San Bernardino Valley College
Curriculum Approved: November 18, 2002
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I. CATALOG DESCRIPTION

A. Department Information

Division:	Science and Math
Department:	Chemistry
Course ID:	CHEM 212
Course Title:	Organic Chemistry I
Units:	4 Units
Lecture:	3 Hours
Laboratory:	3 Hours
Prerequisite:	CHEM 150 or CHEM 150H

B. Catalog Description: First semester of organic chemistry. Carbon compounds including aliphatic, aromatic, and heterocyclic series, and modern theoretical concepts are studied. Students identify properties, synthesis, and reactions of functional groups. Mechanisms are examined in detail. Laboratory includes preparation, identification and the study of properties of organic compounds.

C. Schedule Description: First semester organic chemistry which examines carbon compounds, modern theoretical concepts and mechanisms in detail.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon completion of the course, the student should be able to:

A. Recognize and name simple organic compounds
B. Recognize, differentiate, and name constitutional and stereo isomers
C. Identify the functional groups of organic compounds and demonstrate knowledge of the functional basis for classification of compounds
D. Identify and predict ionic reaction mechanisms
E. Identify and predict radical reaction mechanisms
F. Recognize, differentiate, and predict the reactions for several functional groups, such as multiple bonds, conjugated systems, alcohols, and ethers.
G. Interpret and compare the stability of transition states in order to predict the outcome of possible reactions

IV. CONTENT:

Lecture:

A. Chemical bonds and Shape of Carbon molecules
    1. Lewis structures and models of boding
    2. Hybrid orbitals and bond angles
    3. Resonance introduction
    4. Molecular orbital theory
    5. Polar and non polar molecules
B. Representative Carbon compounds
    1. Functional groups
    2. Orbital hybridization and resulting carbon compounds
    3. Physical properties and molecular structure
C. Acid and Base reactions
    1. Bronsted-Lowry acids and bases
    2. Lewis acids and bases
    3. Heterolysis of bonds to carbon; carbocations and carbanions
    4. Acid /base strength
    5. Relationship between structure and acidity

6. The effect of solvent on acidity

D. Alkanes and Cycloalkanes
   1. Structure and shape of alkanes
   2. Constitutional isomers
   3. Conformational analysis of butane
   4. Cycloalkane structure , nomenclature and stability
   5. Conformational analysis of cyclohexane (cis and trans)
   6. Bicyclic alkanes

E. Stereochemistry
   1. Stereocenters and chiral molecules
   2. R and S nomenclature system
   3. Compounds with more than one stereocenter
   4. Enantiomers, diastereomers, and meso compounds

F. Ionic Reactions
   1. Nucleophilic Substitution Reactions
   2. Terminology: nucelophile, leaving group, substrate
   3. Two types of substitution reactions: SN1 and SN2
   4. Mechanisms
   5. Factors effecting SN1 or SN2 reactions
   6. Elimination reactions: E1 and E2
   7. Substitution vs. elimination
   8. Organic synthesis with ionic equations.

G. Alkenes and Alkynes
   1. Nomenclature and properties
   2. Hydrogenation reactions
   3. Elimination reactions to synthesize alkenes and alkynes
   4. Carbocation stability and rearrangement
   5. Acidity of terminal alkynes
   6. Addition reactions of alkenes and alkynes
   7. Stereochemistry of ionic addition reactions.
   8. Oxidation of alkenes and alkynes
   9. Oxidative cleavage of alkenes and alkynes
   10. Synthetic strategies

H. Radical Reactions
   1. Homolytic bond dissociation energies
   2. Alkyl radical geometry
   3. Reactions of alkanes with halogens
   4. Polymer formation

I. Alcohols and Ethers
   1. Structure, properties, and physical properties
   2. Alcohol Synthesis
   3. Reactions of alcohols
   4. Synthesis of ethers
   5. Reactions of ethers
   6. Epoxide formation and reactions

J. Carbonyl compounds
   1. Synthesis of alcohols from carbonyl compounds
   2. Organnometallic compounds, including Grignard Reaction
   3. Oxidation-Reduction reactions in organic chemistry

K. Conjugated Unsaturated Systems
   1. The allylic system
   2. The allylic radical and cation
   3. Resonance rules
   4. 1,3-butadiene – understanding conjugation, and addition reactions
   5. Diels-Alder reactions

L. Optional Topics
   1. Neighboring Group Participation in Nucleophilic Substitution Reactions
   2. Chain Growth Polymers
   3. Divalent Carbon Compounds - Carbenes

Laboratory:
Lab sessions introduce students to organic laboratory techniques. Many experiments are done with microscale glassware, but several are done with standard glassware. Lab sessions compliment the lecture topics. Instruments used in first semester of Organic Lab are melting point apparatus, polarimeters, refractometers, a gas chromatograph, and an infrared spectrophotometer. The theory and application of IR spectrometry is covered in lab.

V. METHODS OF INSTRUCTION:

A. Lecture
B. Laboratory
C. Work groups
D. Video
E. Multimedia
F. Discussion
G. Examination
H. Demonstration
I. Computer Drills
J. Molecular Model Exercises

VI. TYPICAL ASSIGNMENTS:

A. Lecture: Read chapter on Alkanes and Cycloalkanes and do the problems assigned (use molecular models for these problems.)
B. Laboratory: Read assigned techniques, the essay on analgesics, and the experiment on Acetaminophen. The first day of lab, procedures will be done through decolorization of crude Acetaminophen. Crystallization and melting point will be done the second week. In lab report, answer questions at the end of the lab.

VII. EVALUATION(S):

A. Methods of Evaluation
   1. Examinations: Typical multiple choice type of question: Which statement is true of 1, 3-dimethylcyclobutane?
      a) Only one form of the compound is possible.
      b) Two diastereomeric forms are possible.
      c) Two sets of enantiomers are possible.
      d) Two enantiomeric forms and meso compound are possible.
      e) None of the previous statements is true.
   2. Typical problem solving question: Write structural formulas for the two chair conformations of cis-1-isopropyl-4-methylcyclohexane. Are the two conformations equivalent? Which would be the preferred conformation at equilibrium and why?

3. Laboratory Performance: Criteria:
   a) Attendance
   b) Participation
   c) Safety skills
   d) Lab quizzes
   e) Lab reports with evidence of accurate and honest reporting of data and observations and critical thinking demonstrated in the "Conclusions" of report.
4. Typical Lab assignment: A complete lab report is due for each lab. The report includes Purpose, Reactions, Procedures, Results (all masses, calculations, percent yields, melting or boiling point, etc.), Conclusion, and assigned questions.
5. Typical Lab question: In the reaction of p-aminophenol and acetic anhydride to form acetaminophen, 0.450 mL of water was added. What was the purpose of the water?
6. Optional evaluations:
   a) Quizzes in lecture
   b) Computer assignments checked
   c) Homework checked

B. Frequency of Evaluations
1. Exams are given several times a semester, usually 4 a semester, with a comprehensive final given during "finals week."
2. Quizzes (optional) are given each week on the homework.
3. Lab work and assignments are turned in weekly.

VIII. TYPICAL TEXT(S):

Solomons, Organic Chemistry, 6th ed., New York, NY; John Wiley and Sons, 1996.
Solomons, Study Guide & Solutions Manual, 6th ed, New York, NY; John Wiley & Sons, 1996.
Pavia, Lampman, Kriz, Engel, Organic Laboratory Techniques, A Microscale Approach, 2nd ed., San Diego, CA; Saunders College Publishing, 1995.
Brown & Foote, Organic Chemistry, 2nd ed., San Diego, CA; Saunders College Publishing, 1998.
Brown & Foote, Solutions Manual, 2nd ed., San Diego, Ca; Anders College Publishing, 1998.

IX. OTHER SUPPLIES REQUIRED OF STUDENTS: Organic Molecular Model Kit