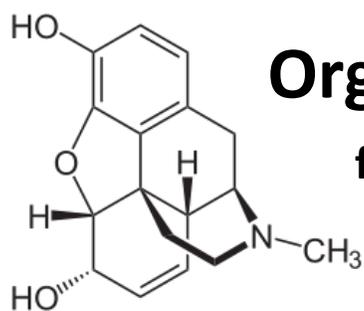


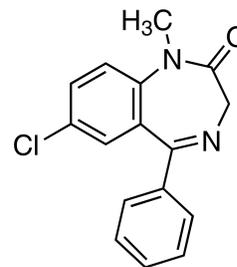
# William & Mary CHEM 207 Summer 2022



## Organic Chemistry II

for Life Science Majors

Location: ISC 1280



Instructor - Dr. Dana Lashley

Office - ISC 1052

Email - [DLashley@wm.edu](mailto:DLashley@wm.edu)

**Office hours:** Mondays 2pm – 2.50pm, Wednesdays 2pm – 2.50pm, or by appointment.

**Class Zoom link:** <https://cwm.zoom.us/j/93426353829?pwd=VIN4SXFekQ4aXpJZ3dJa3RUcU5xQT09>

Meeting ID: 934 2635 3829      Passcode: enantiomer

Zoom may occasionally be used for help-sessions, lectures, or office hours.

But the majority of our class-work is in-person!

**Mandatory materials:** **Workbooks** (price varies for e-book vs paperback ~ \$10 - \$60) and **CHEM101** for online homework/attendance (ca. \$30) are the only mandatory materials.

**Workbook (mandatory):** "Organic Chemistry as a Second Language" 4<sup>th</sup>/5<sup>th</sup> edition, by Klein

- **First Semester Topics** (ISBN: 978-1-1191-1066-8) AND

- **Second Semester Topics** (ISBN 9781119110651)

These are TWO different books and you need both! **Please make sure you get the 4<sup>th</sup> or 5<sup>th</sup> edition !!!**

**Textbook (optional):** "Organic Chemistry", 7th or 8th edition, by Brown, Iverson, Anslyn & Foote (ISBN: 978-1-1339-5284-8). A study guide bundle with **solution manual** (ISBN: 978-1-2850-5261-8) are also available but not mandatory. Both this textbook and the solutions manual are **on reserve for check-out at SWEM library**. For safer usage I have also posted the pages of the textbook that contain assigned problems as well as their solutions on Blackboard.

**Contact:** You should always feel free and comfortable to contact me with any questions or concerns. Visit me in my office hours (listed above) or shoot me an email to schedule an appointment.

**Blackboard:** Course related materials such as lecture templates/notes, exam keys and announcements will be posted on Blackboard ([www.blackboard.wm.edu](http://www.blackboard.wm.edu)).

**Inclusion and Diversity:** I value all students regardless of their background, country of origin, race, religion, ethnicity, disability status, sexual orientation or gender identity. I am committed to providing a climate of excellence and inclusiveness within all aspects of this course. If there are aspects of your culture or identity that you would like to share with me as they relate to your success in this class, I am happy to meet to discuss. Likewise, if you have any concerns in this area or facing any special issues or challenges, you are encouraged to discuss the matter with me. You can set up a meeting with me via email with an assurance of full confidentiality (only exception being mandatory reporting of academic integrity/code violations and sexual harassment/misconduct).

**Course Objective:** Building upon the foundation you acquired in Chem 206 you will be introduced to a series of more advanced topics. You will explore the chemistry and reactions as well as the interconversions of various functional groups. Reaction mechanisms, which explain why reactions occur in a certain way, will be emphasized. Students will also learn about application of organic molecules as drugs & how some drugs exhibit their medicinal properties.

Organic molecules form the basis of living species on our planet. Once we have investigated the principles that control the properties of such molecules, this course will travel from simple organic molecules to complex biomolecules such as carbohydrates, proteins and DNA. Note: we may not be able to cover all biomolecules, but you will be well-prepared for Biochemistry, where these are discussed in-depth!

**Course Delivery:** Taught completely synchronously & mostly in person. Virtual LIVE lectures only on Thursdays. All lectures will be recorded and placed on Blackboard.

**Technical issues may arise and I can't promise that there won't be a problem with a recording – your best bet is to come to live classes!**

**Help- & Review-Sessions:** Varies from week to week:

1<sup>st</sup> week: TUESDAY & FRIDAY at 10.10am – 1.40pm in ISC 1280

2<sup>nd</sup> week – 5<sup>th</sup> week: TUESDAY (in ISC 1280) & THURSDAY (virtual on Zoom) at 2pm-3.30pm

Help-sessions, whether on Zoom or face-to-face, will be recorded and posted on Blackboard.

Help-sessions are not mandatory but HIGHLY RECOMMENDED. Homework assignments will be reviewed, additional practice problems will be discussed and course content will be clarified upon request. You will have the chance to ask many questions.

**Don't miss out on this opportunity it can make a big difference in your understanding of orgo!**

## Final grade:

Graded Coursework	Points
Exam 1*	200
Exam 2*	200
Exam 3*	200
Final	300
Quizzes (4x 25 pts)	100
Attendance	36
Homework (10 x 16.4 pts)	164
<b>Total (minus lowest 200)</b>	<b>1000</b>

\* can be dropped

Your lowest 200 points, stemming from either one of the midterm exams will be dropped. This policy is also in place in case of sickness, i.e. **if you miss an exam due to sickness, this will be your dropped exam.** You cannot drop the final examination, the quizzes or the homework grade.

The maximum amount of points you can achieve in the course are 1000. Your final grade will be determined by the sum of your points throughout the semester in the following **FIRM scale**:

A	93-100%	A-	90-92.99%
B+	87-89.99%	B	83-86.99%
B-	80-82.99%	C+	77-79.99%
C	73-76.99%	C-	70-72.99%
D+	67-69.99%	D	63-66.99%
D-	60-62.99%	F	< 60%

For example, the minimum amount of points required for an A- are 90% of 1000 points = 900 points.

## General information for Attendance, Quizzes & Exams:

**Attendance & Daily in-class questions:** In accordance with W&M policy, class attendance is expected. See undergraduate catalog for more information. Please notify me of any absences by email.

I will take daily attendance using the CHEM101 app. The course meets 20 times this semester for class in the morning. You will be given 1 point each time you attend for a max total of 18 points. In other words you can miss up to 2 classes without any penalty. In case of extenuating circumstances or long-term illnesses please contact me so we can find the best solution on a case-by-case basis.

No attendance will be taken during Help-Sessions.

Each class day there will also be a live question. The question will be delivered using the CHEM101 app and will test your understanding of class content from the previous class or from what was

covered in class that same day. This is to encourage you to pay attention in class and to review class notes from the previous class.

This way, you can earn 1 quiz point in addition to the 1 attendance point each class day:

Correct Answer on Attendance question = 2pts

Incorrect Answer on Attendance question = 1pt (this counts as your attendance)

As mentioned above under attendance, you can miss 2 class days for no penalty at all.

Only 18 quiz/attendance scores will count toward your final grade for a max total of 36 pts.

**QUIZZES: HonorLock will be used to proctor you** while you are taking quizzes! Please see detailed instructions for HonorLock use at the end of this syllabus! **Please understand that you can't take this class this semester if you do not wish to use HonorLock or do not have access to a computer with webcam.** Please contact me if you have accommodations that prevent you from using HonorLock and we will work with SAS to find a way around it. I am very sorry about having to do this, but there are not many options for preventing academic dishonesty.

CLOSED NOTES Quizzes will be taken on

**Wednesdays (weeks 2,3,4 & 5) OUTSIDE of class in a window from 1pm – midnight.**

**Time: 20 minutes**

Quizzes will be taken directly on Blackboard via a Blackboard quiz. You can take the quiz ANYTIME you wish in the given window.

There will be four (4) quizzes, each worth 50 points. You will be given 20 minutes to finish quizzes. Dates for quizzes are shown in the schedule below and are subject to change.

**Orgo 1 Review Quiz:** This Quiz is an EXTRA CREDIT. It does not count as one of the four regular quizzes. The points you earn on this quiz will be added to your final grade at the end of the semester. This quiz serves as an assessment for me to see where you stand with Orgo 1 material. It is utmost important that you review Orgo 1 material as this class heavily relies on Orgo 1 knowledge!

**Scheduled for THURSDAY, June 2nd between 1pm - midnight.**

.

**Midterm EXAMS:**

ALL Exams will be taken **in-person on Fridays during class time** on the days indicated on the schedule below (dates are subject to change).

There will be three (3) midterm exams, each worth 200 points. The lowest of these exams will be automatically dropped.

**Final examination (firm date) will be a comprehensive in-person final:**

**Friday, July 1<sup>st</sup>, 10am - 1 pm.** There will be **NO EARLY FINAL EXAM**... plan your schedule (for example travel, jobs, vacation) now to accommodate the day and time for the final exam.

Once exams are taken I will scan them and submit them to Gradescope, a program that assists me in grading your exams more efficiently & fairly.

**Grading concerns/re-grades:** All grading concerns need to be discussed with me within 3 class days upon receiving your graded exam. After that there will be no re-grades.

You must submit regrade requests directly through Gradescope.

**Make-up work:** Exams, homework and other graded work cannot be easily made-up. See me in the event of extenuating circumstances.

**Extra credit:** There are two opportunities:

1. The orgo 1 review quiz at the beginning of the semester
2. Extra-credit TicToc video about orgo. (will explain in class). **Due Date: Monday, June 27<sup>th</sup>.**

**Student Accessibility Services:** Students must contact the Student Accessibility Services in the Dean of Students office to arrange for special accommodations or extra-time during exams.

**Honor Code:** All students are bound to the Honor Code. There will be **zero tolerance for cheating** and all incidences will be reported to the honor system. See the student handbook for more information on the honor code.

**Important dates:**

First day of class is Tuesday, May 31<sup>st</sup>.

Add/drop ends on Friday, June 3rd

Last day to withdraw from this course is Friday, June 17<sup>th</sup>.

Last day of class is Thursday, June 30<sup>th</sup>.

**Final Exam is on Friday, July 1st, 10 am - 1 pm.**

## THE KEY TO SUCCESS IN ORGANIC CHEM: DOING HOMEWORK & PRACTICE PROBLEMS!

### Homework assignments:

Homework will consist of graded and ungraded assignments.

It is IMPERATIVE for success in this class to do both graded AND ungraded homework. If you only do the graded homework, you are doing just the **bare minimum**. You can pass the class that way but to get an A or a B you must practice way beyond the bare minimum.

Set yourself aside several hours per week to do practice problems.

**This is really the only way to master organic chemistry!**

**GRADED homework assignments** will be done using **CHEM101**. You have to purchase access for the semester. The costs are ca. \$30 for online purchase and probably a bit higher at the WM bookstore. There will be twelve (12) online homework assignments. Each problem-set will be worth 16.4 points. **The lowest two** (2) assignments will be dropped, and your **highest ten** (10) assignments will count for a maximum total of 164 points. Assignments are **due at 11.59 pm** on the dates shown in the schedule below. These dates are subject to change and any changes to the schedule will be announced in class or via email. Late homework assignments are allowed UP TO ONE DAY late will be penalized with a 20% penalty for lateness. (i.e. submission at 12.01am is considered one day late all the way until 11.59pm of that day)

To sign up for CHEM101 follow the instructions provided on Blackboard (BB).

**UNGRADED homework assignments** from your workbook and textbook and some created by myself, are assigned to help you prepare for exams. **I HIGHLY recommend doing these!**

1. **Klein Workbook**: Homework problems can be found below. Updates will be emailed to you weekly do you know exactly which problems you can do each week.
2. **Brown Textbook**: Homework problems for each chapter can be found below.
3. **Problems designed by Prof Lashley**: will be posted on Blackboard weekly to be solved in Help-sessions

**The ungraded problems** that I am assigning to you can be found **further below in this syllabus**.

Additionally, supplemental problems will be posted on blackboard or handed out during help sessions.

***IF you find yourself short on time do 1 & 3. But whatever you do, don't skip doing those!***

**Schedule:** You will find a tentative schedule below. **This schedule is subject to change!**

Unless otherwise stated:

Exams are taken during regular class times.

Quizzes are taken OUTSIDE of regular class times.

Date	Lecture number/ subject	Chapter in Brown	Chapter in Klein	Quizzes/problem-sets
<b>WEEK 1</b>				
T 5/31	1 - Intro and Alcohols (nomenclature, properties),	10	13*	-
W 6/1	2 - Alcohols (reactions)	10	13*	<b>HW1 due</b>
R 6/2	3 - Alcohols (reactions) (virtual)	10	13*	<b>EC review quiz on BB</b>
F 6/3	4 - Ethers (intro, reactions)	11	14*	-
<b>WEEK 2</b>				
M 6/6	5 - Ethers and Epoxides (reactions)	11	14*	<b>HW2 due</b>
T 6/7	6 - Organometallic Chemistry	15	N/A	
W 6/8	7 - Aldehydes and Ketones	16	6**	<b>Quiz 1 on BB, HW3 due</b>
R 6/9	8 - Aldehydes and Ketones (virtual)	16	6**	<b>HW4 due</b>
F 6/10	<b>Exam 1 during class time</b>			-
<b>WEEK 3</b>				
M 6/13	9 - Aldehydes and Ketones	16	6**	-
T 6/14	10 - Aldehydes and Ketones; Carboxylic Acids	16 / 17	6/7**	<b>HW5 due</b>
W 6/15	11 - Carboxylic Acids	17	7**	<b>Quiz 2 on BB</b>
T 6/16	12 - Carboxylic Acids and Derivatives (virtual)	17 / 18	7**	<b>HW6 due</b>
F 6/17	<b>Exam 2 during class time</b>	-		-
<b>WEEK 4</b>				
M 6/20	13 - Carboxylic Acid Derivatives	18	7**	-
T 6/21	14 - Carb. Acid Deriv; Enols & Enolates	18 / 19	7/8**	<b>HW7 due</b>
W 6/22	15 - Rxns of Enols & Enolates watch video b4 class	19	8**	<b>Quiz 3 on BB</b>
R 6/23	16 - Rxns of Enols & Enolates (virtual)	19	8**	<b>HW8, HW9 due</b>
F 6/24	<b>Exam 3 during class time</b>	-		-
<b>WEEK 5</b>				
M 6/27	17 - Dienes, Conj. Systems & MOs, Diels-Alder Rxn	20	10**	-
T 6/28	18 - Diels-Alder Rxn and [2+2]-cycloaddition; Benzene	20 / 21	10**	<b>HW10 due</b>
W 6/29	19 - Benzene and Aromaticity	21 / 22	1**	<b>Quiz 4 on BB, HW11 due</b>
R 6/30	20 - Benzene Reactions (virtual) watch video b4 class	22	4**	<b>HW12 due</b>
F 7/1	<b>Final Exam 10 am - 1 pm</b>	cumulative		<i>ALL covered chapters</i>

\*Klein, 1<sup>st</sup> semester topics

\*\*Klein, 2<sup>nd</sup> semester topics

## Suggested End-of-chapter Problems from Klein Textbook 4<sup>th</sup> or 5<sup>th</sup> Edition

### Assigned homework from the Klein workbook relevant for EXAM 1:

#### KLEIN 1<sup>st</sup> semester topics:

##### Chapter 13:

Problems:

13.2 - 13.5, 13.6, 13.11, 13.13, 13.14, 13.15, 13.57 - 13.61, 13.62, 13.63 - 13.65, 13.68 (deals w/ alcohols & rxns)  
13.37, 13.38 - 13.43, 13.44 - 13.49 (deals with aldehyde and ketone reactions)

##### Chapter 14:

Problems:

14.1 - 14.3, 14.5 - 14.7, 14.8 - 14.13, 14.14 - 14.17, 14.18 - 14.22, 14.23 - 14.25, 14.26 b), 14.27 - 14.30, 14.32  
(deals with ethers and epoxides)

Problems: 14.31 (deals with epoxide opening with organometallics)

### Assigned homework from the Klein workbook relevant for EXAM 2:

#### KLEIN 2<sup>nd</sup> semester topics:

##### Chapter 6:

Problems: 6.2 - 6.7, 6.8, 6.9 - 6.12, 6.16, 6.61, 6.62 - 6.65 (deals with oxidation reactions and organometallic rxn with aldehydes/ketones)

Problems: 6.66, 6.67 - 6.69 (Wittig rxn (C-nucs))

Problems: 6.23, 6.24 - 6.26, 6.28, 6.29 - 6.32 (acetal and hemiacetal formation (O-nucs))

Problems: 6.48, 6.53, 6.54, 6.58, (N-nucs) also do 6.50 and 6.57

Problems: 6.14 - 6.18, 6.19 - 6.22 (H-nucs / reduction reactions)

note: MeOH can be used as work-up for NaBH<sub>4</sub> instead of H<sup>+</sup>, H<sub>2</sub>O or just H<sub>2</sub>O

Mixed synthesis problems w/ different topics: 6.81, 6.83, 6.84, 6.88, 6.89, 6.90, 6.91, 6.92, 6.94, 6.95, 6.96, 6.97, 6.98, 6.100, 6.101, 6.103, 6.105, 6.106, 6.107, 6.108, 6.109

##### Chapter 7:

7.24, 7.25 - 7.28, 7.32, 7.33, 7.35 (Fischer Esterification)

7.55, 7.61, 7.63 (solution for the last two problems using rxns that you know is different from Klein book solution - see below)

7.29, 7.30, 7.31, 7.32 - 7.36, 7.39\*, 7.41, 7.44\*, 7.46\*

\*NOTE: there is a typo in Klein for the problems marked by an asterisk (\*). The Nitrogen in the PRODUCT should have an extra proton and a positive charge.

7.47 - 7.50, 7.51, (the correct solution is slightly wrong in Klein, see below), 7.52, 7.53

7.2 - 7.4, 7.5 (only draw product for this one, no mechanism), 7.7 - 7.10, 7.12, 7.13, 7.14 - 7.18 (for 7.15, 7.16 and 7.17 the Klein solution is missing -78°C with the Gilman Cuprate), 7.18 (pyridine acts as a base on the carb. acid!), 7.19, 7.20, 7.22, 7.43, 7.54 (again Klein is missing -78°C with the Gilman Cuprate), 7.58, 7.60, 7.62, 7.65

**7.61 solution:** 1. H<sub>2</sub>SO<sub>4</sub>, heat ; 2. O<sub>3</sub> ; 3. Me<sub>2</sub>S (Ozonolysis work-up step); 4. CrO<sub>3</sub>, H<sup>+</sup>, heat

**7.63 solution:** 1.  $\text{LiAlH}_4$  ; 2.  $\text{H}^+$ ,  $\text{H}_2\text{O}$  ; 3. PCC,  $\text{CH}_2\text{Cl}_2$  ; 4. 1,2-ethanediol,  $\text{H}^+$

**7.63 alternative shorter solution:**

1. DIBAL
2.  $\text{H}^+$ ,  $\text{H}_2\text{O}$
3. 1,2-ethanediol,  $\text{H}^+$

**7.51 solution:**

1. NaOH,  $\text{H}_2\text{O}$
2. Ethanoyl chloride

## Assigned homework from the Klein workbook relevant for EXAM 3:

**KLEIN 2<sup>nd</sup> semester topics:**

### Chapter 8:

8.1 - 8.7, 8.8, 8.9 - 8.12, 8.14, 8.18, 8.19, 8.20 - 8.23, 8.24 - 8.27, 8.28 - 8.36  
8.37- 8.50 (Aldol and Aldol Condensation)  
8.51 - 8.56, 8.57 - 8.60, 8.61, 8.62 - 8.63 (Claisen Condensation)  
8.64 (Dieckman Condensation)  
8.65, 8.66 - 8.68, 8.69, 8.70 - 8.72, 8.73 - 8.76 (AAES and MES)  
8.77 - 8.80, 8.85 (Michael Reaction and 1,4 addition)

Note: Robinson annulation is sadly not covered in Klein.

### Chapter 10: Diels-Alder

10.1 - 10.8, 10.10 - 10.16, 10.9

**Note:** The Diels-Alder problems in the Klein book are on the easy side. Make sure you also practice more difficult ones as seen on Sapling, Brown book and also via Handout for Exam 3 Help-session after the break.

### Chapter 1: Aromaticity

1.7 - 1.15

## Additional homework from the Klein workbook relevant for Final exam:

**KLEIN 2<sup>nd</sup> semester topics:**

### Chapter 4: Electrophilic Aromatic Substitution (EAS)

4.5 - 4.8, 4.9 - 4.17, 4.18 - 4.27, 4.30 - 4.37, 4.38 - 4.45, 4.46 - 4.56, 4.57 - 4.67, 4.68. 4.69 - 4.74, 4.75 - 4.79, 4.82, 4.84, 4.86, 4.87 - 4.92, 4.94, 4.97 - 4.99, 4.101

### Chapter 9: Amines (we may not get to this)

9.11 - 9.16 (amine synthesis, methods learned in previous chapters e.g. reductive amination), 9.17 - 9.22 (retrosynthesis)

## Suggested End-of-chapter Problems from **Brown Textbook 7<sup>th</sup> or 8<sup>th</sup> Edition**

These are not graded, but exam problems may be similar to these. We will discuss SOME solutions in help-sessions. **I recommend doing ALL other graded & ungraded homework before you start these!**

### **Chapter 10:**

10.15(parts a, c, d, j and o), 10.16 (parts a, c, e, f, g and k), 10.26-10.27, 10.29-10.32, 10.35, 10.37-10.38, 10.40-10.42, 10.45, 10.47, 10.51, 10.57-10.59

### **Chapter 11:**

11.10 (parts a, e and h), 11.11 (parts c, e and h), 11.12, 11.15, 11.16, 11.17(concentrated = excess), 11.20, 11.21, 11.24, 11.27, 11.29, 11.31-11.35, 11.43-11.46

### **Chapter 15:**

15.7-15.13, 15.15, 15.20 (parts a, c and d) 15.21-15.23

### **Chapter 16:**

16.14 (exclude parts g and h), 16.15 (exclude parts e, g, h and i), 16.18-16.22, 16.24, 16.25, 16.29-16.32, 16.37, 16.38-16.40, 16.43-16.44(exclude parts d and k), 16.51-16.53, 16.55, 16.56, 16.61 (parts a and b), 16.67 (part a), 16.68, 16.73 (exclude part d), 16.74, 16.78, 16.81

### **Chapter 17:**

17.7(parts b, c and e), 17.8 (exclude parts e, g, h and i), 17.9, 17.10 (exclude part d), 17.13, 17.15, 17.18 (parts a and d), 17.19-17.23, 17.25, 17.28, 17.32, 17.35, 17.36, 17.38, 17.40, 17.42, 17.44, 17.46 (parts a, c and d), 17.47, 17.48, 17.52 (practice drawing mechanism here, even though it doesn't ask for mechanism), 17.53

### **Chapter 18:**

18.12 (parts c, e, f, h, i and l), 18.13 (parts a, c, d and i), 18.19-18.21, 18.22 (exclude part c), 18.23-18.25, 18.27-18.33, 18.35, 18.36, 18.37, 18.39 (part a), 18.40-18.44, 18.49 (on this one wait until we have covered Chapter 19), 18.52, 18.56, 18.57, 18.63-18.67,

### **Chapter 19:**

19.18-19.25, 19.27-19.35, 19.44-19.45, 19.49-19.53, 19.59, 19.62, 19.67, 19.70, 19.71 (exclude rxns 7 and 10), 19.73 (exclude part b), 19.76

### **Chapter 20:**

20.14-20.20, 20.30-20.32, 20.34, 20.37, 20.39-20.40, 20.46, 20.56 (parts b and c)

### **Chapter 21:**

21.8 (parts a, b and g), 21.9 (exclude parts b, g, m and n), 21.12-21.17, 21.19, 21.22, 21.27, 21.32, 21.34-21.37, 21.40, 21.46, 21.50 part (a) and (b), 21.51, 21.53, 21.55 part (a).

### **Chapter 22:**

22.7 (a) and (b), 22.14, 22.15 (a), (b) and (c), 22.16, 22.18, 22.20, 22.21, 22.31 (a)-(d), 22.32, 22.34, 22.35, 22.37(a), 22.40, 22.43

### **Chapter 23: (we may not get to this)**

23.16, 23.18, 23.19, 23.20, 23.21, 23.22, 23.25, 23.27, 23.28, 23.30, 23.33, 23.34, (23.49-23.50)

### **Chapter 25: (we may not get to this)**

25.7-25.19, 25.24, 25.34