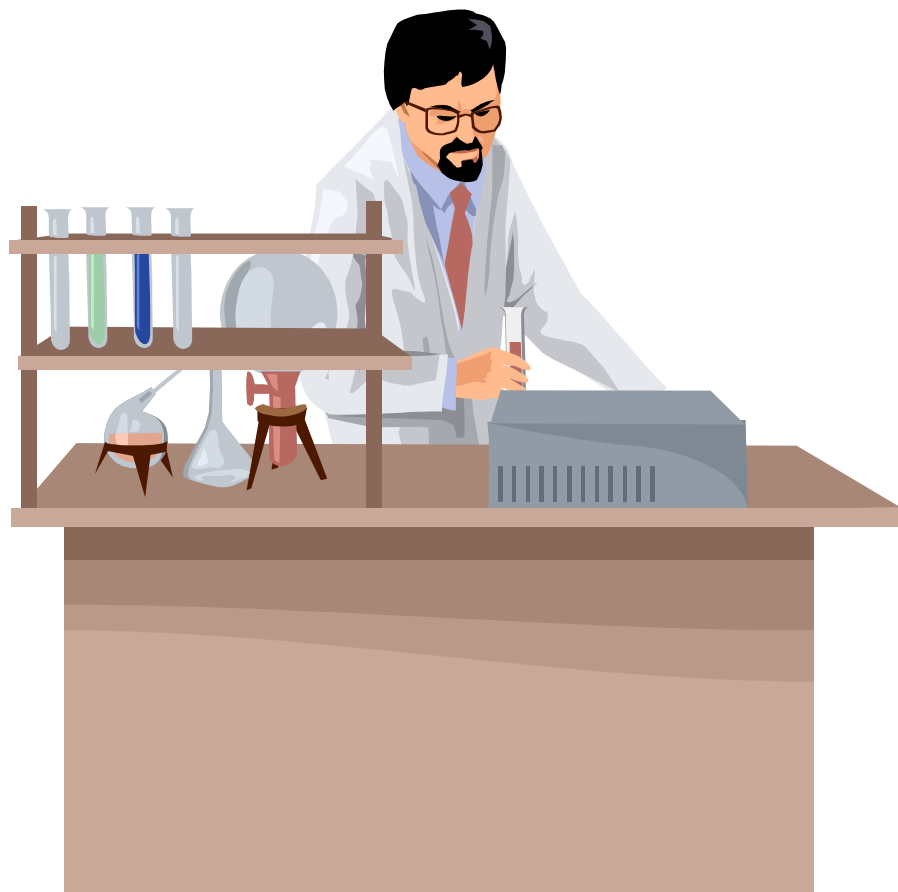


# Organic Chemistry CHEM 300 & CHEM 302

*Four Credit hours each  
Six Lecture hours per week  
Four Lab hours per week  
(3/2/4/75)*



**Name:** \_\_\_\_\_

**Term:** \_\_\_\_\_

**Organic Chemistry  
Chemistry 300 & 302**

**Instructor:**

Tim Schoof, Ed. D.

Office Location: Undergraduate Department, Office # 2050

Office Hours: By Appointment

Phone: (913) 234-0665

E-mail: [tim.schoof@cleveland.edu](mailto:tim.schoof@cleveland.edu)

**Textbook:**

T. Graham Solomons, "[Organic Chemistry](#)", Ninth edition, John Wiley and Sons ISBN: 978-0-471-68496-1 <http://www.wiley.com/WileyCDA/WileyTitle/productCd-0471684961.html>

**Grading:**

There will be three examinations given in lecture. Exam questions include primarily short answer essay, problem sets and fill-in-the-blank. However, other forms of questions may occasionally appear. Each exam is worth 100 percentage points. Date and scope to be announced at least three days prior to exam date. Any incident of academic dishonesty merits a grade of failure in the course. Lecture will constitute 80% of the combined grade and Lab will constitute 20% of the combined grade. Further lab details contained in laboratory section.

Grading Scale is as follows:

90% and above	A
80% to 89%	B
70% to 79%	C
60% to 69%	D
59% and below	F

The instructor reserves the sole right to modify, but not raise the grading standards in the course. The instructor also reserves the sole right to modify parts of the syllabus.

**Attendance:**

An absentee rate of more than two days (10%) will constitute an "XF" in the course, unless approved by the instructor. A grade of "XF" means an "F" or failing due to excessive absences. Other than, to explain excessive absences (more than two days) and to request makeup exams, no excuses are necessary. At the point of excessive absences, the student may write a letter to his/her instructor, attaching documentation that qualifies his/her absences as having occurred due to "extenuation circumstances." With proper documentation, the student may have the absences excused. Determination of validity and authenticity of the excuse is solely at the discretion of the instructor. Please do not go to the instructor in advance of being dismissed from class with notices about present or future absences. Save your letters and your documentation of excuses for the time when you must

request special consideration, should that becomes necessary. According to college policy (see Student Handbook) no consideration will be given to students who exceed four absences (15%)

**Attendance Sheet:**

Attendance is taken through use of an attendance sheet. It is your responsibility to sign the attendance sheet each class period. If you have not signed the attendance sheet before the end of the class period, you will be marked absence. These absences cannot be removed without solid evidence that you were in attendance. Students coming in late or leaving early will receive a tardy. Two tardies will equal one absence.

**Make-ups:**

If you should miss a class, it is your responsibility to get notes from someone in the class. Do not ask the instructor for notes! Get the notes, analyze the notes and then if questions remain, ask your instructor.

Test days are mandatory attendance days and cannot be made up without prior approval of your instructor. In order to make up a test you must present an official written document explaining the reason you missed the scheduled test date. Your instructor reserves the right to determine the validity and authenticity of your excuse and retains the right to refuse giving the makeup for any reason.

The makeup is given at a time specified by your instructor. The makeup is given only at this specified time. You should be prepared to take the test the day you return to school. Remember makeup exams are generally harder and do not have bonus points on them. Should you not take the makeup test at the specified time, it will be an indication of your accepting a zero on the test. You can only make up one test regardless of the situation. Zeros are assigned, if you miss more than one test.

**Student Challenge:**

If a student feels the method of teaching and/or examining or the conduct of the instructor does not meet their expectations, the following acceptable “challenge” procedure must be followed in this order: (It is best to contact people in writing)

1<sup>st</sup> Course instructor

2<sup>nd</sup> Dean of Undergraduate Studies

3<sup>rd</sup> Provost

4<sup>th</sup> V. P. of Academic Services

Should you ignore this administrative chain of responsibility, the instructor reserves the right to conclude the matter in any way deemed appropriate.

**Academic Policies:**

The college policies outlined in the catalog & student handbook will be followed.

**Special Accommodations:**

Cleveland Chiropractic College has adopted the definition of disability as “a physical or mental impairment that substantially limits one or more of the major life activities of an individual, such as caring of oneself, learning, working, performing manual tasks, walking, seeing, hearing, speaking and breathing.: Impairment may be “any physiological disorder or condition, cosmetic disfigurement, anatomical loss or psychological disorder such as retardation, organic brain syndromes, emotional or mental illness and specific learning disabilities.

If you have a documented disability, which requires academic accommodations, please see the Office of Academic Enhancement. In order to receive accommodations in this course, I must be provided a Letter of Accommodation from the office of Academic Enhancement. If you have not already done so, please register with Academic Enhancement. Also, I am available to discuss any questions or concerns regarding accommodations in my class.

**Student Conduct:**

Students are expected to uphold the school honor code. Additional standards of student conduct are published in the College Catalog and the Student Handbook. Students observed violating these standards of professional and personal conduct will be asked to leave class and an incident report will be submitted to student services, which may result in additional disciplinary action.

**Final Grades:**

Time: Assuming a class size of 25 or fewer students, your instructor will post grades on line or e-mail grades by noon two working days after the final examination. Allow an additional day or two for larger classes. Please, do not call to ask if the grades are done!

Posting: If you signed the posting permission sheet, provided a valid posting code and initialed the sign-in sheet, your instructor will post your grades on line at <http://www.cleveland.edu/Schoof.cfm> or e-mail your grades to your Cleveland account. Valid posting codes consist of a four digits number that does not begin with zero. Due to privacy of information acts, your instructor cannot give out grade information over the phone, nor can your instructor e-mail non-coded grade information. Please note that posted grades are non-official. The registrar will mail you a copy of your official grades. Your instructor is not responsible for mistakes in posted grades.

Alt: Wait for your grades to be mailed to you by the registrar. Otherwise, there are no other alternatives to getting your grades.

**Grade Changes:**

If you feel there has been an error in grading, please contact your instructor in writing before the first week of the new term detailing why you believe the grade is in error. All errors in grading or grade disputes are handled the first week of the new semester. The only grades that your instructor will change are grades, which are wrong due to recording or computational errors. Do not ask your instructor for extra credit to improve your grade. Each test has a generous amount of extra credit. In addition, there are no retake exams for any reason. The way to improve your grade is to study hard and learn the material before you get to the final.

**Exam Review:**

Students who wish to review their exam/s may do so up to one week after the administration of the exam. All exams will be reviewed in the instructors' office without books, writing utensils, cellular phones, backpacks, recording devices, etc. After the one-week review period, students will not be allowed to review their exams

**Utilization of Technology:**

Computers make writing and revising documents much easier and more productive. Students must recognize that technology can also cause problems. Printers run out of ink, hard drive crash, etc. Students must be responsible for planning ahead and meeting deadlines in spite of technology. Be sure to take the necessary measures to ensure your work is safe, secure, and submitted on time.



“Chance favors the prepared mind.”

Louis Pasteur

**Catalog Description: (6/0/3/48)**

The sequence of organic I & II courses presents the fundamental concepts, theories, and reactions of carbon-containing compounds. The course emphasizes properties, structure-reactivity relationships, and mechanisms of the major classes of carbon compounds. Special consideration is given to carbon compounds found in living systems. Prerequisite: Minimum grade of C in General Chemistry I and II. Organic Chemistry I with a minimum grade of C is a prerequisite for Organic Chemistry II.

**Course Description:**

The course material is subdivided into studies of homologous series. The study of each homologous series is detailed in the following categories.

- I. Generalizations:  
Broad generalizations are made about structure, bonding, and generic nomenclature of members of the homologous series.
- II. Nomenclature:  
IUPAC nomenclature is emphasized, but common and derived systems are presented to introduce structural features within each series. Structural differences and correlations are emphasized. This topic becomes naturally de-emphasized in later homologous series.
- III. Electronic Structure:  
The electronic structure of the particular homologous series is developed in detail. Bonding, geometry, and resonance structures are used to predict relative physical properties of the homologous series and to provide a basis for the mechanism of characteristic reactions.
- IV. Physical Properties:  
After a molecular basis for the physical properties is established, reliable predictions of physical properties is offered as evidence supporting the proposed structure.
- V. Chemical Properties:  
Chemical reactions of a homologous series are mechanistically interpreted as acid, base, free radical, or redox reactions appropriate to the documented electronic structure. Strong emphasis is placed upon proof of mechanism using kinetics, stereochemical reactions, isotopic studies, catalytic studies and molecular structures.
- VI. Synthesis:  
The reactions of the class are outlined and discussed from a mechanistic viewpoint. Interpretation of evidence to support the mechanisms is stressed.
- VII. Miscellaneous:  
Representative compounds of commercial interest within the homologous series are discussed in terms of their source, their usefulness as consumer products or biological and environmental significance.

**The Homologous Series:**

- |                       |                      |
|-----------------------|----------------------|
| 1. Alkanes            | 6. Alcohols          |
| 2. Alkenes            | 7. Amines            |
| 3. Alkynes            | 8. Carboxylic Acids  |
| 4. Arenes             | 9. Ethers            |
| 5. Carbonyl compounds | 10. Acid Derivatives |
| a. aldehydes          | a. acyl halides      |
| b. ketones            | b. amides            |
| c. carbohydrates      | c. esters            |

**Course General Outline:**

- I. General review of major general chemistry concepts, which are important to the understanding of Organic
- II. An investigation of each of the homologous series as described in the course description
- III. A summary of the major organic concepts is given by the utilization of an introduction to biochemistry.

**Other Information:**

For other information concerning academic policies, student conduct, grade appeals, and special accommodations, please refer to your student handbook.

# Organic Chemistry I

## Course Outline

1. Introduction to Organic Chemistry
  - A. Organic Definition
  - B. Reasons for Organic Chemistry
2. Review of Major Concepts in Chemistry I (Chapter 1)
  - A. Trends in the Periodic Table
  - B. Atomic Theory
  - C. Bonding
  - D. Chemical Formulas
  - E. Lewis Structures
  - F. Formal Charge
  - G. Molecular Geometry
  - H. Isomers
  - I. Resonance
  - J. Physical Properties
  - K. Functional Groups

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**Test 1**

5. IUPAC Nomenclature (Chapter 4)
  - A. Basic Rules
  - B. Functional Groups
  - C. Side chains and substitutive groups
  - D. Ring Structures
  - E. Bicyclic Compounds
  - F. Side chains and substitutive groups
6. Alkanes (Chapter 4)
  - A. Sources of Alkanes
  - B. Petroleum Refining
  - C. Cracking
  - D. Physical Properties
  - E. Sigma Bonds and Bond Rotation
  - F. Relative Stabilities (Energy & Stabilities)
  - G. Chair Conformation
  - H. Cis-Trans Isomers
  - I. Chemical Reactions of Alkanes

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**Test 2**

**“Organic chemistry is the chemistry of carbon compounds.  
Biochemistry is the study of carbon compounds that crawl.”**

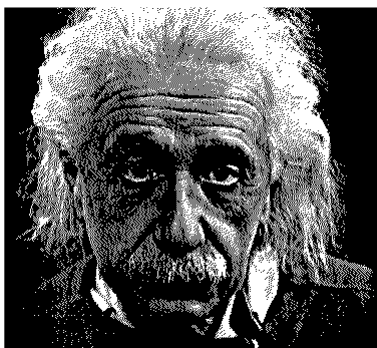
Mike Adam

- 7. Stereochemistry (Chapter 5)
  - A. Chirality
  - B. Enantiomers
    - 1. History
    - 2. Biological Importance
  - C. Nomenclature of Enantiomers
    - 1. +/- System
    - 2. D/L System (Chapter 22)
    - 3. R/S System
- 8. Fischer Projection vs. Haworth Formulas
- 9. Anomers (Chapter 22)
- 10. Polysaccharides (Chapter 22)
- 11. Racemic Forms
- 12. Meso Compounds
- 13. Separation of Enantiomers
- 14. Reactions (Chapter 6)
  - A. Physical Properties of Alkyl Halides
  - B. Substitution Reactions
    - 1) Sn2
    - 2) Sn1
    - 3) Sn2 vs. Sn1
  - C. Elimination Reactions
    - 1) E2
    - 2) E1
  - D. Energy of Activation ( $E_a$ ) vs. Collision

**Test 3**

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**“Any fool can know.  
The key is to understand.”**



**Albert Einstein**

# Organic Chemistry II

## Course Outline

1. Introduction
2. Review of Major Concepts in Organic I

**Review Only**

- 
3. Alkenes & Alkynes (Chapter 7)
    - A. Physical Properties of Alkenes & Alkynes
    - B. E-Z System
    - C. Relative Stabilities of Alkenes & Cycloalkenes
    - D. Zaitsev's Rule & Hofmann Rule
    - E. Dehydration of Alcohols
    - F. Vicinal (Vic) & Geminal (Gem)
    - G. Terminal Alkynes
    - H. Hydrogenation of Alkenes
    - I. Syn & Anti Additions
    - J. Index of Hydrogen Deficiency
  4. Addition Reactions (Chapter 8)
    - A. Mechanism
    - B. Markovnikov's Rule
    - C. Acid-Catalyzed Hydration
    - D. Variations
    - E. Oxidations of Alkenes
    - F. Oxidative Cleavage of Alkenes
  5. Radical Reactions (Chapter 10)
    - A. Description
    - B. Importance in Biology, Medicine & Industry
    - C. Mechanism
    - D. Selectivity of Halogens
    - E. Anti-Markovnikov Reaction
    - F. Ozone Depletion & CFC's

**Test 1**

- 
6. Spectroscopy (Chapters 9)
    - A. Electromagnetic Spectrum
    - B. General Principle
    - C. Infrared Spectroscopy (Chapter 2)
    - D. Ultraviolet Spectroscopy (Chapter 13)
    - E. NMR Spectroscopy (Chapter 9)
    - F. MRI Spectroscopy (Chapter 9)
    - G. Structural Analysis
  7. Alcohols & Ethers (Chapter 11)
    - A. Important Alcohols & Ethers
    - B. Physical Properties
    - C. Synthesis of Alcohols from Alkenes

- D. Dehydration Synthesis (Condensation)
- E. Phase-Transfer Catalysis
- 8. Carbonyl Compounds (Chapter 12)
  - A. Carbonyl Containing Compounds
  - B. Nucleophilic Addition Reactions
  - C. Oxidation-Reduction (Redox) Reactions
  - D. Organometallic (Grignard Reagents) Note: overview only

**Test 2**

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- 9. Conjugated Systems (Chapter 13)
  - A. Classification
  - B. Resonance Review
  - C. Stability of Conjugated Dienes
  - D. Kinetic vs. Thermodynamic Control
- 10. Aromatic Compounds (Chapter 14)
  - A. Aliphatic vs. Aromatic
  - B. Nomenclature
    - 1. Ortho, Meta, Para
    - 2. Annulenes
  - C. Stability
    - 3. Aromatic
    - 4. Antiaromatic
    - 5. Nonaromatic)
  - D. Huckel's Rule
  - E. Heterocyclic Aromatic Compounds
  - F. Aromatic Compounds in Biochemistry
  - G. Energy Transport
- 11. Electrophilic Aromatic Substitution Reactions (Chapter 15)
  - A. General Mechanism
  - B. Specific Examples
  - C. Affect of Substituents
  - D. Activators
    - 6. Deactivators
    - 7. Ortho-Para Directors
    - 8. Meta Directors
  - E. Reaction Scenarios
- 12. Odds & Ends
  - A. Reactivity of Aldehydes & Ketones
  - B. Hemiacetals & Hemiketals
  - C. Enol
  - D. Tautomers
  - E. Carboxylic Acid Derivatives
  - F. Decarboxylation
  - G. Thio Group
  - A. Amines vs. Amides
  - B. Biologically Important Amines

- C. Chemotherapy
- D. Biochemistry Prep. (Glycolysis)

**Test 3**

**Note:** Test 3 is semi-comprehensive: Major concepts and reaction mechanisms will be a significant part of this test.

**Your theory is crazy, but it's not crazy enough to be true.**



**Niels Bohr**, *to a young physicist*  
*Danish physicist (1885 - 1962)*

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## Organic Laboratory

**Instructor:** Tim Schoof, EdD      [tim.schoof@cleveland.edu](mailto:tim.schoof@cleveland.edu)      913-234-0665

**Lab Manual:**  
Chemical Education Resources Packet

**Grading:** Constitutes 10% of combined lecture and lab grades

Lab Papers .....	200 pts
Learning Points.....	50 pts
Participation.....	25 pts
Accuracy and efficiency .....	25 pts

**Attendance:**  
Lab days are mandatory attendance days and cannot be made up. However, with proper documentation as to the reasons for missing lab and at the discretion of your instructor, a 5 to 10 page term paper may be substituted for a maximum grade of 89% for that lab.

**Learning Points:**  
Unless otherwise stated, learning points are due one week after completion of the lab. Learning point submissions should contain the formal honor code reaffirmation statement with the signature of each group member who participated “fully” during the lab period.

**Lab Groups:**  
Lab groups consist of four or fewer people. Your instructor will select members of your group and have final say on who will work with whom. The groups will share the responsibility of performing the labs, cleaning the group’s workspace and writing up the lab. (Only one write-up is required per group per experiment, but it is expected that all members contribute to and know the contents of each write-up. All individuals are responsible for maintaining and cleaning the shared areas of the lab.

**Late Submission of Course Materials:**  
Computers make writing and revising much easier and more productive. Students must recognize though that technology can also cause problems. Printers run out of ink and hard drives crash. Students are responsible for planning ahead and meeting deadlines in spite of technology. Be sure to save copies of your work to disk, hard drive, and print out paper copies for backup purposes. No late work will be accepted.

**Note:**

You are expected to work with your lab partners, as a team, on all sections. The report should contain only the names of people who fully participated in the lab and the lab write-up. If you do not participate in the lab or on the lab write-up, do not expect your name to be on the lab report and do not expect any points. In order to get your work back you must turn in two copies of each assignment.

For additional information, please consult your Organic Chemistry Lecture Syllabus, the Cleveland Student Handbook or the Cleveland College Catalog. All statements in the Organic Chemistry Lecture Syllabus apply to this laboratory as well.

Laboratory work means?

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**Organic Chemistry  
Lab I  
Laboratory Schedule**

**I. Organic Chemistry Laboratory Techniques**

❖ Lab Period 1

- Safety Talk, Checkout Lockers (Tech 700)
- Microscale (Tech 702)

❖ Lab Period 2

- Melting Point (Tech 701)
- Molecular Model Kit

\* **Paper 1:** Explain the NFPA Diamonds & Signs found on the chemicals in the lab.

**II. Synthesis of Organic Compounds**

❖ Lab Period 3

- Nylon (Handout)
- Non-Newtonian Fluids (Discussion)

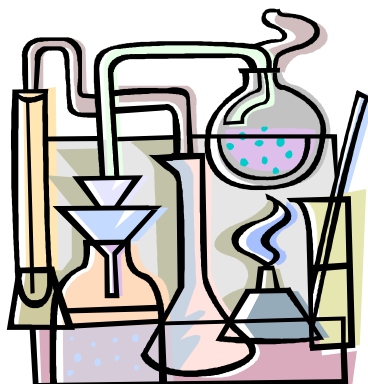
❖ Lab Period 4

- Preparation of Soap (Prop 506)

❖ Lab Period 5

- Preparation of Esters (Synt 470)

\* **Paper 2:** Compare and contrast Nylon, Soap and Ester Synthesis



**Organic Chemistry  
Lab II  
Laboratory Schedule**

**III. Extraction of Organic Compounds**

- ❖ Lab Period 1
  - Milk Components (Prop 513)
  
- ❖ Lab Period 2
  - Isolating Caffeine from Tea (Synt 471)
  - Nicotine from Tobacco (Handout)
  
- ❖ Lab Period 3
  - Isolating Clove Oil (Tech 722)

\* **Paper 1:** Outline the general principles for extraction of organic compounds

**IV. Analysis of Organic Compounds**

- ❖ Lab Period 4
  - Breathalyzer (Discussion)
  - Paper Chromatography (Anal 215) (Read Only)
  
- ❖ Lab Period 5
  - Classifying and Identifying an Unknown (Anal 727) (Read Only)
  - Classifying an Unknown Alcohol (Anal 729)

\* **Paper 2:** Explain the two basic laboratory techniques used to identify unknown chemical compounds.



Cleveland Chiropractic College  
Code of Honor and Integrity

**Honesty, integrity and high ethical standards are essential features of Cleveland Chiropractic College. The honor code helps to build trust within the college community and instills common values and principles that will extend into all facets of personal and professional life.**

*As members of the Cleveland Chiropractic College community all faculty, staff and students are bound by honor to uphold professional standards of respect, honesty, integrity and social responsibility. We are responsible for promoting ethical behaviors, endeavors both in and out of the classroom, and will act in a manner, which demonstrates concern for the personal dignity, rights and freedoms of all members of the community. We pledge that we will not take unfair advantage of any other member of the College community by either lying, cheating or plagiarizing. We are respectful of college property and the property of others.*

*Recognizing the importance of honor and integrity in the academic process, I, as your teacher, acknowledge that I am responsible for upholding and enforcing the Honor Code at all time.*

*Tim Schoof, EdD*

Signature

May 6, 2009

Date

Tim Schoof

Printed Name