Chem 12C • Spring 2023 • Sections 01 & 02

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1A — CONTACT INFORMATION

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OFFICE HOURS • **MW**: 1:30 PM - 2:20 PM | **TTH**: 10:30 AM - 11:20 AM | **F**: 11:30 AM - 12:20 PM

Note: All office hours will be held simultaneously in-person in my office and over the Zoom platform.

1B — COURSE DESCRIPTION

PURPOSE • This course is the third quarter of a three-quarter, one-year organic chemistry sequence, Chem 12. The sequence articulates to most one-year organic chemistry sequences for chemistry non-majors at two- and four-year institutions.

LECTURE CONTENT • The goal of this course is to apply the fundamentals of organic chemistry to the study of biologically significant molecules. Four core topics will be covered this quarter: 1) the synthesis and reactivity of *carboxylic acids and derivatives*; 2) the unusual reactivity of *α-hydrogens* in carbonyl-containing compounds, including *enolate reactions*; 3) the synthesis and reactivity of *amines*; and 4) a survey of major classes of *biological molecules*, including carbohydrates, amino acids, and terpenes.

LAB CONTENT • A series of laboratory experiments will focus on the synthesis of small organic compounds, using principally *infrared* (*IR*) *spectroscopy* and *nuclear magnetic resonance* (*NMR*) *spectroscopy* to confirm their formation. Key reactions will include an aldol condensation, a Robinson annulation, the synthesis of an amide, and a multistep organic synthesis.

1C — CLASS STRUCTURE

SECTIONS • This course is divided into two sections (see ***TABLE 1*** for course registration numbers [CRNs].) Once you enroll in a particular section, you must attend only that section for the duration of the quarter. Both sections are completely independent of any other sections offered this quarter.

TABLE 1 — COURSE SCHEDULE

Session	*Room*	*Section 01 (46386)*		*Section 02 (46387)*	
Lecture	FOR3	MWF	12:30 PM – 1:20 PM	MWF	12:30 PM – 1:20 PM
Lab	SC2210	MW	7:30 AM – 10:20 AM	MW	2:30 PM – 5:20 PM

CLASS PERIODS • This course is divided into a *lecture* and a *lab*. Only one grade is assigned for lecture and lab combined, so 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.

All lectures and labs will be held in-person on the De Anza campus. This course cannot be taken in online format.

1D — GRADES

GRADES • The total number of points possible in this course is 1000 (see ***TABLE 2*** for the point distribution). No artificial curve is used in grading, meaning the final letter grade is based solely on the number of points earned. Final grades will be assigned based on a plus/minus grading scale (***TABLE 3***). ***A grade is 'C' or better is required to pass this course.***

LAB POINTS* • The total number of points possible in lab is 200. However, this point total can and will be reduced due to the improper handling of chemicals or waste or the failure to maintain a safe and clean laboratory environment. See ***SECTION 7A*** for more information on this policy.

TABLE 2 — POINT DISTRIBUTION

LECTURE (80%)				*LAB (20%)*			
Task	*Pts*	*#*	*Total*	*Task*	*Pts*	*#*	*Total*
Quiz	75	3	225	*Lab report*	20	5	100
Exam	125	3	375	*Lab exam*	100	1	100
Final	200	1	200	———	——	–	——
LECTURE TOTAL :			800	*LAB TOTAL :*			200*

TABLE 3 — GRADE SCALE

GRADE	*%*	*GRADE*	*%*
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

1E — REGISTRATION

DEADLINES • Registration deadlines (***TABLE 4***) are ***strictly*** enforced by De Anza in accordance with state regulations. Exceptions to deadlines are only made in extreme emergencies, so make sure you take whatever action you need to take before the deadline.

ENROLLMENT • Due to safety policies related to the operation of the lab within the space that is available, enrollment in each section of organic chemistry is strictly limited to 26 students with ***no exceptions whatsoever***. Additionally, due to liability concerns, you may not attend this class unless you are enrolled or auditing (see ***SECTION 3C***). Students on the wait list may attend lecture until the add deadline passes to attempt to add into the course but cannot participate in lab experiments.

TABLE 4 — REGISTRATION DEADLINES

ADMINISTRATIVE DEADLINE	*DATE*
Add or audit this course	4/22/23
Drop with refund and/or no grade record	4/23/23
Withdraw from this course	6/2/23

WAIT LISTS • Open spaces in each section will be filled following the order of the official wait list; any remaining spaces will be filled on a first-come, first-serve basis.

DROPS AND WITHDRAWALS • If you do not attend the first day of class, *I am required by contract to drop you from the course*, unless you inform me in writing as to why you were absent. Additionally, if you are absent without excuse before the drop deadline (see ***TABLE 4***), you may be automatically dropped from the course so that students from the wait list may add the course instead. ***After the drop deadline, you are entirely responsible for initiating any drops or withdrawals from the course.***

1F — Assessment schedule

Planning • In creating the assessment schedule for this course (***Table 5***), it is not feasible to avoid assessments in other courses, since each course runs at its own pace. Part of being an adept student is having the ability to balance the demands of different courses simultaneously. You have been given this schedule at the beginning of the quarter, so you have ample forewarning to properly manage your study time. ***Assessments will not be given on alternate days due to the workload in other classes.***

Table 5	Schedule		
	Quiz	Exam	Lab Exam
#1	4/19/23	5/1/23	6/21/23
#2	5/15/23	5/24/23	———
#3	6/3/23	6/21/23	———

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

Final exam • The final exam for this course will held on **Wednesday, June 28th, 2023** at **11:30 am** in room **FOR3**. This time has been assigned by the college and cannot be changed except in dire emergencies (see ***Section 3b*** for details). ***The final exam will not be given at an alternate time due to the final exam schedule of other courses.***

1G — Assessments

Types of assessments • *Quizzes* are focused assessments intended to gauge your level of preparedness between tests. Quizzes are not explicitly cumulative and will instead focus on recently-presented material. *Exams* are broader assessments that are more cumulative in nature and will focus on all material presented since either the beginning of the quarter or since the previous exam. The *final exam* is a comprehensive assessment that covers all material presented in lecture. The final exam does not include lab-related material, but it will include lecture-related material that was presented in lab. The *lab exam* is focused solely on material presented in lab. Questions on lab exams will include material presented during lab lecture as well as any calculations or interpretations associated with your lab reports. No lab final is given during finals week, only a lecture final.

Format • The types of questions on assessments may include: true/false, fill-in-the-blank, definitions, short-answer, and formats specifically for this course, such as mechanism, synthesis, or structure solving. *No multiple choice questions will be given.*

Time and place • All quizzes, exams, and the lab exam will be held in-person in lab lecture for each section in room **SC2210**.

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.

1H — Course Materials

- 1) a combination padlock for securing your lab locker (must be a numerical combination lock, not a lock with a key)
- 2) a laboratory notebook for recording your experimental procedures and results (a plain composition book is sufficient)
- 3) chemical safety goggles (see ***Section 4c*** for more information about safety goggles)

1I — Online resources

This course ***requires*** the use of the Canvas platform for the completion of some or all of the course assignments. You can access Canvas either through your MyPortal account or directly at **https://deanza.instructure.com/**.

1J — Disability accommodations

Accommodations for a range of disabilities are available through Disability Support Programs & Services (DSPS). To receive an academic accommodation on assessments – such as additional time, a reduced-distraction environment, or the use of alternative media or assistive technology – you must first be evaluated by Disability Support Services (DSS) and obtain a Test Accommodation Verification (TAV) form. ***Absolutely no accommodations can be provided on assessments without a completed TAV form.***

1K — 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. Violations of the Code may be reported for disciplinary action and, in extreme cases, may prompt your removal from the class pending further action.

1L — Diversity

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

1M — COVID-19 vaccination policy

De Anza requires all students attending in-person classes to be fully vaccinated against COVID-19 before being allowed to register for those classes, unless granted a religious or medical exemption, and all persons must wear appropriate masks at all times when indoors on-campus. For more information go to **https://www.deanza.edu/return-to-campus/students.html**.

2A — Lecture text and schedule

Textbook • *Organic Chemistry, 4th edition* by *David Klein (Wiley: 2020, ISBN 978-1-119-74510-5)*

Alternate texts • There are other excellent texts available which may be useful if you are seeking additional problems or an alternate presentation of the course material. If you wish to use an alternate text, please consult with me first so that I can advise you whether the text you intend to use is appropriate for the level of this course. Also, due to the high cost of textbooks, if you have already purchased a previous edition of the official text, you are welcome to use the old edition, with the understanding that the problem numbers and section numbers (or even topics) in older editions may not match those found in the syllabus.

Suggested problems • In addition to the in-chapter problems in each section, the problems listed below are suggested for further skill development. These problems are not necessarily an indicator of the types of questions that will be found on assessments, but they do address the same material. Although homework can improve your understanding immensely, you are not required to submit homework, so you are not required to use any homework system the may be associated with the text.

Table 6 — Lecture schedule

Week	Day	Assess	Sections	Topic	Problems
1	4/10		20.1 – 20.3	*Carboxylic acids* – They'll put the fizz in your soda.	20: 35, 43
	4/12		20.10 – 20.11	*Esters* – A fistfull of fun-filled fruit flavors and fragrances!	20: 47, 52, 56, 71, 80
	4/14		20.6 – 20.8	*Carboxylic acid derivatives* – But what about the integrals?	20: 37, 38, 59, 73, 76
2	4/17		20.5	*Alkylation and reduction* – Putting the carbonyl to work.	20: 45, 55, 70, 74
	4/19	Quiz 1	20.4, 20,9, 20.14	*Synthesis of carboxylic acids and derivatives* – Assembly required.	20: 42, 44, 48, 75
	4/21		20.12; 25.6	*Amides* – The groups that hold proteins together.	20: 49, 51, 53, 54, 61, 69, 72, 87
3	4/24		20.13	*Nitriles* – More than just a type of glove.	20: 46, 79
	4/26		8.12	*Ozonolysis* – Not to be confused with the ozone layer	8: 67, 81, 96
	4/28		21.1	*Enolates* – You'll get a charge out of 'em.	21: 47 – 56, 70, 89, 92, 98
4	5/1	Exam 1	21.2	*α-Halogenation* – Add a little salt to your diet.	21: 65
	5/3		21.3	*Aldol condensation* – Not what makes the rain fall.	21: 57 – 64, 66, 71, 74, 75, 81, 87, 90, 95
	5/5		21.4	*Claisen condensation* – Putting esters together.	21: 67, 79, 80
5	5/8		21.5	*Alkylation of enolates* – Customize your carbonyls.	21: 68, 69, 76, 84, 93, 96
	5/10		21.6, 23.3	*Conjugate additions* – Nothing imaginary about these reactions.	21: 73, 77, 78, 83, 85, 86, 91, 94
	5/12	• Synthesis workshop •			
6	5/15	Quiz 2	22.1 – 22.3	*Amines* – Getting back to basics.	22: 35 – 37, 70, 73
	5/17		22.4 – 22.7	*Synthesis of amines* – Something smells fishy about this.	22: 45, 46, 49, 55, 56, 67, 74, 79
	5/19		22.8	*Aryl amines* – No relation to Flynn.	22: 50, 51, 77
7	5/22		22.9 – 22.10	*Reactions of amines* – Nitrogen gets its day in the sun.	22: 57, 58, 62, 64, 76
	5/24	Exam 2	22.11 – 22.12	*Heterocycles* – The wheel goes round and round.	22: 44, 63, 65, 66, 71
	5/26		24.1 – 24.4	*Carbohydrates* – There goes my diet.	24: 42 – 45, 52, 56, 81, 83, 85
8	5/29	• College Closed – Memorial Day •			
	5/31		24.5	*Structure of carbohydrates* – My sweet tooth is tingling.	24: 46 – 50, 53, 54, 60, 82, 84
	5/2		24.6	*Reactions of carbohydrates* – Now that's a sticky situation.	24: 57 – 59, 61, 64 – 67, 69, 70
9	6/5		24.7 – 24.8	*Polysaccharides* – Making even more complex sweets.	24: 73, 75 – 78
	6/7	Quiz 3	————	*The Fischer stereochemistry proof* – A molecular masterpiece.	————
	6/9		25.1, 25.3	*Amino acids* – The proverbial primordial goo.	25: 40 – 43, 56 – 60, 69
10	6/12		25.2	*Isoelectronic points* – Revenge of the pK_a!	25: 45 – 51, 53 – 55, 84, 86
	6/14		25.4, 25.6	*Peptide synthesis* – Putting the pieces together.	25: 64, 65, 76 – 78, 85, 87, 88
	6/16		25.5, 25.7 – 25.8	*Sequencing* – Pulling the pieces back apart.	25: 72, 73, 75
11	6/19	• College Closed – Juneteenth •			
	6/21	Exam 3	26.1 – 26.8	*Lipids and terpenes* – Building blocks of biological molecules.	26: 29, 32, 33 – 38, 49, 51 – 54
	6/23		————	*Neurotransmitters* – Makes you stop and think.	————

2B | Lecture topics

The following is a listing of the major topics that will be covered each day in lecture. This list should not be considered the exclusive set of topics that found on assessments; instead, it should be viewed as a set of milestones to be reached in your study.

Table 7 — Core topics

Week	Day	Topics
1	4/10	Nomenclature of carboxylic acids; physical properties of carboxylic acids; dicarboxylic acids; naturally-occurring carboxylic acids; Fischer esterification; reversibility of esterification; acidity of carboxylic acids
	4/12	Reactions of esters: acid-catalyzed hydrolysis and base-promoted hydrolysis (saponification); tetrahedral intermediate; transesterification, aminolysis; hydrolysis of esters with tertiary alkyl groups; carboxylates; micelles; soaps
	4/14	Nomenclature and physical properties of carboxylic acid derivatives; relative reactivity of carboxylic acids and derivatives: polarity and leaving group ability; synthesis of acyl halides; synthesis of carboxylic acid derivatives from acyl halides
2	4/17	Reduction of carboxylic acids and derivatives; selective reduction of acyl halides and esters; alkylation of acyl halides and esters
	4/19	Synthesis of carboxylic acids
	4/21	Synthesis of amides: DCC; reactions of amides: hydrolysis, saponification, reduction, and alkylation
3	4/24	Synthesis of nitriles; reactions of nitriles: hydrolysis, saponification, reduction, and alkylation
	4/26	Formation of molozonides and ozonides; decomposition of ozonides under oxidative and non-oxidative conditions
	4/28	Acidity of α-hydrogens: delocalization, hyperconjugation, induction; keto-enol tautomerization; acidic versus basic α-hydrogen mechanisms; lithium diisopropylamide; reversibility of base-promoted enolate reactions
4	5/1	α-Halogenation: acidic versus basic conditions; haloform reaction
	5/3	Aldol condensation; E1cB mehanism; crossed aldol condensation; ideal aldol condensation; intramolecular aldol condensations
	5/5	Claisen condensation; crossed Claisen condensation; Dieckmann condensation
5	5/8	α-Alkylation; kinetic versus thermodynamic alkylation; decarboxylation; malonic ester synthesis; acetoacetic ester synthesis
	5/10	Stork enamine synthesis; Michael addition; Robinson annulation
	5/12	————————————
6	5/15	Nomenclature of amines; acid-base properties of amines; pyrrole, pyrrolidine, imidazole, pyridine, purine, pyrimidine; amine inversion
	5/17	Synthesis of amines: reduction of nitriles, amides, azides, imines; exhaustive alkylation; Gabriel synthesis; reductive amination; Curtius and Hofmann rearrangements;
	5/19	Attenuation of aniline reactivity by acylation; nitroarenes
7	5/22	Hofmann elmination; nitrosamines; diazotization
	5/24	Diazonium salts; azo coupling; heterocycles: pyrrole, imidazole, pyridine, pyrimidine
	5/26	Classification of carbohydrates: size (mono-, di-, tri-, oligo-, polysaccharides), number of carbons (triose, tetraose, pentose, hexose), aldose versus ketose, D/L convention; +/– designations; names and configurations of aldoses and ketoses of 3, 4, 5, and 6 carbons
8	5/29	• College Closed – Memorial Day •
	5/31	Furanose versus pyranose forms of carbohydrates; Haworth projection; anomers; α versus β forms of cyclic carbohydrates; mutarotation; structural favorability of glucose
	6/2	Epimerization of carbohydrates; alditols; aldonic acids; aldaric acids; osazones; glycosides; Kiliani-Fischer synthesis; Wohl degradation
9	5/5	Disaccharides: sucrose, lactose, maltose; polysaccharides: starch, cellulose, chitin; reducing sugars; carbohydrate derivatives
	6/7	Role of osazone formation and chain extension in establishing relationship between glucose, mannose, and arabinose; role of optical activity of aldaric acids of arabinose, glucose, and mannose; role of lack of rotational symmetry of aldaric acid of glucose
	6/9	Names of common naturally-occurring amino acids; D/L convention for amino acids; classes of amino acid side chains; essential amino acids; synthesis of amino acids: *N*-phthalimidomalonic ester and Strecker syntheses
10	6/12	Effect of pH on amino acid structure; zwitterions; isoelectric point; graphical depiction of forms of amino acids versus pH; electrophoresis; ninhydrin; ion-exchange chromatography
	6/14	Peptides and proteins; di-, tri-, oligo-, polypeptides; disulfide bridges; *t*-BOC; Merrifield resin synthesis
	6/16	Edman degradation: phenyl isothiocyanate, thiazolinone, phenylthiohydantoin (PTH); cyanogen bromide; primary protein structure; secondary protein structure: α-helix, β-pleated sheet, coil; tertiary protein structure: denaturization; quaternary protein structure; enzymes
11	6/19	• College Closed – Juneteenth •
	6/21	Fatty acids: polyunsaturated fatty acids, omega fatty acids, essential fatty acids; waxes, fats, oils; triglycerides; phospholipids; prostaglandins; terpenes: monoterpenes, sesquiterpenes, diterpenes, triterpenes; isoprene units; isoprene oritentation; pyrophosphates; steroids
	6/23	————————————

2c Lab text and schedule

Textbook • *Experimental Organic Chemistry: A Miniscale and Microscale Approach, 6th edition by John C. Gilbert and Stephen F. Martin (Brooks/Cole: 2011; ISBN 978-1-439-04914-3)*

If you have a previous edition of the lab text or you are unable to purchase the current lab text, a copy of the lab text is available on reserve at the library. Be aware that aside from page numbers, the procedures in older editions may also differ from the current version of the text.

Table 8 — Lab schedule

Week	Day	Report	Theory	Procedure	Activity
1	4/10		———	———	*Introduction and check-in*
	4/12		759 – 763	764 – 765	*Lab 1 –* Synthesis of benzocaine
2	4/17		759 – 763	764 – 765	*Lab 1 –* Synthesis of benzocaine
	4/19		759 – 763	764 – 765	*Lab 1 –* Synthesis of benzocaine
3	4/24		759 – 763	764 – 765	*Lab 1 –* Synthesis of benzocaine
	4/26		689 – 691	691 – 692	*Lab 2 –* Aldol condensation
4	5/1	*Lab 1*	689 – 691	691 – 692	*Lab 2 –* Aldol condensation
	5/3		689 – 691	691 – 692	*Lab 2 –* Aldol condensation
5	5/8		697 – 699	700 – 702	*Lab 3 –* Robinson annulation
	5/10	*Lab 2*	697 – 699	700 – 702	*Lab 3 –* Robinson annulation
6	5/15		697 – 699	700 – 702	*Lab 3 –* Robinson annulation
	5/17		697 – 699	700 – 702	*Lab 3 –* Robinson annulation
7	5/22				*Spectral Elucidation –* Mass spectrometry
	5/24	*Lab 3*			*Spectral Elucidation –* ^{1}H–NMR
8	5/29	• College closed – Memorial Day •			
	5/31				*Spectral Elucidation –* ^{13}C–NMR
9	6/5				*Spectral Elucidation –* Combined
	6/7		882 – 883	883 – 886	*Lab 4 –* Identification and characterization of carbohydrates
10	6/12		782 – 786	787 – 789	*Lab 5 –* Luminol
	6/14	*Lab 4*	782 – 786	787 – 789	*Lab 5 –* Luminol
11	6/19	• College closed – Juneteenth •			
	6/21	*Lab 5*			*Lab exam and check-out*

3A	ABSENCES

If you are absent from class, please contact me *by e-mail* and provide a brief explanation for your absence so that I have a written record, even if the reason for your absence is as simple as sleeping through your alarm. Without written notice, no opportunity will be given to make up any missed work (see ***SECTION 3B*** below for more details). Depending on the reason for your absence, you may be required to provide some form of verification of your absence such as a doctor's note or jury summons. 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 so that someone from the wait list may take your place. By contract, I am required to drop any student that does not attend on the first day of class.

3B	MAKE-UP POLICIES

LECTURE • No assignments will be given during lecture, so there is nothing to make up if you miss lecture. Audio recordings of the lecture and written notes can be found online at the class Canvas site (see ***SECTION 1I***).

LAB LECTURE • If you are absent from lab lecture on a day when a pre-lab is due, you must show me that pre-lab on the very next day that you are in class (see ***SECTION 5C*** for information on pre-labs). Audio recordings and written notes of the lab lectures can be found online at the class Canvas site (see ***SECTION 1I***).

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 conduct 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 actual lab. Except under rare circumstances, you may not attend another lab section to make up a missed lab, especially if that section is fully enrolled.

QUIZZES AND LAB EXAM • Missed quizzes and the lab exam 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 at some other mutually agreed-upon time. Due to problems with academic integrity, make-up quizzes and lab exams will 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 miss an exam due to truly exceptional circumstances – such as a debilitating accident or the death of a close relative – then the opportunity to make up the exam may be given, although the exam will differ from the original version. Otherwise, the grade for the missing exam will be substituted by your grade on the final exam (adjusted proportionally for the difference in the number of points possible).

FINAL • The final exam time and date is scheduled by De Anza 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 and you are unable to take the final exam within the scheduled time, please contact me ***immediately*** by e-mail explaining you situation. If circumstances warrant it, alternate arrangements will be made for you to complete your final. If for whatever reason you are unable to take your final exam before the end of the quarter, a grade of *incomplete* may be given so that you may finish the work at a later time. If the incomplete is not resolved within a mutually established time frame, a zero will be given for the final and your grade will be assigned based on your remaining work.

3C	GRADING OPTIONS

PASS/NO PASS • If you are taking this course to receive course credit but do not need receive 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 non-passing. You must designate this course pass/non-pass before the official registration deadline (see ***TABLE 4***). ***Note:*** Once the pass/non-pass deadline has passed, you cannot later convert a pass/non-pass grade into a letter grade or *vice versa*.

AUDITING • If you have taken this course before at De Anza or another community college, you may take this course again on an *audit* basis for review. Auditing students may attend lecture and lab lecture but may not participate in lab experiments and will not receive credit for the course. Information about auditing can be found at **https://www.deanza.edu/policies/auditing.html**.

PLUS/MINUS GRADES • According to 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 GPA. Additionally, since a grade of 'C' is considered the minimum passing grade for a course within the California Community College system, there is no such grade as 'C–' at De Anza.

3D	ELECTRONIC RESOURCES

Cell phones, tablets, computers, and similar devices may be used in class as long as they are in silent mode. No electronic devices may be used on assessments except for approved, dedicated calculators (see ***SECTION 2E*** for academic accommodations).

3E	ACADEMIC INTEGRITY

Cheating and plagiarism are two of the most serious academic violations of the Code of Conduct (see ***SECTION 1K***). No matter how difficult your life situation might currently be, and no matter how much pressure you might be under to succeed or to help someone else, **I do not consider cheating or plagiarism to be excusable in any form or under any circumstance**. I fully believe such a lack of ethics in this early phase of your academic career is indicative of how you will behave in your future occupation, and since many of your are seeking careers in professions that involve the public, I find such behavior not merely unethical but dangerous. ***Any student(s) caught cheating or plagiarizing on any assignment will automatically receive zero credit for that assignment.*** Further, all instances of cheating or plagiarism will be reported to the deans of Physical Sciences, Math, and Engineering (PSME) and of Student Development for possible further disciplinary action, which in extreme cases may result in expulsion from De Anza.

3F EXPECTATIONS

SELF-RELIANCE • It is only through your own effort and dedication that you will ever truly master the material in this course. I can teach you in every way imaginable, but I can do nothing to make you learn; I can only act as your guide. You have to be the one that dedicates yourself to your own future.

TIME • Although the quantity of time needed to master the material will vary widely from person to person, a standard academic guideline is to expect that – between reading, review your notes, and working problems – you will need to set aside at least two hours for studying for each hour of lecture or lab lecture.

READING • Chemistry is its own language. Even common English words have a completely different meaning in a chemical context; for example, a hood is normally something worn over the head, but in lab it is a safety system for removing hazardous fumes. Therefore, the only way I can conduct a lively class discussion is if you read all assigned passages *before* you come to class. I do not expect you will understand everything that you read – otherwise there would be no need for this course – 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 so you are far more able to understand a lecture.

PARTICIPATION • I am not a video to be viewed passively; I am a living, breathing, feeling creature that expects to interact with you in class. When I ask a question or request participation from the class, I get 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, the class, will be engaged.

PROBLEMS • Working problems is often an extremely effective means of mastering a concept. I only have limited time in lecture, so I cannot cover every single detail presented in the text. You must take it upon yourself to work as many problems as you deem necessary in order to succeed. When you do work problems, resist the urge to look at the answer key first. You will learn far more by first running into the proverbial brick wall then learning from your mistakes than simply glancing at the answer.

PROFICIENCY • Assessments for this course are designed under the assumption you have reached a reasonable level of proficiency is each concept or skill. If it takes too long for you to solve problems because of a lack of practice, you will unable to complete the assessments. Likewise, you are expected to be able to address the heart of a problem with concise yet complete answers. If you answer in several paragraphs what requires just a few sentences to express, you will never finish; yet, if you answer in just a few words what requires a few sentences to clearly express, you are unlikely to receive full credit.

3G SUBMITTING ASSIGNMENTS ONLINE

All assignments turned in online will be submitted through the Canvas system; assignments sent by e-mail will not be accepted. If you have a physical document that needs to be converted into electronic format and do not have access to a document scanner, many apps such as Adobe Scan are available for using your phone as a scanner. All assignments must be submitted as a *single document* in *PDF format*. Several tools are available for converting a wide range of electronic formats into PDF format.

3H STUDY TIPS

MAKE STUDYING A HABIT • Make studying a habit, not a chore. Clear out time every day, even if it not at the same time every day. Do not worry about how much you accomplish at first, just remained focused on your goal. Over time, you will condition yourself to put this time aside automatically, as it easily takes just as much time to worry about studying as it takes to actually study.

CREATE A STUDY SPACE • Make your own study space, whether it is alone at your own home, in a public setting, or somewhere outdoors. Maybe you find your bliss in a quiet room with soft lighting, a comfy sofa, and a steaming cup of herbal tea; maybe instead you hit your groove in a noisy coffee house sipping on extra super triple roasted fair-trade sustainable organic low-fat double raspberry-infused mocha lattés. Whatever your ideal studying space may be, make it yours.

SET ATTAINABLE GOALS • You are not going to make that website to help you study while you start a chat group and rewrite all of your notes and highlight all of your books and index your study cards and organize your backpack and read those two chapters and finish that lab report by tomorrow at seven in the morning. Break “studying” down into manageable tasks so you do not feel overwhelmed. Then, once you are caught up, you can get back to work on that homework color-coding project.

LEARNING MODES • To make the best use of your study time, you should know what modes of learning you tend to use: are you an *aural* learner, meaning you absorb material by hearing or speaking; a *mechanical* learner, meaning you learn by repetition, such as working problems or copying notes; or a *visual* learner, meaning you learn from seeing or drawing diagrams or pictures?

BREATHE! • Pay attention to all aspects of your well-being. The mind, body, and spirit can handle excessive stress for only so long before they break down, leading to exhaustion, depression, desperation, and worse. Exercise, listen to music, get outdoors, mediate, do something positive to release the stress, otherwise you will lose your balance before you know it.

TEACH • I can honestly say that I have learned more about chemistry in the years I have been teaching at De Anza that I ever learned during my doctoral program in graduate school. You may think you have mastered a topic, but as soon as you try to turn around and explain it to someone else, you may quickly find out you do not know as much about it as you thought you did. When you answer questions on assessments, it is as if you are teaching me. So, if you have tried every other study technique and find you are not making enough progress, trying teaching someone else and see how far you get. You may be surprised by the results.

4A LAB SAFETY

The chemistry department has adopted the following rules from the ***American Chemical Society Safety in Academic Laboratories Guidelines, 7th edition***, as mandatory for all chemistry lab classes:

1 • Department-approved safety goggles must be worn at all times that chemicals or glassware are in use, including when obtaining items from the stockroom or moving equipment to or form from your locker. Goggles may not be removed until all lab work has been completed and all chemicals and glassware have been stored.
2 • 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 sock on, may be worn in lab.
3 • Shorts, cut-offs, skirts, or pants exposing skin above the ankle, and sleeveless tops may not be worn in lab.
4 • Hair reaching the top of the shoulders or below must be tied back securely.
5 • Loose clothing must be constrained, while form-fitting items should be avoided as chemicals can be held against the skin.
6 • Wearing jewelry (rings, bracelets, watches, etc.) is discouraged as chemicals can seep in between jewelry and skin.
7 • Eating, drinking, or applying cosmetics in the laboratory room is forbidden at ***all*** times, including during lab lecture.
8 • Headphones are prohibited in lab at all times as you must be able to hear any emergency announcements made.
9 • Students are required to know the locations of the eyewash stations, emergency shower(s), and all exits.
10 • You may not be in the laboratory, balance, or instrument rooms unless an instructor is present to supervise.
11 • Students not enrolled in the course may not remain in the lab even for lecture once the add deadline has passed.
12 • If you any reason you feel faint during the lab, notify an instructor before stepping out for air so you can be supervised.
13 • Never point a heated system towards any person, including yourself.
14 • Glass and needles must only be disposed of in the appropriate containers, never in the regular trash.
15 • Except for soapy or clear rinse water from cleaning glassware, ***no chemicals may be poured into any sink***; any remaining chemicals from an experiment must be poured into the appropriately labeled waste bottle.
16 • Students must follow the Code of Conduct at all times while in the lab. Any behavior that could startle, frighten, or injure anyone in the lab is not allowed.

4B EYE SAFETY

EYE HAZARDS • Although chemicals can certainly cause eye injury, it is often glassware that is the greater hazard in lab. For example, if a small chemical sample in a test tube explodes, the chemicals themselves might not cause much injury, but the flying pieces of broken glassware certainly have the potential to cause harm. In fact, it is often innocent bystanders that are injured since they may not be immediately aware of what is occurring next to them. As such, you must wear your goggle the ***entire time*** you are in the lab space, which includes the stockroom area – even if you are finished with lab and you are "just" chatting with your friends. ***Refusal to wear your safety goggles during your entire time in lab will result in your expulsion from the course.***

TYPE OF GOGGLES • Your safety goggles must be specifically designed for chemical lab work; goggles designed for yard work or industrial work may not be adequate. Your safety goggles must make a seal all the way around your eyes to prevent objects or chemicals from striking from the sides. 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 have appropriate side shielding. If you wear prescription glasses and will be taking several lab classes, you may want to consider purchasing a pair of prescription safety goggles.

CONTACTS • There is some concern that certain types of contact lenses (particularly soft lenses) may potentially be hazardous to wear in the presence of some chemicals. Although there is no department policy against wearing contacts (as long as you also wear appropriate safety goggles) and there is unlikely any real risk, you should decide for yourself whether or not to wear them.

4C PERSONAL PROTECTIVE EQUIPMENT (PPE)

In additional to safety goggles, to reduce your chemical exposure it is highly recommended that you consider other forms of personal protective equipment (PPE), including nitrile disposable gloves and a chemically-resistant lab coat. You can also reduce your chemical exposure simply by wearing clothing appropriate for lab, such as a long-sleeve shirt instead of a t-shirt.

4D MEDICAL CONSIDERATIONS

Although your health and 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 the experiment so I can determine whether alternate arrangements should be made. Similarly, if you have a preexisting medical condition that may impact your ability to operate in a lab environment, I request (but cannot require) that you let me know so that I can assist you in the event of an emergency. Finally, if you are pregnant or feel that you may become pregnant, I urgently recommend that you consult with your doctor about being in enrolled this course. A list of chemicals used during the quarter is available upon request so that your doctor can advise you about your participation in lab.

4E EMERGENCIES

SPILLS • Do not attempt to clean spills yourself. Notify me so that I can quarantine the area and begin mitigation procedures.
CHEMICAL EXPOSURE • Have someone alert me and immediately rinse the affected skin or clothing with large amounts of water.
EYE EXPOSURE • If chemicals splash in your eye, immediately flush your eyes at an eyewash station and have someone alert me.
INJURY • If you are cut or burned during a lab, please notify me immediately so I can send you for appropriate medical treatment.
EVACUATION • In the event the room must be evacuated, use only doors marked 'exit' and proceed to the track and field area.
FIRE • Do not attempt to put out any fires yourself. Notify me immediately and prepare to evacuate the room if necessary.
EARTHQUAKE • Step away from equipment, duck under a desk until the shaking stops, then evacuate to the track and field.

4F — *Chemical hygiene*

Chemical safety • Most chemicals inherently have some form of health risk associated with them; sometimes the risk may be minor, sometimes it is life-threatening. A chemical might be a *irritant*, a *lachrymator* (causes you tear up or choke), a *carcinogen* (causes cancer), a *mutagen* (causes genetic mutations), a *teratogen* (cause fetal deformations), a *pyrophor* (spontaneously ignites upon contact with air), or a *neurotoxin* (attacks the nervous system). Although in *relative* terms many of the chemicals used in this course are not overtly hazardous, others can be quite harmful and can cause truly hazardous reactions if mixed improperly, so you should always take appropriate precautions to protect yourself (see ***Sections 4b***, ***4c***, and ***4d***). Additionally, you should always wash your hands ***immediately*** after you exit the lab area, especially before eating, using the restroom, or applying cosmetics.

Chemical storage • All stored samples must be clearly labeled with the English name(s), not formula(s), of the primary hazard(s) in the container, the date the sample was created, and your name. All liquids must be stored in containers sealed with the appropriate lid or stopper to prevent evaporation. Solids may be stored in open containers, for example when drying a precipitate, but all containers must be stored in secondary containment to prevent spillage.

Chemical segregation • Aside from properly storing cheicals, the containers themselves must be placed into a larger storage bin that would prevent the materials from spreading if one of the bottles were to somehow break. This additional precaution is known as *secondary containment*, and it is meant to prevent an unintended chemical reaction in the event of a catastrophe like an earthquake. To further reduce the chances of an adverse chemical reaction, only compatible substances or mixtures may be stored together in the same secondary containment. For example, acids may only be stored with other acids and cannot be stored along with bases, and oxidizers and reducers must similarly be separated. Chemical waste must also be appropriately stored and segregated (see ***Section 4g*** for further details).

4G — *Chemical disposal*

General directions • ***No chemicals may ever be poured down the sink unless specifically directed.*** All chemical waste must be disposed in appropriately labeled waste containers. If you do accidentally pour a chemical down the sink, please notify me immediately so I can quarantine the area initiate the appropriate protocol for mitigating the spill.

Types of waste • There are three types of waste containers available in the lab: acidic aqueous, basic aqueous, and organic.

Rinses • When cleaning glassware, the first rinse with either water or another solvent should be treated as hazardous waste and disposed of in the appropriate container. Subsequent rinses with water can be disposed down the drain if there is no obvious sign of chemical contamination remaining.

Labels • All waste bottles are labeled with the type of waste they contain and the name of the instructor who prepared the bottle. Always make sure you check that you are disposing of waste only in a bottle that I generated that corresponds to the correct waste type. Waste is also labeled according as to whether it contains solids or liquids. Solids may be disposed of in containers labeled for liquids, but liquids may not be disposed of in containers labeled for solids. This is so that the waste can be properly packed for transportation when it is removed from the lab.

Fill level • Waste bottles should never be filled completely to the top; instead, a small amount of "head space" must be kept above the level of the liquid, so that the contents of the container have room to shift in the event the container is suddenly dropped or shaken violently. Please let me know right away whenever a bottle reaches its fill level so that I can general another waste container.

Disposal area • With the large number of people needing to use the same waste bottle, it is easy for the area around the waste bottles to get contaminated if you are careless. Although the waste bottles are located within secondary storage, you must make a conscientious effort to keep the area around the waste bottles clean.

4H — *Chemical safety rules*

- Always read labels twice; for example, it is easy to misread "sodium nitrite" for "sodium nitrate" when you're in a hurry.
- Always refer to the Safety Data Sheet (SDS) for any substance or mixture for which you are uncertain of the hazards.
- Always return any reagent bottles to their appropriate secondary containment after you are finished with them.
- Never leave any substance or mixture uncapped after use, as it may potentially react with the surrounding environment.
- Never return unused reagents to their original containers as you must assume they are contaminated once removed.
- Never take a personal stock of reagents to use at your own bench since the excess cannot be returned so it will be wasted.
- Never re-use the same pipette to transfer a substance or mixture once that pipette makes contact with another object.
- Never consume any products made in any lab, as the regents and techniques you will use are not pharmaceutical grade.
- Never remove any chemicals from the laboratory as you are not licensed to transport hazardous materials.
- Never use chemical refrigerators to store food or any other personal items.
- All ethanol available in the lab has been intentionally poisoned so as to render it unfit for consumption.

4I — *Locker policy*

If you are provided a lab locker for the quarter, you are required to officially check out of that locker, whether you complete the course or not. If you drop the course before the official *add* deadline (see ***Table 4***) your locker may be cleared and reassigned to another student without your being present if there are students on the wait list attempting to add into the course. After the official add deadline, you must check out by the assigned checkout date for the lab section. If you drop or withdraw from the course, you may make arrangements to check out of your locker at an earlier time. Failure to check out of your lab locker by the official checkout date may result in a your grades being held and/or a block being placed on your future registration.

5A LAB NOTEBOOKS

A laboratory notebook is not just a simple notebook; it is a crucial legal document that never leaves the lab. Many research projects, such as the synthesis of naturally-occurring molecules, cannot be accomplished by a single researcher within a single year. The discoveries made must therefore be passed down in a way that the results can be reliably duplicated; that vehicle is the laboratory notebook. Research can be a competitive endeavor, with academic, industrial, or governmental groups often vying for limited economic resources. In a patent dispute, a well-annotated notebook can make the difference in winning or losing the case (and maybe your job). In fact, it is common practice for researchers to sign each page of a notebook to affirm it is legitimate. Obviously you will not invent any patents in this class, but you will learn the habits for properly maintaining a laboratory notebook.

5B LAB NOTEBOOK FORMAT

GENERAL • Never erase, write in pencil, or use white-out in a lab notebook! In legal cases, any alterations may be considered forms of forgery. Always write in pen. Mistakes should be corrected by drawing a single thin line through the original data, leaving them still legible; this way you can still recover your original result if it turns out it was correct! Finally, any data you collect should be immediately recorded directly into your lab notebook, not stored on a post-it note (or the back of your hand) for copying later.

TABLE OF CONTENTS • Any organized lab notebook begins with a table of contents. Each entry might include the page number(s), experiment title, and the date the experiment was performed. You might not see the usefulness of a table of contents in a class such as this wherein only a few experiments are performed, but if you are in a research lab where literally hundreds of reactions might be run, a table of contents is absolutely necessary.

EXPERIMENTS • At the very minimum, each experiment must include a title, a completed pre-lab (see ***SECTION 5C***), and any data or observations you directly acquired during the lab. If you are a science major and/or you are otherwise interested in maintaining a more complete laboratory notebook, additional suggestions for experiment formatting can be found in ***SECTION 5E***.

5C PRE-LABS

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 are unfamiliar with the procedure for an experiment before coming to class, you are not aware of the hazards you might encounter. You are therefore a danger to both yourself and the other students in the class.

COURTESY • If you are not prepared for an experiment and you constantly ask people around you for help, you are distraction to those who took the time to properly prepare for their lab.

EFFICIENCY • If you do not prepare for an experiment before coming to lab, you will waste a lot of time trying to figure out how to conduct the experiment, which means you may not be able to complete the experiment in time.

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. If you prepare before an experiment, you are far more likely gain something from it.

5D PRE-LAB FORMAT

Pre-labs should be prepared directly in your lab notebook. Unless otherwise directed, you do not need answer any pre-lab or post-lab questions in the laboratory manual. Your pre-lab should include at a minimum the following three items:

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 give any specific chemical safety information for a particular compound, you can find more information online by searching for that compound's Safety Data Sheet (SDS).

CHEMICAL DISPOSAL • List each substance or mixture generated during the experiment and the appropriate waste container – acidic aqueous, basic aqueous, or organic – is should be disposed in. If you are unsure how a substance or mixture should be properly disposed, leave space so that you can fill in that information during lab lecture.

PROCEDURE • You must rewrite the full procedure in your own words with enough detail that you can perform the lab successfully without referring to lab textbook. Do not simply copy the procedure verbatim. You do not have to include any portions of the experiment that are related only to theory, only the procedure itself.

5E ADVANCED FORMATTING

REACTION SCHEME • If you running a more complex experiment, I highly recommend you include a reaction scheme. This might take the form of an abstract, a flowchart, a series of diagrams, a set of mechanisms, or a set of synthesis steps. You might include key reagents, solvents, environmental conditions, or hazards.

REAGENTS • Reagent preparation alone can sometimes consume large quantities of time, since some reagents may be air- or water-sensitive or might have to be isolated or purified before use. Preparing a table of reagents can sometimes therefore be critical in planning for an experiment since you can therefore determine how much of each substance or mixture you will need. For each reagent you are going to use, you might include its name and/or formula, molar mass, the mass or volume to be used (with units!), moles (if appropriate) or molarity/molality (for solutions).

PROCEDURE • For your pre-lab procedure, I recommend using a two-column format, the left column wide, the right column narrow. In the first column, you can list your step-by-step procedure, while in the second column you can record any data you obtain, such as the mass of a sample. Since your results will be located right next to the corresponding procedure step, you will be able to more easily find your results when you write your lab reports.

6A — *Lab reports*

Chemical research is usually published in peer-reviewed journal articles. This means the research has been submitted to an academic journal that vetted the research through a panel of reviewers before it was published. These articles usually follow a standard format: (i) relevant background information and the justification for the research; (ii) the goal of the research; (iii) a vividly detailed experimental procedure; (iv) all relevant data, calculations, and interpretations; and (v) all conclusions drawn from the data, along with hints at future research possibilities. The format for lab reports in this class will follow the same spirit as these journal articles, although the implementation will be dramatically simplified since no new research is being performed.

6B — *Lab report structure*

Title • The title should be short and to the point. Please number your reports in chronological order, meaning the first report should be titled "Lab 1: ...", the second report "Lab 2: ...", and so forth.

Objective • Clearly state each key *quantitative* or *qualitative* result you of the experiment – for example: "The purpose of this experiment is to 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 about the results, not about you.

Procedure • *Do not* include the procedure in your report. You have already prepared the procedure for your pre-lab, so there is no reason to include the procedure again in your report. No biblograhpic reference to the report is needed either.

Data and calculations • Information about formatting data and calculations can be found in ***Sections 6F*** and ***6G***.

Conclusion • 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 means that the conclusion could potentially be just a one-sentence statement, such as: "The concentration of acetic acid in household vinegar is 0.829 *M*."

Discussion • When appropriate, you should include a brief discussion of how your observations led to your conclusion, and, when possible, you should compare your results to accepted results. For example, if a lab involves the synthesis of a compound, your discussion could contain your interpretation of any relevant spectra that demonstrate the formation of that compound. Alternately, if a lab involves determining the molarity of a known solution, your discussion should include a calculation of the percent error. Finally, you should describe any specific, significant sources of error, but only if those sources can be clearly identified.

6C — *Lab report formatting*

Digital format • All lab reports must be typed and all tables, graphs, and diagrams must be electronically generated. Handwritten work, such as worksheets you printed, must be converted into digital format (see ***Section 3G***). If you do not have regular access to a computer, the Library West Computer Lab is available for any De Anza student to use. There is no charge to use the computers, and since you will be submitting your reports electronically (see ***Section 6D***), you will not need to print anything.

Third person • Research articles in the field of chemistry are almost universally written entirely in third person, meaning that you should never use first person ('I', 'me', 'my', 'mine', 'we', 'us', 'our', 'ours') or second person ('you', 'your', 'yours'), and you should also never use the impersonal third person 'one' as a subject. For example, instead of writing "I measured the temperature every ten seconds", you should use a passive construction: "The temperature was measured every ten seconds". It is exactly because this writing style is passive that it is used, since the focus of most research articles is on the science, not the scientists.

6D — *Submitting lab reports*

All lab reports must be submitted through the Canvas system (see ***Section 3G***) in PDF format. If you generate spectra or other printed data during an experiment, your data should be converted into digital format and included as part of your report.

6E — *Data versus calculations*

Data are the specific numerical or qualitative observations directly obtained during an experiment. Any form of manipulation of these data, no matter how small, is a form of calculation. For example, imagine you want to measure the mass of a liquid. You could first measure the mass of a beaker, followed by the combined mass of the beaker and the liquid. These two measurements would be considered data, since they were directly observed. The mass of the liquid itself could only be obtained by subtracting one measurement from the other, so the mass of the liquid would be considered a calculation. You should use your own best judgment in determining how to logically present your data and calculations in your report.

6F — *Formatting data*

Labels and units • Every piece of data should have an intelligible label such as "mass of crucible" or "sample number", and any numerical piece of data must always be written with the appropriate unit(s) of measure.

Variables • It is often helpful to define a variable name for a piece of data, an abbreviation that can be used to represent that datum in mathematical equations. For example, the temperatures of three different samples might be labeled T_1, T_2, and T_3. Make sure that your variable names make intuitive sense and/or that they are clearly explained.

Typography • Chemical formulas must be written with subscripts and superscripts. For example, the formula for magnesium phosphate must be written "$Mg_3(PO_4)_2$", not "Mg3(PO4)2", and the copper (II) ion should be written Cu^{+2}, not Cu+2. Remember: spell checkers are not logic checkers; for example, you likely mean "trial 1" instead of "trail 1", and "molarity" instead of "morality". Learn how to properly create a degree symbol (°), and remember water is 'H_2O' (with the letter 'O'), not "H_20" (with a zero)!

Tables • Any large or related sets of data must be presented in the form of a table when it makes sense to do so.

	6G	*FORMATTING CALCULATIONS*

LABELS, UNITS, AND VARIABLES • All calculations must include appropriate labels and units. Clearly define any variable names used in your calculations; for example, do not use the variable 'x' unless you define what 'x' is.

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

SUBSTITUTED FORMULA • Following a prototype formula, each unique calculation must include one example of the equation substituted with your own data. For example, the number of moles of water obtained from 10.00 g of water can be written as n_{water} = 10.00 g H_2O ÷ 18.01 g/mol H_2O = 0.5552 mol H_2O. This way I can tell if you substituted the wrong piece of data in the wrong spot in the equation. If you performed multiple trials, you should state which trial the substituted data came from.

TABLES • If you perform the same calculation multiple times – for example, determining the densities of six different solutions – ***do not*** include full calculations for each trial. For each unique calculation, only one prototype formula and one substituted formula is necessary. The results of multiple identical calculations should then summarized in a table.

AVERAGE VALUES • If you perform multiple trials of an experiment, you should calculate the overall result from each trial separately and then average the overall results from all of the trials together. Although frequently the same mathematical result would be obtained by averaging the data from multiple together and then performing only on set of calculations, this is not always the case, and it is also conceptually incorrect.

	6H	*ACCEPTABLE COLLABORATION*

While it is enitrely acceptable for you to work together with others from the class to analyze the data from an experiment, you must prepare and submit your own individual lab report. No portion of a report, including any text, tables, graph, or formatting styles, may be shared from one person to another. Any such sharing will be considered a form of plagiarism (see ***SECTION 3E***).

	7A	*Safety enforcement*

Responsibility • Maintaining a clean and safe laboratory environment is the direct responsibility of every student in the class. Unfortunately, during lab I far too frequently countertops with chemicals spilled on them, balances left with unidentified solids covering them, reagents bottles left open with their contents evaporating, pipettes left dripping outside of their bottles, bits of contaminated *p*H paper scattered around the lab, and so on. Even though De Anza is not a research facility, there are still very real chemical hazards present in our labs, and *any* amount of unnecessary chemical exposure is unacceptable. Failure to immediately clean a chemical spill because you cannot be bothered to spend the minute or two necessary to do so demonstrates that you have no concern for the environment around you nor your own personal safety nor the safety of others, and it also violates the legal requirement to proper store, segregate, and dispose of chemicals. It is not the job of faculty of staff to maintain a clean laboratory; it is the user of the space – you – who is wholly responsible.

Enforcement • Violations of lab safety and cleanliness are grouped into three categories: chemical safety (*Section 7B*), chemical disposal (*Section 7C*), and lab cleanliness (*Section 7D*). At the beginning of each lab period, both you and I will assess the condition of the laboratory space, including the balance room and instrument room. Any violations that we find will be documented so they can be communicated to the instructor(s) of the previous lab(s) and then remedied before commencing with the our lab. If at any point during the lab I discover a violation has occurred, a penalty of one (1) point will be deducted for each violation from the total possible number of lab points, up to a total of ten (10) points per day. If the violations occur in a common area, this penalty will apply to everyone in the section, as this is unfortunately the only recourse I have to ensure the common areas are kept clean.

	7B	*Chemical safety*

Chemical spills • All chemical spills must be cleaned up immediately, particularly in common areas such as the balance room.
Secured reagents • All reagents bottles must be kept properly sealed when not in active use.
Secondary containment • All chemicals must be kept in secondary containment when not in active use.
Segregated containment • All chemicals must be segregated according to these classes: *acid*, *base*, *organic*, or *oxidizer*.
Sealed samples • All products must be stored in sealed containers, except for non-reactive solid products being dried.
Labeling • Stored products must be labeled with the full name of the primary hazard(s), the date, and your name.

	7C	*Chemical disposal*

Sinks • Absolutely no chemicals may be poured down the sink, with the exception of rinse water from cleaning glassware.
Disposal area • The secondary containment area where waste bottles are stored must be kept clean from any spills.
Chemical compatibility • All waste must be disposed according to the following classes of compatibility: *acid*, *base*, or *organic*.
Designated container • Unless otherwise directed, you may only use waste containers labeled with my initials (DHG).
Fill line • All waste containers must be maintained with some empty space at the top. Never completely fill a waste container.

	7D	*Lab cleanliness*

Common areas • Items from common areas, such as filter papers, pipettes, and *p*H paper, should be properly disposed.
Fume hoods • Any spills in fume hoods, including sand or residues left over from evaporation, should be clean up during lab.
Sinks • No solid debris should be left in any of the sinks. Please help to ensure the strainers in the drains are also kept clean.
Glass and needles • Broken glass and needles should only be disposed of in appropriate containers, never in regular trash.
Equipment • Any equipment used during a lab, such as hotplates or stands, must be properly stored before leaving lab.

Student Learning Outcome(s):

*Apply the principles of thermodynamics, kinetics, equilibrium to biologically important molecules.
*Conduct sectroscopic analysis and identifiy structures of biologically important molecules.
*Generate stepwise reaction mechanisms of biologically important molecules.
*Design logical syntheses and structural modifications of biologically important molecules.

Office Hours:

Zoom,In-Person	SC1214	M,W	1:30 PM	2:20 PM
Zoom,In-Person	SC1214	T,TH	10:30 AM	11:20 AM
Zoom,In-Person	SC1214	F	11:30 AM	12:20 PM