

Syllabus – Organic Chemistry
Laney College – Spring 2019
Chemistry 12A – Section 21481 (Lab 21492)

Instructor:	Professor Joseph Lipson	Lecture:	A – 273	Tu/Th: 1:00-2:15pm
Office:	A-237A (may change)	Lab:	A – 277	Tu/Th: 9:00-11:50am
e-mail:	JLipson@peralta.edu	Course Website (w/ up to date schedule and HW):	Canvas system – Accessed from https://laney.edu Student Email and Canvas Button	
Office Hours:	Tu/Th: 11:50-12:20pm A- 277 and 2:20-2:50pm in A- 237A			

Prerequisite

Chem 1B , (required, or the equivalent from another school, which must have had a chemistry laboratory component)

Required Materials

- **Textbook:** Klein, David R. Organic Chemistry, Wiley, 3rd Edition, 2017
 - *Note: The textbook only comes in loose leaf or e-text. You can find a bundle at the bookstore with both of those and the solutions manual/student study guide (also required)*
- **Solutions Manual and Student Study Guide for above**, Wiley
- **Lab Textbook:** Pavia, et al., A Microscale Approach to Organic Laboratory Techniques, Brooks/Cole, 5th Edition, 2013 (**NOT THE 6th Edition**)
 - *Note: I would buy this used since there is a newer edition it is likely MUCH cheaper used now*
 - *An e-text version is highly discouraged since this is a LAB resource*
- **Lab Notebook:** 100 pages with **carbonless** copy pages. The pages must be sequentially numbered. For future classes they want the kind where the copy page is the perforated one (called bottom perforated).
 - *For example: ISBN-13: 978-1930882744 (ISBN-10: 1930882742) from Hayden-McNeil*
- **Spartan Student v7 Software**
 - *Go to: https://store.wavefun.com/product_p/spstudent.htm*
 - Use discount code Laney25 to get it for \$25 instead of \$50
 - Used in Chem 12B as well
- Scientific calculator (no graphing calculators allowed)
- Appropriate lab attire (see lab instructor for details)

Optional/Recommended Materials

- **Supplemental Textbook:** Klein, David R., Organic Chemistry as a Second Language: First Semester Topics, Wiley, 3rd or 4th Edition
 - *No assignments will be from this book, so an older edition is great*
- **Supplemental Lab Textbook:** Pavia, et al., Introduction to Spectroscopy, 4th Edition, 2009
 - *No assignments will be from this book, so this older edition is great!*
 - **Only get the 4th Edition**
- **Highly Recommended:** Organic Chemistry Model Set (\$25 or less should net you a good one)
 - *It was recommended to me that some students go with Maruzen set number 1013 alpha from this link: <http://www.maruzen.info/hqs/catalog>
 - *This is similar to the one I use (the basic set which has more pieces) at home**
- Your own chemical splash goggles (no glasses allowed)
 - *We provide them in lab, but some students prefer to have their own*

Preamble

Organic chemistry is an amazing subject where we will begin the journey to understanding the chemistry of life, materials, and medicine. The stunning power of organic chemistry allows us to investigate the mechanisms of life, understand them, and harness them to improve humanity. We are reliant on the products of organic synthesis to get through our day. All plastics are essentially organic. That gasoline in your car to get here (assuming you drove)? Yep, that is organic too!

Organic chemistry is often viewed as a challenging subject by many students. The reason for this is that it moves away from the very quantitative, numerical answers of general chemistry onto a more qualitative approach to problem solving. You will be asked to weigh various factors and come to *reasonable* conclusions based on your assumptions, your knowledge, and your ability to synthesize that knowledge into new ideas. Don't panic! We are in this together and we will develop these skills together.

In order to be successful in a subject that so heavily emphasizes the synthesis of ideas (and compounds!), it is essential that you have a deep and nuanced understanding of the material. The most common mistake students make in organic chemistry is trying to memorize it. The course starts off slower in terms of new material because we are still learning a lot of the concepts. When it accelerates to applications, a memorization strategy will be left in the dust, as will the grade of the student who chooses this path.

I was once asked by a student, "Isn't there a shortcut?" There is no shortcut for dedication, hard work, self-reflection, problem-solving, asking questions, and finally understanding. I like to think of learning organic chemistry as a bit like sculpting. You

add new material in the form of concepts to be your clay. It is wonderful and full of promise, but it is unrefined. You then must ask questions to be sure you have enough of the concept to get started. Then you get to work shaping and forming that knowledge into a final and more useful structure. We do this by solving problems, reflecting on the solutions, and then doing more problems. If you don't do the problems, you will have no idea what the boundaries of the ideas are, how they interact with other ideas, and where new ideas will fit in. It can be frustrating at times to shape this knowledge into the right form, but what artist doesn't face the same struggles? This is where learning from our mistakes becomes a major part of the process.

We will delve into exception after exception to the "rules". These are among the most interesting and informative part of organic chemistry. This gives us a depth of knowledge you cannot achieve merely by memorizing a set of facts. You would be surprised to know just how many facts in organic chemistry I have forgotten over the years, but the understanding to rediscover them on my own is ever present. That is what I want you to realize as we takes this journey together.

My Teaching/Learning Philosophy

You are in college to learn to think and learn how to learn. Nobody leaves college knowing how to do their future job. What they have is a framework to build that new knowledge onto, and the skill to do so. In order to learn these skills, I structure my course in such a way that it takes a fair bit of personal responsibility to be successful.

In lecture, we will do numerous active learning exercises to engage your brain in processing the new material. If you don't participate fully and accountably, you will not get as much out of the class. That includes coming prepared, having finished the previous reading and homework to the best of your ability. I expect students to **ask questions**. I design my lectures so questions should arise and lead to discussions. If nobody takes the bait, it won't be nearly as interesting as it could be.

In lab, I expect not only following instructions, but the continuous attempt to understand the reasons behind every step. In that vein I will circulate around the room and ask you questions about what you are doing. That doesn't necessarily mean you are doing anything wrong, just that I want to push you along this intellectual path. Your partner will be an invaluable resource in this way as well.

If you ever feel like something that I am doing isn't working for you please come share that with me. I often have reasons for why I do things a certain way, and sometimes my assumptions about what results that will bring aren't always correct. I cannot accommodate every student request, but I try and take all feedback to heart and make changes accordingly. Unfortunately, shortening the syllabus is one I just cannot seem to manage...

Attendance/Expectations During Class

I expect all students to be **present and on time** for all lecture and lab meetings. I also know that things outside of our control sometimes happen, so if they do please e-mail me. It is critical to your success to make every effort to make it to class and be on time. This will **save you time** in the end. Attending lecture is amongst the most efficient methods of “studying” and learning the material.

In class I expect you to be: taking notes (not copying verbatim!), working on in class problems, participating in any group activities, **asking questions**, trying your best to answer my questions to the class, remaining awake, and not disrupting the learning experience of other students.

Most lecture notes will be automatically synchronized to the course website in the “Class Notebook” tab. It will require you to log in to access, but you should all be able to open them in OneNote online. If this becomes troublesome, I will save them as .pdf files and toss them up in the Lecture Materials module on Canvas. I do this so there is no reason to panic if you need to listen instead of write, or you miss something. This shouldn’t replace all note taking.

Expectations Before Class

Successful students will skim the sections likely to be covered that day. Sometimes I will jump around a little bit to make connections more apparent, but so long as you have looked at some of the material beforehand you should be able to follow along with the lecture.

I expect all students to have their pre-labs finished before walking into lab.

I expect assignment to be completed on time.

I hope you have eaten something and gotten some sleep before coming into class, especially since lab is 3 hours long first thing in the morning.

Textbook

I expect all students to read the entirety of sections covered. This includes doing the problems in each section and looking at all diagrams carefully. This book does a wonderful job of supplying practice in line with the text and you should take advantage of that and work them all! Those problems are also part of your assigned homework for every chapter.

I highly recommend taking notes as you read or adding to your lecture notes as you go. Combining the information from both sources into a coherent set of notes is a powerful way to start the learning process. Some students do lecture notes on one side of a page and add to them on the other as they read. You should also record all questions you have as you go, so you can ask them later.

Homework/Practice/Engagement (10%)

Homework in this class is **absolutely necessary to your success**. Knowledge of facts and concepts is of little use without the ability to apply it, and that means **problem solving** (*note that if I keep talking about something, it is probably really important*). There is no shortcut to becoming a good problem solver. You have to do lots of problems. You will struggle. You will get frustrated at times, but trust me when I say, "This is the only way to **earn** your problem-solving skills." You may not plan to become a chemist, and you may not even do chemistry in any form again, but you WILL face hard problems that these skills will apply to.

Homework assignments will be collected on the day of the quiz covering that material. Each assignment will consist of the in-chapter exercises, assigned end of chapter problems, and occasionally worksheets or handouts. Some of these will be graded and others will not. I will be spot checking in most cases, meaning if I go looking for problem 48 and you skipped that one you are out of luck even if you did every other problem. Detailed solutions to the problems are in the solutions manual. However, in order to succeed in this class, you must be able to do these problems on a test, without the help of the solutions manual. In order to learn how to do the problems, you need to struggle with them for a while. Don't turn to the solutions manual too soon.

**** When you turn in your homework**, write on the top of the first page the entire HW assignment for that chapter. I want you to circle the problems you didn't complete for that assignment. If you are dishonest here, you will receive **no credit** for the assignment. You must show your work, and also make sure to write the answers in your own words. (It's obvious when people copy the answers from the solutions manuals.) **You are responsible for checking your answers to the homework problems.**

Assigned problems can be found on the course website. They should be completed as soon as we cover the appropriate topics for the question. This will give you the opportunity to **ask questions** and **get help** (*if needed*) before an assessment.

While I **highly** encourage students to form study groups and help each other with problem solving strategies, if you do not attempt and complete the vast majority of assigned problems on your own (go back and do them again if you solve them as a group in order to prove you really understand them) you will *struggle to even pass this class*. When exam time comes around, it will do you no good to have only had someone explain how to do the problems or walked you through them.

If you don't struggle with the problems yourself, no amount of observation will allow you to sufficiently master the material for the exams. If you are having trouble completing the problems without solution guides and the book, you need to spend more time reading, going over notes, and **practicing extra problems** to master the material. You should keep track of which problems in the homework are giving you trouble so you can be extra sure to review them before the quizzes and exams. If you look at the solutions guide or get help with a problem, for your own sake, go back and try it again later. *Everyone learns differently, so find what works best for you and **do it**.*

In this category of points will also be the occasional in class points opportunity I am calling engagement. These will typically be group exercises or brief individual exercises that you turn in. Extra credit will typically only go towards your homework grade.

Quizzes (10%)

Quizzes will *approximately* be weekly and cover material from the previous chapter. Each quiz will usually be given **at the beginning** of lecture or lab. The quizzes will be based on the assigned problems, including the *occasional identical* problem. Quizzes are meant to test whether you are keeping up with the coursework and are typically more straightforward than the exams. I drop the low quiz score.

Exams (40%)

There will be 3 tests together worth 40% of your overall grade. You will not be allowed to use any kind of notes during an exam. Generally, no make-up tests will be given, unless the instructor is notified, agrees to the make-up and arrangements are made before the test is scheduled (e-mail or in person), except in extraordinary circumstances as determined by the instructor. Students qualifying to take their tests with special accommodations must give the instructor the appropriate paperwork the lecture period before the test (preferably sooner).

The exams will require you to demonstrate your understanding of the relevant topics from class and lab. In order to do so efficiently you *must* have sufficient practice from the homework and extra resources provided, including laboratory experiments. This does *not* mean that the questions will be identical to those in the homework and elsewhere, therefore memorization will not serve you well. Expect to face new wrinkles in the problems on the exam, so flexibility will be essential. There will be minimal multiple-choice questions throughout this class.

Your lowest exam score can be augmented by your final exam percentage if this leads to a higher overall grade in the class. Usually only half of the class will get a higher percentage on the final than their lowest exam score, so don't rely on a very high final exam score.

Note: If you are not successful on an exam you are REQUIRED to submit to me, in writing, a short statement outlining your efforts prior to the exam and what you plan on changing to prevent a recurrence of your performance. This is due within one week of receiving your graded exam back. You are also required to discuss this plan with me and get free tutoring in the tutoring center or during my office hours. If you fail to do this, you *may not* be allowed to take any further exams. The intent of this policy is to make changes soon enough to prevent failure in the course, **not** to punish a **momentary struggle**.

Final Exam (20%)

There will be a comprehensive final in this class (9:00 am - 12:00 pm, Thursday, May 23 in A-277). The final is worth 20% of your overall grade and therefore is critical to your success in the class, so don't wait to study until the final days of the class. If your final exam percentage is higher than your lowest exam percentage, I will use it to bolster that exam percentage (roughly replace 50% of the lowest exam score). So every exam still counts.

Laboratory (20%)

The laboratory is an integral part of chemistry and your chemistry education. We will be exploring new concepts, applying concepts from lecture, strengthening our understanding of the physical world, and learning new practical skills in lab. You will be responsible for completing a pre-lab for every new experiment.

Before the Lab (pre-lab):

- **Title** – the title should describe the purpose of the experiment. Example: "Purification and Analysis of Estradiol by HPLC and ^1H NMR"
- **Purpose** - In two or three sentences describe the purpose of the experiment. Example: "Estradiol transdermal patches will be dissolved in an appropriate solvent. The estradiol will be separated by extraction and further purified by preparative scale HPLC. The resulting purified compound will be confirmed by ^1H NMR analysis.
- **Structures/Equations** – For an experiment that involves a chemical reaction, a balanced chemical equation should follow the purpose statement. Organic compounds in the equation should be drawn as structures not listed as chemical formulas (where the structure is known). For other experiments where the structures of the compounds under investigation are known they should also be included alongside their names in a neat and organized table
- **Table of Reagents** – A table with the pertinent physical data for the compounds that will be used in the experiment, or the reaction and organic product(s) of a reaction must be listed in the notebook. You should include molar mass,

physical constants like melting or boiling points. For an experiment involving a known reaction the prescribed number of equivalents to be used should be listed alongside the amount listed in the procedure (in mg and mmol). The actual amounts will vary and will go in a separate data table. Molarities of all solutions to be used should be included here

- **Outline** – Briefly outline the procedure to be following in the experiment. This should not be a list of all the tiniest details in the lab textbook, but a clear and concise description of steps being taken to achieve the purpose. You should include sketches of apparatus to be employed if they are novel.
- Do not leave large spaces between these sections to add more to later. This should span the width of the page and not be in columns.

During the Lab:

- Take pre-lab quiz using your lab notebook only
- Record the actual steps taken in sufficient detail that you could repeat the process months from now
- Record observations
- Record measurements directly into the notebook
- If you use TLC to monitor a reaction you must sketch each TLC plate in the notebook with sufficient labelling that another person could understand what it is they are looking at

After the Lab:

Each experiment will have some sort of post lab workup. This could be in the form of a template you fill out (can be found online) and print. These resemble worksheets. We will have partial lab reports and one full lab report as well. Details will be forthcoming on these.

Other Lab Related Points

You will take a laboratory final for this class in the lab. More details on this as we get closer. This will be worth a percentage of your overall laboratory grade. This will likely require you to be able to perform techniques learned during the semester and show understanding of the principles behind experiments, including spectroscopy.

Requirement for Passing the Class!

If you do not pass the lab portion of the class, you cannot pass the class. Laboratory work is an integral part of organic chemistry and a requirement for further courses. This means earning at least a 65% for your lab grade. Students doing the pre-lab work, showing up on time, following instructions, and working diligently on lab reports outside of class

Al lab reports are due in their entirety at the beginning of lab on their due date

Penalties for Late Work:

Not turned in during the first 10 minutes of class: -5%

Turned in the day it was due but after lab is over: -10%

Turned in the class after it was due: -20%

Turned in 2 classes after it was due: -40%

No work will be accepted more than 1 week late except under extreme circumstances.

Grading

Your grade in the class will be based on a total of points earned in the class. The following is the weightings of each category. Points within one category cannot directly be compared to another, only the percentage you have in that category can be compared.

3 Exams	40%
Quizzes (low dropped)	10%
Lab Work	20%
Homework/Engagement	10%
Comprehensive Final	20%

Grades will be assigned as follows:

A = 88% or above

B = 77% to 87%

C = 65% to 77%

D = 50% to 65%

F = below 50%

The minimum percentage required for each grade *may* be lowered at the end of the class, but will never be raised. (So a 87% might be the cutoff for an A but it won't be raised to 91% for example). Don't count on this!

Important Dates (for a complete list please see the college website)

February 3	Last day to add a full-term class, online , with instructor permission number
February 3	Last day to drop a full-term class, online , to be eligible for a refund
February 3	Last day to drop a full-term class, online , <u>without</u> a "W" on transcript
February 15-18	Holiday – Presidents' Birthday Weekend
March 21	No Instruction – Professional Development Day
April 1-7	Holiday – Cesar Chavez Day and Spring Recess
April 26	Last day to withdraw from a full-term class <u>with</u> a "W" on transcript
May 23	Final Exam (9-12pm) in A-277

My Role

I will do my best to help you take your newfound knowledge and distill it into something clear and meaningful. We will work *together* to understand how all the, sometimes, apparently disparate, topics fit together into a deeper understanding of the natural world. As you learn the concepts, we will use those to solve new and interesting problems. We will also work in reverse, where we look at problems and their solutions to derive a better conceptual understanding. While I am always eager to assist you in your journey for knowledge...

The final responsibility for learning lies with you.

I am available to answer questions, clear up misunderstandings, clarify concepts, and help you hone your problem-solving skills. I implore you to **ask questions** during lecture when a topic or statement doesn't make sense, or you are just curious about something. **I love questions.** Don't worry if you aren't sure the question is pertinent to the discussion. That is my job, not yours. It does neither of us any good to keep going with lecture when anyone is lost or confused. If I ever appear confused or concerned by your question, it is because I am trying to think about the topic in a different way to better explain it for you, not that lack of understanding is in any way a problem. If there isn't time to answer the question right then, I will do my best to get you an answer as soon as possible afterwards. You can always seek my help during lab (as time permits) and in office hours. Office hours can be used for anything you want, including just sitting there to read the book or do your homework. I am also available by e-mail. I will open discussion forums on the website if students are interested in using them.

Where to Get Help

Laney College has a free tutoring center in Eagle Village - 1 (check to see if it had been moved since this writing). The hours that chemistry tutors are available will be posted once we know them. Not all tutors are qualified to help with organic chemistry, so I will try and find out which ones you should go to. Tutors aren't there to do your work for you but to give you hints and advice on solving the problems. I also encourage you to work with your classmates. Many times, they are your best resource, and you should get phone numbers and e-mails so you can get together and solve problems. There are often online resources students find that can be very helpful, so don't forget to look if you are lost and in need of immediate help, just be careful that your sources are reliable. Lastly, I am available in office hours, and by e-mail, so **please don't hesitate to ask**. I am here to assist in your chemistry education, and I am happy to be of help.

Disability Support Services

Accommodations: Students with documented learning and/or physical disabilities may receive reasonable classroom and/or testing accommodations. Please make these arrangements with me at the beginning of the semester or as soon as possible after documentation has been determined. Last minute requests may not be determined to be "reasonable." Students with disabilities are encouraged to meet with me in private to discuss their services and accommodations. Please bring your "Services and Accommodations" form from the Disability Services Program to our meeting. This information will be kept confidential and will not affect your grade. Also, students who think they could use support from the Disability Services Program for temporary or permanent conditions, or if you suspect you might have a learning disability, please visit their website (<http://www.laney.edu/wp/dsps/>) and contact their office (510-464-3428) in Building E, Room 251.

Helpful Tips

- 1) Plan on spending **15+ hours** of your week on chemistry outside of class. You cannot do everything on the weekends, so plan to invest a few hours a day in reading, doing problems, preparing for lab, and completing lab reports. For some students it takes *considerably* longer to achieve the level of mastery required for the course. Keep this in mind.
- 2) *Read* the textbook. If you read the material before you come to class you will be able to focus more on the way I present/view the material and connect the material together than focusing on basic definitions and terminology. Furthermore, as you read take notes and write down questions you may have so that you can ask them during lecture when I cover that topic. There will be nuances that I won't have time to emphasize in lecture and I *expect* you to get from the textbook.
- 3) *Be organized!* By keeping your notes, problems, and lab material well organized you can find things when you need them and not lose track of important papers. Furthermore, use the schedule I give you to keep track of when tests/quizzes are, when topics are being covered, and what is going on in lab. Being prepared requires knowing when things are needed.
- 4) *Practice, practice, practice.* You cannot learn to do problems simply by reading about them. You have to try your hand at the problem, play with it, and eventually overcome it in order to learn the necessary skills.
- 5) *Don't try to memorize your way through the class.* There is a reason behind everything in chemistry and understanding those basic reasons allows you to predict many behaviors so that you don't have to memorize them. Memorization fades quickly, but fundamental understanding lasts. (This is my foremost personal strategy for learning chemistry, or anything really!)
- 6) *Be assertive.* You are here for your education, first and foremost. **Ask questions** when you have them. You probably have been told dozens of times that there are no stupid questions, and it is actually true! The only "dumb" question is the one you

don't ask. Waiting only makes it harder, but you have to be willing to ask for help to receive it. If you need assistance in lab, the instructor won't know to come help you if you don't get their attention. No one knows what you need better than you, so don't rely on us to guess what it is you need to succeed.

- 7) *Get help early!* So often the first time I hear from a failing student is halfway through the semester when it is very difficult to turn things around. **Come to office hours whenever you like, for any reason you like.** Seek help from your classmates and friends. There are lots of resources available if you are willing to look or ask for them.

Miscellaneous Policies

Absences

I would appreciate your notifying me of your intentions to stay in or drop this course if you are absent for 2 days or more. If 4 days of class (do not need to be consecutive) are missed, the student MAY be dropped from the course. Do not rely on the instructor to drop you however! Always file your paperwork (usually available via online systems) with the Admissions Office. There are also financial aid implications to your decision to drop or remain in the course, so please look into that before making your decisions.

Technology

Please be polite and turn off cell phones during class time. They cannot be used while taking tests. No texting in class! Recording of any kind must be approved by me (state law), and if you are using an electronic device to take notes, pictures, or access suitable resources please let me know beforehand. Please make every effort to stay awake in class as you will miss valuable information/announcements and distract your neighbors.

Class Materials

You are responsible for picking up all handouts and returned materials. Extra handouts and any returned materials not picked up will be available after class, during lab, or during office hours (depending on when it was returned). In addition, almost all of the materials traditionally handed out will instead be posted online using the course website. If you have trouble accessing the website please let me know immediately.

Academic Integrity

Academic dishonesty is defined as "an act of deception in which a student claims credit for the work or effort of another person or uses unauthorized materials or fabricated information in any academic work". This includes (but is not limited to) copying or

collaboration on a quiz, test or **assignment (especially lab reports!!)**, use or attempted use of unauthorized materials, altering or interfering with evaluation documents, falsifying experimental data or results, plagiarism, and assisting another student in an act of academic dishonesty. It is appropriate for you to seek help from your instructor, tutors, and your colleagues. I encourage you to work together; as a matter of fact we will sometimes work with partners/groups in the laboratory to collect data. This does **not** mean that copying or working together and submitting identical lab work is acceptable (including calculations and equations). Each person should work on his/her own lab report **individually** (even the graphs!).

Any students caught cheating on a quiz, test, or lab will receive a zero for that quiz, test, or lab, and a disciplinary report will be filed with the appropriate office. A second instance of cheating in this course will result in an "F" in the course. We have to maintain our academic integrity because you want your academic record to count for something. Nobody would respect your degree or credits if our integrity can be questioned.

Let's have a fun, successful, informative, and productive semester!

Course Details:

Course Description

Introduction to structures, nomenclature, properties, and reactions of carbon compounds: Hydrocarbons, monofunctional and polyfunctional compounds; emphasis on structures and mechanisms, spectroscopy, and other analytical techniques. Laboratory work includes reactions, purification techniques, measurements, qualitative analysis, and use of instrumentation.

Student Learning Outcomes (What you should be able to do at the end of this class)

The following is a list of the student learning objectives (SLO's) and the ultimate goals for this Organic Chemistry class.

1. **Nomenclature** - Apply naming rules (nomenclature) to name or draw the structures for organic molecules and, where appropriate, indicate stereochemistry.
2. **Bonding** - Describe the overall structure and properties of organic molecules using the principles of chemical bonding, atomic hybridization, and orbital theory.

3. **Mechanisms** - Apply thermodynamic and kinetic principles to characterize organic chemical reactions and mechanisms.
4. **Spectroscopy** - Use common spectroscopic techniques (NMR, IR, UV/Vis, MS) to determine the molecular structure of organic compounds and also to correlate with chemical reactivity.
5. **Lab Safety** - Operate in the laboratory using routine acceptable safe laboratory practices to handle chemicals, glassware, and common laboratory equipment. (Apply the precautionary principle when handling hazardous materials, especially those of unknown toxicity.)
6. **Notebook** - Record laboratory results and data correctly in a scientific notebook and report and interpret results using appropriate notational and descriptive content in standard scientific format.

Institutional Learning Outcomes (what you should get from any class at Laney)

The following outcomes (ILOs) are what we expect all students at Laney College to receive in any course:

1. **Communication** - Students will effectively express and exchange ideas through various modes of communication.
2. **Critical Thinking and Problem Solving** - Students will be able to think critically and solve problems by identifying relevant information, evaluating alternatives, synthesizing findings and implementing effective solutions.
3. **Career Technical Skills** - Students will demonstrate technical skills in keeping with the demands of their field of study.
4. **Global Awareness, Ethics and Civic Responsibility** - Students will be prepared to practice community engagement that addresses one or more of the following: environmental responsibility, social justice and cultural diversity.
5. **Personal and Professional Development** - Students will develop their knowledge, skills and abilities for personal and/or professional growth, health and well-being.

Course Content (*Note: Each topic is not equally weighted and this isn't necessarily the order we will follow*)

Lecture Content:

1. Carbon compounds and chemical bonds 8%
2. Polarity, resonance, acid/base - Bronsted-Lowry, Lewis 10%
3. Alkanes and cycloalkanes: Bonding, naming, properties 8%
4. Conformational analysis, thermodynamics, kinetics 8%
5. Alkenes and Alkynes I: Bonding, naming and properties 8%
6. Alkenes and Alkynes II: Addition reactions, oxidation/reduction reactions 8%
7. Stereochemistry 10%
8. Radical reactions 8%
9. Alkyl halides 8%
10. Nucleophilic substitution (S_N1 , S_N2) and elimination reactions (E1, E2) 10%
11. Spectroscopy I: NMR, IR, Mass spectrometry 6%
12. Alcohols, ethers, thiols, sulfides 8%

Lab Content:

Laboratory experiments that support the topics listed in the lecture content utilize combinations of the following techniques and methods:

(50%) Laboratory techniques: Melting point, fractional distillation, thin-layer chromatography, gas chromatography, high-performance liquid chromatography, liquid-liquid extraction, recrystallization.

(30%) Spectroscopic techniques: Infrared spectroscopy, mass spectrometry, nuclear magnetic resonance spectrometry

(20%) Synthetic methods: Reactions and synthesis of representative functional groups