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1A	CONTACT INFORMATION
DR. DAVID HAMILTON GRAY • De Anza College, Room SC1214, 21250 Stevens Creek Boulevard, Cupertino, CA 95014-5702 PHONE • +1.408.864.5608 (<i>voice only</i>) E-MAIL • graydavid@fhda.edu ZOOM • 965-7285-6942 (<i>for office hours</i>) OFFICE HOURS • M: 1:30 PM - 2:20 PM T: 11:30 PM - 12:20 PM W: 1:30 PM - 2:20 PM Th: 11:30 PM - 12:20 PM <i>Note: All office hours will be held simultaneously in-person in my office and over the Zoom platform.</i>	

1B	COURSE DESCRIPTION
LAB CONTENT • This lab course will introduce key physical techniques – extraction, distillation, recrystallization, and thin-layer chromatography (TLC) – and instrumental techniques – gas chromatography (GC), infrared spectroscopy (IR), mass spectrometry (MS), and nuclear magnetic resonance spectroscopy (NMR) – routinely used in synthesizing and identifying organic compounds.	

1c		CLASS STRUCTURE			
SECTIONS • This lab is directly connected to only one lecture section (see TABLE 1 for the course registration number [CRN].) Once you enroll in a particular section, you must attend only that section for the duration of the quarter.					
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.					
		TABLE 1		COURSE SCHEDULE	
Session		Room		Section 03 (27866)	
Lecture		SC1102		TTh	11:30 AM – 12:45 PM
Lab		SC2210		TTh	8:30 AM – 11:20 AM
All lectures and labs will be held in-person on the De Anza campus. This course <u>cannot</u> be taken in online format.					

	1D	GRADES			
LAB POINTS* • The total number of points possible in lab is 300 (see TABLE 2 for details). 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. THE FINAL GRADE IN THE COURSE IS DETERMINED BY THE LECTURE INSTRUCTOR.					
	TABLE 2		POINTS		
	Task	Pts	#	Total	
	Labs	20	5	100	
	Lab exams	100	2	200	
	LAB TOTAL :		300*		

1E	REGISTRATION
DEADLINES • Registration deadlines (<i>TABLE 3</i>) are <i>strictly</i> 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 <i>no exceptions whatsoever</i> . Additionally, due to liability concerns, you may not attend this class unless you are enrolled or auditing. 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.	
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>I am required by contract to drop you from the course</i> , unless you inform me in writing as to why you were absent. Additionally, if you are absent without excuse before the drop deadline (see <i>TABLE 3</i>), you may be automatically dropped from the course so that students from the wait list may add the course instead. <i>After the drop deadline, you are entirely responsible for initiating any drops or withdrawals from the course.</i>	

TABLE 3	REGISTRATION DEADLINES
ADMINISTRATIVE DEADLINE	DATE
Add or audit this course	10/4/26
Drop with refund and/or no grade record	10/4/26
Withdraw from this course	11/13/26

1F	ASSESSMENTS
TYPES OF ASSESSMENTS • <i>Lab exams</i> are focused solely on material presented in lab. Questions on lab exams will include material presented during lab lecture as well as any calculations or spectral 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. <i>No multiple choice questions will be given.</i> TIME AND PLACE • All lab exams will be held in-person in lab lecture at the beginning of class in room SC2210 .	

1G	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)
1H	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/.
1I	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. <i>Absolutely no accommodations can be provided on assessments without a completed TAV form.</i>
1J	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.
1K	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.

TEXTBOOK • *Experimental Organic Chemistry: A Miniscale and Microscale Approach, 6th edition by John C. Gilbert and Stephen F. Martin (Cengage Learning: 2016; ISBN 978-1-305-08046-1)*

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 4		LAB SCHEDULE				
WEEK	DAY	EXAMS	LAB TECHNIQUES	THEORY	PROCEDURE	ACTIVITY
1	9/22		2.1 – 2.6	—	—	<i>Introduction and syllabus</i>
	9/24		2.17 – 2.19, 2.21	155 – 163	163 – 165	<i>Lab 1</i> – Base and acid extractions: Part B
2	9/29		2.24 – 2.29	155 – 163	165 – 166	<i>Lab 1</i> – Base and acid extractions: Part C
	10/1		2.9 – 2.11	91 – 99	99 – 104	<i>Lab 1</i> – Base and acid extractions: Recrystallization
3	10/6		2.7	111 – 115	—	<i>Lab 1</i> – Base and acid extractions: Melting point
	10/8		—	179 – 184	185 – 186	<i>Lab 2</i> – Thin-layer chromatography (TLC): Plate preparation
4	10/13		—	179 – 184	185 – 186	<i>Lab 2</i> – Thin-layer chromatography (TLC): Plate development
	10/15		2.11	471 – 473	473 – 474	<i>Lab 3</i> – 2-chloro-2-methylbutane: Synthesis
5	10/20		2.13 – 2.16, 2.22	125 – 145	—	<i>Lab 3</i> – 2-chloro-2-methylbutane: Distillation
	10/22		—	235 – 254	—	<i>IR spectroscopy workshop</i>
6	10/27	<i>Lab exam</i>	—	235 – 254	—	<i>Lab 3</i> – 2-chloro-2-methylbutane: Infrared (IR) spectroscopy
	10/29		—	258 – 278	—	<i>Nuclear magnetic resonance (NMR) spectroscopy workshop</i>
7	11/3		4.7	342 – 346	347 – 348	<i>Lab 4</i> – Dehydration of an alcohol: Synthesis
	11/5		—	196 – 206	—	<i>Lab 4</i> – Dehydration of an alcohol: Gas chromatography (GC)
8	11/10		—	258 – 278	—	<i>Lab 4</i> – Dehydration of an alcohol: IR & NMR spectroscopy
	11/12	• COLLEGE CLOSED – VETERANS' DAY •				
9	11/17		—	Hand-out	Hand-out	<i>Lab 5</i> – Relative reactivity of alkyl halides
	11/19			372 – 374	374 – 375	<i>Lab 6</i> – Bromination of (E)-stilbene: Synthesis
10	11/24		—	235 – 254	—	<i>Lab 6</i> – Bromination of (E)-stilbene: IR spectroscopy
	11/26			258 – 278	—	<i>Lab 6</i> – Bromination of (E)-stilbene: NMR spectroscopy
11	12/1		—	301 – 308	—	<i>Mass spectrometry</i>
	12/3	<i>Lab exam</i>	—	—	—	<i>Check-out</i>

3A	ABSENCES
If you are absent from class, please contact me <i>by e-mail</i> 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 3) 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
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 1H). 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. LAB EXAM • 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 at some other mutually agreed-upon time. Due to problems with academic integrity, make-up lab exams will differ from the original versions given in class, although they are of comparable difficulty.	
3C	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 1I for academic accommodations).	
3D	ACADEMIC INTEGRITY
Cheating and plagiarism are two of the most serious academic violations of the Code of Conduct (see SECTION 1J). 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 you are seeking careers in professions that involve the public, I find such behavior not merely unethical but dangerous. <u>Any student(s) caught cheating or plagiarizing on any assignment will automatically receive zero credit for that assignment.</u> 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.	
3E	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 <i>single document</i> in <i>PDF format</i>. Several tools are available for converting a wide range of electronic formats into PDF format.	
3F	STUDENT LEARNING OBJECTIVES (SLOs)
1 • Predict products in reactions of alkanes and haloalkanes by applying concepts from General Chemistry 2 • Generate logical stepwise reaction mechanisms for simple organic reactions. 3 • Construct molecular structures from IR and ¹H NMR data.	

4A	LAB SAFETY
The chemistry department has adopted the following rules from the <i>American Chemical Society Safety in Academic Laboratories Guidelines, 7th edition</i>, 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 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 <i>all</i> 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, <i>no chemicals may be poured into any sink</i>; 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 <i>entire time</i> 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. <i>Refusal to wear your safety goggles during your entire time in lab will result in your expulsion from the course.</i> 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 addition 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 <i>irritant</i>, a <i>lachrymator</i> (causes you tear up or choke), a <i>carcinogen</i> (causes cancer), a <i>mutagen</i> (causes genetic mutations), a <i>teratogen</i> (cause fetal deformations), a <i>pyrophor</i> (spontaneously ignites upon contact with air), or a <i>neurotoxin</i> (attacks the nervous system). Although in <i>relative</i> 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 <i>immediately</i> 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 chemicals, 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 <i>secondary containment</i>, 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 • <i>No chemicals may ever be poured down the sink unless specifically directed.</i> 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 generate 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 reagents 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 <i>add</i> deadline (see TABLE 3) 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 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 <i>quantitative</i> or <i>qualitative</i> 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 • <i>Do not</i> 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 bibliographic 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 $\text{Mg}_3(\text{PO}_4)_2$, not $\text{Mg3}(\text{PO4})2$, and the copper (II) ion should be written Cu^{+2}, not $\text{Cu}+2$. 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 ($^\circ$), 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 (<i>moles of water = mass of water ÷ molar mass of water</i>) or by using logical abbreviations ($n_{\text{water}} = m_{\text{water}} \div MM_{\text{water}}$). 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 $n_{\text{water}} = 10.00 \text{ g H}_2\text{O} \div 18.01 \text{ g/mol H}_2\text{O} = 0.5552 \text{ mol H}_2\text{O}$. 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 be 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 one set of calculations, this is not always the case, and it is also conceptually incorrect.	
6H	ACCEPTABLE COLLABORATION
While it is entirely 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 pH 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 <i>any</i> 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 or 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: <i>acid, base, organic, or oxidizer</i>. 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: <i>acid, base, or organic</i>. 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 pH 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):

- Predict products in reactions of alkanes, haloalkanes and alkenes by applying concepts from General Chemistry.
- Generate logical stepwise reaction mechanisms for simple organic reactions.
- Construct molecular structures from IR and ^1H NMR data.

Office Hours:

SC1214	M,W	1:30 PM - 2:20 PM
SC1214	T,TH	11:30 AM - 12:20 PM