Comprehensive Course Syllabus

Organic Chemistry I

Course Description:

Organic Chemistry I provides students with a basic understanding of the underlying processes of hydrocarbon chemistry and the skills needed to be successful in university level organic chemistry. The curriculum includes a study of nomenclature, properties, basic reactions, and lab techniques. This course presents organic chemistry as a progressive and systematic building of molecules from methane to benzene. The course is hands-on, inquiry-based, and places heavy emphasis on lab work. Because much of introductory organic chemistry lab involves learning organic chemistry laboratory techniques, lab experiences at times reinforce concepts being learned in the classroom, but at other times are intended as stand-alone learning opportunities intended to enhance the student's organic chemistry laboratory skills. Applications of the lab and homework problems will culminate with the separation and identification of organic compound unknowns.

Instructors:

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Meeting Days, Time and Room:

Organic Chemistry I-1	A/C days Mods 1-2	B148	Dr. White
Organic Chemistry I-3	A/C days Mods 5-6	B148	Dr. Thurmond
Organic Chemistry I-2	B/D days Mods 3-4	B148	Dr. Thurmond

Text/Materials:

The textbook is Organic Chemistry – A Short Course, 12th edition, by Hart, Craine, Hart, and Hadad. Additional classroom materials will be handed out or posted for student acquisition. Required materials are a laboratory notebook for labs, a notebook, calculator, and pens/pencils.

Student Learning Objectives:

Name alkanes, alkenes, alkynes, cyclic hydrocarbons, and aromatics using IUPAC rules given the formula, structural formula, or abbreviated structural formulas

Draw structural or abbreviated structural formulas for hydrocarbons given the name

Recognize basic organic functional groups and incorporate some of those groups into naming organic molecules

Explain the carbon-carbon single bond, double bond, and triple bond and the hybridization that occurs to achieve each

Explain the differences between polar and non-polar covalent bonds

Draw Lewis structures of organic molecules

Explain resonance using Lewis structures and hybridization

Predict the effects of intermolecular forces on the physical properties of hydrocarbons

Explain structural isomerism and stereoisomerism and the differences between them

Predict and explain basic reactions of alkanes, alkenes, alkynes, cyclic hydrocarbons, and aromatics and the role of reaction mechanisms in those reactions

Explain the role of reaction rates and chemical equilibrium in organic reactions

Describe fundamental properties of the benzene molecule such as it's hybridization, orbital model, and symbols, and recognize it as the central structure in aromatics

Laboratory Objectives

Use melting point of a substance as a means of identification and to the determine a substance's purity

Purify a substance in a mixture using the process of recrystallization.

Distinguish solubility and miscibility properties of organic compounds based on functional group and carbon chain length.

Safely assemble and use the appropriate distillation apparatus to carry out simple and fractional distillation, and explain the differences between the two types of distillation

Use extraction and recrystallization to purify caffeine from tea

Explore alkane conformers by constructing compounds using molecular models

Explore cis-trans isomerism in alkenes and cycloalkanes using molecular models

Synthesize, purify, and analyze aspirin (an ester)

Use the knowledge gained in the organic laboratory to separate and identify organic substances in an unknown mixture of substances

More detailed objectives are provided at the beginning of each unit

SSLs and Outcomes:
IA= Informally Assessed; FA=Formally Assessed; NA=Not Assessed; ABNA=Addressed But Not Assessed

I. Developing the Tools of Thought
A. Develop automaticity in skills, concepts, and processes that support and enable complex thought. This is done through lab observations, data collection, analysis, and using lab equipment properly. **FA**
B. Construct questions which further understanding, forge connections, and deepen meaning. This is done by analyzing data to draw conclusion and relate it to the concept. **FA**
C. Precisely observe phenomena and accurately record findings. This is done through laboratory observations, data collection and analysis. **FA**
D. Evaluate the soundness and relevance of information and reasoning. This is done by drawing conclusions from laboratory data. **FA**

II. Thinking About Thinking
A. Identify unexamined cultural, historical, and personal assumptions and misconceptions that impede and skew inquiry. This is done by using Lewis dot structures and looking at Bohr models. **FA**
B. Find and analyze ambiguities inherent within any set of textual, social, physical, or theoretical circumstances. **ABNA**

III. Extending and Integrating Thought
A. Use appropriate technologies as extensions of the mind. This is done by the use of calculators and computers. **IA**
B. Recognize, pursue, and explain substantive connections within and among areas of knowledge. This is done by making historical connections to the scientists as well as relationships to everyday phenomena. **FA**
C. Recreate the beautiful conceptions that give coherence to structures of thought. This is done through analyzing and learning about molecular structures and chemical reactions. **IA**

IV. Expressing and Evaluating Constructs
A. Construct and support judgments based on evidence. This is done by laboratory exploration, constructing laboratory reports as well as identifying unknown compounds based on previous learnings. **FA**
B. Write and speak with power, economy, and elegance. This is done through lab reports, demonstrating understanding through discussions and oral presentations. **FA**
C. Identify and characterize the composing elements of dynamic and organic wholes, structures, and systems. This is done by applying basic naming and reaction properties to more complex molecules. **FA**
D. Develop an aesthetic awareness and capability. This is done by drawing attention to links between current content and the world around them. **IA**

V. Thinking and Acting With Others
A. Make reasoned decisions which reflect ethical standards, and act in accordance with those decisions. This is done by not manipulating data to fit conclusions and preventing plagiarism in lab reports. **FA**
B. Establish and commit to a personal wellness lifestyle in the development of the whole self. This is done by adhering to safety rules of the laboratory. **IA**

Instructional Design and Approach:

The Organic Chemistry curriculum at IMSA provides a learning environment that is competency-driven, based on previous experiences, laboratory-based, and integrative. Students are expected to construct their own knowledge under the facilitation of a teacher who is committed to creating these learning opportunities. Consistent with the expectation that students construct their own knowledge, a significant amount of the student's time is spent on group or laboratory activities that reinforce classroom learning. Students are expected to ask questions, make observations, collect data, look for evidence and draw conclusions. Students share their findings by writing laboratory reports or summaries and/or by applying their findings to new situations. The classroom environment is collaborative and student-centered, where students have the opportunity to ask questions, discuss concepts and teach each other.

Student Expectations:

The experience you have in this course will be directly related to your level of participation!! One cannot choose to be a non-participant and expect to reap all of the possible benefits. Therefore, some guidelines for a successful experience are listed below.

1. PLEASE be on time and ready for class - both mentally and physically. It is the responsibility of each student to inform the instructor and arrange for make-up work due to excused absences (preferably in advance!).
   Students who are more than 5 minutes but less than 50 minutes late will be given an unexcused absence for the day. Any assignment due that day will also be considered late. Any activity that is submitted for credit on that day can be made up by the student but will also be marked late.
   Students more than 50 minutes late will also be given an unexcused absence and any assignment submitted will be marked late. NO credit will be awarded for make-up work. Refer to the Student Handbook for specific effects of excessive tardies and absences.
2. Besides being on time, please have all the materials you will need for the class WITH YOU! Our classroom work on many days will require your notebook or laptop (whichever you use to take notes on), a folder for handouts, and a pen or pencil. Notebooks and/or lab data forms will be the only items allowed in the lab in which to record data. Therefore if you forget it, you cannot participate in lab work until you retrieve it!
3. Turning work in late is discouraged. When an assignment has been collected, it may be submitted for late credit at a 10% penalty per day. Once the teacher has returned material that has been assessed, it cannot be submitted for late credit.
4. Due to the volatility of many of the organic chemicals, no personal electronic equipment may be brought into the lab. In addition, no sunglasses, food or drinks are allowed in the lab.
5. Collaboration is encouraged throughout all facets of this course. Academic dishonesty, however, is not. It is expected that students will discuss classroom activities, homework assignments and laboratory results, and partners will share common data but copying homework or lab reports is not allowed and will result in a zero on the assignment. It is also expected that all reports/work reflect individual thought and other sources will be referenced appropriately.
6. Goggles and closed-in shoes must be worn at all times in lab. A closed-in shoe covers the toes and the entire top of the foot. Keep your work/lab area neat and clean. Penalties **will** be incurred for lab areas not cleaned up. **All** IMSA materials and equipment will remain in the classroom unless given permission by the instructor. Perform only those experiments authorized by the instructor.

7. If, at any point, you are experiencing some confusion - get help ***immediately.*** Concepts cannot build upon each other if early ones are not understood. Do not wait until office hours occur. Schedule an appointment for a mutually convenient time.

Assessment Practices, Procedures and Processes:

Your grade in this course will be a reflection of all aspects of the course. Points will be earned for lab experiments and reports, problem solving, written assignments, quizzes, and tests. 30% of your class average will be from lab work. This component of your grade will include lab reports, summaries, and/or quizzes (either pre-lab or post-lab). In lieu of a written final exam, the "Unknown Analysis" lab at the end of the semester will be considered the final assessment. This grade will be incorporated into the 30% lab grade. Another 60% of your final grade will come from your quiz and test average (this will not include any lab and/or homework quizzes). The remaining 10% will come from everything else other than the above mentioned grades. We will call this the "miscellaneous" category. The miscellaneous category includes such items as homework, homework quizzes, presentations, and activities.

Your grade for the semester will be determined by the following standard scale:

A = 90% B = 80% C = 70%

Sequence of Topics and Activities: see detailed calendar

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Aug 20 A-Short Course Introduction Pre-test ***Assignment 1***	**21 B-Short**	**22 I**	**23 C** Electron configuration, bonding, valence, Lewis structures **Lab: Melting pt. determination** ***Assignment 2***	**24 D**
27 A Structural formulas, isomers **Lab: Melting pt. determination** ***Assignment 3***	**28 B**	**29 I**	**30 C** Resonance, formal charge **Lab: Separation of Liquids by Distillation** ***Assignment 4***	**31 D**
Sept 3 **Labor Day Holiday**	**4 A** Hybridization, sigma bonds **Lab: Separation of Liquids by Distillation** ***Assignment 5***	**5 B**	**6 C** **Quiz: structures, bonding, isomers** Molecular framework Functional groups **Activity: Molecular models** ***Assignment 6***	**7 D**
10 A Chapter 1 Review **Activity: Functional group identification**	**11 B**	**12 I** Interims Start	**13 C** **Unit 1 Test** ***Assignment 7***	**14 D**
17 A Alkane and cycloalkane nomenclature **Lab: Recrystallization of an Impure Solid** ***Assignment 8***	**18 B**	**19 I**	**20 C** Alkane properties **Lab: Recrystallization of an Impure Solid** ***Assignment 9***	**21 D**
24 A Alkane conformation **Activity: Alkane conformers** ***Assignment 10***	**25 B**	**26 I**	**27 C** **Quiz: Alkane naming** *Cis-Trans* Isomers **Lab: Solubility of Organic Compounds** ***Assignment 11***	**28 D**
Oct 1 A Alkane Reactions/ Halogenation mechanism **Lab: Solubility of Organic Compounds** ***Assignment 12***	**2 B**	**3 I**	**4 C Condensed** Chapter 2 Review	**5** **No class Faculty Development**
8 **No Class Academy Closed Columbus Day**	**9 D** Chapter 2 Review	**10 I** **Special Schedule PSAT**	**11 A** **Unit 2 Test** ***Assignment 13***	**12 D**

Oct 15 A **Lab: Extraction of caffeine from tea**	**16 B**	**17 I** **1st Qtr Ends**	**18 C** Alkene and alkyne nomenclature **Lab: Extraction of caffeine from tea** ***Assignment 14***	**19 D**
22 A Cis-trans/ E-Z isomers, Cahn Ingold Prelog rules Hybridization, Pi bonds **Lab: Extraction of caffeine from tea** ***Assignment 15***	**23 B**	**24 I** **Grading Day**	**25 C** **Quiz: Naming Alkenes and alkynes** Electrophilic addition reactions Mechanism and Energy Diagrams **Lab: Extraction of caffeine from tea** ***Assignment 16***	**26 D**
29 A Alkene reactions **Lab: Extraction of caffeine from tea** ***Assignment 17***	**30 B**	**31 I**	**Nov 1 C** Alkyne reactions **Activity: Alkene/ alkyne reactions** ***Assignment 18***	**2 D**
5 A Chapter 3 Review **Lab: Preparation of an alkene**	**6 B**	7 I	8 C **Unit 3 Test** ***Assignment 19***	**9 D Assembly sch.**
12 A Aromatics, nomenclature Aromaticity and resonance **Lab: Aspirin synthesis** ***Assignment 20***	13 B	14 I	15 C Electrophilic substitutions reactions **Lab: Aspirin isolation** ***Assignment 21***	**16 D**
19 A **Quiz: Naming Aromatics** Activating and deactivating groups Ortho, Para, Meta-Directing Groups Organic Synthesis **Lab: Aspirin recrystallization** ***Assignment 22***	20 D condensed	21	22 Academy Closed Thanksgiving Day	**23** Academy Closed
26 A **Activity: Aromatic Synthesis**	27 B	28 I	29 C Chapter 4 Review **Lab: Aspirin Analysis**	**30 D**
Dec 3 A **Unit 4 Test**	4 B	5 I	6 C **Lab: Unknown analysis**	**7 D**
10 A **Lab: Unknown analysis**	11 B	12	13 C **Lab: Unknown analysis**	14 **D**
17 Special schedule- all classes meet Post-test Unknown analysis lab due	18 **Final Exams**	19 **Final Exams**	20 **Final Exams**	21 **Grading Day**

Organic Chemistry I
Fall 2018

Readings and Problem Assignments

Assignment	Textbook Reading	PowerPoint Slides	Textbook Problems
1	1.1-1.7	Slides 1-1	
2	1.8-1.10	Slides 1-2	1.31-1.37
3	1.11-1.13	Slides 1-3	1.38-1.44
4	1.14-1.16	Slides 1-4	1.45–1.50
5	1.17-1.18	Slides 1-5	1.51-1.55
6			1.57-1.60
7	2.1-2.5, 2.9 (nomenclature only)	Slides 2-1	
8	2.6-2.7	Slides 2.2	2.26-2.31, 2.33
9	2.8-2.11	Slides 2-3	2.34-2.35
10			2.37
11	2.12-2.13	Slides 2-4	2.38-2.43
12			2.44-2.48
13	3.1-3.2	Slides 3-1	
14	3.3-3.5, 5.4	Slides 3-2	3.33-3.36
15	3.6-3.12	Slides 3-3	3.38-3.39, 5.39
16	3.13-3.17	Slides 3-4	3.42-3.43
17	3.20-3.21	Slides 3-5	3.41, 3.44-3.56
18			3.57-3.61
19	4.1-4.7, 4.13	Slides 4-1	
20	4.8-4.9	Slides 4-2	4.20-4.27
21	4.10-4.12	Slides 4-3	4.28-4.34
22			4.35-4.44

Note: Problems are at the end of the chapters and are intended to demonstrate understanding of chapter material. More basic practice problems are embedded within the chapters and should be worked during reading.