Quarter: Fall, 2020
Chemistry 2010, Elements of Organic Chemistry
Lecture: Section 2010-01, Tu,Th 8:30-9:45 am
Room: Synchronous Zoom Lectures (CRN 73717)
Classes begin: Thursday, August 20
Classes end: Friday, December 11
Final Week: Monday, Dec. 14 – Friday, Dec. 18
Last day to withdraw without a W: Wednesday, Sep. 2
If you withdraw between Sep 3-17 you will get a W
To withdraw on Sep 18 or after you need to petition with a serious or compelling reason.

Phil Beauchamp, Professor
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Office Hours: Zoom times, Tu, W 10-11 am, F 4-5 pm
Tentative times, sometimes I help at my wife's dental office in COVID times (unpredictable)
You can also email me questions, attach a scan of your work.

Check your Cal Poly email for messages sent about Chemistry 2010 (Fall, 2020). I also use Blackboard.

I. **Catalog Description** - Fundamental concepts of organic chemistry will be covered. Lecture-discussion. Prerequisite: Chem 123/123L (quarters) or 1220/1220L (semesters). Chem 2010L is a co-requisite. The lab is not required for the lecture, but the lecture is required for the lab. Not sure how labs will run in COVID times.

II. **Text and References** – We will use a book I wrote, which is available at Amazon.com for $25 + tax? (I notice that Amazon currently lists it as $16.25.) (Essential Logic of Organic Chemistry, Phil Beauchamp). A solutions manual is also available at Amazon.com for $12 + tax. There are used books that cost less (varies depending on who is selling). If you have Amazon Prime, you do not have to pay shipping when ordering a new book, and get next day delivery. Quiz and exam keys will be posted as they are made. Currently, the textbook is available at Cal Poly Bookstore: $29.95 (new), $16.75 (used). The solution guide is $12 (new), $5.31 (used). There are some other options listed at the Cal Poly Bookstore web page.

III. **Expected Outcome**
You should have a working knowledge of the basic principles of organic chemistry.

IV. **Technology** - Access to a device with audio, microphone, and webcam capabilities, Scanner, scanner app, or camera and the ability to combine several images into a single pdf

V. **Tentative Schedule of Coursework -** Tentative schedule on last pages (could be slower or faster).

VI. The method of evaluation has been changed because of remote teaching.

Method of Evaluation	**Variable Grading Scale - Your Choice**
Assignments and Quizzes (multiple per week)	30%
Midterm	30%
Final	40%
Total	100%

Homework (Assignments and quizzes) is crucial for your success in this course. I tend to give multiple assignments every week to keep you thinking about organic chemistry. Homework and quizzes will be turned in as pdf files that you upload to Blackboard. If there are multiple pages, please group them into one pdf file. If I spend 1 minute on each student's assignment and entering the grades in excel it takes over 3 hours and at least ½ hour to copy them into Excel. It usually takes me longer than that. I assign a holistic grade on each problem in an assignment or quiz for every student. Assignments or quizzes might be worth 10 or 20 points. I factor in a 20% "effort" part of the grade (2 pts or 4 pts) for an honest effort whether you are correct or not. If it is a quiz, there is no "effort" part of the grade. I will drop the lowest 2 scores of either assignments or quizzes. Overall, this will contribute 30% to your grade. This part of the grade has some 'padding,' based on your effort in the course and tends to be higher than exam scores. **Don't let this gift slip away.** Because lecture time is limited, we cannot cover everything in lecture that is in the book. I assume you are in the course to learn organic chemistry and I assume you are doing the reading and working the problems. This is probably an inaccurate assumption on my part. It is human nature to procrastinate and put things off until the last moment, but in this course that is deadly. This is a **VERY FAST** moving course. Please, **DO NOT FALL BEHIND!!! You will not recover.**

Because this course is taught remotely it is easy to let days go by without looking at or thinking about the course material. There is an extra burden on you to have the discipline to keep up with the material. The longer you let days go by, the more frustrating (and difficult) it will be to try and catch up. Usually the material becomes overwhelming when that happens and you give up. Try to schedule "time certain" everyday for your study time (in all of your courses). You will have a much better experience if you can do that.

Midterm and Final Exam

There will be 1 midterm (30%) and a final exam (40%). The midterm will come after Chapter 8 (Acid/Base Chemistry). Each exam will cover all material presented to that point of the course (cumulative exams). The midterm is ***tentatively*** scheduled for Thursday, October 8th depending on how we are covering the material. The final could count 40% or it could count 75% if you do not take the midterm. **On all exams you are allowed one 8.5" by 11" page of notes (both sides)**. You can include any information that you desire on this page of notes. Obviously, I cannot control what you actually do, but I must trust that you respect the conditions of the course. All partial credit counts. I tend to grade easier on "assignments" and harder on "quizzes and exams". I will schedule a large time window to during which you can access the quizzes and exams, but a smaller time limit to actually take them. Overall course grading will be approximately based on the following percentages. It is too your advantage to turn in all the assignments as there are less time constraints on those and they are graded easier (effort points).

	Overall Average	
A	85-100	
B	70-84	
B-	68-70	(B- is a special grade for Foods & Nutrition)
C	55-69	
C-	50-54	(C- is a special grade to take Biochem 3210)
D	40-49	
F	below 40%	

There will be no makeup exams. **If you take the midterm exam, it counts 30%.** If you miss the midterm or do not want to take it, then the final exam will count the additional amount (final exam = 40% or 30 + 40% = 70%). In borderline cases, I will look at the homework portion to make a decision about the grade, since this is an indicator of your effort in the course. Samples of recent prior Chem 2010 exams (and even some keys) are posted on my 'Exams' web page up at the top of the page. However, those exams mostly extend through a 10 week quarter and designed for "in-class" testing. The only semester examples are from the last few semesters. We cover more material in a 15 week semester. Here is the link to my "Exams" web page. Link: http://www.cpp.edu/~psbeauchamp/sample_exams.html

Final Exam Schedule: Double check this to make sure I did not make a mistake. (Please let me know if I did.) If the final exam is cancelled for any reason (has never happened in my 40+ years of teaching), then the overall grade will be determined by the midterm (50%) and homework/quizzes (50%).

Chem 2010-01, Tu,Th (8:30-9:45 am), Final Exam is on Thursday, December 17, 2 hour time window, plus 0.5 hour to scan and upload pages (2.5 hours total).

Cheating and Plagiarism

The University Policy on cheating is DON'T! You are NOT allowed to use your cell phone or the internet on quizzes exams. You **are** allowed ONE page of notes on exams (however, both sides). Any student caught cheating on an exam or quiz will be given a zero on that work. On the midterm or final exam that is effectively an F in the course. A memo will also be placed in your student records. "On-line" it is much more difficult for me to detect this, but if I confirm it you will get the F. You are in college to learn; cheating does nothing to further that goal. It can be helpful to form small groups (2-?) to study together, though usually active participants gain much more than passive participants. In some previous courses, the Learning Resource Center (LRC) offered study sessions every other week. I am not sure if that will be available remotely. The bottom line is that at some point you have to do your own work. I have not used it before, but we can see if the "Discussion" section of Blackboard might help here.

Free advice (for what it's worth)

Working problems is how you learn organic chemistry (and most other subjects as well). The list of homework problems represents the absolute minimum necessary to have a chance at passing this course. Is it enough for you to learn the material? Probably not. You really need to do as many problems as it takes for your particular mind to absorb the material, and check your answers to discover what you did wrong, and repeat them to correct your mistakes. You are not born with "intuition" for organic chemistry, though a strong background in freshman chemistry helps. Essentially, you have to learn everything as you go along because there is no time to "catch up". If you think of other skills you might have learned in your life (music, athletics, driving, cooking, sewing, etc.) repetitive practice of every detail is required, over and over, maybe even 100s of times! How much practice you need in this course depends on your prior chemistry knowledge and overall science background. Bottom line: one look at a problem won't do it. Also, the quality of your effort is probably more important than the quantity of your effort. Quality means developing correct answers using your own brain, not copying answers from a key. Compare doing a workout vs. watching an exercise video.

The assignments show me that you made some minimal effort, outside of class, to learn the material, and I am willing to reward you for that effort (20% effort points). For many students taking organic chemistry, this is a make or break course. Only you know how important it is to your future. One thing is certain: that 40 year lifetime goal you have won't happen unless you get through this 15 week organic chemistry course. To do well in this course you probably need to invest about 2 quality hours/day (that should get you an A or a B). Consider this investment vs. the payback.

Investment = (15 weeks) x (7 days) x (2 hours) = 210 hours of hard work in organic chemistry
versus
Payback = (40 years) x (52 weeks) x (7 days) x (24 hours) = 349,440 hours enjoying your career choice.

A 210 hour grind vs. 349,440 hours of future satisfaction (career, family and other life details). Wait you say, I have other important stuff to do in my life (job, commuting, family, other college courses, Instagram, etc). Yes, those are all important, but for the next 16 week period you need to squeeze in the time it takes to succeed in organic chemistry (fill in whatever crucial course it happens to be). You need to approach this course like your life depends on it, because it does. **It you don't make it this time, it will cost you a minimum of another 16 weeks of your life in some future semester to make it up (and that's a whole lot more expensive than 210 hours), and you will still have to put in the work. If you are repeating this course, you can contact me in the first week to discuss a different strategy to succeed this time.** Officially, you can only take a course 3 times at Cal Poly and every time it is half of a school year (though I have heard of students petitioning to take a course more than 3 times)!

The course is just beginning. Right now, you have the most control over what happens in this course. Don't let this opportunity slip away into empty wasted hours. If you have questions as you are studying, use the answer keys or email me or visit my virtual office (keep a sheet where you write out your questions as they occur to you, otherwise you will forget them). However, do not request help with a blank piece of paper. I need to look at your work so that I can see how your mind is operating to see where you are doing things right and wrong.

I am not you, and I am not your parent (though I am acting like it in this message to you). I am just some random professor in a course that students typically think is hard. My advice: turn off the electronics and turn on your brain while you focus on the challenges in front of you. I find that old fashioned pencil and paper work best. Google won't make it happen. You might just find there is some powerful, exciting stuff going on between your ears. We'll know in about a week or two into the semester how it will likely turn out, because every lecture is packed with information and missing even one lecture puts you in a hole almost too big to climb out of. Will that be you? I hope not. If you have the book before the first lecture, I think we already know how this might turn out.

Remember, the assigned homework/quizzes represent a minimum effort for your organic grade (30%). Maybe it will be enough for a C (…or maybe not). Some foods and nutrition majors need a B- to take a senior level sequence and to take Biochem 3210 you need a C-. Remember, you are not doing the work for me, you are doing it for yourself!

Overall percents for course grades: 85=A 70=B 68=B- 55=C 50=C- 40=D

* I drop the 2 lowest HW/quiz grades.

Syllabus Quiz (Beauchamp) Name _____

Due: First day of class (Thursday, August 20). Scan and upload to Blackboard.

This syllabus quiz will give you a preview of how I am structuring this course. Long answers are not expected or desired for this quiz. Homework is often due over material covered to that date. You have opportunities to pre-read the lecture notes and try problems before our lectures. This will help you better understand the lecture. You can also visit zoom office hours or email me and ask questions, or pose questions in the discussion area on Blackboard. You will know pretty quickly, if you are keeping up or falling behind. The last day to drop, without a petition or a W, is Wednesday, September 2. After that date a "W" will be recorded on your transcript. If you are unable to do the work, drop the course now and avoid a "W" (Sep 2 deadline) which counts as a repeat of the course (taking a course 3 times is the 'official' max at Cal Poly), however a W is better than a bad grade (Sep 3-17 without petition).

1. Get the name and phone number and/or email address of another student you can contact in case you miss a lecture? Just include the name here, not the phone number. Is there someone else you could also contact?

2. What is my email address?

3. What are the prerequisites for this course?

4. What is the textbook for this course? Is there a solution manual? Where can you purchase the book? How much?

5. What should you write on all of your textbooks, course notebooks and lecture notes in case you lose them?

6. Is homework required? How is it graded? Might there be quizzes? All together, how much do they contribute to your grade?

7. How many problems should you to try to succeed in this course? How many times should you try them?

8. What is the format of the exams? Where can you find examples of prior exams and exam keys?

9. Can you use any supplemental material on the exams?

10. How many exams are there in this course?

11. What parts of the course does the final exam cover? When is your final exam (date and day)?

12. Briefly, how do you earn your grade in this course? Is there more than one way to earn your grade?

13. What is the course policy on cheating? How about studying together in a group? What is your obligation to the group?

14. What should you do before every lecture in preparation for the lecture? Why might you want to do this?

15. What are some possible strategies you can use to have a better chance of succeeding in this course?

16. What can you do if you do not understand the material?

17. Have you taken this course before? If so, how many times? If you want, contact me by email to discuss a possible better strategy.

18. List at least two generic reasons for knowing something about organic chemistry that mean something to you.

19. Generate a question of your own, and answer it.

Page numbers to problems in each chapter. Each assignment/quiz counts 10-20 points toward the homework grade. I drop your lowest 2 scores. There is a solutions manual you can buy. First try to do the problems by your own effort. Try to only consult the key after you have made an honest effort to do a problem. Lectures are only 75 minutes long, not enough time to cover all the material in the book. That job belongs to you. If you really need help, consider virtual office hours and/or email. Embrace the challenge, don't avoid it. You learn the material in the struggle, not by copying answers.

Chapter 1 (p 5-46) Atomic Structure, Z_{eff}, electronegativity, formal charge, resonance, hybridization, 2D, 3D
Probs –
1 (p.7), atomic config. (H through Cl)
2. (p.8) Z_{eff} (all)
3 (p. 10) ionization potential (a-c)
4 (p. 10) ionization potential (all)
5 (p. 10) trends in atomic radii (all)
6 (p. 10) a,b,c,d, various trends (all)
7(p. 12) bond polarity (a,b,c,d,g,h,i,j,p)
8 (p. 17) 3D sp hybrid
9 (p. 18) 3D sp2 hybrid
10 (p. 20) 3D sp3 hybrid.
11 (p. 23) hybridization (1,2,3,4,7,11,13,16,15,17)
12 (p. 24) hybridization of lone pairs
13 (p. 24) nitrogen with 4 bonds?, oxygen with 3 bonds?, fluorine with 2 bonds?
14(p. 25) hybridization (1,2,4,7,8,11,12,13,15,16,17,19,22)
15 (p. 29) formal charge a-f, l, r, u (and rows 1,2,3,4,7,8 on pages 30-31)
16 (p. 35) 2D structures (b,c,d,g,h,j,k,n,o,p,r)
17 (p.35), 2D structures (a,b,d,e,k,l,m,p,t)
18. (p.36) 3D (CH compounds) a,c,e
19 (p. 38) 3D (CH compounds) b,c,d,e,f,g,i,k
20 (p. 44) 3D (other atoms) a,b,c,d,h,i,j,k

Chapter 2 (p 47-70) Types of Bonding, Physical Properties (mp, bp), Solubility
Probs.
1 (p.51), do rows K+, Zn+2 and Al+3
2. (p.52) dipole arrows (b,c,d,e,g,i,j,m,t)
3 (p. 57) Δ mp (a,c)
4 (p. 61) Δ bp (columns 4B and 6B)
5 (p. 61) Δ bp (a,c,d,f)
6 (p. 63) Δ bp (a,c,e)
7 (p. 64) match bp's
8 (p. 67) solvation (DMSO, MeOH)
9 (p. 67) density
10(p. 67) mp/bp NaCl, solubility
11 (p. 67) a (NaCl in DMSO vs hexane)
12 (p. 67) vitamins (water vs fat soluble)
13 (p. 69) a (carbs vs fats)
14 (p. 69) bile salt

Chapter 3 (p 71-92) Isomers, functional groups, degrees of unsaturation
Probs –
1 (p.81), C_{18} isomers
2. (p.82) isomers, C4H9Br (4), C6H13F (17)
3 (p. 84) isomers, C4H10O (7), C6H14O (32, do 10 alcohols and 10 ethers)
4 (p. 85) isomers, C4H11 (8), C6H15N (39, do 3 each of primary, secondary and tertiary amines)
5 (p. 88) degree of unsat., a,c,e,g,i

6 (p. 88) alkenes (6) and cycloalkanes (6), C5H10
7 (p. 87) C5H8, two of each possibility
8 (p. 90) degree of unsat, a,c,e
9 (p. 90) degree of unsat. a,b,c,d,e
10 (p.91) degree of unsat, a,b,d,e
11. (p.91) functional group isomers, 7 parts, C5 isomers
12 (p. 91) isomers of CH3NO2, draw 4

Chapter 4 (p 93-145) Nomenclature, functional groups, common terms
Probs –
1 (p. 97) a,b,c,d, alkanes
2 (p. 102) a – r, common names
3 (p. 104) a,c,d, cycloalkanes
4 (p. 107) a,b,c,d,e, priorities
5 (p. 107) a,b,c,d, E/Z
6 (p. 110) a,c,d,i, alkenes
7(p. 112) a,b,c,e, alkynes and alkenes
8(p. 114) a,c,e,g, alk-en-ynes
9 (p. 138) a,c,e,h, functional groups
10 (p. 139) k, functional groups
Be familiar with "in lecture" examples

Chapter 5 (p 146-161) Conformations of chains
Probs –
1 (p.152), hexachloroethane
2. (p.158) 2-methylpropane, C1 → C2
3 (p. 159) 2-methylbutane, C1 → C2 and C2 → C3
4 (p. 159) CH3NH2, CH3OH, fill in energy table
5 (p. 159) 2,3-dimethylbutane, C2 → C3
6 (p. 160) ΔH calculations for 360^o rotations (use energy tables: eclipsing and gauche)
7(p. 160) ΔH calculations for 360^o rotations (use energy tables: eclipsing and gauche)

Chapter 6 (p 162-184) Conformations of cyclohexanes (1 and 2 substituents)
Probs –
1 (p.164), cyclohexane, Newman projections
2. (p.172) which boat? Flip-flop between two chairs
3 (p. 174) substituted cyclohexanes, axial preferences? Why?
4 (p. 182) dimethyl cyclohexane conformation possibilities and preferences
5 (p. 182) bromomethylcyclohexanes, conformations, Newman projections, energy, equilibrium mixture
5 (p. 183) trisubstituted cyclohexanes, 2,3,4,5,8,12,20,24

Chapter 7 (p 185-213) Stereochemistry
Probs –
1 (p.197), R/S absolute configuration, chiral centers
2. (p.198) evaluating priorities (pi bonds too)
3 (p. 207) full exam style problem, Fischer projections (2 chiral centers)
4 (p. 208) full exam style problem, Fischer projections (3 chiral centers)
5 (p. 209) full exam style problem, Fischer projections (3 chiral centers)
6 (p. 210) glyceraldehydes, 3D
7 (p. 210) redraw Fischer, Newman, sawhorse figures
8 (p. 21012) polyalcohol carbohydrates, R/S, types of stereoisomers
10 (p. 212) find chiral centers in cholesterol

Lecture 12 (Thurs of the 6th week, Feb 9th) **Midterm Exam** 1

Chapter 8 (p 214-246) Acid/Base chemistry
Probs –
1 (p.216), show acid/base reactions with acid, HA? a,c,d,e,g
2. (p.217) show acid/base reactions with acid, HA? a,c,d,f,g
3 (p. 217) show base reaction with t-butyl carboncation (at C vs at H)?
4 (p. 219) stronger/weaker acid than water? a,b
5 (p. 219) stronger/weaker base than hydroxide? a,b,d
6 (p. 220) order acids from strongest to weakest? b,e
7 (p. 220) stronger/weaker base than hydroxide? b,e
8 (p. 220) predict Keq? a
9 (p. 221) estimate Keq? a,b
10 (p.222), ΔG for reactions in water? d,e
11. (p.223) PE vs. POR diagram from prob 10? d,e
12 (p. 228) predict order of base strength? N,F,O,C
13 (p. 228) X-OH acidity, inductive effects
14 (p. 229) substituted ethanoic acid pKa's, inductive withdrawing or donating effects? a,b,h,i,j,k
15 (p. 229) ROH inductive effects
16(p. 230) substituted carboxylic acid inductive effects (distance and number)?
17 (p. 230) carbanion and carbocation stability? a,b
18 (p. 230) b
19 (p. 232) hybridization and acidity, sp, sp2, sp3? a
20 (p. 233) hybridization and acidity? a
21 (p. 233) hybridization and acidity? b
22. (p.235) delocalization, choose stronger acid, a
23 (p. 235) delocalization, choose stronger acid, c
24 (p. 235) delocalization, choose stronger base, a
25 (p. 236) explain pKa's b
26 (p. 237) weaker base? a,b
27 (p. 237) most acidic H, b,c,,d
28 (p. 238) write full "arrow pushing" equations, in strong base, a,b,c,d,e,f,g,h,i,j,
29 (p. 240) most basic in amide (N or O), compare to acid? a,c
30 (p. 241) write full equations, in strong acid, a,b,c,e,f,g,i,l

Chapter 9 (p 247-299) SN/E chemistry
Probs –
1 (p.254), SN2 attack,? a
2. (p.249) better nucleophile? a,c
3 (p. 256) SN2, E2 mechanism details, do as many as necessary to understand
4 (p. 262) base hydrolysis of ester
5 (p. 263) hydride as base
6 (p. 263) aluminum hydride as nucleophile
7 (p. 264) location of leaving group?
8 (p. 268) SN2 or E2 mechanism? Do as many as necessary to understand
10 (p.268), different Cβ-H and possible E2 products
11. (p.268) alkyne stability
12 (p. 268) E2 vs. SN2
13 (p. 269) E2 vs. SN2
14 (p. 269) E2 vs. SN2
15 (p. 270) stereochem of E2
16(p. 271) alkyne synthesis and mechanism details, 1st example
17 (p. 272) supply reaction details, a-i
18 (p. 273) SN2/E2 products, first two rows using hydroxide, ethanoate, cyanide and acetylide nucleophiles
19 (p. 277) leaving groups (Cl, Br, I)
20 (p. 278) SN1 b

21 (p. 279) E1 products
22 (p. 280) SN1/E1 products
23 (p. 281) rearrangements, b
24 (p. 282) lanosterol rearrangements
25 (p. 287) ROH + HBr a
26(p. 288) acyl substitutions, acid chloride + amine
27 (p. 289) toaylate synthesis, 3,4
28 (p. 290) E2 mechanism, ROH + H2SO4 / heat
29 (p. 291) butanol + hydroxide or H2SO4
30 (p. 294) SN2E2 conditions vs. SN1/E1 conditions
31 (p. 294) Possible SN/E conditions with C6H13Br isomers, do 1,2,11,13 (know others)

Chapter 10 (p 300-325) Free Radical Chemistry – Substitution and Addition
Probs –
1 (p.303), which bond breaks?
2. (p.308) ΔH ?
3 (p. 310) Free radical substitution mechanism, use Cl
4 (p. 312) predict relative amounts of product
5 (p. 312) predict relative amounds of product, a
6 (p. 316) predict relative amounds of product, b
7 (p. 320) Free radical addition of HBr to alkene, mechanism arrows, anti-Markovnikov addition
8 (p. 320) Free radical addition of HBr to alkene, mechanism arrows, anti-Markovnikov addition, mechanism arrows
10 (p.322), Propose synthesis, c,d,e,f,k,l,o,r,s,w,y,z,aa,bb,cc,ff,gg,hh,jj,ll,oo,pp,uu (do a few, know all of them)

Chapter 11 (p 326-357) Oxidation, C=O addition, Acyl Substitution, Synthesis
Probs –
1 (p.327), oxidation states of carbon
2. (p.327) energy content in glucose vs. hexan-1-ol
3 (p. 328) oxidation states of carbon and chromium
4 (p. 331) add mechanism details in CrO3 oxidations
5 (p. 337) mechanism of hydrolysis of imine
6 (p. 337) fill in reagents of synthesis sequence of tertiary amine
7 (p. 337) propose synthesis of triethylamine
8 (p. 339) fill in mechanism details of acyl substitution
9 (p. 340) pKa and DG of "X" in acyl X family (RCOX
10 (p.341),) which ketone reacts faster?
11. (p.343) relative reactivity of C=O compounds

Chapter 12 (p 358-404) Epoxides, Grignards and Enolates
Probs –
1 (p.358), T_{bp} of THF vs. diethyl ether and oxiranes vs. dimethylether
2. (p.361) synthesis of epoxides using sulfur ylids
3 (p. 361) mechanism for cyclohexene oxide from bromohydrin
4 (p. 362) radical side product from Grignard reaction
5 (p. 363) propose synthesis of Grignard reagents
6 (p. 366) simple mechanisms of nucleophile/electrophile reactions (RBr, C=O and epoxides)
7 (p. 367) show expected products and mechanisms
8 (p. 368) short reaction sequences to simple target molecules
9 (p. 372) possible cuprate coupling reactions
10 (p.376), fill in mechanistic details for nucleophile / carbonyl or nitrile addition reactions
11. (p.378) predict the products and show the mechanisms with esters + nucleophiles
12 (p. 379) predict the products and show the mechanisms with epoxides + nucleophiles
13 (p. 382) propanone enolate + various electrophiles
14 (p. 383) cyclohexene oxide + LDA (predict product, show mechanism)

15 (p. 384) aldehyde or ketone + H2O or ROH in acid (predict product, show mechanism)
16 (p. 385) write the reverse reaction from a ketal or acetal in acid
17 (p. 385) write the reverse reaction from an ester in acid
18 (p. 386) predict products of epoxides and H2O or ROH in acid
19 (p. 390) propose synthesis of alkenes using the Wittig and other reactions
20 (p. 394) supply the missing reagents (around 39)
21 (p. 395-397) show synthesis of many, many target molecules from given starting structures and reagents

Chapter 13 (p 405-451) Alkene and Alkyne Chemistry
Probs –
1 (p.406), classify CC pi bonds as electron rich or electron poor
2. (p.409) what are the stereochemical relationships of products from C=C addition reactions
3 (p. 410) are addition reactions regioselective?
4 (p. 415) predict stereochemistry of products of addition of HBr or DBr to cyclohexene
5 (p. 417) provide a mechanism for alkene + HBr
6 (p. 417) provide a mechanism for alkyne + HCl
7 (p. 422) predict stereochemistry of hydration reactions with alkenes
8 (p. 422) complex mechanism of aqueous acid + tri-alkene
10 (p.422), alcohol addition reaction with DHP to make THP protecting group
11. (p.423) simple mechanisms for acid and base tautomer reactions
12 (p. 425) glucose/fructose and glyceraldehydes/dihydroxyacetone machanisms
13 (p. 428) predict stereochemistry of Br2 + alkene reactions
14 (p. 431) predict reaction products of reaction sequences
15 (p. 432) Br2/H2O addition products with methylcyclohexene
16(p. 432) Br2/H2O addition products with various alkenes
17 (p. 435) mechanism for formation of cyclohexene oxide
18 (p. 435) propose steps for synthetic transformation to epoxides
19 (p. 436) various syntheses with different regioselectivites
20 (p. 437) aqueous acid or base additions to epoxides
21 (p. 438) mechanism for reoxidation of OsO3 to OsO4 using amine oxides
22 (p. 439) syn or anti addition of OsO4 to alkenes and stereochemistry evaluations
23 (p. 442) different ways to make epoxides
24 (p. 444) predict products of hydrogenation of alkenes using D2 / Pd
25 (p. 449) Propose many, many syntheses of target molecules

Chapter 14 (p 452-473) Aromatic chemistry
Probs –
1 (p.453) propose acceptable names for aromatic compounds
2. (p.455) draw various possible resonance structures for simple polycyclic aromatic hydrocarbons (PAH) and predict short and long bonds
3 (p. 460) propose mechanism for nitroylation reaction with toluene
4 (p. 460) fill in mechanism details for Fe/H3O+ reduction of nitro to amine given template
5 (p. 462) fill in mechanism details for Fe/H3O+ reduction of nitro to amine given template (repeat, same problem)
6 (p. 464) propose mechamism for sulfanyl chloride acyl-like substitution reactions
7 (p. 466) possible Grignard reactions from bromobenzene
8 (p. 466) unusual electrophilic aromatic substitution reaction
9 (p.471), explain regioselectivity of electrophilic aromatic substitution reaction (nitration) of alkylbenzenes
10. (p.472) write mechanism for bromination of phenol
11 (p. 473) predict directing influence of various substituents on aromatic rings
12 (p. 473) predict which aromatic ring in biphenyls will undergo electrophilic aromatic substitution

Tentative Schedule (only approximate)

Week	Tuesday	Thursday
1 (8/18) (8/20)	Classes begin on Thursday Because of Thanksgiving Holiday	Syllabus (YouTube video), Topic 1 atoms, bonds (ionic, polar, covalent) (single, double, triple) ionization potential, electronegativity, sigma, pi, mp, bp
2 (8/25) (8/27)	Topic 1 – Hybridization, shapes, 2D and 3D structures, resonance, formal charge, functional groups	Finish topic 1 and begin Topic 2
3 (9/1) (9/3)	Finish Topic 2	Topic 3 – isomers, functional groups, carbon intermediates, degree of unsaturation (YouTube video, learn on own, this topic Start Topic 4 (Nomenclature)
4 (9/8) (9/10)	Topic 4 – Nomenclature, special terms, alkanes, alkenes, alkynes, functional groups, priorities, prefixes, suffixes, stereochem (E/Z)	Finish Topic 4 (Nomenclature)
5 (9/15) (9/17)	Topic 5 – chain conformations, Newman projections, staggered, eclipsed, torsional strain, potential energy diagrams,	Topic 6 – cyclohexane conformations, chair boats, staggered, eclipsed, axial, equatorial, mono and disubstituted rings,
6 (9/22) (9/24)	Topic 7 – stereochemistry – chiral and stereogenic centers, chiral molecules, enantiomers, diasteromers, meso compounds, optical activity, Fischer projections 7	Topic 7 – stereochemistry – chiral and stereogenic centers, chiral molecules, enantiomers, diasteromers, meso compounds, optical activity, Fischer projections, Example exam problem
7 (9/29) (10/1)	Start Topic 8 – Acid/base, inductive and resonance effects, arrow pushing mechanisms, Ka, pKa, rxns in strong base, rxns in strong acid	Topic 8 – Acid/base, inductive and resonance effects, arrow pushing mechanisms, Ka, pKa, rxns in strong base, rxns in strong acid
8 (10/6) (10/8)	Topic 8 – Acid/base, inductive and resonance effects, arrow pushing mechanisms, Ka, pKa, rxns in strong base, rxns in strong acid Possibly review and/or catch up	**Midterm Exam** (schedule is tentative for material after midterm, includes everything covered through Tuesday)
9 (10/13) (10/15)	Start Topic 9 - SN2 and E2 chemistry, nucleophiles (strong and weak), electrophiles, arrow pushing, C1-C6 RBr compounds, alkene stabilities,	Topic 9 – SN2 and E2 chemistry, nucleophiles (strong and weak), electrophiles, arrow pushing, C1-C6 RBr compounds, alkene stabilities, ester hydrolysis with NaOH to make ROH
10 (10/20) (10/22)	Topic 9 SN1 and E1, carbocations, rearrangements	Topic 9 – SN reactions of alcohols in HBr, PBr3, tosylates, and E1 with H2SO4
11 (10/27) (10/29)	Topic 10 – Free radical reactions, Br substitution of sp3 C-H bonds and	Topic 10 –antiMarkovnikov addition of HBr to alkenes, oxidation of hydrocarbons and biochemical oxidation
12 (11/3) (11/5)	Topic 11 /12 – Alcohols, ROH, SN reactions with HBr, E1 reactions with H2SO4, CrO3 oxidations to make aldehydes, ketones and carboxylic acids	Topic 11 / 12 – Grignard and LiAlH4 (or "LiAlD4") Rxns with Alds, Kets, CO2, Nitriles, epoxides, S ylids, P ylids
13 (11/10) (11/12)	Topic 11 / 12 – reactions and synthesis of target molecule (TM)s	Topic 11 / 12 – reactions and synthesis of target molecule (TM)s strategy
14 (11/17) (11/19)	Topic 11 / 12 - continues	Topic 12 - continue
15 (11/24) (11/26)	Topic 13 – Alkenes and Alkynes	Topic 13 – Alkenes and Alkynes

16 (12/1) (12/3)	Topic 13 – Alkenes and Alkynes	Thanksgiving Break
17 (5/12) (5/14)	Topic 13 – Aromatics	Topic 13 – Aromatics
17 (12/15) (12/17)	Finals Week – No meeting	**Final Exam – 3 hours to take, plus extra half hour to scan and upload**