Ohio Articulation Number (OAN)
Course Submission Form
2005-2006

College/University: Lakeland Community College

Course(s) Submitted:

Title & Course #  CHEM 2500 Organic Chemistry I
Ohio Articulation Number  OSC 010

Date: February 1, 2006   Course: 1 of a 2 Course OAN mapping.

Name and title of individual submitting on behalf of the college/university

Name: Marilyn S. Jones       Title: Associate Provost

Address: Kirtland, Ohio 44094
E-mail: mjones@lakelandcc.edu
Phone: (440) 525-7828
Fax: (440) 525-7657

Credit Hours: 5 qtr 3 sem
Lecture Hours: 3
Laboratory Hours: 6 (if applicable)
Pre-Requisites(s): CHEM 1600

Placement Score (if applicable)
(Name of test)
(Domain)  (Score)

Catalog/Course Description (Includes Course Title and Course #)

CHEM 2500 Organic Chemistry I: This specialized course is the first in an organic chemistry sequence. It focuses on basic relationships between structure and physical, chemical and spectral properties for organic compounds, including alkanes, alkenes, alkynes, aromatics, halides, alcohols, and ethers. The course covers
free radical substitution, electrophilic addition, elimination, electrophilic aromatic substitution and nucleophilic substitution reactions, with emphasis on mechanisms and stereochemistry. It also introduces infrared and nuclear magnetic resonance spectroscopy and mass spectrometry. Laboratory work emphasizes basic skills such as recrystallization, extraction, distillation, chromatography, synthesis, and analysis using chemical and instrumental methods. This course is intended for chemistry majors and chemical technician, pre-medical, pre-dental, and pharmacy students.

Texts/Outside Readings/Ancillary Materials

Organic Chemistry by Bruice; Intro to Organic Lab Tech: Small Scale Appr by Pavia

Course Objectives and/or Plan of Work

GENERAL COURSE GOALS:

1. Develop a foundation in the fundamental principles and concepts in organic chemistry.

2. Develop students' problem-solving abilities with theoretical material and in the laboratory setting.

3. Develop strategies that emphasize the processes of science and scientific thinking as related to organic chemistry at the macro and molecular level.

4. Develop students' ability and speed in the handling and manipulation of chemical equipment in the organic laboratory.

5. Demonstrate the relationships between theoretical concepts, practical applications and laboratory investigations.

6. Provide students with the opportunity to develop effective group skills through participation in group laboratory experiences.

COURSE OBJECTIVES:

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

1. Describe, draw, and distinguish between sp, sp2, and sp3 hybridized atoms in covalent bonds.

2. Draw Lewis structures.

3. Explain the relationship between molecular structure and physical
properties including solubility, boiling point, and acid-base characteristics.

4. Define, distinguish between, recognize, and react Bronsted-Lowry and Lewis acids and bases.

5. Distinguish between optically active and optically inactive molecules.

6. Identify and resolve enantiomers and diastereomers. Use RS nomenclature.

7. Identify, name (IUPAC) and describe the major physical (b.p. and solubility) and chemical properties (acid-base oxidation, reduction) for the following functional groups: alkanes, alkenes, alkynes, dienes, alkyl halides, alcohols, aldehydes, ketones, carboxylic acids, and amines.

8. Distinguish between and list the major characteristics of free radicals, carbonium ions, and carbonions.

9. Define and identify oxidation and reduction reactions of functional groups.

10. Recognize, write and explain the following reaction mechanisms: free radical substitution, electrophilic addition, catalytic addition, nucleophilic substitution (SNI, SN2), elimination (E1, E2), electrophilic aromatic substitution, and nucleophilic aromatic substitution.

11. List the characteristics of aromatic molecules.

12. Distinguish between aromatic and non-aromatic molecules.

13. Carry out organic synthesis reaction with major functional groups and aromatic molecules.

14. Draw the electromagnetic spectrum and distinguish the regions in terms of wavelength, frequency, energy, and application.

15. Define, describe, and show application for Infrared spectroscopy (IR) and nuclear magnetic resonance spectroscopy (NMR).

16. Identify the major functional groups using IR spectroscopy. Interpret IR spectra.

17. Identify carbon backbones using NMR spectroscopy. Interpret NMR
18. Use the chemical literature to find information beyond the text.

19. Develop and maintain a "legal" laboratory notebook.

20. Carry out the following procedures in the laboratory:
   a. recrystallization
   b. simple, fractional, and steam distillations
   c. extractions - simple and soxhlet
   d. paper, thin layer, column, and gas chromatography
   e. operate an IR spectrometer; interpret IR spectra
   f. operate an NMR spectrometer; interpret NMR spectra
   g. synthesize and analyze organic compounds; calculate theoretical and percent yields
   h. use the chemical literature to find properties of compounds
   i. conduct and evaluate melting points and boiling points

21. Demonstrate cooperative investigative skills in the laboratory.

Description of Assessment and/or Evaluation of Student Learning

INSTRUCTIONAL PROCEDURES THAT MAY BE UTILIZED:
Lecture, including discussion and problem solving sessions.
A.V. and demonstrations as needed.
Laboratory work to learn lab skills and to apply lecture theory.
Student presentations along with student generated topic summaries will also be a part of the lecture class.

SUGGESTED GRADING PROCEDURES:
Exams and Quizzes 1,000
Homework 100
Individual and Group Laboratory Work 400
"Scavenger Hunt" 100

Total 1,600 points possible

Master Syllabi and Working Syllabi (if both are used)

ORIGINATION DATE: 08/02/99 APPROVAL DATE: 02/13/01
LAST MODIFICATION DATE: 08/29/01 EFFECTIVE TERM/YEAR: FALL 2001
This course provides an introduction to the fundamental principles and concepts of organic chemistry for students who need transfer credit in chemistry or chemical engineering or for a pre-medical program.

COURSE DESCRIPTION:
This specialized course is the first in an organic chemistry sequence. It
focuses on basic relationships between structure and physical, chemical and spectral properties for organic compounds, including alkanes, alkenes, alkynes, aromatics, halides, alcohols, and ethers. The course covers free radical substitution, electrophilic addition, elimination, electrophilic aromatic substitution and nucleophilic substitution reactions, with emphasis on mechanisms and stereochemistry. It also introduces infrared and nuclear magnetic resonance spectroscopy and mass spectrometry. Laboratory work emphasizes basic skills such as recrystallization, extraction, distillation, chromatography, synthesis, and analysis using chemical and instrumental methods. This course is intended for chemistry majors and chemical technician, pre-medical, pre-dental, and pharmacy students.

GENERAL COURSE GOALS:
1. Develop a foundation in the fundamental principles and concepts in organic chemistry.
2. Develop students' problem-solving abilities with theoretical material and in the laboratory setting.
3. Develop strategies that emphasize the processes of science and scientific thinking as related to organic chemistry at the macro and molecular level.
4. Develop students' ability and speed in the handling and manipulation of chemical equipment in the organic laboratory.
5. Demonstrate the relationships between theoretical concepts, practical applications and laboratory investigations.
6. Provide students with the opportunity to develop effective group skills through participation in group laboratory experiences.

COURSE OBJECTIVES:
Upon completion of this course the student should be able to:

1. Describe, draw, and distinguish between sp, sp2, and sp3 hybridized atoms in covalent bonds.
2. Draw Lewis structures.
3. Explain the relationship between molecular structure and physical properties including solubility, boiling point, and acid-base characteristics.

4. Define, distinguish between, recognize, and react Bronsted-Lowry and Lewis acids and bases.

5. Distinguish between optically active and optically inactive molecules.

6. Identify and resolve enantiomers and diastereomers. Use RS nomenclature.

7. Identify, name (IUPAC) and describe the major physical (b.p. and solubility) and chemical properties (acid-base oxidation, reduction) for the following functional groups: alkanes, alkenes, alkynes, dienes, alkyl halides, alcohols, aldehydes, ketones, carboxylic acids, and amines.

8. Distinguish between and list the major characteristics of free radicals, carbonium ions, and carbonions.

9. Define and identify oxidation and reduction reactions of functional groups.

10. Recognize, write and explain the following reaction mechanisms: free radical substitution, electrophilic addition, catalytic addition, nucleophilic substitution (SNI, SN2), elimination (E1, E2), electrophilic aromatic substitution, and nucleophilic aromatic substitution.

11. List the characteristics of aromatic molecules.

12. Distinguish between aromatic and non aromatic molecules.

13. Carry out organic synthesis reaction with major functional groups and aromatic molecules.

14. Draw the electromagnetic spectrum and distinguish the regions in terms of wavelength, frequency, energy, and application.

15. Define, describe, and show application for Infrared spectroscopy (IR) and nuclear magnetic resonance spectroscopy (NMR).

16. Identify the major functional groups using IR spectroscopy. Interpret IR spectra.
17. Identify carbon backbones using NMR spectroscopy. Interpret NMR spectra.

18. Use the chemical literature to find information beyond the text.

19. Develop and maintain a "legal" laboratory notebook.

20. Carry out the following procedures in the laboratory:
   a. recrystallization
   b. simple, fractional, and steam distillations
   c. extractions - simple and soxhlet
   d. paper, thin layer, column, and gas chromatography
   e. operate an IR spectrometer; interpret IR spectra
   f. operate an NMR spectrometer; interpret NMR spectra
   g. synthesize and analyze organic compounds; calculate theoretical and percent yields
   h. use the chemical literature to find properties of compounds
   i. conduct and evaluate melting points and boiling points

21. Demonstrate cooperative investigative skills in the laboratory.

COURSE OUTLINE:

I. Introduction to Organic Chemistry
   A. Review and background
   B. A meaningful survey
   C. Structure, bonding and hybridization theory

II. Bonding and Molecular Properties
   A. Covalent bonding—chemical structures
   B. Properties of covalent bonds
   C. Lewis structures and resonance
   D. Structure vs. properties: boiling point, solubility, acid and bases

III. Alkanes and Cycloalkanes
   A. Functional Groups
   B. Structure, Nomenclature and Properties
   C. Reactions - An Overview
   D. Conformations
   E. Bicyclic and polycyclic compounds

IV. Acid and Bases
   A. Bronsted-Lowry Theory
   B. Lewis Theory
   C. Applications to Organic Chemistry

V. Stereochemistry
   A. Optical Activity and Enantiomers
   B. Diastereomers
   C. Applications

VI. Alkenes I
A. Structure, Properties and Nomenclature
B. Occurrence
C. Synthesis - An overview

VII. Alkenes II
A. Reactions - An overview
B. Electrophilic addition
C. Catalytic Hydrogenation

VIII. Dienes
A. Conjugated vs. unconjugated

IX. Alkynes
A. Structure, properties, nomenclature
B. Acidity
C. Synthesis
D. Reactions

X. Alkyl Halides
A. Structure, Properties, Nomenclature
B. Free radical halogenation
C. Organometallic compounds

XI. Nucleophilic Substitution and Elimination Reactions
A. SN1 and SN2
B. E1 and E2
C. Phase Transfer Catalyst

XII. Infrared Spectroscopy and the Electromagnetic Spectrum
A. Electromagnetic spectrum and you
B. IR interpretation and application
C. problem solving

XIII. Nuclear Magnetic Resonance Spectroscopy
A. Theory of NMR
B. Interpretation and application
C. Problem solving

XIV. Aromatic Chemistry I: Benzene and its Derivatives
A. Structure of Benzene: Aromaticity
B. Benzylic Position Reactions, etc.
C. Spectroscopy

XV. Aromatic Compounds II: Reactions
A. Electrophilic Aromatic Substitution
B. Nucleophilic Aromatic Substitution
C. More Side Chain Reactions

INSTRUCTIONAL PROCEDURES THAT MAY BE UTILIZED:
Lecture, including discussion and problem solving sessions.
A.V. and demonstrations as needed.
Laboratory work to learn lab skills and to apply lecture theory. Student presentations along with student generated topic summaries will also be a part of the lecture class.

---

**SUGGESTED GRADING PROCEDURES:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams and Quizzes</td>
<td>1,000</td>
</tr>
<tr>
<td>Homework</td>
<td>100</td>
</tr>
<tr>
<td>Individual and Group Laboratory Work</td>
<td>400</td>
</tr>
<tr>
<td>&quot;Scavenger Hunt&quot;</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,600 points possible</td>
</tr>
</tbody>
</table>

---

**SUGGESTED COURSE EVALUATION PROCEDURE:**

Student evaluations

---

[ End of Course Outline for 'CHEM2500' ]
<table>
<thead>
<tr>
<th>3. Complexities of Social Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Math and Science</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>5. Past and Present Cultures</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>6. Technology</td>
</tr>
</tbody>
</table>

---

*** CRITICAL THINKING ***

---

<table>
<thead>
<tr>
<th>7. Identify Personal Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Identify Ethical Dimensions</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>10. Evaluate Issues from Various Perspectives</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>11. Collect, Analyze, Interpret Information</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>12. Support Hypotheses</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>13. Synthesize Information</td>
</tr>
<tr>
<td>----------------------------------------</td>
</tr>
<tr>
<td>14. Draw Conclusions</td>
</tr>
</tbody>
</table>

---

*** COMMUNICATION SKILLS ***
| 15. Speak Clearly and Effectively |
| 16. Read with Comprehension |
| 17. Write Clearly & Effectively in Standard English |
| 18. Work Effectively in Groups |
| 19. Listen Actively and with Understanding |
| 20. Practice Effective Interpersonal Skills |
| 21. Interpret/Use Graphic Communication |
| 22. Use Technology-Based Communication |

Methods of Assessment codes:


Additional Documentation
<table>
<thead>
<tr>
<th>OBR Use</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved</td>
<td></td>
</tr>
<tr>
<td>Additional Information</td>
<td></td>
</tr>
<tr>
<td>Requested</td>
<td></td>
</tr>
<tr>
<td>Rejected</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
</tbody>
</table>