0 — *Chem 1B • Winter 2017 • Sections 01 & 02*

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office hours • **M:** 12:30 PM – 1:20 PM | **TWTh:** 1:30 PM – 2:20 PM | **F:** 9:30 AM – 10:20 AM

1A — *Course Description*

Chemistry • Chemistry is a cornerstone of modern science, providing both a practical and theoretical foundation that supports increasingly interwoven fields of study, such as chemical engineering, forensics, genetics, materials science, and molecular cell biology. Organic chemistry – the study of carbon and the classes of molecules that contain it – plays a pivotal role in agriculture, cooking, cosmetics, environmental reclamation, pharmaceutical design, and polymers. Having a firm, intuitive grasp of the essential concepts of chemistry is therefore crucial to unlocking the pathway to many academic endeavors.

Lecture content • This second quarter of a three-quarter sequence covers the fundamentals of chemical reactivity, focusing on ***thermodynamics***, ***kinetics***, and ***equilibrium***. ***Thermodynamics*** describes the flow of energy during a chemical reaction and can be used to predict the likelihood that a reaction will occur based on two key quantities: ***enthalpy***, the raw energy difference between reactands and product; and ***entropy***, the tendency of both matter and energy to become evenly dispersed. ***Kinetics*** describes the rate of chemical reactions and the factors that affect their rate. Aside from temperature, the concentration of the reagents in the pivotal or ***rate-limiting step*** of a reaction generally has the most profound effect on reaction rate. ***Equilibrium*** unites thermodynamics and kinetics by viewing chemical reactions as reversible, dynamic systems in which the distribution of products versus reactants can be controlled energetically. At equilibrium, the rates of the forward and reverse processes are equal, the concentrations of reactants and products are constant (but not necessarily equal), and the energy of a system is constant.

The course will also cover the effects of intermolecular forces on solids and liquids, as well as the behavior of gasses.

1B — *Class Structure*

Class periods • This course is split into two time periods: the **lecture** and the **lab** (see ***Table 1***). One registration code automatically enrolls you in ***both*** instructional periods. Since only one grade is assigned for lecture and lab combined, the lecture and lab **cannot** be taken separately ***under any circumstances***, since doing so would violate articulation agreements with other institutions. This means that, even if you only need to complete the lecture to satisfy your transfer requirements, or even if you have previously taken the lab at De Anza, you are still required to complete the lab this quarter.

Table 1 — *Course Schedule*

	Room	Section 01 (32202)		Section 02 (32203)	
		Day	Time	Day	Time
Lecture	MLC103	MWF	10:30 AM – 11:20 AM	MWF	10:30 AM – 11:20 AM
Lab	SC2202	MW	7:30 AM – 10:20 AM	MW	2:30 PM – 5:20 PM

Sections • This course consists of two sections (see ***Table 1***). Once you are enrolled in a particular section, you must attend ***only*** that section for the duration of the quarter.

1C — *Grading*

Points • The total number of points possible is 1000 (see ***Table 2*** for details). ***Regardless of your overall point total***, you will receive an ‘F’ for the entire course if you do not complete all of the lab experiments (see ***Section 2B*** for missed labs) **or** if you do not complete the lab portion of the class with a passing grade (a grade of ‘C’ or better).

Lab total* • The total number of points possible in lab is 250. However, this total will be reduced due to improper handling of chemicals or waste or failure to maintain a safe and clean laboratory environment. See ***Section 7A*** for more information.

Table 2 — *Grade Distribution*

Lecture (75%)				Lab (25%)			
Task	*Pts*	*#*	*Total*	*Task*	*Pts*	*#*	*Total*
Quiz	37.5	4	150	Short report	10	6	60
Exam	100	4	400	Long report	20	2	40
Final	200	1	200	Lab exam	75	2	150
Lecture total :			750	*Lab total :*			250*

Table 3 — *Grading Scale*

Grade	Percentage	Grade	Percentage
A+	95 – 100 %	C+	73 – 76 %
A	90 – 94 %	C	70 – 72 %
A–	87 – 89 %	D+	66 – 69 %
B+	84 – 86 %	D	63 – 65 %
B	80 – 83 %	D–	60 – 62 %
B–	77 – 79 %	F	0 – 59 %

Curves • Grades in this course are not based on any form of curve. This means that with sufficient focus and dedication, everyone in the class could receive an ‘A’. By the same token, with sufficient procrastination and lack of discipline, everyone in the class could receive an ‘F’ instead. See ***Section 1D*** below for information regarding curving of the lowest exam.

Grades • The grading scale is given in ***Table 3***. ***A grade of ‘C’ (or better) is required to continue on to Chem 1C.***

1D — *Final Curve*

It is always possible something in your life might interfere with your studies and cause you to perform poorly on a particular exam, or even miss an exam entirely (see ***Section 2B*** for missed exams). To me, performing well on the final exam shows that you have overcome whatever temporary difficulty you may have encountered and is therefore reasonable justification for curving a low exam score. Thus, if your ***percentage*** on the final exam is higher than the ***percentage*** on your lowest exam, the score for that lowest exam will be replaced by the final exam score (***in terms of percentage***). Contrariwise, if you score lower on your final than any of your exams, no points will be taken off of any of your exams (you will not be penalized twice for a low score on the final).

1E REGISTRATION

REGISTRATION • The registration deadlines for this quarter are listed in ***Table 4***. Deadlines are **strictly** enforced by De Anza in accordance with state regulations. If you need to drop or withdraw from the course, you ***must*** do so by the appropriate deadline.

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.***

Table 4 — REGISTRATION DEADLINES	
Administrative deadline	***Date***
Add this course	1/21/17
Drop this course with full refund	1/22/17
Drop this course with no grade record	1/22/17
Designate this course as pass/no-pass	2/3/17
Withdraw from this course	3/3/17

WAIT LISTS • 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 (see ***Table 4***). 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. See ***Section 4I*** for additional information on checking out of lab.

1F QUIZ & EXAM SCHEDULE

ASSESSMENT SCHEDULE • The assessment schedule for this class is given in ***Table 5***. It is not feasible to coordinate the assessments for this class to be accommodating to the schedules of all other classes, since every course runs at its own individual pace. Part of being an adept student is having the ability to balance the demands of several different classes simultaneously. Since you have been given this schedule at the beginning of the quarter, you have ample forewarning to properly manage your time. ***Exams will not be given on alternate days due to the workload in other classes.***

Table 5 — ASSESSMENTS			
	Quiz	***Exam***	***Lab exam***
#1	1/18/17	1/25/17	2/15/17
#2	2/3/17	2/10/17	3/22/17
#3	2/24/17	3/3/17	———
#4	3/13/17	3/20/17	———

SCHEDULE CHANGES • Although every attempt will be made to adhere to the established schedule, unforeseen circumstances may arise that require a change in the day an assessment is given. Difficulties resulting from such unexpected changes will be handled on an individual basis.

FINAL • The final exam will be held on **Wednesday, March 29th** at **9:15 AM – 11:15 AM** in room **MLC103**. This time is assigned by the college and cannot be changed except in cases of dire emergency (see ***Section 2B*** for details). ***Note:*** The final exam only covers material from lecture or lecture-related material presented in lab; there is no final exam for lab, only the last lab exam.

1G LECTURE ASSESSMENTS

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 be found in ***Table 6*** (next page). 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.

QUIZZES • Quizzes are intermediate assessments that are intended to gauge your level of preparedness and direct your studying before an exam. Quizzes will normally last half the length of the class period.

EXAMS • 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 • The 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 material.***

1H COURSE MATERIALS

There are two items that are required for this course:

- 1) a laboratory notebook for recording your experimental procedures and results (a plain composition book is sufficient)
- 2) chemical safety goggles (see ***Section 4C*** for more information about safety goggles)

1I — Lecture Text

Textbook • The lecture text for this course is ***Chemistry*** by ***OpenStax*** (Rice University: 2016; ISBN 978-1-938168-39-0). This is a free text that can be downloaded in electronic format at **https://openstax.org/details/chemistry**. You can also download the text into iBooks or order a physical print copy of the text by following the same link above.

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 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.

Table 6 — Lecture Schedule

Week	Day	Sections	Topic	Problems
1	1/9	9.1, 9.2	*Gases* – They're under a lot of pressure.	9: 1 - 3, 7, 12, 18 - 21, 27 - 29, 31, 34
	1/11	9.5, 9.6	*Kinetic molecular theory* – Molecules on the move.	9: 90 - 92, 101 - 103
	1/13	9.3, 9.4	*Ideal gas law* – A perfect gas for an imperfect world.	9: 48, 50, 54, 59, 63, 65, 71, 84, 85, 89
2	1/16	• College Closed – Martin Luther King Day •		
	1/18	———	*Polarity* – Opposites attract.	
	1/20	10.1	*Intermolecular forces* – Keeping it all held together.	10: 1 - 4, 7 - 9, 11, 13, 17, 21
3	1/23	10.3, 10.4	*Phase diagrams* – If you can't stand the heat....	10: 30, 31, 33 - 37, 39, 40, 44, 45, 58
	1/25	• Exam 1 •		
	1/27	———	*Water* – And not a drop to drink.	————
4	1/30	10.2, 10.5, 10.6	*Solids and liquids* – What a gas!	10: 24, 25, 64, 67, 69
	2/1	12.1	*Kinetics* – A molecule in motion stays in motion.	12: 1, 3
	2/3	12.5	*Collision theory* – Surviving the chemical freeways.	12: 51 - 54, 56
5	2/6	12.2 – 12.4	*Rate laws* – Rules even reactions have to obey.	12: 12 - 16, 25, 32
	2/8	12.6, 12.7	*Reaction mechanisms* – Taking a reaction step-by-step.	12: 68 - 71, 77, 78, 80
	2/10	• Exam 2 •		
6	2/13	13.1	*Equilibrium* – Keeping everything in balance.	13: 1 - 5
	2/15	13.2	*Reaction quotients* – Making sure reactions keep up.	13: 6 - 9, 13, 15 - 17, 20
	2/17	• College Closed – Abraham Lincoln's Birthday •		
7	2/20	• College Closed – George Washington's Birthday •		
	2/22	13.2	*Equilibrium constants* – The more things stay the same....	13: 25
	2/24	13.4	*Solving equilibrium problems* – The answer certainly isn't money.	13: 53, 55, 65, 69, 73, 78, 79
8	2/27	13.3	*Le Châtelier's Principle* – Maintaining chemical composure.	13: 31 - 33, 35, 37, 39, 41
	3/1	14.1	*Acids and bases* – Not the tools of a successful rock band.	14: 1 - 3, 7 - 12, 14
	3/3	• Exam 3 •		
9	3/6	14.2	*The pH scale* – This is one scale you don't have to diet for.	14: 15, 16, 18, 21, 24
	3/8	14.3	*Strong versus weak acids* – Smack-down comes to chemistry.	14: 26, 27, 29 - 33, 35 -37, 40 - 41, 43, 47, 51, 56, 60, 74
	3/10	14.5	*Acid-base reactions* – Surprise, shock, elation, and confusion.	14: 81, 82
10	3/13	14.4	*Salts* – Not just a seasoning for your soup.	14: 78, 79
	3/15	16.1	*Spontaneity* – When molecules get a mind of their own.	16: 1 - 3
	3/17	16.2, 16.3	*Entropy* – The disorder in my office is constantly increasing.	16: 6 - 9, 13 - 15, 21
11	3/20	• Exam 4 •		
	3/22	16.4	*Free energy* – It's the 60's all over again.	16: 30 - 33, 36, 39, 47
	3/24	———	*Reaction progress diagrams* – Report cards for reactions.	————

1J — Core topics

The following is a listing of the major topics that will be covered each day in lecture. Please note that this list should not be interpreted as the exclusive set of topics to be covered on a quiz or exam; instead, it should be viewed as a set of milestones to be reached in your studying or as key concepts around which to organize your notes.

Table 7 — Lecture topics

Week	Day	Topics
1	1/9	Properties of gases; barometers and manometers; units of pressure: pascals, atmospheres, torr, mm Hg; ideal gases; individual gas laws: Amonton's law (P & T); Boyle's law (V & P), Charles's law (V & T), Avogadro's law (V & n); combined idela gas law
	1/11	Kinetic molecular theory; molecular energy distribution; conceptual assumptions of an ideal gas; role of kinetic energy in behavior of gases; diffusion and effusion; deviation of real gasses from ideal behavior; van der Waal's equation; vapor pressure; relationship between vapor pressure and boiling point;
	1/13	Rearrangements of ideal gas law: density of a gas, molar volume of a gas; partial pressure & Dalton's law; collection of a gas over water
2	1/16	**• College Closed – Martin Luther King Day •**
	1/18	Electronegativity; periodic trends of electronegativity; bond polarity; molecular polarity
	1/20	intermolecular forces (IMF); relative strength of IMFs: ions versus permanent dipoles versus temporary dipoles; hydrogen bonding; polarizability; induced dipoles versus instantaneous dipoles; (London) dispersion forces
3	1/23	Phases of matter: solids, liquids, gases; phase changes: melting, freezing, evaporation, condensation, sublimation, deposition; heat of fusion, heat of vaporization; heating-cooling curves; phase change equilibrium; phase diagrams; triple point; critical point; supercritical fluids
	1/25	Structure of solid water; decrease of density upon freezing and relationship to phase diagram of water; physical properties of water
	1/27	Surface tension; capillarity; viscocity; crystalline versus amorphous solids; cystal lattices; unit cells: simple cubic, body-centered cubic, face-centered cubic; cubic versus hexagonal closet packing; conductors, semiconductors, and insulators; liquid crystals
4	1/30	Effects on reaction rate: concentration, physical state, frequency and energy of collisions; average versus instantaneous rate; expressing reaction rate in terms of reactants versus products
	2/1	Collision theory; Arrhenius equation; activation energy; transition state; frequency factor; reaction coordinate diagrams (RCDs)
	2/3	Form of rate law; reaction order; determining reaction order by variation of initial concentration; determining rate constants
5	2/6	Integrated rate laws; graphical determination of reaction order; reaction half-life
	2/8	Molecularity and reaction order; elementary steps; rate-determining step (RDS); relationship of RDS to actiation energy; catalysts; homogeneous versus heterogeneous catalysis; enzymes
	2/10	**• Exam 2 •**
6	2/13	Descriptions of equilibrium: equal rates of forward and reverse reaction, constant (not equal) concentrations of reactants and products, lowest energy point of the system; dynamic, non-static nature of equilibrium
	2/15	Law of mass action; chemical potential; form of equilibrium constants; exclusion of pure solids and liquids in heterogeneous equilibria; similarity and differences between K and Q; K_c versus K_p
	2/17	**• College Closed – Abraham Lincoln's Birthday •**
7	2/20	**• College Closed – George Washington's Birthday •**
	2/22	Predicting direction of reaction by comparing Q and K
	2/24	Solving equilibrium problems using ICE method: initial, change (in), and equilibrium concentrations; simplifying equilibrium expressions
8	2/27	Le Châtelier's principle; effects on equilibrium: adding or removing a reactant or product, change in pressure, volume, and temperature; lack of effect of catalyst on equilibrium
	3/1	Definitions of acids and bases: Arrhenius, Brønsted-Lowry, Lewis; acid dissociation constants (K_a); strong and weak acids and bases
	3/3	**• Exam 3 •**
9	3/6	Auto-ionization of water; definition of neutral versus neutralized; pH scale; temperature dependence of neutral pH; pOH; K_w
	3/8	Conjugate acid-base pairs; relative acid strength and direction of neutralization; determining K_a from concentrations and vice versa; activity and extent of dissociation; polyprotic acids; structural effects on acidity
	3/10	Base dissociation constants (K_b); examples of weak bases; relationship between K_a and K_b; the leveling effect
10	3/13	Salts that yield acidic, basic, and neutral solutions; solutions of weakly acidic cations and weakly basic anions; salts of amphoteric ions
	3/15	Spontaneity; homogenization of matter and energy; entropy; microstates; first, second, and third laws of thermodynamics; standard molar enthalpies; entropy changes in common chemical and physical processes
	3/17	Determining entropy microscopically and macroscopically; calculating entropy; spontaneity of endothermic and exothermic processes
11	3/20	**• Exam 4 •**
	3/22	Free energy; calculating standard free energy ($\Delta G°$); $\Delta G°$ of formation; relationship of free energy and work; effect of temperature on $\Delta G°$
	3/24	Relationship between free energy and equilibrium; free energy outside of the standard state; reaction progress diagrams

1K LAB TEXT

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 (see ***Section 5a*** for more information). 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.

Table 8 LAB SCHEDULE

Week	Day	Report	Topic
1	1/9		*Introduction and Check-In*
	1/11		*Lab B1* – Molar volume of an idea gas
2	1/16		• *College Closed – Martin Luther King Day* •
	1/18	*Lab 1*	*Lab B1* – Molar volume of an idea gas
3	1/23		*Lab B2* – Vapor pressure
	1/25	*Lab 2*	*Lab B2* – Vapor pressure
4	1/30		*Lab B7* – Synthesis of a green crystal
	2/1	*Lab 3*	*Lab B7* – Synthesis of a green crystal
5	2/6		*Lab B7* – Synthesis of a green crystal
	2/8	*Lab 4*	*Lab B7* – Synthesis of a green crystal
6	2/13		*Lab B3* – Iodine clock reaction (kinetics)
	2/15	*Lab 5*	*Lab B3* – Iodine clock reaction (kinetics)
7	2/20		• *College Closed – George Washington's Birthday* •
	2/22	*Lab 6*	*Lab B3* – Iodine clock reaction (kinetics)
8	2/27		*Lab B4* – Spectroscopic determination of an equlibrium constant
	3/1	*Lab 7*	*Lab B4* – Spectroscopic determination of an equlibrium constant
9	3/6		*Lab B5* – Acid dissociation constant of a weak acid
	3/8	*Lab 8*	*Lab B6* – pK_a of an acid/base indicator
10	3/13		*Lab B6* – pK_a of an acid/base indicator
	3/15	*Lab 9*	*Lab B8* – Effect of temperature on an equlibium constant
11	3/20		*Lab B8* – Effect of temperature on an equlibium constant
	3/22	*Lab 10*	*Check-out*

2A 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 ar 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 (please see ***Section 2B*** below for more details). 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 (see ***Table 4***) 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.

2B 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 web site (see ***Section 0*** for the address). 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 (see ***Section 5A*** for information on pre-labs).

LAB • ***Missed 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 allowed to take or receive a score for the exam.***

QUIZZES AND 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. See ***Section 1D*** regarding curving of the lowest exam.

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.

2C 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 (see ***Table 4***). ***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.

2D ELECTRONIC RESOURCES

Cell phones, tablets, computers, and similar devices may be used in class during lecture, so long as no form of assessment is being given, and so long as their use does not cause any disruption to any students or to me – specifically, while lecture is in progress, you may **not** carry on any conversations out-loud on such devices, and they must be in silent mode. No form of electronic devices may be used on assessments except for approved, dedicated calculators (see ***Section 2E*** for academic accommodations).

2E — *Academic accommodations*

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.***

2F — *Expectations*

Self-reliance • It is only through **your own effort** and dedication that you will ever truly master the material presented in this course. I can teach in every way imaginable, but I can do nothing to make you then take over the burden to learn – I can only act as a guide. **You** have to dedicate yourself to your own future.

Time • To excel in this course, you will have to commit a substantial amount of time. Although the quantity of time needed to master the material varies widely from person to person, a standard guideline is to expect that – between reading, reviewing notes, and working problems – you will need to set aside ***at least two hours*** for studying for ***every hour*** of lecture or lab lecture.

Reading • It is impossible to conduct a lively class discussion if only I am prepared; as such, I expect that you will read all assigned passages ***before*** coming to class. I ***do not*** expect you will understand everything that you read – otherwise there would be no need for you to take this class – but you will be far more able to participate in and benefit from class discussions by reading ahead of time. If English is not your primary language, reading in advance is even more crucial, since it provides you the opportunity to familiarize yourself with new vocabulary or terminology first and thereby enable you to far more easily understand a lecture. Even common English words can have completely different meanings in a chemistry-related context; for example, a hood is normally something worn over the head, but in the lab it is a safety system for mitigating the release of hazardous gases.

Participation • I am not a video to be viewed passively at your discretion; I am a living, breathing, feeling creature that will reach out and interact with you in class. As will become evident, I am able to talk indefinitely in lecture, so when I do ask a question or request some other form of participation from class, I become irritated when I receive no form of response. I do not expect that you, individually, will always have the right answers, but I do expect that you, as a class, will be engaged.

Problems • Working problems is often an effective means of mastering a concept. I only have a limited quantity of time in lecture to present a broad range of material, thus I frequently will be unable to cover every single conceptual or mathematical detail. You must therefore take it upon yourself to work as many problems as you deem necessary in order to master the material. I will cover the essential framework; you have to fill in the details yourself. ***Note:*** Resist the urge to refer to a solution manual or answer key until you are completely stuck on a problem. It is (comparatively) easy to work backwards from the correct answer; it is far more beneficial (but, of course, more difficult) to run into the proverbial brick wall first and learn from your mistakes.

Proficiency • Assessments for this course are designed presuming you reach a level of proficiency in a skill or concept that enables you to then use it to efficiently solve a problem. If you take too long to solve a particular problem due to lack of practice, you will be unable to complete the assessments. Likewise, you are also expected to be able to address the core of a problem with concise yet complete answers. If you answer in several paragraphs what requires just a few sentences, you will never finish an assessment; likewise, if you answer in just a few words what requires a few sentences, you are unlikely to receive full credit.

Promptness • ***All assessments will begin promptly at the beginning of lecture or lab.*** No extra time will be given if you are late, so plan to arrive early if you are regularly stuck in traffic or if you have a habit of tardiness.

2G — *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; and, 4) compliance with all rules and regulations. It is fortunate that only occasionally am I prompted to take action against violations of the Code, 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 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 the Code (see ***Section 2H*** below).

2H — *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.

3A — Teaching philosophy

Knowledge • Knowledge is the ultimate weapon, ignorance the ultimate weakness. We are all born into a world filled with knowledge for us to grow from, and we perish by those who embrace ignorance instead. There are those who seek knowledge to entertain, to heal, to build, to understand the divine, and there are those who seek to control knowledge to deceive, to subjugate, and to destroy. I view creating, maintaining, and transmitting knowledge for the greater good of all a noble pursuit in life.

Globalization • Knowledge does not exist in a vacuum; it reflects and serves the society from which it came. Each society has it own set of customs, mores, and beliefs. These beliefs provide a framework within which a society can function. Thanks to technology, the ease with which we now exchange knowledge has brought the ideas of countless cultures together. It is a new form of globalization – a globalization of knowledge. For those who appreciate the creativity that differences in culture can bring, our close contact with one another has prompted unprecedented achievement; for those who fear and exploit the differences in our cultures and misrepresent the ideas that lie within them, our technological prowess has also produced unprecedented destruction. Now more than ever, it is imperative that education be conducted in the context of a constructive cultural awareness.

Collaboration • Chemistry itself is a distinct form of intellectual pursuit, with its own traditions, its own conventions, its own method of viewing and explaining the various phenomena of life. A good many other academic traditions – archaeology, geology, history, philosophy, theology – have also tried to explain the world around us, merely beginning from different points of view. To shun the humanities altogether as "unscientific" is to ignore that science itself is founded on unique philosophical and historical precepts, while to eschew the sciences as "culturally insensitive" is to ignore the objectivity and uniformity it intrinsically seeks. The ability to blend different traditions of thought to solve a problem is an important outcome of a complete education.

Teaching philosophy • My role as an instructor is threefold:

• 1) To be prepared in all ways to effectively pass on the knowledge I have gathered. This includes maintaining myself physically and mentally fit to execute the task of teaching, keeping fluent in the course material, constantly refining my methods of classroom instruction and assessment, and staying current with innovations within the field of chemistry.

• 2) To create a class environment based on respect for the many types of people that we are, so that I can encourage my students to flourish in our increasingly diverse, global society. No student in class should ever feel uncomfortable being around his or her peers, nor should any student ever be afraid of expressing ideas which may differ from those of a neighbor (or myself).

• 3) To place the content and skills learned in this course within a broader context – historical, social, political, economic, or practical – whenever possible. Aside from making the class more interesting by reaching out to the surrounding world, command of a well-rounded academic background is invaluable in securing a more stable, fulfilling job.

3B — Learning philosophy

Self-reliance • All of us have been students in life, and many of us at some point will teach someone in some capacity as well. Certainly, good teachers help in learning, but the bulk of the burden falls on the student. For example, a dance instructor can show a student a particular move every day for a year, but unless the student practices that move over and over and over again, there is nothing that the instructor can do to make the student improve.

Self-discipline • I myself am nothing more than an older student. What I know I only know because of the time and the dedication I have put into bettering myself. I am still a student, I still learn from each successive class that I teach – new ways to present a problem, new realizations of how concepts fit together. The knowledge that I pass on is not my own, I am just acting as a caretaker. To truly succeed, you have to have you own inner thirst for knowledge, a drive to better yourself, to open up more possibilities in you future life. We are usually our own worst enemies – doubting that we can succeed; giving in to procrastination; failing to discipline ourselves. I realize that few people take chemistry for their enjoyment, but since you are taking this course, you should dedicate yourself to your studies, learn what you can, and apply that knowledge to thrive to the best of your abilities.

3C — Collegial philosophy

Unity • Each of us is born into different cultures, raised speaking different languages, driven to follow different beliefs, compelled to preserve different traditions. But we breathe the same air, we drink the same water, we are warmed by the same sun, we are made of the same atoms. Beneath our skin there is less than a 1% variation in our genetic composition. To discriminate on the basis of race, color, national or ethnic origin, age, gender, religion, marital status, sexual orientation, physical ability, economic disposition, or appearance is to focus on these insignificant differences between us and ignore the fact we are all human.

Tolerance • I firmly believe that it is the intersection of the many cultures represented on out campus that ignites academic discourse and philosophical innovation. Academia thrives on respectful disagreement, but withers in the face of ignorance or intolerance. Should there be a problem with intolerance in the class, it will be swiftly and sternly dealt with.

3D — Campus resources

De Anza has a number of services available to help you in your studies – and to help you as an individual – including:

- ***Math & Science Student Success Center*** (S34) – Both individual and group tutoring services are available
- ***Counseling and Advising*** (SCS) – Provides academic counseling, transfer planning, and psychological services
- ***Health Services*** (Hinson Campus Center) – Includes services such as minor first aid, medical exams, and immunizations
- ***Inter Club Council*** (Hinson Campus Center) – Dozens of student-run clubs available to engage the De Anza community

3E *Surviving college*

De Anza, being a community college, is an institution in which a class may contain students from all age and academic levels. For those of you coming directly out of high school, developing rock-solid study habits right away is crucial. For some students returning from the workforce to further their education, coming back to college can be both an exciting and unsettling experience. Quite unfortunately, many students pass through high school without feeling particularly motivated or challenged, and thus wind up in college unprepared for the dramatically heavier burden of study they will have to carry. If you are a new college student, the following suggestions may be helpful.

Making studying a habit • Make studying a habit, not just a chore. Clear out the same amount of time each day, even if you cannot schedule it at the same time each day. In the first week, study whichever subjects you feel like. Don't be concerned at first how much or how little you have accomplished as long as you remain focused and have a positive outlook. Over time, you can condition yourself to automatically put this time aside and think twice about procrastinating.

Study environment • Make a space devoted to studying, whether it is at your own home, in a public setting, or somewhere outdoors. Some people need a quiet room with soft lighting, a comfy sofa, and a steaming cup of herbal tea in order to find their groove, while other people are more serene in a noisy coffee house sipping on extra super triple roasted organic low-fat double raspberry mocha lattés. Whatever your ideal studying space may be, make it yours.

Set attainable goals • Give yourself reasonable goals. Unless you are superhuman, you are not going to make that web site to help you study and start a chat group and rewrite all of your notes and highlight all of your books and index your references and organize your backpack and read those two novels by tomorrow at seven in the morning. Break down "studying" (which is a large and nebulous task) into the most essential objectives that you need to meet (smaller, more digestible tasks). Then, once you accomplish your primary mission, you can work on that homework color-coding project.

Schedule, schedule, schedule! • Know when your next assessment is coming in all of your classes. Plan ahead so that when your work schedule is heavy you do not have as much homework. Read your notes during that ride on the bus instead of a blog. Play your lecture recordings in the car while you're stuck in traffic. Squeeze every little bit of time out of life that you can.

Breathe! • Pay attention to your physical and mental well-being. The human mind and body can handle excessive stress only so long before it breaks down, leading to insomnia, exhaustion, depression, and a whole host of psychosomatic illnesses. Make yourself some hot chocolate, listen to some soothing music, take a walk, exercise, meditate, do something positive to release the pressure periodically. It is easy to become lost in a job, in hobbies, in relationships, but without balance and our health (both mental and physical), we are useless.

3F *Surviving chemistry*

Chemistry – particularly organic chemistry – is infamous for being a difficult subject – but it is not, in fact, evil. Yes, there are difficult concepts in chemistry, and in advanced courses there is a lot of difficult math. However, I believe that it is not the individual concepts themselves that make chemistry hard, but the sheer volume of material that must be assimilated in such a short time frame. To more easily survive chemistry, avoid the four common mistakes below that I see students make year after year.

Do not only memorize • Memorization is unavoidable sometimes for facts and figures, but my intent is to help you develop an intuitive understanding of the underlying concepts. So much of the information in this course is interrelated that, once your intuitive grasp has developed, you will often be able to answer questions based solely on fundamental precepts. Memorization alone – without any kind of framework for assembling that stored knowledge – often leads to confusion and frustration. When mathematical formulas are involved, try to relate those formulas back to the concepts they describe.

Don't cram! • We have all crammed for an exam, but consistently relying on late nights and massive doses of caffeine (or other substances) can only take you so far. Coasting then cramming generally produces only a fleeting grasp of a concept. Chemistry should be treated as a foreign language: persistent, consistent exposure and practice is the only true way to master it. Unless you are one of the lucky few, you are guaranteed to fail eventually if you always wait until the night before an exam to study.

Study together • Don't suffer alone. Take advantage of the academic environment around you. Form study groups, chat rooms, mailing lists, instant message groups, blogs, tweets, circles – whatever it takes. Most of all, go to office hours. Even at my best, my lectures cannot always be revelations for every student. The individual aid available in office hours is an unparalleled supplement to studying. Seeking out help should never be seen as a weakness or as a last resort, but as a study aid.

Teach • I can honestly say that I have learned more about chemistry in the years I have been teaching at De Anza than I ever did in graduate school. You can think that you have mastered a topic, but as soon as you have to turn around and explain it to someone else, you may quickly find out you do not know as much as you thought you did. Take turns asking each other questions in a group; try to give a mock lecture at a chalk board or white board or by instant message. You may be surprised at the results.

3G *Learning modes*

We each absorb and interpret information in our own individual ways. There are **visual** learners – those who best absorb material in the form of diagrams or figures; **aural** learners – those who best assimilate material by listening or speaking; and **mechanical** learners – those who best retain knowledge by repetition, such as rewriting notes or working problems. Knowing which blend of these or other learning formats best suits your abilities can greatly enhance your learning experience. For aural and visual learners, audio recordings of all lectures and digital scans of the accompanying written notes are available for download on the course web site (see ***Section 0*** for the address). For mechanical learners, several example problems are listed in ***Table 6***.

4A — *Lab Safety*

No functioning chemistry lab can ever be entirely free from hazards or accidents. As humans, we all make mistakes – a fact that is confirmed every quarter by the quantity of glassware broken. Human error is most frequently the cause of accidents in a chemistry laboratory at the undergraduate level. However, in more advanced laboratories, fires, explosions, and floods (yes, floods) often occur unexpectedly, especially when the outcome of a chemical reaction may not be known (because it may have never been done before). Regardless of the type of laboratory involved, it is your responsibility to be aware of your safety and the safety of those around you the entire time you are in the laboratory environment.

4B — *General Safety Rules*

- Unauthorized experiments are expressly forbidden and can result in your expulsion from the course.
- Absolutely no chemicals may be taken from the lab without the express explicit written permission of your instructor.
- You may not be in the laboratory unless an instructor is present to supervise.
- If for any reason you feel faint during lab, notify an instructor before stepping out for air so you can be supervised.
- Eating, drinking, or using cosmetics in lab is not permitted due to the spread of chemical contamination by touch.
- Appropriate clothing must be worn in lab. Specifically, shorts and open-toed shoes of any form are ***not*** allowed.
- Personal headphones may not be used in lab, as you must be able to hear any emergency announcements.
- Never point a heated system towards any person, including yourself (or me).
- Glass and needles must only be disposed of in the appropriate containers, ***never*** in the regular trash.
- Never use chemical refrigerators to store food or any other personal items.

4C — *Eye Safety*

Rules numbers one, two, and three • ***Safety goggles must be worn in the lab at all times!***

Eye hazards • One of the most preventable but most serious types of laboratory accidents is eye injury. Many students incorrectly assume that chemicals are the prime source of danger in the laboratory, when in fact it is often glassware that is more hazardous. If a test tube is dropped unexpectedly, for example, 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. All it takes is one shard of glass travelling in just the right (or wrong) way to damage an eye irreparably. 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. ***Refusal to always wear safety goggles when required will result in expulsion from the course.***

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.

4D — *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 ***immediately*** 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.

4E — *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.
- 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.

4F 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 **pyrophor** (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. ***Note:*** 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 ***secondary containment*** 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.

4G 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, as it may decompose or evaporate/sublimate, causing a 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” when in a hurry.
- Never return unused chemicals to their original containers (make sure to only take the quantity you need to avoid waste).
- Never re-use the same pipette to transfer a chemical once it has made contact with another container.

4H CHEMICAL DISPOSAL

All chemicals or chemically-contaminated waste must be disposed of in an appropriately labeled waste container. ***No chemicals may ever be poured down the sink unless specifically directed.*** 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; and **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.

4I MEDICAL CONSIDERATIONS

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.

4J LOCKER POLICY

LOCKERS • You 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 (see ***Table 4***) 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).

5A — *Pre-lab 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.

5B — *Pre-lab format*

Your pre-lab should be prepared directly in your lab notebook and should normally include at least the three items listed below. See ***Section 5D*** and ***Section 5E*** 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 ***in your own words*** 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. ***You do not have to include any sections that only relate to theory and you do not have to answer any pre-lab questions.***

5C — *Lab Notebooks*

Knowledge archive • 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 document • 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.

5D — *Lab Notebooks format*

General • ***Never erase, write in pencil, or use white-out in a lab notebook!*** 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.

5E Experiment format

General formal • As mentioned in ***Section 5B***, 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 (optional) • 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 (partly optional) • 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.

6A 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 communiqué, 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.

6B 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 ***do not*** have to answer any pre-lab or post-lab questions found in your lab text for your lab report.

TYPED REPORTS • For this class, ***all lab reports must be typed*** (except in cases in which an academic accommodation has been approved). ***All tables and graphs in your report must also be electronically generated***; 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 (see ***Section 6D*** below regarding electronic lab report submission).

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.

6C LAB REPORT SECTIONS

TITLE • The title should be a short statement alerting the reader (me) to which experiment you are presenting. If you number your experiments, please do so chronologically instead of using the experiment numbers in your text – meaning that the report on the first lab should be titled “Experiment #1: ....”, the report on the second lab should be titled “Experiment #2: ...”, and so on.

OBJECTIVE • Your should clearly state the key ***qualitative*** or ***qualitative*** 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) ***should not*** be mentioned **at all** in the objective, since the report is not about you.

PROCEDURE • Since you have already written a complete procedure for any experiment as part of your pre-lab exercise, ***do not include the procedure in your lab report***; it would simply be repetitive and a waste of time and paper (physical or otherwise).

DATA AND CALCULATIONS • Please see the following page (***Page 15***) for more detailed information on these crucial sections.

CONCLUSION • To maintain symmetry in your report, your conclusion should exactly parallel your objective – meaning 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.

6D DIGITAL LAB REPORTS

ELECTRONIC SUBMISSION • To avoid the expense and environmental waste of paper, instead of submitting a printed report, you may e-mail your lab report to ***graydavid@deanza.edu*** using the subject “**Chem 1B Lab Report**”. ***Do not*** send any questions in the same message as your report, as I may not read the message until I grade the report. ***Do not also submit a paper report!!!!***

FILE FORMATS • I ***strongly*** encourage you to submit your reports in PDF format, as it is a format that can be opened reliably across multiple platforms. On a Mac, most programs can generate PDF files simply by selecting the ‘PDF’ menu within the ‘Print’ command. On a PC, some applications directly export files in PDF format, while other applications – such as PrimoPDF and PDF4Free – allow you to create PDF files from other sources. I also accept documents in Word (.doc, .docx), Excel (.xls, .xlsx), plain text (.txt, .rtf), or common graphics formats (.jpg, .tif, .gif). If I receive a lab report that I am unable to open, I will return it and ask that it be converted into another format (no points will be deducted if the report is resubmitted within the time frame given).

SPECTRA AND PRINTED DATA • If you generate spectra or other printed data during an experiment, even if you submit your report electronically, you may submit those data in print form instead. However, if you have the interest and the capability, feel free to scan your data and include it either as part of your digital report or as an attachment to the message used to send the report.

6E DATA VERSUS 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. ***Data*** 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 ***calculation***.

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(e), versus whether the correct formula was chosen for that particular calculation in the first place.

6F FORMATTING DATA

LABELS • ***Always*** make sure that every piece of data has some kind of intelligible label, such as "mass of crucible" or "sample number". Do not assume I can determine what a random, unlabeled number refers to.

UNITS • Any numerical piece of data must always be written with the appropriate unit(s) of measure.

VARIABLES • If you have multiple calculations that a particular type of data will be used in, it is often helpful to define a variable name for that data – an abbreviation that can be used to represent that piece of data in mathematical equations. For example, if you measure the temperature of three different objects, you may wish to name those three measurements T_1, T_2, and T_3. Make sure that your variable names make some intuitive sense and/or they are clearly explained.

TYPOGRAPHY • Chemical formulas ***absolutely must*** be written with appropriate subscripts and superscripts. For example, the formula for magnesium phosphate must be written "$Mg_3(PO_4)_2$", not "Mg3(PO4)2". Realize that spell checkers are not always intelligent and may not catch errors such as writing "trail 1" instead "trial 1" when referring to a particular experimental run. You should learn how to generate the proper degree symbol (°) for temperature measurements instead of using the letter 'o' or number '0'. Similarly, the formula for water is written "H_2O" (with the letter 'O'), not "H_20" (with the number zero)! Finally, variable names (and some units of measure, such as molarity) are normally written in italics (for example "0.3 *M*").

TABLES • If you have a large set of data – for example, the masses of fifty different beakers – you should tabulate that data to make the data far easier for the reader to interpret. Always include a title for your table and clearly label you columns and rows.

6G FORMATTING CALCULATIONS

LABELS, UNITS, AND VARIABLES • All calculations must include the appropriate unit(s) of measure and should be logically labelled. Be sure to define any variable names used in your calculations (do not use the variable *x* unless you define what *x* is).

PROTOTYPE FORMULA • For each unique kind of calculation you perform, you must write out the mathematical formula corresponding to that particular calculation once. For example, calculating the number of moles of graphite used in a reaction can be expressed in words (*moles of carbon = mass of carbon ÷ molar mass of carbon*) or by using logical variables or abbreviations instead ($n_{carbon} = m_{carbon} \div MM_{carbon}$). This way, if you arrive at an incorrect result in your calculations, I can at least verify whether you used the correct formula and thus made a simple computational mistake instead of a conceptual mistake.

SUBSTITUTED FORMULA • Following the prototype formula, you must then write one example of the equation substituted with your data. Using the example above, the number of moles of carbon obtain from 10.00 g of graphite can be written: n_{carbon} = 10.00 g C ÷ 12.01 g/mol C = 0.8326 mol C. If multiple trials are performed, you should mention which trial the data came from.

TABULATED CALCULATIONS • For each unique type of calculation, you only need to write the prototype formula and the substituted formula once. If the calculation is repeated multiple times, the rest of the results may simply be tabulated.

6H COLLABORATION

Most of the experiments in this class are performed individually; however, there will be times when you will work with one or more classmates together on an experiment, either because of the nature of the experiment or due to some form of restriction on the lab space or equipment available. In those cases, it is perfectly acceptable for you to work together with your classmate(s) to analyze the data from an experiment. However, you must prepare and submit your own individual lab report. No portion of a report – including any text, tables, graphs, or formatting – may be shared; to do so will be considered plagiarism (see ***Section 2H***).

7A LABORATORY MANAGEMENT

RESPONSIBILITY • Maintaining a clean and safe laboratory environment is the responsibility of every single student in the class. Unfortunately, each year I have found that there are always a few students who do not take chemical safety or laboratory cleanliness seriously. Any number of times, I have seen spilled chemicals covering counter tops, balances left a sloppy mess, chemical bottles left opened, pipettes left in fume hoods, bits of contaminated *p*H paper scattered around the lab, and so on. Even though this is a lower-level undergraduate class, do not make the mistake of presuming that the chemicals we use are free of hazards. Any amount of unnecessary exposure to chemicals is unacceptable. To be blunt, to fail to clean up chemical spills because you cannot be bothered to spend the minute or two necessary to do so demonstrates that you have absolutely no concern for the environment around you nor any concern for your own safety or the safety of others around you. Further, there are legal requirements for the proper storage, segregation, and disposal of chemicals – requirements that, again, are ignored by a few due to their lackadaisical attitude towards laboratory safety. If you were to display these same careless and sloppy habits regarding hazardous chemicals or waste in a workplace environment, you would be likely fired – or procecuted. It is not the job of faculty or staff to clean the laboratory; it is instead the user of the space – you – who are solely responsible.

CONSEQUENCES • Below is a list of safety violations or lapses in laboratory cleanliness that I have routinely encountered each year. At the beginning of each class period, I will assess the condition of the laboratory in general, while you will assess the laboratory space assigned to you. Any violations found by either you or myself will be remedied before the continuing with the lab. If ***at any point*** during the lab I find that new violations have occurred, a penalty of up to ten (10) points will be deducted for the total number of lab points, depending on the seriousness of the infraction. If I am able to determine the specific student or students responsible, these points will be deducted from their total lab scores. However, if the responsible party cannot be identified, these points will from every student's total lab score. Since it is impossible for me to constantly track the behavior each individual student, my only solution is to grade the class as a whole, as it is the responsibility of the entire class to maintain the lab.

ENFORCEMENT • Naturally, if the entire class is being held responsible for the condition of the lab space, you individually might be concerned that the actions of your neighbors may have an impact on your grade. You are ***not at all*** expected to monitor or supervise those who are around you, as that is my responsibility. However, I strongly encourage you to inform me of any violations that you observe, as it will help to ensure the safety of the lab as well as enable me to reinforce the importance of following safety guidelines. Also, there inevitably ends up being one or more students who – concerned for their grade or their safety (or both) – take it upon themselves to clean the lab when violations occur. Although this sincerity is appreciated, it should not be the responsibility of just a handful of students to maintain the lab – safety in the laboratory is the direct responsibility for the entire class. Instead of taking it upon yourself to remedy violations, please inform me when violations occur. If you find that any violations are present at the beginning of class, please let me know, both so that I do not unfairly penalize your class and so that I can inform the other instructors who use the classroom of the violations.

7B 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.

7C 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, take the time to carefully dispose of any waste.
- Segregating waste – All waste must be disposed of only in a chemically-compatible container.
- Designated container – Only use waste containers bearing my initials (DHG) 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.

7D LABORATORY CLEANLINESS VIOLATIONS

- Common areas – Make sure that all items available in the common area – including filter paper, pipettes, and *p*H test strips – are disposed of as soon as you are finished with them.
- Sink areas – Please ensure that no solid debris is left in any of the sinks (regularly check the drain strainers for waste).
- Glass waste – Glass should **never** be disposed of in regular trash cans. Heavily chemically-contaminated glassware should be disposed of in a chemically-compatible waste bottle. Clean glassware should be disposed of in glass recycling.
- Sand – If you use a sand bath during an experiment, make sure that you clean up any sand that is spilled in moving it.
- Equipment – All equipment you use during the lab, such as hot plates or stands, must be returned to the appropriate location at the end of lab.