always report any chemical spills to me. Do not attempt to clean any chemical spills yourself unguided.
• If a chemical splashes in your eye, alert me immediately then flush your eyes at an eyewash station as directed.
• If you are splashed with a chemical, alert me immediately then, unless otherwise directed, rinse the affected skin or clothing with large quantities of water for at least 15 minutes.
• If you are splashed with large quantities of a hazardous chemical, alert me immediately then, if advised, use the emergency
chemical shower. You may wish to keep an extra change of clothes in your car for this very rare but possible emergency,
since in such cases you may be forced to remove chemically contaminated clothing.
• In case of a fire, alert me before attempting to put out the fire, as water cannot be used to put out all kinds of fires,
particularly electrical fires or fires involving metals. Please note that fire alarms are located in all lab classrooms.
• In case of an earthquake, step away from all lab equipment, duck under a lab bench or door frame, and cover your head. Do not exit the building during an earthquake as exit doors may contain glass or be near windows, and tiles or debris
may fall from the roof. Once the quake passes, gather only vital personal possessions and evacuate the building.

Handling Chemicals

- **Chemical safety:** Most chemicals inherently have some form of health risk associated with them; sometimes the risk is quite minor, sometimes it is extreme. A chemical might be a skin irritant, a **lachrymator** (causes tearing or choking), a **carcinogen** (causes cancer), a **mutagen** (causes genetic mutations), a **teratogen** (causes fetal deformations), or a **pyrophoric** (spontaneous ignites upon contact with air). Although in **relative** terms many of the chemicals used in this course are not overly hazardous, others can be quite harmful, so you should always take appropriate precautions to protect yourself. Aside from always wearing safety goggles and appropriate clothing, you may want to consider purchasing a lab coat to further protect yourself (and your clothes). You may also want to consider buying disposable lab gloves. Some people have allergies to specific materials, particularly latex, so you may want to make sure you know the type of glove you purchase in case you need to switch to a glove of a different kind of material. Finally, regardless of whether you wear gloves, you should always wash your hands immediate after lab.

- **Chemical storage and segregation:** All liquids must be stored in an appropriate container that will prevent a liquid from spreading if the bottle containing it were to somehow break. This additional precaution is known as and is intended to prevent an unintended reaction in the event of a catastrophe like an earthquake. To further reduce the chances of an adverse reaction, only chemically compatible chemicals may be stored together in the same secondary containment – for example, acids may only be stored with other acids. Solids do not need to be kept in secondary containment, however they must still be segregated by type – particularly if they are flammable solids such as sodium metal.

Chemical Safety Rules

- All stored samples must be labeled with the names (not formulas) of the chemicals and the date the sample was created.
• Never leave any chemical uncapped after use, may decompose or evaporate/sublimate, causing greater hazard.
• Please return any reagent bottles neatly to the appropriate storage bin after you are finished with them.
• Always double-check reagent labels; it is easy to misread “sodium nitrite” for “sodium nitrate”
• Never return unused chemicals to their original containers.
• Never re-use the same pipette to transfer a chemical once it has made contact with another container.

Chemical Safety Violations

• **Secure storage** – All containers must be kept tightly closed to prevent evaporation, sublimation, or reaction of the contents.
• **Secondary containment** – All liquids must be kept within a secondary container large enough to contain the full quantity of liquids in the event the primary container breaks.
• **Segregated storage** – All chemicals must be stored so that they are segregated by chemical hazard to prevent unwanted reactions in event of a disaster. In general, four classifications will be used: acids, bases, organics, and oxidizers.
• **Zero-spill environment** – All spills must be immediately cleaned up to prevent any unnecessary exposure, especially in common areas including the instrument room or the balance areas. Be sure to clean up any chemical residues or sand in you fume hood area as well.
• **Labeling** – All stored chemicals must be clearly labeled with at least the following information: the name of the owner, the date the sample was created, and the full English name(s) of the primary hazardous chemical(s) being stored.

Chemical Disposal

All chemicals or chemically-contaminated waste must be disposed of in an appropriately labeled waste container. Besides the legal ramifications of contaminating the environment by improperly disposing of chemicals, we as humans have already caused enough damage to the planet without our class contributing to the problem. Accidents do happen, so if you do accidentally pour a chemical down the sink, please notify me immediately so that I can quarantine the sink and initiate the appropriate protocol for mitigating the spill.

Types of waste: Three types of waste containers will be available in the lab:

- **Acidic aqueous** waste
- **Basic aqueous** waste;
- **Organic** waste.

Just as chemicals must be segregated when in storage, chemicals must also always be disposed of in the appropriate, segregated container to avoid unintended reactions.

Rinses: When cleaning glassware, the first rinse with water or another substance should be treated as hazardous waste and disposed of appropriately. Subsequent rinses with water can be disposed down the drain if there is no obvious contamination.

Labels: ALL waste bottles are labeled with the type of waste they contain and the instructor who prepared the waste bottle. Always make sure to check that you are disposing of waste only in a bottle that I generated and that corresponds to the appropriate waste type. Waste is also labeled according to whether it only contains solids or whether it also contains liquids. Solids may be disposed of in containers labeled as liquid waste, but liquids may not be disposed of in containers labeled as solid waste.

Fill level: Waste bottles should never be filled completely; instead, a small amount of space called "head space" must be kept, so that the contents of the container have less chance of accidentally escaping if the container were to somehow be dropped or hit. If you need to dispose of waste and the appropriate bottle is full, let me know so that I can quickly create a new waste bottle.

Chemical Disposal Violations

• **Clean disposal area**: The area surrounding the waste containers must be kept clean from chemical spills, even if the area around the containers becomes congested.
• **Segregating waste**: All waste must be disposed of only in a chemically-compatible container.
• **Designated container**: Only use waste containers bearing my initials (RS) unless otherwise instructed.
• **Fill line:** All waste containers must have a small volume of unoccupied space ("head space") to prevent the contents from overflowing while the container is being transported. Do not fill the container above the marked fill line.

Medical Concerns

- Although your health and your medical history is entirely confidential and you are in no way obligated to divulge any such private information to me, if you are aware that you have an allergy to a specific compound being used in an experiment, for your own safety you should inform me prior to that experiment so that alternate arrangements can be made. Also, if you are a woman and you are pregnant or feel that you may be, I strongly recommend that you consult with your doctor about being in this course. Many doctors recommend that pregnant women avoid this course due to some of the organic compounds used in lab. A list of chemicals used during the quarter is available upon request so that your doctor can best advise you.

Locker Policy

- **Lockers** are required to officially check out of your lab locker, whether you complete the course or not. If you drop before the official **add** deadline and fail to check out of lab, your locker may be cleared and reassigned to another student without your being present due to the long wait lists in this course. After the official add deadline, you must check out by the assigned checkout date for your laboratory section. Failure to check out of lab by the scheduled check-out date will result in a late fee and may also result in your grades being held and/or a block being placed on your future registration. You are responsible for any missing or broken lab locker equipment (please see your check-in sheet for details).

Prelab Policy

Before each new experiment, you are required to prepare a pre-lab. On the first day of a new experiment, I will verify whether you have completed the pre-lab satisfactorily. If your pre-lab is not complete, you will not be allowed to perform the experiment and will therefore receive a zero for that lab. There are four reasons why I insist you complete a pre-lab ahead of time:

- **Safety:** If you have not even bothered to read the procedure for an experiment before coming to class, you are not aware of the hazards you might encounter. You are therefore a danger both to yourself and the other students in class.
- **Courtesy:** If you are not prepared for an experiment and you are constantly asking people around you for help, you are a nuisance – and a hazardous distraction – to those people who did take the time to properly prepare for their experiments.
- **Efficiency:** If you do not review an experiment at least once before coming to lab, you will waste a lot of time trying to figure out how to conduct that experiment, which means you may run out of time to finish your experiment.
- **Learning:** Whether or not chemistry is your favorite subject, you have signed up for this course, so you might as well take the time to benefit from it and learn something. If you do not read the experiment before lab, you have little chance of retaining anything meaningful from the lab experience.

Prelab Format

Your pre-lab should be prepared directly in your lab notebook and should normally include at least the three items listed below. See below for more information about formatting your lab notebook.

- **Chemical hazards:** List any important safety information about the chemicals you are using that is given in your experimental procedure. If the procedure does not gives any chemical safety information for a particular compound, leave a space so that you can write in any information given during the lab lecture about that compound.

- **Chemical disposal:** List each chemical used during the experiment and the appropriate waste container – acidic aqueous, basic aqueous, or organic – it should be disposed in. If you are unsure how a chemical should be disposed of, leave a space so that you can fill in the information during the lab lecture.
- **Procedure:** You must rewrite the full procedure with enough detail that you would be able to perform the lab successfully without using your laboratory manual. Do not simply copy the procedure given in the laboratory manual verbatim.

Lab Notebooks

- **Well-kempt laboratory** notebooks are the lifeblood of research chemists. Many advanced research projects – such as the synthesis of complex naturally-occurring molecules – cannot be accomplished by a single researcher within a single year. As such, the endeavors of each member of a research group must be scrupulously passed down in such a way that the results obtained can be perfectly preserved. Sloppy notebooks can spell disaster for the viability of a complicated project.

- **Legal documentation** Chemistry is often a competitive endeavor. It is quite commonplace for groups of academic, industrial, or governmental researchers to race to be the first to synthesize novel – and thus potentially lucrative – molecules or materials. Lab notebooks serve in these situations as viable legal documents. Meticulously annotated notebooks are the best legal defense if any portion of a project is ever called into question. Notebooks are painstakingly examined in patent disputes, since in order to obtain a patent, the originality of any research has to be exhaustively demonstrated from the inception to the conclusion of a project. A shoddily prepared notebook can result in a lost court case (and possibly a lost job). Obviously, no such important results will come from the experiments performed in this class. However, if you are going to wind up in a job that requires you maintain a notebook, now is the chance to acquire some good laboratory skills and habits.

Lab Notebook Format

- **General** In legal cases, even the slightest hint of alteration or omission of data could be considered forgery. Always write in pen. Any data collected should be immediately recorded directly in your lab notebook, not stored on post-it notes or scraps of paper (or the back of your hand) for transferring later. Mistakes should be corrected by drawing a single thin line through the original data, leaving them still legible; this way, the correction can be readily seen – and you can recover your original result if you discover the change itself was a mistake!

- **ID** Many research groups do not allow lab notebooks to ever be removed from the lab out of fear that they will be lost or stolen. Since you will be taking your lab notebook home with you, you should prominently include key identifying personal information – at the very least your name, my name, and the quarter in which you are taking this class – on the inside front cover to help your notebook wind its way back to you should it ever go astray. You might also want to consider including an e-mail address or phone number in case you loose your lab notebook off-campus (although you may certainly wish to take into account privacy considerations before doing so).

- **TOC** The ability to find pertinent experimental data rapidly is necessary in research. For lab notebooks, this is normally accomplished by listing all of the experiments in a table of contents at the front of the notebook. Each entry in the table should at a minimum contain the experiment title and the page(s) on which it can be found. More sophisticated researchers will often devise a unique experiment number for each experiment; some even put a brief description of the results in the table of contents

Experiment Format

- **General format** As mentioned in the pre-lab for each experiment must include any information relating to chemical hazards or chemical disposal mentioned in the lab procedure. You must also include a complete procedure for the experiment, as described below. Optionally, you may want to include a reaction scheme or a table of reagents, as described below.

- **Reaction scheme** Each notebook entry should ideally begin with an abstract (a brief overview) of the experiment to be performed. In some cases, this might be a flowchart of the steps to be followed, a diagram of the experimental equipment, or a summary of the results to be monitored. For chemical reactions, you should list the key reagents, solvents, and environmental conditions. In "real life", these schemes can allow future readers of your notebook to understand the intent of an experiment without reading the entire entry. Although this section is optional, it is particularly recommended for students in the organic chemistry (Chem 12) sequence as a way of practicing writing synthetic schemes.

- **Reagents (Required)** Preparing a table of reagents before beginning an experiment can be a huge time-saver for complex experiments. Reagent preparation alone can often consume large quantities of time, since some reagents may be air- or water-sensitive. For each reagent you are going to use, it is optionally suggested you include the following: name of the reagent; molecular mass; mass or volume to be used and/or actually used (with units!); and moles (if appropriate or useful) or molarity (for solutions). You are required to make note of any chemical hazards for the reagents you will use and to determine how each chemical will be properly disposed of at the end of the experiment. Although such a table may seem overkill in undergraduate lab classes, it is enormously beneficial in a research environment in which a particular experiment may be repeated frequently.

- **Procedure (required)** Without question, the two most crucial aspects of a laboratory notebook are the procedures used and the data obtained. To highlight the connection between the two, I suggest you use a two-column format for writing your experimental procedures. In the first column, you should list step-by-step each task of the experiment you are performing; in the second column, you should record any numerical data or empirical observations you make, as well as any deviations from the planned procedure. This way, when you walk into the lab to perform your experiment, you already have a list prepared in your own writing style that clearly shows what you need to do at each step in the experiment. Since your results would be written next to each of these steps, you can more easily find and transfer your results into your calculations when writing your lab reports. Since the space needed to write your data is likely much smaller than the space needed for writing the procedure, you may wish to make the first column wide and second column narrow in comparison if you are following the suggested format.

Lab Reports

Whether an experiment takes days, weeks, or years to complete, the results of an experiment are useless unless they can be clearly and succinctly transmitted to others. This communication can take the form of a laboratory report, a conference poster, an article in a peer-reviewed journal, a thesis, a technical communication, or a patent application. Regardless of the format, these reports have a common thematic structure. First, supporting background information for the experiment is presented to justify – both conceptually and financially – why the experiment is being conducted. The purpose or goal in performing the experiment is clearly expressed, along with a detailed description of the experimental procedure used. All pertinent results obtained during the experiment are presented, along with all relevant calculations and interpretations. Finally, all conclusions drawn from the data are stated, along with any helpful comparisons to previously conducted experiments and references to related or future research

Lab Report Format

- **General notes:** The lab report format given below is somewhat abbreviated from the version that might be used in advanced chemistry classes or in a full-fledged research environment. The format has been simplified since the experiments that you will perform already have well-established results that will not be published. Unless otherwise instructed, you have to answer any pre-lab or post-lab questions found in your lab text for your lab report.

- **Typed reports:** For this class (except in cases in which an academic accommodation has been approved).; graphs hand-written on graph paper will not be accepted. To be competitive in a society swimming in technology, the earlier that you master the skills needed to craft a slick-looking yet thorough report, the better. If you do not have regular access to a computer, the Library West Computer Lab (also known as the Open Media Lab) is available for any De Anza student to use. There is no charge for the time spent using the campus computers, although there is a small fee for printing.

- **Third person:** Research reports in the field of chemistry are almost universally written entirely in third person, meaning that you should never use first person words ('I', 'me', 'my', 'we', 'us', or 'our') or second person words ('you' or 'yours' or 'y'all'); the use of 'one' as a subject should also be avoided. For example, instead of writing "I measured the temperature every ten seconds", use a passive construction: "The temperature was measured every ten seconds". It is exactly because this writing style is impersonal that it is used, since the focus of technical communications is usually on the science and not the scientist(s) involved.

Sections

- **Title:** The title should be a short statement alerting the reader (me) to which experiment you are presenting.
- **Objective:** Clearly state the key findings of your result(s) you are seeking in the experiment
    - for example: "The purpose of this experiment is determine the concentration of acetic acid in household vinegar". The fact that you learned from the experiment (while important) mentioned at all in the objective, since the report is not about you.
- **Procedure:** The procedure you have already written a complete procedure for any experiment as will be used here.
- **Data and calculations:** Please see below for more detailed information on these crucial sections.
- **Conclusions:** To maintain symmetry in your report, your conclusion should exactly parallel your objective.
    - You should state exactly those qualitative or quantitative results that were the focus of the experiment. This sometimes means that the conclusion is just a one-sentence statement, such as: "The concentration of acetic acid in the unknown solution is 0.0270 *M*."
- **Discussion:** To help justify your conclusion, you should include a brief discussion of how your calculations led you to your stated results.
    - For example, for a lab involving the synthesis of a compound, the discussion section could contain your interpretation of any spectra used to identify the compound. You may also describe anything unusual that occurred during the experiment or any significant sources of error. Whenever possible, you should compare your results to known results in the chemical literature.

Data and Calculations

- **What is the difference?** Data and calculations are the heart of a lab report, as they support any conclusions that you make from your experiment. Although it may seem somewhat trivial at first, there is a strong distinction that should be made between data and calculations. There are the specific numerical results directly obtained during an experiment – for example, mass, volume, or temperature – along with any subjective observations – color change, gas formation, spontaneous combustion. Any form of manipulation of these data – no matter how superficial – is considered a form of cheating.

- **Measuring mass example:** To examine this distinction, imagine that you are trying to measure out a certain quantity of a powdered solid into a beaker. One common method for obtaining the mass of a substance while protecting the balance is to use some kind of intermediate container, such as a watch glass. For example, the mass of the watch glass would be measured first (remembering to tare the balance beforehand) followed by the combined mass of the watch glass and the added powder. These two measurements would be considered data, since they were directly observed. The mass of the powder itself, in contrast, must be considered a calculation, since it is a manipulation of data (specifically, the difference between two separate mass measurements).

Benefit of separation: Maintaining the distinction between data and calculations reinforces the fact that data are directly collected – without any form of interpretation by the observer – while calculations require some form of interpretation. In the above example of measuring mass by difference, the mass of the watch glass and the combined mass of the watch glass and powder are the two pieces of data. The interpretation of these data – in this case, to obtain the mass of the powder – can be accomplished only through the correct choice of the proper mathematical formula. For experiments with far more complex numerical analysis, separating the equations from the data enables the reader (me!) to determine – in the event of an error in your report – whether you might have made a simple transcription error in transferring the data into the formula, versus whether the correct formula was chosen for that particular calculation in the first place.

Student Learning Outcome(s):

*Identify and explain trends in the periodic table.
*Construct balanced reaction equations and illustrate principles of stoichiometry.
*Apply the first law of thermodynamics to chemical reactions.