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CHMY 222.00: Organic Chemistry I - Lab

Valeriy V. Smirnov

University of Montana - Missoula, valeriy.smirnov@umontana.edu

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CHMY 222 – Organic Chemistry Laboratory I Syllabus Fall 2014

Professor: Valeriy V. Smirnov

Office: Interdisciplinary Science Building (ISB) 219

Office Hours: Tuesday and Thursday noon to 1 PM, or by appointment

Phone: X-6470

E-mail: valeriy.smirnov@umontana.edu

Pre-requisites: One semester of CHMY 100-level chemistry laboratory class (or an equivalent) is a pre-requisite for this class. CHMY 221, Organic Chemistry I, is a co-requisite for CHMY 222. Laboratory pre-requisites are very important (for example, safety) and will be enforced. You may be required to provide proof such as a transcript or name, number and term of the UM course.

Course Objective: To illustrate organic chemical reactions and the analysis techniques for organic compounds and to successfully manipulate small amounts of organic compounds.

Required Text: Pavia, D. L., Lampman, G. M., Kriz, G. S., and Engel, R. G. (2007) *Introduction to Organic Laboratory Techniques: A Microscale Approach*, 4th Ed., Thomson Brooks/Cole, Belmont, California; ISBN 0-495-01630-6

Other Required Materials: Splash-protection safety goggles and a bound laboratory notebook must be purchased.

Grading: There are 7 (seven) labs, each worth 100 points for 700 points total. The following are the letter grades corresponding to the numerical scores in this course:

A	from 90.0% to 100%
A-	from 86.7% to 89.9%
B+	from 83.3% to 86.6%
B	from 80.0% to 83.2%
B-	from 76.7% to 79.9%
C+	from 73.3% to 76.6%
C	from 70.0% to 73.2%
C-	from 66.7% to 69.9%
D+	from 63.3% to 66.6%
D	from 60.0% to 63.2%
D-	from 56.7% to 59.9%
F	from 0% to 56.6%

Disabilities: Any students in this course, who have disabilities that may prevent them from fully demonstrating their abilities in this class, are welcome to contact me directly/personally as soon as possible to discuss accommodations that are necessary to ensure their full participation in this class and facilitate their educational opportunities.

Experiments and Reading Assignments

All page references are for the 4th edition of the Required Text (see page 1 of this Syllabus)

Pages 542-573 are to be read before the first experiment is started. All sections which precede an experimental procedure, such as Required Reading (Techniques), Special Instructions, Waste Disposal, must be read before each experiment is started. Assigned problems and/or questions must be included with the lab report.

L1 – Introduction to Microscale (one 2-hour lab period)

Essay: p. 2-10

Procedure: p. 10-11, Lab Exercises 1A, 1C and 2

New Techniques: None

Problems: None from the text

L2 – Distillation/Gas Chromatography (GC)/Nuclear Magnetic Resonance (NMR) (five 2-hour lab periods)

Procedure: Handout

New Techniques: p. 703, Tech. 14; p. 715, Tech. 15

New Analytical Techniques: GC – Tech. 22 on p. 797 & NMR – Tech. 26 on p. 868

Problems: p. 714 #1-4; p. 731-732 #2, 6-8; and p. 817-818 #1, 2, 4

L3 – Steam Distillation/Infrared Spectrometry (IR)/NMR (four 2-hour lab periods)

Essay: p. 108-111

Procedure: p. 115, Exp 14B

New Technique: p. 750, Tech. 18

New Analytical Technique: IR – Tech. 25 on p. 833

Questions: p. 116 #1, 2, 4

Problems: p. 755 #1, 2, 3

L4 – *n*-Butyl Bromide Prep with IR and NMR Analysis (four 2-hour lab periods)

Procedure: p. 197, Exp 23A

Questions: p. 203 #1-6 (for *n*-butyl bromide)

L5 – *t*-Pentyl Chloride Prep with IR and NMR Analysis (three 2-hour lab periods)

Procedure: p. 200, Exp 23C

Questions: p. 203 #2, 3, 5 (for *t*-pentyl chloride)

L6 – Methylcyclohexene Prep with IR and NMR Analysis (three 2-hour lab periods)

Procedure: p. 213, Exp 25A

Questions: p. 216-217 #1, 2a-d, 3, 5

L7 – Nitration of Methyl Benzoate with melting point determination (three 2-hour lab periods)

Procedure: p. 228, Exp 28

Problems: None from the text

Pre-lab (10 points)

Prior to coming to lab, you are required to complete a pre-lab exercise: prepare a typed, one-page sheet that details the following:

Title of the experiment.

Introduction. Briefly describe the purpose of the lab (2 sentences max.), usually to learn a technique and synthesize a product.

Reaction. Write the overall reaction, using chemical formulas to show reactants and products. Indicate the conditions of the reaction.

Table of chemicals used. For each chemical used in the experiment the table should include the following columns: name of compound, its skeletal diagram ('zigzag' formula), molecular weight (rounded to 2 sig. figures after the decimal point), physical properties (such as physical state, color, melting point for solids, boiling point for liquids), amount used (g, mL), number of moles, and any relevant safety information (toxic, flammable, corrosive, etc.).

Brief procedure summary and/or a flow diagram. Use action verbs such as weigh out, add, place, charge, mix, stir, dissolve, soak, heat, boil, remove, cool, filter, collect, etc. Construct your sentences in such a way that this part reads like a 'cookbook recipe'. Be brief, but don't leave out the important details.

Print two copies – one for yourself to use during the lab and another one to hand in to your TA for grading. The TAs will be collecting pre-labs prior to the start of the experiments. This pre-lab exercise will make up the first portion of your final, written lab report. 10 points will be deducted from the total lab report grade if the pre-lab component is not completed prior to class.

Laboratory Notebook and Laboratory Technique (20 points)

Students must use a laboratory notebook which has a permanent stitched binding. All details of the experiments must be recorded accurately and neatly in the notebook. Record what was done, how it was done and what happened. A reference to the text by page number is allowed, but any changes in the procedure must be recorded. The final written reports will be a reflection of what was recorded during the experiment.

All observations, weights, melting points, etc must be entered directly into the notebook (not a slip of paper). Points may be deducted for failure to record data directly into the notebook. The notebook is to be kept up-to-date. Write the information as you do it, not afterwards. Notebooks will be graded for completeness during the lab.

If a mistake is made, draw one or two lines through it and write the correct entry. Never obliterate an incorrect entry or remove pages. Numbers must have units and tabulate data whenever possible. Begin a new experiment on a new page.

Students will also be graded on laboratory technique, safety, cleanliness, etc.

Laboratory Report (70 points)

Lab reports must be typed. It's ok to handwrite chemical structures and calculations. Below is the format for most lab reports. Not all lab reports will have the same format or breakdown of points. More information will be given for each lab.

Title of the experiment (5 points). See Pre-lab on page 3 of this Syllabus.

Introduction (5 points). See Pre-lab on page 3 of this Syllabus.

Reaction (5 points). See Pre-lab on page 3 of this Syllabus.

Table of chemicals used (10 points). See Pre-lab on page 3 of this Syllabus.

Brief procedure summary and/or a flow diagram (5 points). See Pre-lab on page 3 of this Syllabus.

Procedure and observations (10 points). Review your laboratory notebook and report what was done, how it was done and what happened. Write in the past tense.

Mechanism of product formation (10 points). Write the reaction mechanism, including the electron pushing.

Results (5 points). Qualitatively describe your results (color and appearance of product). Report your melting point, percent yield, and any other results.

Conclusions (5 points). Discuss the experimental procedure, your observations and sources of error. Try to relate your discussion to the reaction mechanism where possible.

Assigned problems and/or questions (10 points). Your answers must be included with the lab report.

Typed lab reports are due to your TA one week following the last scheduled day of the lab, with the exception of the last lab report which is due on Check-Out Day. In order to grade your last lab report and return it to you, it is recommended that you turn in the last lab report as soon as possible.

Late lab reports will be penalized 5 points for each lab period they are late.

Other Notices: This course Syllabus is not a contract; changes may be made anytime. All changes will be announced in class, via e-mail, or on Moodle.

Academic Honesty: All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the university. All students need to be familiar with the Student Conduct Code. The Code is available for review online at:

http://www.umt.edu/vpsa/policies/student_conduct.php

Safety Rules

Read "Laboratory Safety" section on pages 542-558 of the Required Text (see page 1 of this Syllabus).

1. GENERAL SAFETY RULES

- a. Safety goggles must be worn at all times! Contact lenses are not allowed.
- b. You are not allowed in the lab unless an instructor (TA or professor) is present.
- c. Learn the location of the lab's safety equipment, such as fire extinguisher, safety shower, eye-washing fountains/facilities, hoods, and bench vents.
- d. Adequate clothing must be worn. Clothing which exposes a lot of skin (tank tops, shorts, sandals, etc.) is not allowed without a lab coat.
- e. No food or drinks in the lab.
- f. Turn off cell phones.
- g. Use only the explosions-proof freezer in room 217 for storing flammable solvents.
- h. Unauthorized experiments are not allowed.
- i. Open flames are never to be used in the organic lab.
- j. Material Safety Data Sheets (MSDS) are on file at Chemistry Stores. Read pages 548-554 of the Required Text (see page 1 of this Syllabus) for more information.
- k. Chemical products must never be taken out of the lab unless taken for analysis.
- l. Never analyze products by taste.

2. GENERAL ADVICE

- a. Keep your work area and glassware clean.
- b. Use caution when mixing chemicals as evolution of heat may occur.
- c. Always add concentrated acids and bases to the water when diluting them. Never mix concentrated acids and bases.
- d. Never heat a closed system. Always provide a vent.
- e. When boiling any liquid, always use adequate stirring.

f. When inserting thermometers into adapters, always use an O-ring and only gentle force.

3. ACCIDENTS

- a. If a chemical is spilled on the skin, wash it off immediately with cold water and notify the instructor.
- b. Use the pull-down eye-washing fountains if chemicals get in your eyes.
- c. If large amounts of chemicals are spilled on you, use the safety shower.
- d. If you are burned from a heat source, soak the area in very cold water and notify the instructor.
- e. Report any cuts to your instructor.

4. DISPOSAL OF USED CHEMICALS

- a. Solids => In trash
- b. Water soluble (such as inorganics, alcohols, acetone, HCl, H₂SO₄, etc.) => Down the drain diluted with lots of water.
- c. Nonhalogenated (nonpolar) solvents (such as toluene, hexane, etc.) => Used solvent container labeled "nonhalogenated". NO WATER
- d. Halogenated solvents (such as CH₂Cl₂, CHCl₃, etc.) => Used solvent container labeled "halogenated". NO WATER
- e. Broken glass => Broken glass box. No paper towels
- f. Biological => Biological trash can with orange liner. Only biologicals

Fall 2014 CHMY 222 Lab Schedule

MW Date	TR Date	Lab	Activity
August 25, M	August 26, T		Introduction (Forestry)
August 27, W	August 28, R		No lab
<i>September 1, M</i>	September 2, T		<i>Labor Day Holiday – No lab</i>
September 3, W	September 4, R	L1	Check In/Introduction to Microscale (Clapp)
September 8, M	September 9, T	L2	Distillation/GC/NMR (Forestry)
September 10, W	September 11, R	L2	Distillation/GC/NMR (Clapp)
September 15, M	September 16, T	L2	Distillation/GC/NMR (Forestry – intro to GC & NMR)
September 17, W	September 18, R	L2	Distillation/GC/NMR (Clapp)
September 22, M	September 23, T	L2	Distillation/GC/NMR (Clapp)
September 24, W	September 25, R	L3	Steam Distillation (Forestry)
September 29, M	September 30, T	L3	Steam Distillation (Clapp)
October 1, W	October 2, R	L3	Steam Distillation (Forestry – intro to IR)
October 6, M	October 7, T	L3	Steam Distillation (Clapp)
October 8, W	October 9, R	L4	<i>n</i> -Butyl Bromide Prep (Forestry)
October 13, M	October 14, T	L4	<i>n</i> -Butyl Bromide Prep (Clapp)
October 15, W	October 16, R	L4	<i>n</i> -Butyl Bromide Prep (Clapp)
October 20, M	October 21, T	L4	<i>n</i> -Butyl Bromide Prep (Clapp)
October 22, W	October 23, R	L5	<i>t</i> -Pentyl Chloride Prep (Forestry)
October 27, M	October 28, T	L5	<i>t</i> -Pentyl Chloride Prep (Clapp)
October 29, W	October 30, R	L5	<i>t</i> -Pentyl Chloride Prep (Clapp)
November 3, M	<i>November 4, T</i>		<i>General Elections – No lab</i>
November 5, W	November 6, R	L6	Methylcyclohexene Prep (Forestry)
November 10, M	<i>November 11, T</i>		<i>Veterans' Day Holiday – No lab</i>
November 12, W	November 13, R	L6	Methylcyclohexene Prep (Clapp)
November 17, M	November 18, T	L6	Methylcyclohexene Prep (Clapp)
November 19, W	November 20, R	L7	Nitration of Methyl Benzoate (Forestry)
November 24, M	November 25, T	L7	Nitration of Methyl Benzoate (Clapp)
November 26, W	<i>November 27, R</i>		<i>Thanksgiving Holiday – No lab</i>
December 1, M	December 2, T	L7	Nitration of Methyl Benzoate (Clapp)
December 3, W	December 4, R		Check Out