Kingsborough Community College
The City University of New York
Department of Physical Sciences
CHM3100 - Organic Chemistry 1
Syllabus

CHM 3100 – ORGANIC CHEMISTRY I (5 crs. 9 hrs.)
Modern concepts of organic chemistry includes: structure and bonding reaction mechanisms, stereochemistry, nomenclature and synthesis, and relationship between structure and reactivity of the functional groups representing the principal classes of organic compounds. Laboratory covers fundamental operations of organic chemistry including determination of physical properties, experimental reactions and procedures, basic instrumentation and analysis. Student must complete CHM 3100 Laboratory - Initial Student Safety Instruction & Certification prior to the first laboratory meeting. See Department of Physical Sciences website Chemistry Laboratory Safety section for information. Prerequisite(s): CHM 1200; or Department Permission.

Section: SECTION NUMBER
Time: LECTURE AND LABORATORY SCHEDULE FOR SECTION
Room: ROOM (S) FOR SECTION
Instructor: INSTRUCTOR FOR SECTION
Email: EMAIL ADDRESS FOR INSTRUCTOR FOR SECTION
Office Hours: OFFICE HOURS FOR INSTRUCTOR FOR SECTION

Source materials: "Organic Chemistry" by L.G. Wade Jr., Eighth Edition, Pearson Education Inc., 2013. Essential problem-solving skills, and each skill is followed by problem numbers exemplifying that particular skill are included at the end of each chapter. Solutions Manual to the above text.
Molecular Models: Model set or the models available in the campus bookstore or on the Internet (http://www.darlingmodels.com, KIT #1). Other brands of molecular models are also acceptable.
Lab Manual: "Greener Organic Chemistry Experiments 1: A Miniscale and Microscale Approach" by Varattur D. Reddy, Third Edition, John Wiley & Sons, NJ, 2015.

Lecture Schedule

Week 1: Chapter 1. **Introduction and Review** The origin and importance of organic chemistry. Drawing Lewis structures, line angle formulas, condensed structures, resonance structures. Use resonance structures to rationalize stability and reactivity. Lewis acids (electrophiles) and bases (nucleophiles). Curved-arrow formalism. PKa values, predict the relative acidity and basicity of organic compounds based upon the chemical structure and electronic properties of the conjugate acid/base pairs. All of the sections 1-1 to 1-14 are covered and homework problems assigned.
Week 2 Chapter 2**. Structure and Properties of Organic Molecules** Molecular orbitals. Hybridization and molecular shapes. Drawing three-dimensional molecules. Rotation of single bonds, rigidity of double bonds, isomerism. Predict the molecular geometry of an organic compound using hybridization theory. Polarity of bonds and molecules. Distinguish between covalent and non-covalent bonding in organic molecules. Intermolecular forces. Predict physical properties that result from weak intermolecular interactions. Brief description of various types of hydrocarbons, oxygen and nitrogen containing organic molecules (functional groups) All the sections 2-1 to 2-14 are covered and homework problems assigned.
Part of Week 2 and Week 3: Chapter 3. **Structure and Stereochemistry of Alkanes**

Quick review of classification of hydrocarbons. Nomenclature. Reactions of alkanes. Structure and conformations of alkanes. Cycloalkanes, nomenclature, cis-trans isomers, stability. Cyclohexane conformations, conformations of mono and di substituted cyclohexanes, bicyclic molecules. All the sections 3-1 to 3-16 are covered and homework problems assigned.

Week 4: Chapter 4. **The study of chemical reactions**
Introduction. Chlorination of methane. Free-radical chain reaction. Eulibrium constants and free energy, enthalpy, entropy, bond dissociation enthalpies. Explain the mechanism and energetics of free- radical halogenation of alkanes. Stability of reactive intermediates: carbocations, free radicals, carbanions. Use energy diagrams to describe transition states, intermediates, and the rate-determining step in multi-step reactions. Hammond Postulate. All the sections 4-1 to 4-16 are covered and homework problems assigned.

Week 5: EXAMINATION 1
Part of Week 5: Chapter 5 **Stereochemistry**
Introduction. Chirality, R and S nomenclature, optical activity, biological discrimination of enantiomers, racemic mixtures, enantiomeric excess, chirality of conformationally mobile systems, chiral compounds without asymmetric atoms.
Week 6: Fischer projections, diastereomers, stereochemistry of molecules with two or asymmetric carbons, meso compounds, Absolute and relative configuration, physical properties of diastereomers, resolution of enantiomers. All the sections 6-1 to 6-15 are covered and homework problems assigned.

Week 6 and Week 7: Chapter 6. **Alkyl halides: Nucleophilic substitution and elimination**
Introduction, elements of unsaturation. Nomenclature, physical properties, preparation of alkyl halides. Reactions of alkyl halides: substitution and elimination. Draw the mechanism and energy profile of substitution and elimination reactions. Predict products of SN1, SN2, E1, and E2 reactions. All the sections 18-1 to 18-20 are covered and homework problems assigned.

Week 8: Chapter 7. **Structure and synthesis of Alkenes.**
Introduction, elements of unsaturation. Nomenclature, *E-Z* nomenclature, commercial importance of alkenes, Different methods of synthesis of alkenes: debromination of vicinal dibromides, dehydration of alcohols, high temperature methods. All the sections 7-11 to 19-19 are covered and homework problems assigned.

Week 9: EXAMINATION 2
Part of Week 9 and Week 10: Reactions of alkenes
Reactivity of the carbon-carbon double bond. Electrophilic addition reactions (several examples) and predict the products based on regiochemistry and stereochemistry. Reduction, oxidative cleavage, polymerization reactions, olefin metathesis. All the sections 8-1 to 8-16 are covered and homework problems assigned.

Part of Week 10: Chapter 9. **Alkynes**
Introduction, nomenclature, synthesis of alkynes. Addition reactions of alkynes, oxidation of alkynes (several examples). Reactions of Acid Chlorides, Acid Anhydrides, Esters, Amides, and Nitriles. Introversion of acid derivatives. Mechanisms. Synthesis Strategies. Spectroscopy. All the sections 9-1 to 9-1 are covered and homework problems assigned and homework problems assigned.
Week 11: EXAMINATION 3

Part of Week 11: Chapter 10 **Structure and Synthesis of Alcohols**
Introduction. Structure and classification of alcohols, nomenclature, physical properties. Acidity of alcohols and the formation of sodium and potassium alkoxides. Organometallic reagents: Grignard reagents, organolithium reagents. Synthesis of alcohols: Addition of organometallic reagents to carbonyl compounds. Thiols.All the sections 10-1 to 10-12 are covered and homework problems assigned.
Week 12: Chapter 11 **Reactions of Alcohols**
Understand the concept of oxidation states of organic molecules. Alcohols as nucleophiles and electrophiles; formation of tosylates. Reaction of alcohols with hydrohalic acids, phosphorus halides. Formation of esters and ethers.

Week 12: FINAL EXAMINATION

Examinations

There will be three in-class examinations (100 points each) for 50%, final exam (125 points) for 25%, and a Lab grade 25%. Make-up exams are NOT offered. The final exam is mandatory and comprehensive. The average of your lecture exams and final exam grades must be 60% to pass and 70% to pass the lab component. Tutorial services are offered in L605 and phone: 718-368-5118.

These major examinations include lecture material, modeled after the problems assigned from the text, and may include questions on laboratory work as well. Though the assigned problems are not graded they are strongly recommended as the best means of preparing for the examinations. The examinations will generally consist of about 10 questions, some of which will have multiple parts. Like the homework problems, the exam questions will be short answers, often requiring the drawing of a chemical structure, predicting the outcome of a chemical reaction or designing the synthesis of an organic compound. There will be a strong emphasis on the reaction mechanism involved.

The laboratory work 25% consists of exercises dealing with learning of various laboratory techniques, synthesis, and qualitative analysis. This grade is determined by the student's performance in the laboratory, laboratory reports, and the student's notebook.

Laboratory Notebook and Grading – Organic Chemistry I

25% assigned for the laboratory part of the course. Lab grade is determined on the following: lab write- up, doing the experiment and recording the data, accuracy of the experimental data, and post-laboratory questions. You are required to submit a lab report for each experiment. There will be a comprehensive lab final examination for 50 points.

The laboratory notebook-hard bound, composition-type book of at least 150 pages must be used. This is the working record of what you are going to do in the lab and what you have actually done and observed. The notebook **must be prepared in advance** for each experiment. The instructor will grade your notebook for each lab period.

Students are expected to arrive in the lab prepared for the experiment that they are going to perform. And students are required to come on time for pre lab lecture so that they are fully aware of safety precautions and understanding of the experiment.

A good notebook should consist of the following:

I Table of contents-First three pages

II Numbered pages

II Experimental Write-up

A. Heading: Experiment title and date
B. Reference: This is where you found the experiment; that is, lab manual or hand sheets, page number
C. Purpose of experiment: This is simply a brief, one sentence description of the experiment
D. Preparation experiments. (We don't always prepare a compound, so the exact format may not apply. Use your judgment.)
    1. Table of physical constants for the materials used and the products. You should record: grams used, molecular weight, number of moles, melting point, boiling point, density.
    2. Note any unusual warnings are cautions.
    3. Diagram of the experimental set-up. This is not always appropriate, depending on the experiment. Usually, the exact nature of the experiment will be discussed immediately prior to the lab in the recitation hour and this section will be completed at that time.
    4. Concise, step-by step procedure

5. Experimental observations. These should be added as the experiment is being performed. These observations often deal with color changes, temperature at which your compound boiled or distilled, etc. Record any changes you made to the procedure for whatever reason. Be honest. Record exactly what happened. You are still learning in the laboratory and many things go wrong, even for the experienced chemist. You are not being judged solely on the result but on your sincere efforts and the accuracy of your observations.

Utmost importance is given to impart high quality education and delivery of the subject matter effectively to students. The strong emphasis is placed on coordinating the concepts presented mechanistically in lecture material with the laboratory experiments utilizing microscale and miniscale green approach. For example, the experiments involving use of nature solvents and small amount of solvents, and recovery of solvents, and atom economy.

Laboratory Schedule

Week	**Experiment**
1 – Check-in, Safety	Melting Point Determination
2	Recrystallization of crude Benzoic Acid/Aspirin/Acetanilide
3	Molecular Models (Bring your molecular models)
4	Reactions of Hydrocarbons
5	Extraction: Mixtures of Benzoic acid, p-Nitroaniline and Anthracene
6	Simple and Fractional Distillation: Raoult's Law
7	Steam distillation of Natural Product Eugenol from cloves
8	SN1 Reaction: Preparation of t-Butyl Chloride
9	E1 Elimination Reaction: Synthesis of 2-methyl-2-butene
10	Synthesis of Adipic Acid (Oxidative Cleavage of Cyclohexene)
11	Grignard Reaction: Reaction of Alkyl magnesium chloride and an aldehyde to Prepare an Alcohol
12 – Lab Final Exam, Checkout	Qualitative Tests to identify Primary, Secondary, and Tertiary Alcohols

College Mandatory: Safety glasses and lab coat.

Strong emphasis placed on safety and waste disposable rules.

Attendance Policy

A student in any course who has been absent 15% of the total number of instructional hours that a class meets during a semester or session is deemed excessively absent. Where the course includes classroom lectures plus another component such as a lab/field placement, etc., the 15% excessive absence policy applies to either component. Excessive absences may result in the instructor assigning either a lower grade or a "WU" for that course.

Plagiarism and Academic Integrity

Plagiarism is the presentation of someone else's ideas, words or artistic, scientific, or technical work as one's own creation. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism. The full academic integrity policy can be found on KBCC's web site, **www.kbcc.cuny.edu**

Academic freedom-Henderson rules

The tradition of the university as a sanctuary of academic freedom and center of informed discussion is an honored one, to be guarded vigilantly. The basic significance of that sanctuary lies in the protection of intellectual freedoms; the rights of professors to teach, of scholars to engage in the advancement of knowledge, of students to learn and to express their views, free from external pressures or interference. These freedoms can flourish only

in an atmosphere of mutual respect, civility and trust among teachers and students, only when members of the College community are willing to accept self-restraint and reciprocity as the condition upon which they share in its intellectual autonomy. The full academic freedom can be found on KBCC website, **www.kbcc.cuny.edu**

Students with Disabilities

College can be stressful for most individuals. For individuals with disabilities, it can be a daunting task. Access Ability Services (AAS) helps students with disabilities to recognize their potential by removing potential barriers to their education. KBCC is committed to providing equal access to all programs and curricula to all students (Disability related services D205) and **www.kbcc.cuny.edu.**