Instructor's Name: Dr. Allegra Liberman-Martin
Instructor's Email: libermanmartin@chapman.edu
Instructor's office hours: Monday 4:00 pm to 6:00 pm in Keck 236
Wednesday 4:00 pm to 6:00 pm in Keck 236

Textbooks/Materials: Organic Chemistry, Author: Klein, Publisher: John Wiley & Sons, Incorporate, Edition: 3rd, Year Published: 2017 (**required**)

Course Description: CHEM 230 is the first semester of a two-semester (one year) study of organic chemistry. Students will learn fundamental and essential concepts, and the relevance of organic chemistry to a number of subjects. Topics of discussion will include the organic functional groups containing carbon-carbon double bonds, triple bonds, the alkyl halides, alcohols, ethers, and organometallic compounds. The structure and properties of organic compounds, nomenclature of organic compounds, stereochemistry, and spectroscopic methods of analysis will also be studied. There will be an emphasis on the relationship between structure and functionality in organic compounds, and the electron pushing mechanisms for organic reactions. Introductory synthetic organic chemistry will be covered.

Course-Wide Intended Learning Outcomes: At the end of this course, each student will be able to:

- Describe, and give examples of the basic principles, concepts, and theories from the first semester of organic chemistry, including the central role of the scientific method and the importance of observation.
- Apply reasoning skills acquired in the classroom to solve problems through assigned homework sets, guided inquiries and laboratory exercises.
- Apply the scientific method to evaluate and analyze data and draw conclusions based upon that analysis.

Program-Wide Intended Learning Outcomes: In addition to the above learning outcomes, CHEM 230 supports, in part, the learning outcomes for the B.Sc. in Chemistry:

- Students will be able to demonstrate competency in chemistry core knowledge and problem solving.
- Students will be able to demonstrate competency in basic chemical laboratory and computation skills.
- Students will be able to apply the scientific method, critical thinking, and analytical skills to design and execute a scientific experiment, thoroughly analyze the results, and arrive at well-reasoned scientific conclusions.
- Students will communicate effectively in speaking and writing to the science community.

Class Structure:
Prior to each class time, you will be expected to:

- Watch the **pre-class videos** made by the instructor
- Complete the assigned **pre-class readings**
- Take the **pre-class quiz**

During class, you will complete an **in-class worksheet** in groups with guidance from the instructor.

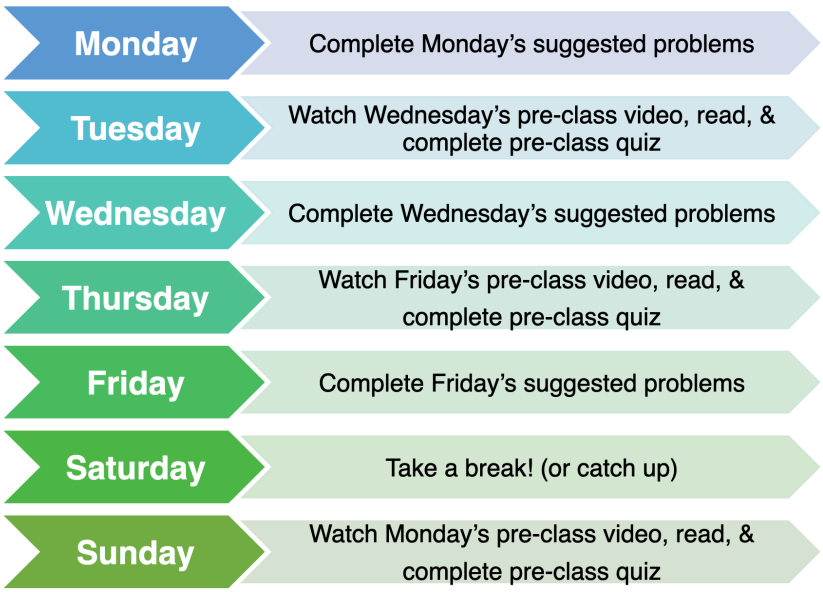
After each class, you will be expected to:

- Solidify your learning by **solving the suggested problems**.
- **Attend office hours and SI sessions** with questions you have on any of the concepts introduced in the pre-class materials, in-class worksheets, or in the suggested problems.

Success Strategies: Your deep understanding of fundamental organic chemistry concepts **coupled** with frequent and consistent practice of conceptual and algorithmic problems is crucial for success in this course. And as we progress through the course material, you will build on, and reinforce, fundamental concepts from previous chapters. As a result, your instructor has designed this course to encourage necessary **daily** practice (see Class Structure). In addition, here are some additional best-practices that you are encouraged to implement:

- Dedicate 2 hours to studying and solving organic chemistry problems every day.
- Attend each class prepared to solve more problems. Ask questions!
- Attend office hours frequently with specific questions on concepts or problems you have attempted.
- **Attend Supplemental Instructor (SI) Sessions Once Per Week**: All SIs are students who not only excelled in the course in previous years but are also trained to teach effectively. Each SI will engage you in instructor-approved practice problems. They will also answer any ongoing questions you have.

Recommended workflow:



Pre-class Quizzes: An online quiz will be assigned before every class (except on test days). Pre-class quizzes will be posted on Canvas ≥24 hours before the upcoming class and will be **due at 8:30 am the day of class**. The pre-class quiz scores and feedback will be released shortly afterward. Use the report and feedback to assess your understanding of the assigned pre-class reading/video. **There are no make-up quizzes and your lowest six pre-class quizzes will be dropped**.

Test and Final Exam Authorizations: Before each test or the final exam, your instructor will provide you with one 4 x 6-inch notecard. You must write your name on the notecard, and you may write any information that you choose on both sides of the notecard. You must submit this notecard when you turn in your test.

During tests and the final exam:

- You are authorized to use your notecard along with a calculator of your choice.
- You are not authorized to speak with anyone other than your instructor or use the internet while completing tests.

Course Policy on Unauthorized Assistance during Tests: The organic chemistry faculty take cases of academic integrity violations very seriously. All suspected academic integrity violations for any tests or the final exam will be investigated fully according to Chapman's Academic Integrity Policy. The baseline sanction for an academic integrity violation on a test or the final exam is an 'F' in the course.

Students with Testing Accommodations who take accommodated exams at the Testing Center will reserve a time on the scheduled test and final exam dates specified in the **Evaluation** section below.

Make-Up Policy for Tests ONLY: The only reasons that qualify for a make-up test or final exam are: (1) serious illness with proper documentation (i.e., doctor's note or Dean of Students' Letter), or (2) required attendance at an OFFICIAL University event with written notification to the professor PRIOR to the exam and as early as possible. Please note that Greek events are not considered official University events.

Evaluation: Your grade in this course is based on:

- Pre-class quizzes (lowest six quiz scores dropped) (11%)
- Five tests (lowest test score dropped) (64%)
- Final exam (25%)

Assessment	Date
Pre-class quizzes	Before each class day
Test 01	Fri., Sept. 15
Test 02	Fri., Sept. 29
Test 03	Fri., Oct. 13
Test 04	Fri., Oct. 27
Test 05	Fri., Nov. 17
Final cumulative exam	Thurs., Dec. 14, 10:45 am – 1:15 pm (CHEM 230-01) Fri., Dec. 15, 8:00 am – 10:30 pm (CHEM 230-03)

Course Grading Rubric:

Score (%)	Grade	Score (%)	Grade
92 – 100	A	71 – 75	C
89 – 92	A–	67 – 71	C–
86 – 89	B+	62 – 67	D+
82 – 86	B	52 – 62	D
78 – 82	B–	47 – 52	D–
75 – 78	C+	< 47	F

Extra Credit Policy: After each test, links to two post-test surveys will be provided (Reflection Surveys A and B). These surveys are designed to help you analyze your test performance and find strategies that work best for you in learning the material. Completing each post-test survey will result in 0.5% of extra credit being added to your test score.

Course Electronic Access: Course materials including the syllabus are available on Canvas. The Canvas site will be the primary repository of all course components, including pre-class videos, weekly assignments, and answer keys.

Academic Integrity Policy: Chapman University is a community of scholars that emphasizes the mutual responsibility of all members to seek knowledge honestly and in good faith. Students are responsible for doing their own work and academic dishonesty of any kind will be subject to sanction by the instructor/administrator and referral to the university Academic Integrity Committee, which may impose additional sanctions including expulsion. Please see the full description of Chapman University's policy on Academic Integrity at www.chapman.edu/academics/academicintegrity/index.aspx.

Students with Disabilities Policy: In compliance with ADA guidelines, students who have any condition, either permanent or temporary, that might affect their ability to perform in this class are encouraged to contact the Disability Services Office. If you will need to utilize your approved accommodations in this class, please follow the proper notification procedure for informing your professor(s). This notification process must occur more than a week before any accommodation can be utilized. Please contact Disability Services at (714) 516–4520 or visit www.chapman.edu/students/student-health-services/disability-services if you have questions regarding this procedure or for information or to make an appointment to discuss and/or request potential accommodations based on documentation of your disability. Once formal approval of your need for an accommodation has been granted, you are encouraged to talk with your professor(s) about your accommodation options. The granting of any accommodation will not be retroactive and cannot jeopardize the academic standards or integrity of the course.

Equity and Diversity Policy: Chapman University is committed to ensuring equality and valuing diversity. Students and professors are reminded to show respect at all times as outlined in Chapman's Harassment and Discrimination Policy. Please see the full description of this policy at http://www.chapman.edu/faculty-staff/human-resources/eoo.aspx. Any violations of this policy should be discussed with the professor, the dean of students and/or otherwise reported in accordance with this policy.

Student Support at Chapman University: Over the course of the semester, you may experience a range of challenges that interfere with your learning, such as problems with friend, family, and or significant other relationships; substance use; concerns about personal adequacy; feeling overwhelmed; or feeling sad or anxious without knowing why. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. You can learn more about the resources available through Chapman University's Student Psychological Counseling Services here: https://www.chapman.edu/students/health-and-safety/psychological-counseling/

Week	Day	Date	Topic	Reading	Suggested Problems
1	M	8/28	Introductions; **Bonding 01 -** Review of Lewis structures, formal charges	**Ch 1 -** sections 01-04	**Ch 1 -** questions 3–6, 8, 9, 11–14, 39, 54
	W	8/30	**Bonding 02 -** VBT, MO, HAO, VSEPR	**Ch 1 -** sections 06-10	**Ch 1 -** questions 18–29, 41, 44, 49, 50, 51, 55, 56, 58, 59
					Additional problems packet
	F	9/1	**Bonding 03 -** Polar covalent bonds, polarity, intermolecular forces	**Ch 1 -** sections 05, 11, 12	**Ch 1 -** questions 15–17, 31–34, 37, 38, 40, 43, 48(a–e, g, h), 52, 53, 57, 60–65
	Integrated & Challenge Problems - **Ch 1 -** questions 66, 69–71, 73–78, 79(a, c), 80				
2	M	9/4	**No Class - Labor Day**		
	W	9/6	**Notation 01 -** Drawing and interpreting bond-line structures, functional groups	**Ch 2 -** sections 01-06	**Ch 2 -** questions 1–10, 34, 37–40, 43–45, 48–50, 54, 55
	F	9/8	**Notation 02 -** Resonance contributors, curved arrow notation, resonance hybrid	**Ch 2 -** sections 07–10, 12, 13	**Ch 2 -** questions 12–25, 29–33, 41, 46, 52, 53, 57–61, 63
	Integrated & Challenge Problems - **Ch 2 -** questions 64–67, 70, 71, 79–81				
3	M	9/11	**Acid/Base 01 -** Bronsted-Lowry acidity, equilibrium position I	**Ch 3 -** sections 01–03	**Ch 3 -** questions 1–11, 27–29, 34–36, 38, 40–42
	W	9/13	**Acid/Base 02 -** Equilibrium position II	**Ch 3 -** sections 04–05	**Ch 3 -** questions 13–25, 43, 44, 46(b-d), 48
	Integrated & Challenge Problems - **Ch 3 -** questions 49, 50, 52–54, 58, 60, 62, 67, 68				
	F	**9/15**	**TEST 01**	**Weeks 1–3**	
4	M	9/18	**Alkanes 01 -** nomenclature, constitutional isomers, relative stabilities	**Ch 4 -** sections 01, 02 (skip bicyclics), 03, 04	**Ch 4 -** questions 1, 2, 4, 5, 8–10, 14, 36(a–i), 37, 40(a, b)
	W	9/20	**Alkanes 02 -** Newman, conformational analysis of acyclic alkanes	**Ch 4 -** sections 06–08	**Ch 4 -** questions 16–19, 38, 41, 42, 45, 47a, 48a, 49, 53, 55–57

Week	Day	Date	Topic	Reading	Suggested Problems
	F	9/22	**Alkanes 03 -** conformational analysis of cycloalkanes, substituted cyclohexanes	**Ch 4 -** sections 09–12	**Ch 4 -** questions 21–26, 44a, 46, 47c, 48b, 51a, 59
	Integrated and Challenge Problems - **Ch 4 -** questions 63(a,i), 66, 72, 74				
5	M	9/25	**Stereo 01 -** Chiral centers, enantiomerism, Cahn-Ingold-Prelog system	**Ch 5 -** sections 01–03	**Ch 5 -** questions 4, 7, 9, 10, 31, 32, 33b, 34, 39 (a–e, g), 50
	W	9/27	**Stereo 02 -** Optical activity, enantiomeric excess	**Ch 5 -** section 04	**Ch 5 -** questions 11–18, 41, 42, 49, 54(a,b), 56
	Integrated and Challenge Problems - **Ch 5 -** questions 57f, 63a				
	F	**9/29**	**TEST 02**	**Weeks 4–5**	
6	M	10/2	**Stereo 03 -** diastereomers, symmetry, chirality	**Ch 5 -** sections 05–06	**Ch 5 -** questions 19, 23, 24, 36, 37, 38(a–c, e), 44 (b, c), 45, 51, 55
	W	10/4	**Stereo 04 -** cyclic systems, E-/Z- alkenes	**Ch 4 -** sections 13–14,	**Ch 4 -** questions 28–32, 43, 44(b–d), 50, 51(b–d), 52, 54, 58;
				Ch 5 - sections 11	**Ch 5 -** questions 29, 30, 44(b–d), 52, 53(b–d)
	Integrated and Challenge Problems - **Ch 4 -** questions 63(b, g, h, j, k), 67; **Ch 5 -** questions 57(a, b, d, g, h), 61–64				
	F	10/6	**Reactivity 01 -** Review of ΔS, ΔH, ΔG, K_{eq} *k*, Ea, reaction coordinate diagrams	**Ch 6 -** sections 01-06	**Ch 6 -** questions 1–4, 6, 7, 19–26
7	M	10/9	**Reactivity 02 -** nuc & elec, arrow pushing	**Ch 6 -** sections 07–11	**Ch 6 -** questions 8–18, 27–41
	Integrated and Challenge Problems - **Ch 6 -** questions 42(a–f, h,i), 44–48, 54–56, 57 (a, c), 59				
	W	10/11	**Substitution-Elimination 01 -** S_N2	**Ch 7 -** sections 01–04	**Ch 7 -** questions 2–6, 8–9, 51–52, 54–56, 72d
	Integrated and Challenge Problems - **Ch 7 -** questions 80–82, 94				
	F	**10/13**	**TEST 03**	**Weeks 6–7**	

Week	Day	Date	Topic	Reading	Suggested Problems
8	M	10/16	**Substitution-Elimination 02 -** E2	**Ch 7 -** sections 06–08	**Ch 7 -** questions 11, 15–19, 21, 23–25, 58–67, 69, 75, 79
	W	10/18	**Substitution-Elimination 03 -** S_N1/E1	**Ch 7 -** section 09	**Ch 7 -** questions 27, 30–31, 33, 34(a, c), 70(c, d), 73
	F	10/20	**Substitution-Elimination 04 -** S_N vs E	**Ch 7 -** sections 11, 13 (except figure 7.22)	**Ch 7 -** questions 37, 44–45, 46, 53, 57, 76 (a–i), 77, 78
	Integrated and Challenge Problems - **Ch 7 -** questions 85, 86, 88, 90, 91, 99, 100				
9	M	10/23	**Alkenes 01 -** thermo, hydrohalogenation,	**Ch 8 -** sections 01, 03-04	**Ch 8 -** questions 1–7, 37a, 41, 44(c, d), 61, 64, 69, 70, 71, 72
	W	10/25	**Alkenes 02 -** acid-catalyzed hydration, Oxymercuration-demercuration	**Ch 8 -** sections 05-06	**Ch 8 -** questions 8–13, 39ab, 44(a–b), 46, 54, 56
	Integrated and Challenge Problems - **Ch 8 -** question 76				
	F	**10/27**	**TEST 04**	**Weeks 8–9**	
10	M	10/30	**Alkenes 03 -** hydroboration-oxidation, catalytic hydrogenation	**Ch 8 -** sections 07-08 (except **Homogenous Catalysis** and **Asymmetric Catalytic Hydrogenation**)	**Ch 8 -** questions 14–16, 18–19, 48, 53, 58, 66, 67, 73
	W	11/1	**Alkenes 04 -** halogenation, halohydrin formation, anti-dihydroxylation	**Ch 8 -** sections 09-10	**Ch 8 -** questions 20–25, 55, 59, 65
	F	11/3	**Alkenes 05 -** syn-dihydroxylation, oxidative cleavage, synthesis strategies	**Ch 8 -** sections 11-14	**Ch 8 -** questions 27–29, 31–33, 35, 37(a, c), 38–40, 42, 43, 45, 46, 50, 52, 57(b–d), 60, 62, 63, 68–70
	Integrated and Challenge Problems - **Ch 8 -** questions 74–78, 79–83, 90–92				
11	M	11/6	**Alkynes 01 -** acidity, preparation, reduction	**Ch 9 -** sections 01, 03-05	**Ch 9 -** questions 5–12, 34, 35, 38, 40, 42, 53

Week	Day	Date	Topic	Reading	Suggested Problems
	W	11/8	**Alkynes 02 -** hydrohalogenation, hydration, halogenation, ozonolysis	**Ch 9 -** sections 06-09	**Ch 9 -** questions 13–26, 39, 44b, 50, 51
	F	11/10	**Alkynes 03 -** alkylation, synthetic strategies	**Ch 9 -** sections 10-11	**Ch 9 -** questions 27, 29–31, 36, 37, 41, 45, 48, 49, 52, 54, 56
	Integrated and Challenge Problems - **Ch 9 -** questions 57–59, 61–66, 69, 70, 72–75				
12	M	11/13	**Alkenes and Alkynes** - Review (Mechanisms)		
	W	11/15	**Alkenes and Alkynes** - Review (Synthesis)		
	F	**11/17**	**TEST 05**	**Weeks 10–12**	
THANKSGIVING BREAK! Nov 22rd – 26th					
14	M	11/27	**Alcohols 01** - structure, properties, substitution and elimination	Ch 7 - section 12; Ch 12 - sections 01 (except Nomenclature), 02, 03, 05, 09	Ch 7 - questions 41–43, 70(a, b), 71, 72(a–c), 76(j, k); Ch 12 - questions 4, 5(b–d), 7, 8, 17, 18a, 19, 30(a, c), 31, 33, 38, 39, 43(a–b)
	W	11/29	**Alcohols 02** - alcohol preparation, redox reactions involving alcohols	**Ch 12** - sections 04, 10, 13 (only Functional Group Interconversion)	**Ch 12** - questions 9, 11(a–c), 20–22, 32(a–g, i–k), 34(a, b), 36, 37b, 42, 44, 45(a, b, d), 47, 48
	Integrated and Challenge Problems - **Ch 7 -** questions 83, 87, 89, 98, 101; **Ch 12 -** questions 53, 54(a, c, e, k–m, p), 55, 56, 62, 63, 68, 76a				
	F	12/1	**Ethers 01** - structure, properties, preparation, acidic cleavage	**Ch 13** - sections 01, 03, 05, 06 (except autooxidation)	**Ch 13** - questions 5–10, 27, 30, 35, 37(b, d), 38(b, e, f), 39, 42

Week	Day	Date	Topic	Reading	Suggested Problems
15	M	12/4	**Ethers 02** - epoxide preparation and ring opening	**Ch 13** - sections 08, 10, 12 (only Installing Two Adjacent Functional Groups)	**Ch 13** - questions 13, 14, 16(b–f), 17, 18(a, c–f), 19, 22(a, c, d, e), 29, 34, 36, 37(c, e), 38(c, d), 44 (except to structure at top-right corner), 45
	Integrated and Challenge Problems - **Ch 13 -** questions 46–49, 51(e–k, o, r–s), 56, 57, 59, 68–70, 71a, 72, 74				
	W	12/6	**Alcohols and Ethers** - Review		
	F	12/8	**Cumulative Review**		

By test 01, you should be able to:

- Draw Lewis structures for all covalent compounds.
- Assign formal charges to all atoms in any organic compound.
- Identify s and p atomic orbitals.
- Draw energy diagrams for the unhybridized and hybridized atomic orbitals of any atom.
- Draw and identify the constructive or destructive overlap of atomic orbitals.
- Identify whether molecular orbitals are sigma or pi type orbitals and if they are bonding or anti-bonding.
- Draw energy diagrams for the molecular orbitals of diatomic compounds.
- Predict hybridization states of atoms within organic compounds.
- Draw hybrid-orbital diagrams for organic compounds
- Determine molecular geometry/shape of organic compounds using VSEPR theory.
- Determine bond polarity and overall dipole moments for organic molecules.
- Identify noncovalent interactions within and between organic compounds.
- Rationalize boiling point differences between organic compounds.
- Interconvert between condensed, skeletal, Lewis structures, and chemical formulas.
- Identify functional groups in any molecule.
- Draw resonance forms of Lewis structures and use curved-arrow notation to interconvert between resonance forms.
- Draw and interpret resonance hybrids.
- Label localized and delocalized electrons
- Determine the type of orbital in which lone-pairs reside.
- Identify the acid, base, conjugate acid, and conjugate base in any Brønsted-Lowry acid-base reaction.
- Predict the curved-arrow mechanism and products of any acid-base reaction.
- Recall the general pK_a range for the following functional groups:
    - alkanes, alkenes, and alkynes,
    - amines,
    - carboxylic acids,
    - hydrogen (H_2)
    - hydrogen halides,
    - sulfuric acid,
    - alpha carbons,
    - alcohols, and
    - water
        - *Including all reasonable protonation states of these species*
- Predict the strength of acids (and the strength of bases) by using qualitative factors such as atomic size, electronegativity, resonance & inductive effects, and hybridized orbitals.
- Predict the equilibrium position of acid-base reactions using quantitative data (i.e., pK_a values) or qualitative arguments.

By test 02, in addition to above, you should be able to:

- Name simple alkanes
- Identify constitutional isomers for organic compounds.
- Predict stability of constitutional isomers using combustion analysis.
- Draw bond-line structures in 3-D perspective (i.e., using dashes and daggers/wedged-dashes).
- Draw Newman projections for saturated organic compounds
- Interconvert between Newman projections and bond-line structures.
- Draw and evaluate the relative energies of staggered and eclipsing conformational isomers arising from single-bond rotations for simple alkanes.
- Compare strain and stability of cycloalkanes with different ring sizes.
- Draw ring structures for (substituted) cyclohexanes.
- Identify and draw ring-flipped chair conformational isomers.
- Predict relative stability of monosubstituted cyclohexane chair conformations.
- Identify chiral centers in organic compounds.
- Draw and identify enantiomers of chiral compounds.
- Assign the Cahn-Ingold-Prelog (CIP) R/S system to chiral centers.
- Determine when plane-polarized light is affected by a sample.
- Calculate enantiomeric excess using optical activity data.

By test 03, in addition to above, you should be able to:

- Define and identify diastereomers.
- Differentiate between enantiomers, diastereomers, meso compounds, and constitutional isomers.
- Explain the relationship between symmetry and chirality.
- Draw and identify cis-trans stereoisomerism in cyclohexanes and predict their relative stabilities.
- Draw and identify E-Z stereoisomerism in alkenes.
- Predict bond strength from bond dissociation energies.
- Calculate enthalpy of reactions (ΔH_{rxn}) using bond dissociation energies.
- Predict entropy of reactions (ΔS_{rxn}) qualitatively.
- Predict spontaneity (ΔG_{rxn}) from enthalpy and entropy data.
- Explain the relationship between equilibrium constants (K_{eq}) and Gibbs free energy (ΔG^{o}).
- Draw and interpret reaction coordinate diagrams.
- Define nucleophiles and electrophiles
- Identify nucleophilic and electrophilic centers within organic compounds.
- Draw and identify curved-arrow mechanisms for the following mechanistic patterns:
    - nucleophilic attack,
    - proton transfer,
    - loss of a leaving group, and
    - carbocation rearrangement.

- Predict the relative stability of carbocations.
- Determine the appropriate reagents, predict the products and stereochemical outcomes, and propose mechanisms for S_N2 reactions involving alkyl halides.
- Identify the effects of nucleophile strength, leaving group ability, and solvent on S_N2 reaction rates.
- Correlate proposed mechanisms to the rate-law of any organic reaction.

By test 04, in addition to above, you should be able to:

- Predict the relative stability of alkenes.
- Predict the relative stability of carbocations.
- Identify the effects of nucleophile/base strength, leaving group ability, alkyl halide structure, and solvent on S_N2, S_N1, E2, and E1 reaction rates.
- Identify addition and elimination reactions.
- Explain enthalpy or entropy changes that occur during addition or elimination reactions.
- Propose multi-step syntheses of compounds using any combination of the reactions learned so far.

Reactions to know:	**Predict appopriate reagents**	**Predict products + stereochemical outcomes**	**Propose reasonable mechanisms**
Alkyl halide substitutions (S_N2 & S_N1)	Yes	Yes	Yes
Alkyl halide eliminations (E2 & E1)	Yes	Yes	Yes
Alkene hydrohalogenation	Yes	Yes	Yes
Alkene acid-catalyzed hydration	Yes	Yes	Yes
Alkene acid-catalyzed alcohol addition	Yes	Yes	Yes
Alkene oxymercuration-demercuration	Yes	Yes	No

By test 05, in addition to above, you should be able to:

- Explain the relative acidities of alkane, alkene, and terminal alkyne C–H bonds.
- Predict the equilibrium position of acid-base reactions involving terminal alkynes.
- Propose multi-step syntheses of compounds using any combination of the reactions learned so far.

Reactions to know:	**Predict appopriate reagents**	**Predict products + stereochemical outcomes**	**Propose reasonable mechanisms**
Alkene hydrohalogenation	Yes	Yes	Yes

Reactions to know:	Predict appopriate reagents	Predict products + stereochemical outcomes	Propose reasonable mechanisms
Alkene acid-catalyzed hydration	Yes	Yes	Yes
Alkene acid-catalyzed alcohol addition	Yes	Yes	Yes
Alkene oxymercuration-demercuration	Yes	Yes	No
Alkene hydroboration-oxidation	Yes	Yes	hydroboration only / not the oxidation mechanism
Alkene hydrogenation	Yes	Yes	No
Alkene halogenation	Yes	Yes	Yes
Alkene epoxidation	Yes	Yes	Yes
Alkene anti-dihydroxylation	Yes	Yes	Yes
Alkene syn-dihydroxylation	Yes	Yes	No
Alkene oxidative cleavage / ozonolysis	Yes	Yes	No
Alkyne preparation	Yes	Yes	Yes
Alkyne reduction	Yes	Yes	No
Alkyne hydrohalogenation	Yes	Yes	No
Alkyne hydration	Yes	Yes	Yes
Alkyne hydroboration-oxidation	Yes	Yes	hydroboration only / not the oxidation mechanism
Alkyne halogenation	Yes	Yes	No
Alkyne ozonolysis	Yes	Yes	No
Acid- and base-catalyzed tautomerizations	No	No	Yes
Alkyne alkylation	Yes	Yes	Yes

By the final exam, **in addition to all of the above items**, you should be able to:

- Predict the equilibrium position of acid-base reactions involving alcohols.
- Propose reagents to prepare alcohols using substitution and addition reactions.

- Determine oxidation states to determine if a reaction involves oxidation, reduction, or neither.
- Identify strong and weak oxidants.
- Propose efficient synthesis strategies to prepare ethers using alkoxymercuration-demercuration and Williamson-ether synthesis.
- Propose efficient synthesis strategies to prepare epoxides.
- Explain the regiochemistry of epoxide ring opening under basic and acidic conditions.
- Propose multi-step syntheses of compounds using any combination of the reactions learned in the course.

Reactions to know:	**Predict appopriate reagents**	**Predict products + stereochemical outcomes**	**Propose reasonable mechanisms**
Alcohol substitution with HX	Yes	Yes	Yes
Alcohol substitution with PBr3 or SOCl2	Yes	Yes	No
Alcohol reaction with TsCl	Yes	Yes	No
Alcohol elimination	Yes	Yes	Yes
Aldehyde and ketone reduction	Yes	Yes	Yes
Alcohol oxidation	Yes	Yes	No
Preparation of ethers (via alkoxymercuration-demercuration)	Yes	Yes	No
Preparation of ethers (via Williamson-ether)	Yes	Yes	Yes
Acidic cleavage of ethers	Yes	Yes	Yes
Preparation of epoxides (via alkenes with peroxy acid)	Yes	Yes	Yes
Preparation of epoxides (via Williamson-ether from halohydrin)	Yes	Yes	Yes
Epoxide ring opening (acidic and basic)	Yes	Yes	Yes