

CHEMISTRY 231 Elemental Organic Chemistry Spring 2024

Course URL: <https://canvas.iastate.edu/courses/105110>

Presentations:	Monday, Wednesday, Friday 11:00-11:50 a.m. Delivery mode: In-person
Lecture Room:	1002 Gilman Hall, Iowa State University.
Instructor:	Professor T. Greenbowe, Ph.D. Office: 3051 Gilman Hall
E-Mail:	tgreenbo@iastate.edu Please write "Chem 231" in the subject line.
Office Hours:	After presentations outside of the lecture hall on the lower-level noon- 12:15 p.m., Wednesdays 1:00-2:00 p.m., and or by appointment.
Head TA:	Yu Fu (yufu@iastate.edu) will handle logistics related to this class such as routine e-mail messages, the On-line homework, exam rearrangements, and exam regrades.
Office Hours:	Tuesdays noon – 1:00 p.m. Room 3354 Gilman Hall or by appointment.

Textbook: *Introduction to Organic Chemistry*, 6th Edition, by William Brown and Thomas Poon, John Wiley & Sons Publisher. The e-book is accessible through the Wiley Course Resources tab on Canvas, which contains many resources including videos and practice problems.

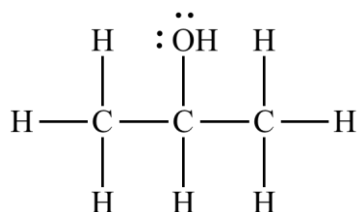
Recommended: *Introduction to Organic Chemistry, Study Guide & Solutions Manual 6th Edition*. The answers and solutions to the end-of-chapter problems in the textbook are included in this study guide.

Canvas: All course-related materials and announcements will be posted on the Chem 231 Canvas web site.

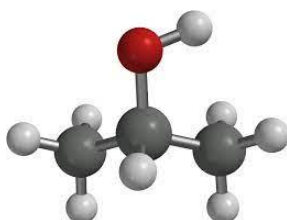
Online Homework: The on-line homework system from Wiley can be accessed from Canvas directly.

Welcome to your organic chemistry course. Organic chemistry is the study of carbon containing compounds. Let's look at rubbing alcohol, technically known as isopropanol or 2-propanol, C₃H₇OH.

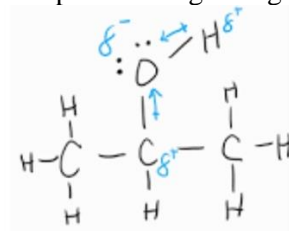
The Lewis structure is



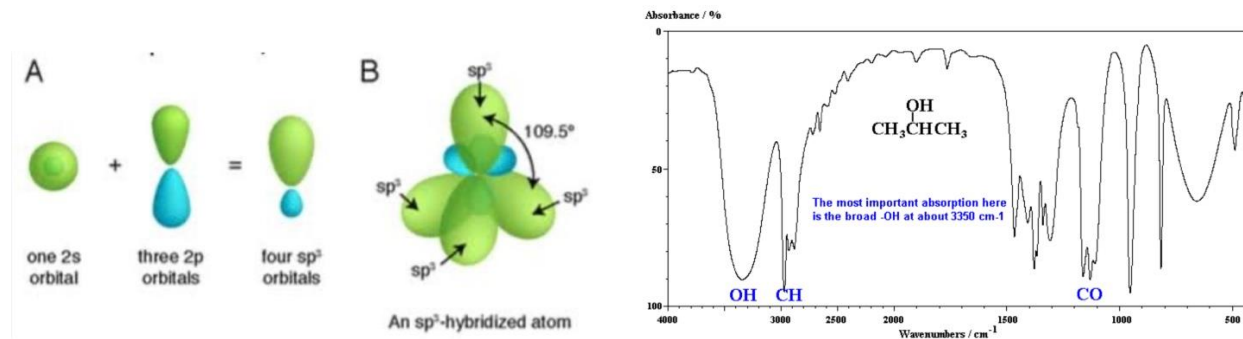
The VSEPR structure is



The partial charge assignment is



Isopropanol is a polar molecule. The boiling point is 82°C and the melting point is 68°C. Each of the carbon atoms are sp³ hybridized, have bond angles of 109.5° and have a tetrahedral shape. The infrared spectrum of isopropanol exhibits an -OH peak and C-H peak in the functional group region. A 5 mL sample of liquid isopropanol will dissolve in 50 mL of water.



Students will need to integrate information about organic compounds in order to solve chemistry problems.

Learning Objectives:

Organic chemistry is a challenging subject. You will be expected not only to learn factual information, but also to apply your newfound understanding to open-ended problems. You should not aim simply to memorize the material. Rather, you should try to make sense of trends so that you can make predictions in unfamiliar situations. Problems fall into Five major categories:

Naming of Organic Compounds: You will learn about naming compounds within the functional group class of compounds discussed in the course. Compounds include alkanes, alkenes, alkynes, alcohols, esters, carboxylic acids, amines, aldehydes, ketones, aromatics, etc. The compounds will be cyclic or acyclic. Fundamental stereochemical information about the structure of the compound such as R, S, E, Z, cis or trans will be included when appropriate.

Structure and properties: Major topics in this area include the properties of functional groups (the key parts of organic molecules), conformational analysis (the study of how molecules fold in three dimensions), and stereochemistry (the study of molecules possessing mirror-imaged partners).

Reactions and mechanisms: You will learn to predict the products of reactions, propose reagents for effecting desired reactions, and explain why reactions proceed the way they do through mechanisms.

Organic synthesis: Using your understanding of reactions, you will propose methods for preparing target molecules through multi-step reaction sequences.

Structure determination: Using your understanding of organic chemistry, you will deduce the structures of unknown compounds by analyzing their physical properties (i.e. b.p., m.p., v.p. etc.), chemical reactions, and IR and NMR spectra.

Course Expectations: A large amount of new material will be covered in this course and it is important that you keep up. Attend the lecture presentations. Read the assigned topics and chapters in the textbook. It is strongly advised that you work as many problems as you can in order to do well in this course.

Co-requisite: Chem 231L (Organic Chemistry Laboratory Course) is a co-requisite for Chem 231. No grade will be given for CHEM 231 unless CHEM 231L is completed.

Pre-requisites: Chem 163 (General Chemistry I) or equivalent is a pre-requisite course. There are several topics discussed in Chem 163 or in an equivalent general chemistry course that are essential for students to understand prior to studying organic chemistry. The first two chapters of our organic chemistry textbook quickly reviews some of the prerequisite topics. We recommend students devote significant time and energy to developing a 90% understanding of the following topics within the first two weeks of the Chem 231 course:

Atomic Structure. Electron configuration. Covalent Chemical Bonding Lewis Structures.

VSEPR Shapes of Molecules. Bond Angles. Hybridization in Bonding: sp , sp^2 , sp^3

Electronegativity. Polar covalent bonds. Polar molecules. Resonance. Formal charge.

Intermolecular Forces (IMFs). How physical properties of compounds depend upon IMFs

Acid-Base Equilibria. pH. K_a , K_b , pK_a , pK_b . Kinetics & Mechanisms

We have placed copies of the appropriate chapters from general chemistry (Chem 163) on the Chem 231 Canvas course web site. We have included recommended end-of-chapter problems from your textbook and problems in your first and second sets of on-line Wiley homework problems.

Online Homework: We will use the online homework system from Wiley that can be accessed from Canvas directly. To get a better grade in this course and to understand the material, you are expected to spend at least 6 hours per week studying the materials and doing homework/End-of-Chapter problems. Scores will be reduced by 50% after due date and by 100% if submitted 3 days after due date. The homework scores will be converted on a scale of 0–100 in the grade calculation (i.e., a perfect score on the homework is worth a total of 100 points).

Exams: In addition to the Final Exam, 200 points, there will be five “midterm or hour” Exams, 80 points each, scheduled throughout the semester. The Hour Exams will be administered in Room 1002 Gilman Hall – the same room as the lecture presentations – at 11:00 a.m. on selected Fridays. Students are allocated 45 minutes to complete the “hour” exam. There are total of 520 points allocated for exams. We will count each student’s best four “hour” exam scores. This allows you to miss one exam for a personal or family emergency (such as an illness, a death in the family, car troubles, etc.), or for other legitimate causes without suffering a grade penalty. If a student misses two or more exams, all missed exams are assigned a score of zero. There are no make-up exams. Students are required to have and show their ISU ID card to a proctor for each exam. Exams are not curved. Missing an exam for any reason will result in that exam being assigned a score of zero. Exams are closed book closed notes.

The Chem 231 Final Exam is scheduled for Thursday May 9, 2024 from 7:30 a.m.– 9:30 a.m., presumably in Room 1002 Gilman Hall. Details of the Final Exam day, time and location will be announced in class. Missing the Final Exam will result in a score of zero for the final exam.

Any re-grade requests on an hour exam must be requested within one week after receiving the graded exam. Mark the questions you request regrade on the cover page and briefly explain the issue. Turn the exam to Ms. Taylor Gerdes (1608 Gilman Hall) and she will pass it on to the head TA. The head TA generally looks over the entire exam to correct any mistakes in grading.

Top Hat: This course will use the Top Hat response system in class and requires the purchase of a license to participate. Visit the [Top Hat learning tool guide](#) to view the terms of service, privacy policy, accessibility statement, and instructions for joining the Top Hat course and engaging with the Top Hat course. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message. You may login or sign up at <https://app.tophat.com/register/student> to access this course (Join Code: TBA). You can also access Top Hat from the Canvas course page. The Top Hat scores will be converted on a scale of 0–80 in the grade calculation (i.e., perfect score on Top Hat is worth 80 points. Scores on the lowest/missed 5 Top Hat questions will be dropped.

Grading: The course grade will be based on a student’s four best 80-point “hour” exam scores (320 points), the final exam score (200 points), in-class Top Hat quizzes (80 points.), and on-line homework score (100 points.). The total points allocated is 700 points. The final course grade will be based more or less on the following scale, depending on the course average:

A ≥ 90%; 89% > **A-** ≥ 87%; 86% > **B+** ≥ 83%; 82% > **B** ≥ 79%; 78% > **B-** ≥ 76%; 75% > **C+** ≥ 71%; 70% > **C** ≥ 66%; 65% > **C-** ≥ 62%; 61% > **D+** ≥ 58%; 57% > **D** ≥ 54%; 53% > **D-** ≥ 51%; **F** < 50%

Suggestions for doing well in this class:

1. Read the book chapter and work the in-chapter problems **prior** to coming to class. This is an effective use of your time because you will be able to follow the presentation.
2. Attend each lecture presentation. We will devote some class time to working in small groups. Be prepared to work the problems and to share information. Ask questions when working in groups.
3. After the lecture presentation, study the posted lecture notes and the corresponding materials in the textbook. *Work the recommended assigned end-of-chapter problems.* We will not collect or grade these problems. The answers to those problems are available in the Study Guide & Solutions Manual.
4. Work the online homework after the chapter is finished (the homework is generally due a

- week after the chapter topics are presented in lecture). These problems are machine graded.
- Schedule specific time each day to study organic chemistry individually and in small-study groups. Don't fall behind, as it is difficult to catch up!
 - If you have questions about solving the assigned organic chemistry problems, make use of the Help Center.

Academic support: • Academic Success Center (asc.dso.iastate.edu). • ISU Library (lib.iastate.edu)
• Student Accessibility Services (sas.dso.iastate.edu)

Organic Chemistry Help Room (3354 Gilman Hall): Organic chemistry teaching assistants will be available to help with questions related to lab and lecture material in the organic chemistry help room. The hours of operation are posted on the following web site: [Current Organic Help Center](#)

Academic Accommodations

Iowa State University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. If you have or anticipate needing an academic accommodation in this course, please contact Professor Greenbowe to set up a brief meeting **within the first two weeks of the semester** or as soon as you become aware of your need. Before the meeting, you will need to obtain a SAAR form with recommendations for accommodations the accommodation office located in Room 1076 on the main floor of the Student Services Building. Their telephone number is 515-294-7220 or online at sas.dso.iastate.edu, by email at accessibility@iastate.edu. Retroactive requests for accommodations will not be honored. For any special exam accommodations, turn the SAAR form to Ms. Taylor Gerdes (1608 Gilman Hall) to set it up.

We will provide reasonable physical and academic accommodations where barriers exist to students' full participation in higher education. However, any accommodation must not interfere with the integrity of the course or course standards. Staff at SAS collaborate with students and campus partners to coordinate accommodations and to further the academic excellence of our students.

This course affirms Iowa State University's commitment to supporting learners in an accessible and reasonable manner. Neurodiversity includes students diagnosed with or displaying symptoms of Attention Deficit Hyperactivity Disorder, Autism Spectrum Disorder, Bipolar Disorder, Anxiety Disorder, Depression, Post Traumatic Stress Disorder, or related disorders that may affect your learning. Your instructor is dedicated to accommodating you in a proactive manner that helps you in this class. To support you, please read the Shared Responsibility Statement (bit.ly/sas-responsibility) and contact Student Accessibility Services by email at accessibility@iastate.edu or by phone at 515-294-7220.

Drops and Audits: Students taking Chem 231L will be required to drop the lab if they drop or decided to audit the Chem 231 lecture course. Auditing does not count towards full-time student status. For signing your drop slip, please see Ms. Taylor Gerdes in 1608 Gilman Hall.

Students may not register to audit Chem 231 after January 30th. The audit does not count towards full-time student status. To add or drop recitation or lab sections during the first week of class, use AccessPlus. After the first week, please email amwade@iastate.edu or call 515/294-6361. The last day to drop CHEM 231 is March 31st.

Extenuating circumstances: Our topic schedule, exam schedule, on-line HW schedule, policies, delivery mode, or procedures in this course are subject to change by Professor Greenbowe for valid

academic reasons. We will make every effort to keep to the schedule of assignment due dates and exams. Any modifications will be communicated in writing, verbally in class, and published in the Canvas course. There may be a few times when the lectures will be delivered on-line.

Academic Honesty and Dishonesty: The class will follow Iowa State University's policy on academic misconduct (5.1 in the Student Code of Conduct, bit.ly/Isu-stu-code). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams and for following directions given by faculty, instructors, and ISU Test Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the Office of Student Conduct in the Dean of Students Office (studentconduct.dso.iastate.edu). Information about academic integrity and the value of completing academic work honestly can be found in the Iowa State University Academic Integrity Tutorial (bit.ly/isu-ai-tutorial).

Free Expression. *“Iowa State University supports and upholds the First Amendment protection of freedom of speech and the principle of academic freedom in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.”*

Basic needs: To learn effectively, you must have basic security: a roof over your head, a reliable place to sleep, and enough food to eat, ISU Student Wellness Food Security site (bit.ly/foodsecurity-isu). If you're having trouble with any of those things, please talk with me, your academic advisor, or the Dean of Students Office, email studentassistance@iastate.edu, or phone 515-294-1020. Together, we can work to meet those needs.

Student health and wellness: Iowa State University is committed to proactively facilitating all students' well-being. We welcome and encourage students to contact the following on-campus services for their physical, intellectual, occupational, spiritual, environmental, financial, social, and emotional needs:

- Student Wellness call 515-294-1099 or web (studentwellness.iastate.edu)
- Thielen Student Health Center call 515-294-5801 (24/7 Medical Advice) or web (cyclonehealth.org) • Student Counseling Services call 515-294-5056 or web (counseling.iastate.edu)
- Recreation Services call 515-294-4980 or web (recservices.iastate.edu).

• If you or someone you know needs support now due to heightened feelings of sadness or hopelessness, thoughts of harm or suicide, or increased anxiety may walk into Student Counseling Services (8 a.m. - 5 p.m., Monday-Friday) for confidential 24/7 trained crisis counselors call or text 988 (Suicide and Crisis Lifeline) or ISU Crisis Text Line (Text ISU to 741-741). Another option is to contact our ISU Police Department at 515-294-4428 (counseling.iastate.edu/in-crisis).

Discrimination and Harassment: Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu.

Tentative Schedule for Lecture Topics and Exams

1	M 01/15	University Holiday (no class)	9	M 03/11	Spring Break (no class)
	W 01/17	Chap. 1 Bonding		W 03/13	Spring Break (no class)
	F 01/19	Chap. 1 Structures		F 03/15	Spring Break (no class)
2	M 01/22	Chap. 1 Hybridization	10	M 03/18	Chap. 8 Alcohols and Ethers
	W 01/24	Chap. 1 Functional Groups		W 03/20	Chap. 8 Alcohols and Ethers +IR
	F 01/26	Chap. 2 Acids and Bases		F 03/22	Chap. 9 Aromatic Compounds
3	M 01/29	Chap. 2 Acids and Bases	11	M 03/25	Chap. 9 Aromatic Compounds +IR
	W 01/31	Chap. 2 Acids and Bases		W 03/27	Chap. 10 Amines
	F 02/02	Chap. 3 Alkanes and Cycloalkanes		F 03/29	Chap. 10 Amines +IR
4	M 02/05	Chap. 3 Alkanes and Cycloalkanes	12	M 04/01	Chap. 11.5–11.12 NMR
	W 02/07	Chap. 4/5 Alkenes/Alkynes		W 04/03	Chap. 11.5–11.12 NMR
	F 02/9	EXAM 1 (Chapters 1, 2, 3)		F 04/05	EXAM 4 (Chapters 8, 9, 10, 11)
5	M 02/12	Chap 11.1–11.4 Infrared Spectroscopy	13	M 04/8	Chap. 12 Aldehydes and Ketones
	W 02/14	Chap. 3 Alkanes and Cycloalkanes (Reactions) +IR		W 04/10	Chap. 12 Aldehydes and Ketones + IR + NMR
	F 02/16	Chap. 4/5 Alkenes/Alkynes (Reactions) + IR		F 04/12	Chap. 13 Carboxylic acids
6	M 02/19	Chap. 4/5 Alkenes/Alkynes (Reactions)	14	M 04/15	Chap. 13 Carboxylic acids + IR + NMR
	W 02/21	Chap. 4/5 Alkenes/Alkynes (Reactions)		W 04/17	Chap. 14 Carboxylic acid derivatives
	F 02/23	EXAM 2 (Chapters 3, 4, 5, 11 IR)		F 04/19	Chap. 14 Carboxylic acid derivatives
7	M 02/26	Chap. 6 Chirality	15	M 04/22	Chap. 16 Organic Polymers
	W 02/28	Chap. 6 Chirality		W 04/24	Chap. 17 Carbohydrates
	F 03/01	Chap. 6 Chirality		F 04/26	EXAM 5 (Chapters 11, 12, 13, 14, 16)
8	M 03/04	Chap. 7 S _N /E Reactions for RX	16	M 04/29	Chap. 18 Amino acids and proteins
	W 03/06	Chap. 7 S _N /E Reactions for RX		W 05/01	Chap. 18 Amino acids and proteins
	F 03/08	EXAM 3 (Chapters 1- 7 and 11 IR)		F 05/03	<u>Review</u>

Final Exam:

7:30 a.m. – 9:30 a.m. Thursday, May 9th Room 1002 Gilman Hall
The final exam is comprehensive – Chapters 1-18 (not Chapter 15)