



## CHEM2410 Organic Chemistry I

The University of Toledo

Department of Chemistry and Biochemistry

College of Natural Sciences and Mathematics

**CHEM 2410 - 001 CRN 11107 and CHEM 2410 - 091 CRN 12803**

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<b>Office Hours:</b>	Online Tue, Thurs: 1:00 pm - 3:00 pm	<b>Class Day/Time:</b>	Mon, Wed, Fri 2:30 pm - 3:25 pm
<b>Office Location:</b>	WO 3269	<b>Credit Hours:</b>	3 credit hours
<b>Office Phone:</b>	419-530-1507	<b>Term:</b>	Spring, 2021

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### CATALOG/COURSE DESCRIPTION

CHEM 2410, Organic Chemistry I, covers the first half of Organic Chemistry, which includes a review of relevant topics from General Chemistry, a study of the structure and bonding of organic compounds, the nomenclature of organic molecules, an introduction to writing reaction mechanisms, and the reaction chemistry of alkenes, alkynes, alkyl halides, alcohols, ethers, and epoxides.

### TEXTS AND ANCILLARY MATERIALS

#### **Required Materials:**

Access to a properly functioning computer with internet access in order to login to Blackboard (<https://blackboard.utdl.edu/>) From the Blackboard course site you will access:

- An electronic copy of the textbook, *Organic Chemistry: Structure and Function* (8<sup>th</sup> Edition) by Vollhardt and Schore. Published by W.H. Freeman/Macmillan, ISBN-10: 1-319-07945-8; ISBN-13: 978-1-319-07945-1;
- SAPLINGPLUS Learning online homework

#### **Recommended Materials:**

Preparing for Your ACS Examination in Organic Chemistry: The Official Guide by the Examinations Institute of the American Chemical Society Division of Chemical Education. 1<sup>st</sup> edition (2002), published by American Chemical Society. ISBN: 0-9708042-1-0.

### PREREQUISITES AND COREQUISITES

Prerequisites: CHEM 1240 with a minimum grade of C-.

### COURSE STRUCTURE

- View the **Online Recorded Lecture Session** on each course date\* and **take notes using the Lecture Outline** that is posted with each recorded lecture. \*It is recommended you view each lecture session at

the regularly scheduled course time, however you are able to view it at a later time in the day if you choose to do so based on your personal schedule. All lecture videos and outlines will be available for the entirety of the course.

- You will earn participation points for viewing each online recorded lecture session in full. Each of the 37 course dates with recorded lectures is worth 1.75 points. The maximum you can earn towards your grade is 50 participation points so there are some extras.
- *It is recommended that you read the text before you view the lecture.*
- Complete the assigned Sapling online homework assignment before each posted deadline. There will be one assigned for each chapter. There are also some tutorials to complete.
- Complete the recommended end-of-chapter homework problems from the textbook. These are not collected or graded, this is recommended practice so that you can do your best on the exams.
- All online recorded lectures, lecture outlines, online exams, and office hours will be accessed through Blackboard. You should consult the site every class day.

## **COMMUNICATION GUIDELINES**

As your instructor, I am here to help, and will do my best to respond to email within 24 to 48 hours. Students are expected to check their UT email account and Blackboard frequently for important course information.

We want you to be successful in this course, so **let's work together!**

## **OVERVIEW OF COURSE GRADE ASSIGNMENT**

### **Homework:**

There are two types of homework associated with this course: 1) SAPLINGPLUS Learning Homework which will count towards your grade; and 2) Problems from the textbook at the end of each chapter which *will not* be handed in or graded.

### **SAPLINGPLUS Learning Homework:**

Thirteen homework assignments (Chapters 1-9, 11 (alkene material only), and 12-14 totaling 150 points) will be administered and graded. In addition, there will be training assignments/videos. A direct link from Blackboard to SAPLINGPLUS will be available *via* this course's Blackboard site. These exercises are not timed, however, you will have unlimited tries with the loss of some credit for each try that is wrong before the due date. The due date/time for each assignment can be found within the SAPLINGPLUS homework system, on Blackboard, and on the syllabus schedule. **Please do your work well in advance of the due date. Do not wait until the last minute!** Technical problems with your computer, SAPLINGPLUS, or your internet connection *will not be grounds for an extension*. You can log in at any time to complete or review your homework assignments. If you have any problems, send an email to [support@saplinglearning.com](mailto:support@saplinglearning.com) explaining your issue.

**Suggested Homework Problems:** There are suggested homework problems assigned from the end-of-chapters in the textbook (end of syllabus). Completion and understanding of these problems will be a big step towards achieving a good grade in this course. It is recommended that you use the problems in the textbook for study and review in your efforts to master the material covered in each chapter. The chapter questions are not graded but as noted they are HIGHLY RECOMMENDED!

### **Examinations:**

The exam schedule is listed in the full course schedule. **Make-up exams will not be given for any circumstance.** Excused absences will be given only to students who miss an exam under the conditions listed on page 3. If an excuse is acceptable, your final course grade will be computed accordingly. **The final exam cannot be excused.** For all exams you must show a **photo identification card\***. You will not be permitted to have a cell phone on your desk. \*A photo identification card is mandatory in order for you to take the exam (<http://www.utoledo.edu/orientation/new/StudentID.html>).

### Exam Absence Policies

Refer to UT Missed Class Policy (<https://www.utoledo.edu/policies/academic/undergraduate/pdfs/3364-71-14%20Missed%20class%20policy.pdf>). Students who will not be able to take an exam at the scheduled time due to an irresolvable conflict with a major responsibility must provide some **written** documentation to verify the conflict. This situation may occur for students on official university business, including athletes. *Approval must be obtained before the scheduled test date.*

Students who do not take an exam due to illness, car accident, and death in the family or similar **extreme circumstance** should inform their instructor of their difficulties within 24 hours of the exam. These difficulties must also be **documented** by a physician's note, an accident report, pastor's note, etc. **Contact information** for the police department, pastor, etc. must be included on the note or report. **In all other circumstances, a missed exam will result in a grade of 0.** Exams cannot be excused for personal reasons. Examples of missing an exam due to personal issues include, but are not limited to: oversleeping, transportation problems, vacation plans, work schedule conflicts, child care issues, sick children, etc. **Please plan accordingly.**

### Course Points:

The following is the distribution of possible points in the course:

Sapling Homework Assignments	150 pts
Practice Exam	5 pts
Midterm Exams 3 @ 100 points each	300 pts
Comprehensive Final Exam	200 pts
Remote Lecture Video Participation	50 pts
<b>Total:</b>	<b>705 pts</b>

**Grade Scale** These are the minimum percentages of total points needed to receive the indicated grade. *Our goal is to achieve an average of 2.67 (B-) GPA or higher including all students who complete the entirety of this course. In the event the average of the final grades for this course does not fulfil this goal we will consider additional rounding up of your final grade to maintain consistency between different sections and semesters.*

	A	93%	A-	90%
B+	B	83%	B-	80%
C+	C	73%	C-	70%
D+	D	63%	D-	60%

**Midterm Grading** A midterm grade should be taken seriously with respect to how well you are doing in the course approximately half-way through the semester. Midterm grades will be calculated based on the score on Exam 1 and up-to-date Sapling and will use the grade scale as listed above.

### Academic Dishonesty:

The academic honesty policies, as stated in the 2013-2014 UT Catalogue will be **STRICTLY ENFORCED**. Any student found violating the UT academic honesty policies will be penalized in accordance with these policies. You should read the university's policy on Academic Dishonesty found at [http://www.utoledo.edu/catalog/2000catalog/admissions/academic\\_dishonesty.html](http://www.utoledo.edu/catalog/2000catalog/admissions/academic_dishonesty.html) . There is also an academic honesty policy posted on Blackboard.

### UNIVERSITY POLICIES

Policy Statement on Non-Discrimination on the basis of Disability (ADA). The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on](#)

[the Basis of Disability Americans with Disability Act Compliance.](#)

## **ACADEMIC POLICIES**

[Undergraduate Academic Policies](#)

[Graduate Academic Policies](#)

## **ACADEMIC ACCOMMODATIONS**

The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the [Student Disability Services Office](#) by calling 419.530.4981 or sending an email to [StudentDisability@utoledo.edu](mailto:StudentDisability@utoledo.edu).

### **Policy Statement on Non-Discrimination on the Basis of Disability (ADA)**

The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability – Americans with Disabilities Act Compliance](#).

## **TECHNOLOGY REQUIREMENTS, SKILLS, AND PRIVACY POLICIES**

Please view the [technology considerations](#) for this course, including technical skills needed, general technology requirements, and technology privacy policies.

## **TECHNOLOGY REQUIREMENTS FOR EXAMS**

### **LockDown Browser + Webcam Requirement**

This course requires the use of LockDown Browser and a webcam for online exams. The webcam can be the type that's built into your computer or one that plugs in with a USB cable.

Watch this brief video to get a basic understanding of LockDown Browser and the webcam feature.

<https://www.respondus.com/products/lockdown-browser/student-movie.shtml>

### **Download Instructions**

Download and install LockDown Browser from this link:

<https://download.respondus.com/lockdown/download.php?id=213815819>

If you have any issues with the Webcam requirement please contact Dr. Li ASAP to arrange for alternate proctoring arrangements for the exams.

## **GENERAL TECHNOLOGY REQUIREMENTS**

Students need to have access to a properly functioning computer throughout the semester. The Browser Check Page <http://www.utoledo.edu/dl/helpdesk/browser-check.html> will enable you to perform a systems check on your browser, and to ensure that your browser settings are compatible with Blackboard, the learning management system that hosts this course.

Software Student computers need to be capable of running the latest versions of plug-ins, recent software and have the necessary tools to be kept free of viruses and spyware. The computer needs to run the following software, available in the UT Online Download Center. • Word Processing Software • Adobe

Acrobat Reader • Java Plugin Console • Adobe Flash Player • Adobe Shockwave Player • Google Chrome Browser – Recommended

Internet Service High-speed Internet access is recommended, as dial-up may be slow and limited in downloading information and completing online tests. This course does contain streaming audio and video content.

Use of Public Computers: If using a public library or other public access computer, please check to ensure that you will have access for the length of time required to complete tasks and tests. A list and schedule for on-campus computer labs is available on the Open Lab for Students webpage.

UT Virtual Labs: Traditionally, on-campus labs have offered students the use of computer hardware and software they might not otherwise have access to. With UT's Virtual Lab, students can now access virtual machines loaded with all of the software they need to be successful using nothing more than a broadband Internet connection and a web browser. The virtual lab is open 24/7 and 365 days a year at VLAB: The University of Toledo's Virtual Labs.

Learner Technical Support can be found here <http://www.utoledo.edu/dl/students/learnersupport.html>

## **ACCESSIBILITY OF COURSE TECHNOLOGIES**

Please view [Accessibility of Course Technologies](#) for information regarding the accessibility of Blackboard and other technologies used in this course.

## **ACADEMIC AND SUPPORT SERVICES**

Please view the [Learner Support](#) page for links and descriptions of the technical, academic, and student support services available to UT students.

## **SAFETY AND HEALTH SERVICES FOR UT STUDENTS**

Please use the following link to view a comprehensive list [Campus Health and Safety Services](#) available to you as a student.

## **COURSE SCHEDULE**

<b>Week/LOs (p. 7 – 10)</b>	<b>Lectures/Notes/Assignments/Exam Schedule</b>
Week 1 LOs: 1.1 – 1.2	Jan 20: Syllabus, Course Tour, Intro, Practice Exam, Jan 22: Remote Lecture 1: Chapter 1 Structure and Bonding in Organic Molecules  <b>Sapling Training (2 assignments) Due by Sunday, Jan 24<sup>th</sup>, 11:55pm</b>
Week 2 LOs: 2.1 – 2.3	Jan 25: Remote Lecture 2: Chapter 1 Continued Jan 27: Remote Lecture 3: Chapter 2 Structure and Reactivity Jan 29: Remote Lecture 4: Chapter 2 Continued  <b>Sapling Chapter 1 Due by Sunday, Jan 31<sup>st</sup>, 11:55pm</b>
Week 3 LOs: 2.4 – 2.6, 3.1 – 3.2	Feb 1: Remote Lecture 5: Chapter 2 Continued Feb 3: Remote Lecture 6: Chapter 3 Reactions of Alkanes Feb 5: Remote Lecture 7: Chapter 3 Continued  <b>Sapling Training and Chapter 2 Due by Sunday, Feb 7<sup>th</sup>, 11:55pm</b>

<p>Week 4 LOs: 3.3 – 3.5, 4.1</p>	<p>Feb 8: Remote Lecture 8: Chapter 3 Continued Feb 10: Remote Lecture 9: Chapter 4 Cycloalkanes Feb 12: Remote Lecture 10: Chapter 4 Continued</p> <p><b>Sapling Chapter 3 Due by Sunday, Feb 14<sup>th</sup>, 11:55pm</b></p>
<p>Week 5 LOs: 4.2, 5.1 – 5.3</p>	<p>Feb 15: Remote Lecture 11: Chapter 4 Continued Feb 17: Remote Lecture 12: <b>Online Exam 1, Chapters 1 – 4</b> Feb 19: Remote Lecture 13: Chapter 5 Stereoisomers</p> <p><b>Sapling Training and Chapter 4 Due by Sunday, Feb 21<sup>st</sup>, 11:55pm</b></p>
<p>Week 6 LOs: 5.4 – 5.7</p>	<p>Feb 22: Remote Lecture 14: Chapter 5 Continued Feb 24: Remote Lecture 15: Chapter 5 Continued Feb 26: Remote Lecture 16: Chapter 6 Properties and Reactions of Haloalkanes (S<sub>N</sub>2)</p> <p><b>Sapling Chapter 5 Due by Sunday, Feb 28<sup>th</sup>, 11:55pm</b></p>
<p>Week 7 LOs: 6.1 – 6.6, 7.1 – 7.2</p>	<p>Mar 1: Remote Lecture 17: Chapter 6 Continued Mar 3: Remote Lecture 18: Chapter 6 Continued Mar 5: Remote Lecture 19: Chapter 7 Further Reactions of Haloalkanes (S<sub>N</sub>1 and E<sub>X</sub> Reactivity)</p> <p><b>Sapling Chapter 6 Due by Sunday, March 7<sup>th</sup>, 11:55pm</b></p>
<p>Week 8 LOs: 7.3 – 7.6, 8.1 – 8.2</p>	<p>Mar 8: Remote Lecture 20: Chapter 7 Continued Mar 10: Remote Lecture 21: Chapter 7 Continued Mar 12: Remote Lecture 22: Chapter 8 Hydroxy Functional Group: Alcohols</p> <p><b>Sapling Chapter 7 Due by Sunday, March 14<sup>th</sup>, 11:55pm</b></p>
<p>Week 9 LOs: 8.3 – 8.5, 9.1 – 9.2</p>	<p>Mar 15: Remote Lecture 23: Chapter 8 Continued Mar 17: Remote Lecture 24: <b>Online Exam 2, Chapters 5 – 8</b> Mar 19: Remote Lecture 25: Chapter 9 Further Reactions of Alcohols and the Chemistry of Ether</p> <p><b>Sapling Chapter 8 Due by Sunday, March 21<sup>st</sup>, 11:55pm</b></p>
<p>Week 10 LOs: 9.3 – 9.5, 11.1 – 11.4</p>	<p>Mar 22: Remote Lecture 26: Chapter 9 Continued Mar 24: Remote Lecture 27: Chapter 11 Alkenes Mar 26: Remote Lecture 28: Chapter 11 Continued</p> <p><b>Sapling Chapter 9 Due by Sunday, March 28<sup>th</sup>, 11:55pm</b></p>
<p>Week 11 LOs: 12.1 – 12.6</p>	<p>Mar 29: Remote Lecture 29: Instructional Break Mar 31: Remote Lecture 30: Chapter 12 Reactions of Alkenes Apr 2: Remote Lecture 31: Chapter 12 Continued</p> <p><b>Sapling Chapter 11 Due by Sunday, April 4<sup>th</sup>, 11:55pm</b></p>
<p>Week 12 LOs: 12.7 – 12.10, 13.1 – 13.3</p>	<p>Apr 5: Remote Lecture 32: Chapter 12 Continued Apr 7: Remote Lecture 33: Chapter 12 Continued Apr 9: Remote Lecture 34: Chapter 13 Alkynes</p> <p><b>Sapling Chapter 12 Due by Sunday, April 11<sup>th</sup>, 11:55pm</b></p>

Week 13 LOs: 13.4 – 13.7	Apr 12: Remote Lecture 35: Chapter 13 Continued Apr 14: Remote Lecture 36: Chapter 13 Continued Apr 16: Remote Lecture 37: Chapter 14 Delocalized Pi Systems
Week 14 LOs: 13.8, 14.1 14.2	Apr 19: <b>Online Exam 3, Chapters 9 – 13 (partial)</b> Apr 21: Remote Lecture 38: Chapter 14 Continued Apr 23: Remote Lecture 39: Chapter 14 Continued  <b>Sapling Chapter 13 Due by Sunday, April 25<sup>th</sup>, 11:55pm</b>
Week 15 LOs: 14.3	<b>Sapling Chapter 14 Due by Sunday, May 2<sup>nd</sup>, 11:55pm</b>
Finals Week	<b>***** Online Final Exam *****</b> <b>Monday, 5/3, 2:45pm – 4:45pm</b> <b>You must take the final at this time!</b>

## **STUDENT LEARNING OUTCOMES**

Following the completion of this course students will be able to:

- 1.1 Interpret Valence Bond Theory, Lewis Structures, condensed structural formulas, bond-line (skeletal) notation, bolded wedge and hashed wedge notation, and resonance structures.
- 1.2 Recognize and assign formal charges to atoms in molecules and ions.
- 2.1 Interpret potential energy diagrams including enthalpy, activation energies, intermediates, the rate determining step, the number of reaction steps, and transition states.
- 2.2 Represent electron-pair movement with curved-arrow notation in reaction mechanisms and resonance structures.
- 2.3 Define and identify alkanes, functional groups, electrophiles, nucleophiles, acids, and bases
- 2.4 Predict the relative strengths of acids and bases
- 2.5 Name organic molecules using systematic nomenclature and common names
- 2.6 Interpret Newman projections and apply them to compare conformational mobility of different molecules
- 3.1 Distinguish heterolytic from homolytic bond dissociation and understand the reaction pathways available to non-functionalized molecules such as alkanes
- 3.2 Define and identify radicals and radical reactions
- 3.3 Define hyperconjugation and recognize its influence on radical stabilities and the relative ease of radical formation
- 3.4 Recognize the interrelationships between the three stages of radical chain reaction mechanisms: initiation, propagation, and termination
- 3.5 Predict results of alkane halogenation reactions on the basis of concepts of reactivity and selectivity
- 4.1 Name cyclic alkanes
- 4.2 Describe and identify the structural and thermodynamic differences between cis and trans isomers of substituted cycloalkanes
- 4.3 Interpret different conformations of cyclohexane including substituted derivatives
- 5.1 Differentiate constitutional isomers from stereoisomers
- 5.2 Recognize the property of chirality in a molecule, including the presence of stereocenters
- 5.3 Apply optical rotation measurements to the determination of enantiomeric excess
- 5.4 Assign the absolute configurations of chiral structures
- 5.5 Model stereoisomers in the form of Fischer projections
- 5.6 Define and identify diastereoisomers, enantiomers, meso compounds, conformers, and identical structures in molecules with multiple chiral centers

- 5.7 Apply the principles of stereoisomerism to the stereochemical outcome of chemical reactions
- 6.1 Identify nucleophiles and the site of nucleophilic attack in a molecule
- 6.2 Use electron-pair arrows to draw the product of reaction between a nucleophile and a substrate
- 6.3 Deduce the transition state structure of nucleophilic substitution  $S_N2$  by following the stereochemical changes during the course of the reaction
- 6.4 Summarize the relationship between basicity and leaving group ability
- 6.5 Define the factors that govern nucleophilicity and recognize steric hindrance as a controlling element in  $S_N2$  reactivity
- 6.6 Distinguish protic from aprotic solvents
- 7.1 Define and identify solvolysis
- 7.2 Interpret the mechanism of the  $S_N1$  reaction and its variables: solvent, leaving group, nucleophile, and alkyl substituents
- 7.3 Compare the  $S_N1$  and  $S_N2$  processes including stereochemistry
- 7.4 Summarize the factors that determine carbocation stabilization through hyperconjugation
- 7.5 Interpret elimination mechanisms and distinguish between  $E1$  and  $E2$  mechanisms
- 7.6 Predict the dominant course of the reaction of haloalkanes with nucleophiles/bases (elimination or substitution) and the underlying mechanism ( $S_N1$ ,  $S_N2$ ,  $E1$ , or  $E2$ )
- 8.1 Identify and name alcohols and the properties of alcohols, including acid and base properties
- 8.2 Apply nucleophilic substitution mechanism for the preparation of alcohols
- 8.3 Relate alcohols, aldehydes, and ketones and how to use oxidation-reduction chemistry to synthesize alcohols, aldehydes, ketones, and carboxylic acids.
- 8.4 Predict the products formed when hydride and organometallic reagents are added to aldehydes and ketones.
- 8.5 Apply retrosynthetic analysis to synthesis problems
- 9.1 Predict the products formed when alcohols are treated with base
- 9.2 Predict the products formed when alcohols undergo substitution and elimination reactions in acidic conditions
- 9.3 Predict carbocation rearrangements and determine what structural changes occur as a result of carbocation rearrangements
- 9.4 Apply inorganic reagents to effect substitution of the hydroxy group in alcohols and predict the products when inorganic reagents are reacted with alcohols
- 9.5 Name and synthesize ethers
- 11.1 Name alkenes including stereochemistry
- 11.2 Identify and interpret stereochemistry in alkenes
- 11.3 Relate stability of alkenes to structure
- 11.4 Apply basic energetic principles to predict isomeric products in elimination reactions
- 12.1 Describe why alkenes undergo addition reactions and correlate mechanisms of addition with predictions of stereochemical outcomes
- 12.2 Predict the products of hydrogenation and recognize what catalysts and reagents are required
- 12.3 Predict the products of electrophilic addition to the  $\pi$  bond and recognize what reagents are required
- 12.4 Relate carbocation stability to regiochemistry of addition: Markovnikov's rule
- 12.5 Model and interpret mechanisms for HX addition and acid-catalyzed hydration
- 12.6 Predict the products of the hydration, oxymercuration-demercuration, and hydroboration-oxidation of alkenes and recognize what reagents are required to carry out these transformations.
- 12.7 Identify reagents for conversion of alkenes to cyclopropanes, oxacyclopropanes, and 1,2-diols and predict what products are formed.
- 12.8 Predict the products of alkene ozonolysis and recognize what reagents are required to carry out ozonolysis.
- 12.9 Recognize under what conditions radical addition may occur, and predict the products formed.
- 12.10 Describe and model alkene polymerization and predict the polymers formed.

- 13.1 Name alkynes according to the IUPAC rules and identify properties of alkynes based on structure
- 13.2 Identify starting molecules and reagents used to synthesize alkynes
- 13.3 Compare addition reactions of alkynes to those of alkenes and predict the products formed as a result of addition reactions.
- 13.4 Distinguish processes that lead to single versus double addition
- 13.5 Model and interpret mechanisms for electrophilic addition reactions to alkynes
- 13.6 Compare Markovnikov to anti-Markovnikov alkyne hydrations
- 13.7 Relate alkenols to their carbonyl tautomers
- 13.8 Predict the products of the organometallic chemistry of alkenyl halides and identify organometallic reagents
- 14.1 Model and interpret  $\pi$ delocalization
- 14.2 Compare kinetic versus thermodynamic product formation in the electrophilic attack on conjugated dienes
- 14.3 Predict the products of the Diels-Alder cycloaddition and its stereochemistry

The following problems listed below are **suggested** end-of-chapter problems (Independent Homework) to attempt. You should be able to do these problems and they might appear on an in-class examination. Many of the solutions to these problems are found in SAPLINGPLUS.

### **Unit I: Chapters 1-5**

Chapter 1 – Structure and Bonding in Organic Molecules  
25-31, 33-34, 37, 39-46, 49, 52, 53, 58

Chapter 2 – Structure and Reactivity  
33-36, 38-39, 42-50, 52, 55-56, 62-63, 65-66

Chapter 3 – Reactions of Alkanes  
15-16, 22-23, 27-29, 48

Chapter 4 – Cycloalkanes  
21-22, 25, 27, 31-32, 34, 37, 44, 58-59

Chapter 5 – Stereoisomers  
32-42, 44-47, 50-52, 54-56, 65, 68-71

### **Unit II: Chapters 6-8**

Chapter 6 – Properties and Reactions of Haloalkanes ( $S_N2$ )  
31-39, 41, 43-47, 49-50, 56, 61, 65

Chapter 7 – Further Reactions of Haloalkanes ( $S_N1$  and  $E_X$  Reactivity)  
25-28, 30, 32-36, 43-52, 61, 67-70

Chapter 8 – Hydroxy Functional Group: Alcohols  
24-25, 29-31, 34-36, 40, 42-46, 48, 53, 55-56, 64-65

### **Unit III: Chapters 9, 11-13**

Chapter 9 – Further Reactions of Alcohols and the Chemistry of Ethers  
34-40, 42-44, 49-51, 56, 60, 65-66, 84-86

Chapter 11 – Alkenes

33-35, 42-43, 45, 54, 74, 76

Chapter 12 – Reactions of Alkenes

41-43, 46, 48-53, 55, 58, 61, 67-68, 70, 81, 83-85

Chapter 13 – Alkynes

29-30, 38-52, 61-63

**Unit IV: Chapter 14**

Chapter 14 – Delocalized Pi Systems

32-33, 39-42, 46, 49-52, 54, 58, 60, 63, 76, 79