CITY COLLEGES of CHICAGO
Harry S Truman
Education that Works

Harry S Truman College
Master Syllabus
Chemistry 205 Organic Chemistry I
Active IAI Code **CHM 914**

1. **Title, Number, and Classification**
   Organic Chemistry I
   073-0205-1

2. **Course Term**
   16 week Semester or 8 week summer term

3. **Credit and Contact Hours**
   Credit hours: 6
   Contact hours: 4 hr lecture; 4 hr laboratory

4. **Prerequisites**
   Grade of C or better in Chemistry 201 & Chem. 203 or consent of the department chairperson

5. **Catalog Description**
   Fundamentals of organic chemistry, orbitals and structural theory, aliphatic and aromatic hydrocarbons, alkyl halides, structural isomerism, introduction to functional groups, nomenclature, stereochemistry, reaction mechanisms, resonance theory, and spectroscopy. Laboratory emphasis on basic organic techniques (determination of boiling points, melting points, distillation, crystallization, extraction), purification techniques (thin layer chromatography (TLC), column chromatography, and organic synthesis Writing assignments, as appropriate to the discipline, are part of the course.

6. **Students for whom the course is intended**

   Organic Chemistry I is a required course for chemistry majors, biochemistry majors, chemical technology majors, pre-pharmacy students, pre-medical students, pre-dentistry students, pre-chiropractic students, pre-optometry students, pre-nutrition students, physician's assistant, some baccalaureate nursing programs, and a few engineering disciplines.

7. **Course Objectives**

   1. Develop students' ability to demonstrate and communicate in both written and verbal modes their understanding of the fundamental principles of organic chemistry, its applications, and its relationship to other disciplines
   2. Develop the students' ability to integrate various technologies in collecting, recording, analyzing, evaluating, and presenting data and information
   3. Create in the students a culture of safety and integrity in the conduct of their laboratory experiments and in the manner in which they gather, interpret, analyze, and evaluate data

4. Foster student engagement in their own learning
5. Develop process skills that help the students become more competitive in the job market
6. Engage the students in proposing logical solutions to current, unresolved problems relevant to individuals/society using the knowledge and skills acquired in the course

8. Learning Outcomes

Upon satisfactory completion of this course, the student will be able to:

1. Solve complex organic chemistry problems using structural analysis, mechanistic theory, spectroscopic analysis, and principles of organic syntheses
2. Safely handle and manipulate chemicals and standard laboratory equipment Record, graph, chart, analyze, and interpret data obtained from experimentation.technologies
3. Record, graph, chart, analyze, and interpret data obtained from experimentation
4. Integrate the knowledge of organic chemistry, including all of the above, in proposing plausible solutions to current, unresolved problems of relevance to individuals/society
5. Communicate an understanding of the fundamental concepts in organic chemistry in verbal and written form.
6. Search MSDS and be able to understand toxicity data

Specific Student Learning Outcomes and the General Education Goals They Satisfy:

At the completion of this course, the successful student should be able to:	General education goal(s) satisfied
1. Use valence bond and orbital hybridization theories to rationalize the three-dimensional structure of organic molecules	**GEG3-5**
2. Identify and define structural features of alkanes, cycloalkanes, alkenes, alkynes, alkyl halides, alcohols, ethers, aromatic compounds, aldehydes, ketones, acids, and acid derivatives and how these influence the physical properties of an organic compound	**GEG3-5**
3. Write the names and structural formulas for alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers and aromatic compounds	**GEG3-5**
4. Write line angle formulas of open chain, cyclic and aromatic compounds	
5. Visualize structures of alkanes, alkenes, alkynes, alkyl halides, alcohols, ethers and aromatic compounds in three dimensions and draw and construct model structures as three dimensional representations.	**GEG2-5**
6. Document the relevant reactions in the multi-step synthesis of an organic compound	**GEG2-5**
7. Investigate and discuss the mechanisms of fundamental organic reactions and thus predict simple reaction pathways for major and minor products using kinetics, thermodynamics, and stereochemical considerations	**GEG3,4**
8. Predict the regiochemistry and stereochemistry of the following organic reaction mechanisms using curved arrow notation: free radical substitution, electrophilic and free radical addition, nucleophilic aliphatic substitution, elimination, electrophilic aromatic substitution, catalytic hydrogenation	**GEG3-5**
9. Differentiate enantiomers, diastereomers, and *meso* compounds	**GEG3-5**
10. Propose reaction schemes that result in the generation of a chiral center	**GEG2-5**
11. Differentiate between precision and accuracy	**GEG3-5**
12. Use NMR, IR, MS, and UV-Vis spectroscopy to determine the structure of organic compounds	**GEG4,5**
13. Calculate the theoretical yield and percent yield for organic reactions	**GEG4,5**
14. Perform standard organic laboratory techniques	**GEG1,2,4,5**

15. Prepare compounds discussed in lecture through single and multi-step synthesis using appropriate techniques listed above for their synthesis, purification, characterization, and analysis **GEG1,2,4,5**
16. Perform laboratory experiments that illustrate basic chemical principles. **GEG1,2,4,5**
17. Maintain a laboratory notebook through the careful recording of observations and experimental data **GEG1-5**
18. Correctly implement articulated laboratory safety and hygiene protocols **GEG1,2**
19. Demonstrate effective laboratory procedures such as transfer of solids, weighing of solids, pouring of liquids, measurement of liquid volume **GEG1,24,5**
20. Organize and graph experimental data **GEG3-5**
21. Interpret experimental data and draw inferences from the data **GEG3-5**
22. Summarize the results of experimental observations and data **GEG3-5**
23. Verify experimental data from authentic sources, handbooks, and scientific journals

9. **Topical Course Outline** (suggested)

- Covalent Bonding and Shapes of Molecules
- Alkanes and Cycloalkanes
- Stereochemistry and Chirality
- Acids and Bases
- Alkenes: Bonding, Nomenclature, Properties, Reactions
- Alkynes: Bonding, Nomenclature, Properties, Reaction
- Haloalkanes, Halogenations, and Radical Reactions
- Nucleophilic Substitutions and β-Elimination
- Alcohols: Nomenclature, Properties, and reactions
- Ethers, Epoxides, and Sulfides
- Benzene and the Concept of Aromaticity, Electrophilic Substitution in Benzene and its derivatives
- IR Spectroscopy and identification of functional groups
- NMR Spectroscopy and interpretation of H^1 & C^{13} spectra
- Mass Spectrometry and interpretation of data

Suggested Calendar

Date	Lecture Topic/Lab Activity
Week 1	Introduction and Review of Covalent Bonding and Shapes of MoleculesI Laboratory Orientation and check-in, Safety instructions
Week 2	Alkanes and Cycloalkanes Review of Organic Laboratory Techniques Lab 1: Physical Properties of Organic Compounds (m.p; b.p; ignition test)
Week 3	Stereochemistry and Chirality Lab 2: Distillation (semi-micro/fractional
Week 4	Acids and Bases Lab 3: Structure in Organic Compounds: Use of Molecular Models I
Week 5	Alkenes: Bonding, Nomenclature, Properties, Reactions Lab 4: Stereochemistry: Use of Molecular Models II

Week 6	EXAM 1 Alkynes: Bonding, Nomenclature, Properties, Reactions
Week 7	Haloalkanes, Halogenations, and Radical Reactions Lab 5: Synthesis of an Alkene (Dehydration of a Tertiary Alcohol)
Week 8	Nucleophilic Substitutions and β-Elimination
Week 9	Alcohols: Nomenclature, Properties, and reactions Lab 6: Isolation of Ingredients of an Analgesic Drug
Week 10	Ethers, Epoxides, and Sulfides: Nomenclature, Properties, Reactions Lab 7: Column Chromatography
Week 11	EXAM 2 Benzene and the Concept of Aromaticity: Electrophilic Substitution in Benzene and its derivatives
Week 12	IR Spectroscopy and identification of functional groups Lab 8: Synthesis of Acetylsalicylic Acid
Week 13	NMR Spectroscopy and interpretation of H^1 & C^{13} spectra Lab 9: Nitration of Methylbenzoate
Week 14	Mass Spectrometry and interpretation of data Lab 10: Purification of a neutral compound by extraction
Week 15	EXAM 3 Final Exam Review; Laboratory clean up and check-out
Week 16	FINAL EXAM

10. Texts and Materials (suggested)

Required: *Organic Chemistry*, 6th ed., by W.H. Brown, C.S. Foote, and B.L. Iverson, Brooks/Cole 2011. The older 5th or 4th editions are acceptable.
Laboratory *Notebook*: *National Notebook 43-375* or similar
***Optional*:** *Molecular Modeling Kit*; the 68845NV Chemistry Molecular Model Set from www.indigo.com would suffice.

11. Methods of Instruction

Lectures, Discussions, and Notes: Lecture outlines and notes will be available on Blackboard.

Laboratory Activities: Students are expected to have reviewed the experimental procedures before coming to class. Some of these may be guided inquiry laboratory activities. Prelab sheets are due at the beginning of the lab period.

Group Exercises/Chem Activities: Guided inquiry learning activities, some chapter exercises

Class Demonstrations: Live demonstrations of chemical and physical processes may be done during both the lecture and lab; students are expected to record these and their observations

Video clips: Certain laboratory techniques, hazardous reactions, safe operations, and processes may be shown through short video clips.

Laboratory Demonstration Videos:
Microscale Technique 4: Solvent Evaporation
Microscale Technique 5: Distillation
Microscale Technique 7: Extraction

Microscale Technique 8: Physical Constanta (including melting points)
Microscale Technique 9: Chromatography (including column chromatography)

http://bcs.wiley.com/he-bcs/Books?action=resource&bcsId=5405&itemId=0471215023&resourceId=19612

Online Activities: Discussions, especially among group members, outside of class through Blackboard Discussion Board or other electronic means agreed upon by the group is encouraged.

12. Methods of Evaluation:

Final course grades will be based on the following:

Class Participation	5%	90 – above	A
Lab	25%	80 – 89	B
Quizzes	25%	66 – 79	C
Long Exams	25%	50 – 65	D
Final Exam	20%	below 50 F	
Total	100%		

***A student needs to pass both the lecture and laboratory portions in order to pass CHEM 205. A failing average in either one at the end of the term will mean a grade of "F" for the course.**

Class Participation: Student participation in class discussion and group activities, including completed problem-solving exercises, and attendance will determine the class participation score.

Exams/Quizzes: The long exam with the lowest score and the two quizzes with the lowest scores will not be included in calculating the final grade.

Lab: Each lab is worth 25 points. The lowest lab score will be dropped. The score will be based on proper conduct during lab (i.e., application of correct lab techniques and observance of lab safety and hygiene), satisfactory completion of the experiment, reasonable results, and prompt submission of the formal report or report sheets. Refer to the list below (and the checklist on Blackboard) for instructions related to the lab reports.

Authorized Signature and File

Date: _____