**I. ASCRC General Education Form**

<table>
<thead>
<tr>
<th>Group</th>
<th>Group XI Natural Science</th>
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<tbody>
<tr>
<td>Dept/Program</td>
<td>Chemistry</td>
</tr>
<tr>
<td>Course #</td>
<td>CHEM 154</td>
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<tr>
<td>Course Title</td>
<td>Organic and Biological Chemistry Laboratory</td>
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<tr>
<td>Prerequisite</td>
<td>pre- or co-requisite Chem 152</td>
</tr>
<tr>
<td>Credits</td>
<td>2 credits</td>
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**II. Endorsement/Approvals**

Complete the form and obtain signatures before submitting to Faculty Senate Office

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<thead>
<tr>
<th>Please type / print name</th>
<th>Signature</th>
<th>Date</th>
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<tbody>
<tr>
<td>Instructor</td>
<td>Holly Thompson</td>
<td></td>
</tr>
<tr>
<td>Phone / Email</td>
<td>x2070/holly.thompson@umontana.edu</td>
<td></td>
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<tr>
<td>Program Chair</td>
<td>Mark Cracolice</td>
<td></td>
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<tr>
<td>Dean</td>
<td>Gerald Fetz</td>
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**III. Description and purpose of the course:** General Education courses must be introductory and foundational. They must emphasize breadth, context, and connectedness; and relate course content to students’ future lives: See Preamble: [http://www.umt.edu/facultysenate/gened/GEPreamble_final.htm](http://www.umt.edu/facultysenate/gened/GEPreamble_final.htm)

The Chem 150 series (Chem 151N, 152N and 154N) provides a one year survey of chemistry. Chem 154, the lab component of the series, coordinates with Chem 152, and is taken by most Chem 152 students.

Chem 154 has several purposes:

1. Chem 154 provides hands-on experience with concepts covered in the lecture course.

2. Lab exercises expose students to common experimental paradigms of organic and biological chemistry.

3. Chem 154 engages students in quantitative descriptions of physical and chemical observations.

4. One of the most important aspects of the course is the development of student self-confidence. Students are provided with a safe, encouraging environment in which to learn new skills. They have three hours of interaction with a teaching assistant each week (ratio 24 students per TA), with the opportunity for extended discussions about science. TAs frequently model problem-solving approaches and engage students in the process (for example: sorting out why a student’s product did not precipitate as expected). This environment helps students to gain confidence in their problem-solving skills.

**IV. Criteria:** Briefly explain how this course meets the criteria for the group. See: [http://www.umt.edu/facultysenate/ASCRCx/Adocuments/GE_Criteria5-1-08.htm](http://www.umt.edu/facultysenate/ASCRCx/Adocuments/GE_Criteria5-1-08.htm)
Each experiment requires students to draw conclusions from data that has been collected. Lab report questions guide students to compare what they have done and seen in lab with descriptions of the same phenomena in lecture.

Students are also guided through considerations of analytic uncertainty. Questions require students to consider the limits of their measurements, including use of significant figures and non-trivial sources of error in the measurements.

V. **Student Learning Goals:** Briefly explain how this course will meet the applicable learning goals. See: [http://www.umt.edu/facultysenate/ASCRCx/Adocuments/GE_Criteria5-1-08.htm](http://www.umt.edu/facultysenate/ASCRCx/Adocuments/GE_Criteria5-1-08.htm)
Chem 154 lab exercises illustrate and reinforce the general principles of organic and biological chemistry. For example, students oxidize various functional groups with reagents that provide visual evidence of reactions (color changes), then correlate those reactions with the classroom approach (structural formulas that represent reactants and products) to oxidation reactions.

Chem 154 experiments include simple examples of paradigms commonly used in organic and biochemical research. 1) One such paradigm involves synthesis or isolation of a compound from a biological source, followed by purification, and analysis. 2) Using another important paradigm, students develop quantitative relationships between two variables in known samples and use those mathematical relationships (calibration curves) to determine characteristics of known samples. This paradigm is introduced with simple colligative properties and revisited with more complex protein characterization.

Efforts are made to avoid "black box" use of laboratory instrumentation. For example, a UV-visible spectrophotometer without cabinet is set up in a darkroom so that students can track the light path and the device that controls which wavelengths of light pass through the sample. Students are introduced to paper and column chromatography of colored molecules, where the separation is seen visually. A later experiment requires students to predict and explore the role of different mobile phases on pigment separation. Based on their hands-on experience, students readily predict behavior of samples in a gas chromatograph at the end of the semester.
CheM 154 Organic & Biological Chemistry Laboratory Fall 2008

Instructor: Dr. Holly Thompson
Office: CP 402
243-2070 holly.thompson@umontana.edu
Office Hours: Monday 9:10-10am, Tuesday 11:10-12pm and by arrangement

Chem 154N satisfies the laboratory component of Perspective 6, Natural Sciences, for the general education requirement. Students synthesize organic compounds or isolate them from biological materials, then purify and analyze the compounds using methods and instrumentation typically used in research laboratories. Students also develop quantitative relationships between variables, apply patterns determined with known samples to various unknown materials, and practice logical/critical reasoning to problems.

Chem 152 is a pre-/co-requisite for this course. Chem 151 or equivalent general chemistry course is a pre-requisite for Chem 152 and 154.

Pre-Lab Meeting:
M 8:10-9:00 am Chem 123
This meeting prepares you to do the experiments efficiently, to understand the experiments, and to be aware of important safety issues. Attendance is mandatory.

Laboratory Sections:
Individual lab sections meet on Tuesday morning and afternoon. You must attend the section for which you are registered.

Supplies Required for Lab (all available in bookstore):
X Organic and Biological Chemistry Laboratory CoursePac
X Safety Goggles-Department policy requires all persons in the laboratory to wear approved safety goggles.
X Sharpie® felt-tip pen is useful for writing on glass.

Student Conduct

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 at http://www.umt.edu/SA/VPSA/indec.cfm/page/1321.
The majority of Chem 154 students are honest and responsible. Be advised that I do enforce the Student Conduct Code in order to protect the honest students from academic misconduct.

Grades will be based on the following components:

180 \( \times \) 9 lab reports with protocols, 15 pts/report + 5 pts/protocol each
20 \( \times \) 2 lab reports, 10 pts/report, no protocol
20 \( \times \) pop quizzes (given at unannounced intervals during M pre-lab meetings)
60 \( \times \) 3 exams, 20 pts each
280 \( \times \) total pts

Letter grades will be based on the total out of 260 possible pts. Letter grades for the course will be assigned as follows:

- 93.33% guarantees A
- 90.00% guarantees A-
- 86.67% guarantees B+
- 83.33% guarantees B
- 80.00% guarantees B-
- 76.67% guarantees C+
- 73.33% guarantees C
- 70.00% guarantees C-
- 66.67% guarantees D+
- 63.33% guarantees D
- 60.00% guarantees D-
- <60.00% guarantees F

Lab protocols are outlines of the procedures that you will do in the laboratory. The purpose of writing these protocols each week is to ensure that you have read and understood the lab exercise, so that you can work safely and efficiently. Protocols are due at the beginning of the lab period.

*If you do not have a complete protocol ready to be initialed by the TA within the first 15 minutes, you cannot start the lab and you will receive a zero for the exercise.*

Lab reports are based on the tear-out report sheets at the end of each exercise.

*Lab reports stapled to appropriate protocols are due the first 15 minutes of the next lab period. Late penalty of 4 pts per day will be assessed after the due time.*
Chem 154 Schedule Fall 2008

Week of: Experiment

Aug 25  Introduction
         Check-in

Sept 1  Monday is Labor Day, no pre-lab lecture
        Procedural and Safety Issues
        Experiment 1: Density and Composition of Solutions

Sept 8  Experiment 2: Synthesis, Purification and Analysis of Aspirin

Sept 15 Experiment 2: Synthesis, Purification and Analysis of Aspirin
         (continued)

Sept 22 Experiment 3: Qualitative Analysis of Functional Groups

Sept 29 Experiment 4: Introduction to Chromatography

Oct 6   Exam 1
        Experiment 5: Chromatographic Separation of Plant Pigments

Oct 13  Experiment 6: Fischer Esterification
        Experiment 11: Automatic Pipette Practice

Oct 20  Experiment 6: Fischer Esterification (continued)
        Experiment 7: Gas Chromatography

Oct 27  Experiment 7: Gas Chromatography (continued)
        Experiment 8: Life Sciences Databases/MSDSs

Nov 3   Exam 2
        Tuesday is Election Day, no laboratory

Nov 10  Introduction to Spectroscopy
        Tuesday is Veteran’s Day, no laboratory

Nov 17  Experiment 9: UV-Visible Spectroscopy, Absorption Spectra

Nov 24  Experiment 10: UV-Visible Spectroscopy, Quantitation

Dec 1   Exam 3; Check-out

Dec 8   Final Exam Week