Instructor  
Prof. Anderson L. Marsh  
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Office Hours: MWF 10–11 am, M 1:30–3 pm, Tu 1–2 pm, Th 1–3:30 pm, or by appointment

Course Overview  
Overall, the faculty views this course as a capstone experience for your work in the Chemistry major. The research you perform draws upon the information from a variety of disciplines relating to chemistry that you have learned over the past three years. This course is designed to aid you in the further development of skills related to literature searching, experimental design, and summarization and interpretation of research results in written and oral format.

Learning Objectives  
Upon completion of the course it is expected that you will be able to:

1. Develop clear hypotheses to be tested experimentally.

2. Draft experimental procedures to carry out laboratory work designed to evaluate your hypotheses.

3. Assemble a thesis in the form of a well-written research report with experimental data displayed properly, as well as correctly cited and referenced literature sources.

4. Deliver a formal seminar summarizing and analyzing your work with comparisons made to results reported in the literature.

Grades  
Semester grades will be assigned using the following cutoff percentages:

<table>
<thead>
<tr>
<th>Grade</th>
<th>A</th>
<th>A−</th>
<th>B+</th>
<th>B</th>
<th>B−</th>
<th>C+</th>
<th>C</th>
<th>C−</th>
<th>D+</th>
<th>D</th>
<th>D−</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutoff %</td>
<td>93</td>
<td>90</td>
<td>87</td>
<td>83</td>
<td>80</td>
<td>77</td>
<td>73</td>
<td>70</td>
<td>67</td>
<td>63</td>
<td>60</td>
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Evaluation Criteria  
Your final grade will be determined based upon four criteria: the research you have performed (50%), your attendance at the chemistry seminars (10%), the thesis you put together on your project (20%), and the seminar that you give this semester (20%).

Research Expectations  
The faculty expects that you spend 4 hours in the laboratory per week for each credit hour of CHM 510 for which you are registered. In addition to time spent attending seminars, preparing your research report and your data seminar is considered separate from time spent conducting research. Your
grade for research will be determined by your research advisor.

**Seminar Attendance**

Attendance at seminars is an important means of learning about current chemical research. As a research student, you are expected to attend the seminar series organized by the department. This includes the outside speakers and LVC faculty, as well as seminars given by your fellow CHM 510 students. Typically (but not always), these seminars will be on Tuesday mornings at 11:00 am. Unexcused absences from seminars will result in a grade reduction for each seminar missed (from A to A−, B+ to B, etc.).

**Research Thesis**

Completion of the ACS certified degree in Chemistry requires the submission of a written report summarizing and interpreting the results from your independent research project. This thesis will contain the following sections: a title page, abstract, introduction, experimental methods, results and discussion, conclusions, and references. With the exception of the title page, each section should begin with a heading that is in boldface type and is capitalized. Number all pages except for the title page. Here are more specific guidelines for each section of the document:

1. The title page should include a short, but descriptive, title for your project. Center this title several lines from the top of the page. Below your title list the following, each on separate lines: your name, your research advisor’s name, and the date submitted.

2. The abstract should appear on a separate page immediately after the title page and should be a brief paragraph (4-6 sentences) summarizing the main goal(s) and finding(s) of the experiment.

3. The remainder of the document should begin on the following page, starting with the introduction section. In this section, you should provide background and motivation for performing the experiment, a concise literature review, and a brief summary of the experiment and the results. The first two components may be taken from your research proposal from last semester. Just be sure to change the voice and/or verb tense as appropriate.

4. The experimental methods section should be a detailed description of procedures you performed. If instrumentation was used, give the manufacturer and any parameters. Indicate any outside source for instrumentation. For synthetic work, synthetic procedures should be included along with appropriate characterizations (ideally IR, $^1$H NMR, and $^{13}$C NMR) for all compounds not previously reported in the literature. An example is given below:
(2-Oxocyclopentylmethyl)-carbamic acid 9H-fluoren-9-ylmethyl ester (6) was prepared in a 1 dram vial by the General Procedure using N,O-acetal 4 (38.8 mg, 0.144 mmol, 1 equiv.), CH₂Cl₂ (2.0 mL) chlorotrimethylsilane (36.5 µL, 0.288 mmol, 2.0 equiv.) and 1-morpholinocyclopentene (69 µL, 0.432 mmol, 3.0 equiv.) to afford 6 (42.0 mg, 0.125 mmol, 87%) as a white solid. IR (KBr) ν 3356, 2961, 2877, 1741, 1693, 1540, 1432, 1403, 1271, 1147, 1008, 1006, 758, 742 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 7.74 (d, J = 7.5 Hz, 2H), 7.58 (d, J = 7.3 Hz, 2H), 7.38 (t, J = 7.3 Hz, 2H), 7.30 (t, J = 7.3 Hz, 2H), 5.30-5.55 (br s, 1H), 4.38 (d, J = 7.0 Hz, 2H), 4.20 (t, J = 6.8 Hz, 1H), 3.47 (ddd, J = 13.1, 6.6, 6.6 Hz, 1H), 3.28 (ddd, J = 13.4, 6.5, 6.1 Hz, 1H), 2.24-2.38 (m, 2H), 1.90-2.20 (m, 3H), 1.67-1.90 (m, 1H), 1.58 (qd, J = 11.2, 6.6 Hz, 1H); ¹³C NMR (75 MHz, CDCl₃): 221.0, 156.7, 144.1, 141.3, 127.8, 127.2, 125.2, 120.1, 66.8, 49.5, 47.4, 40.4, 38.3, 27.4, 20.7.

5. The results and discussion section should be a descriptive report of your main experimental findings, along with your interpretation of the experimental findings, particularly in the context of what is known in the literature.

6. Your main points should be summarized in a conclusions section.

7. The references section should consist of a numbered list of cited literature sources, in the order they first appear in the text. These citations should be represented in the text as a superscript at the end of the sentence. References must be given in ACS format, as shown in *The ACS Style Guide*, and should be listed as endnotes in a final section. Given below are examples for the format of two main types of references:

For a journal article:


For a textbook or monograph:


8. Figures and tables should be used where appropriate to present data or diagram experimental apparatus and should be integrated into the text. Figures must be labeled with a caption underneath, while tables must be
given a header above. Chemical structures must be drawn using a drawing program such as Symyx Draw.

The total length of your thesis should be at least 3000 words. A rough draft will be due to me no later than Wed. Apr. 10th. You are also strongly encouraged to go through preliminary drafts with your research advisor. The final draft will be due Wed. May 1st and will be scored using the rubric given on the penultimate page of this syllabus.

The seminar you present during the spring semester will focus mainly on the results of your research project, but should also include an interpretation of your results with reference to relevant literature. Items that the faculty will assess for each talk are: the thoroughness of preparation for your talk, quality of the presentation material that you assemble, and your delivery and understanding of the material. (Please see the example of the grading sheet faculty members will use to make their comments.) Early in the semester, we will schedule a seminar slot for you at 11:00 am on a Tuesday morning.

The seminar should be 15 to 20 min in length (30 to 40 min in the case of departmental honors) and should focus primarily on your research. You may provide a very brief background, but most of this should have been covered in the 1st semester talk. You should clearly state the goals of your project at the outset. As you prepare your talk, keep in mind that your goal is to organize your research into a logical story for your presentation, which is likely not a chronological account of your work. As you describe your work, focus on the key experiments and information deduced from those experiments. Tell us why the experiments were done and how you interpret the data. Conclude with a clear summary of your work and suggest future directions that you feel the research should go. In creating your presentation, you should design your own text, schemes, graphics, tables and/or charts that allow you to explain complex ideas in a straightforward manner.

All of us have sat through bad presentations from both professors and other speakers. You know they can be painful, so plan to construct a well-organized talk that is delivered in a manner that holds the audience's interest. This is largely independent of the topic and comes with experience, but a few practical hints before you organize the talk can make an enormous difference in its quality. Attached to this document is an example of the grading sheet that the faculty will use; it, along with the comments below should serve as an effective guide for how to put together your talk. Don't hesitate to ask any of the faculty questions about your seminar preparation well before your seminar date. We can help you decide whether your seminar is well-organized or whether it needs some additional work.

- You are to use PowerPoint to put together your talk.
When I give a talk at an ACS meeting, for example, I strive for about one slide per minute of talking time. For a talk of 15 min, the number of slides is about 12 to 15 (including title and acknowledgment slides). Most speakers will average a minute on a slide. Certain slides, such as the title and outline will take less time, but data slides will take more time. Two minutes is an appropriate amount of time for your audience to “digest” what is on a data slide.

The visual portion of your talk is as important as the spoken part. Avoid making overheads that are too wordy. Keep your slides simple and to the point. Use lots of figures and schemes instead of text.

Make sure the audience can read everything on your slides (from the back of the room). Items that are too small do not allow the audience to “digest” the slide properly. Watch certain colors as well. As a general rule avoid the use of yellows—on screen they are hard to see from a distance.

If you are not going to cover something on a slide, remove it. Extraneous material on slides is distracting. If you believe you may get a question on it, leave it as a “reserve” slide at the end.

Include a reference on any slide that contains information, i.e. a figure, from another source. Use a small, but legible, type to add the reference; a short journal reference (see above without article title) is an appropriate way to cite someone else’s work.

Watch color combinations. Computers can allow you to generate some funky looking things. Keep the presentation sharp and professional.

When showing a graph or charts of data, remember to orient your audience as to what they are seeing. Don’t just tell them, for example, “The trend increases over time.” Instead, tell them what they are looking at.

You should be able to give your presentation without notes. Notes are viewed as a crutch, and most people who use them often wind up reading from them—a distracting habit that will reduce the quality of your seminar.

Practice, practice, practice!!! The first time through, work slowly and try to find your words without worrying about the time. As you do the next run through, concentrate on finding the words and watching the time. To avoid speeding up when you give your actual talk, spend enough time practicing (in which you spend a lot of time thinking about your words).

Do at least one practice in front of an audience. Either your research
advisor or I (or both) can fill this role. This will help you gain confidence and help you lose any nervousness you have about giving your talk in front of others. Also, practicing in front of others can provide an excellent means of determining what aspects of your topic need further clarification, what aspects are confusing, etc.

- Don't wait until the last day to do your practice talks because there is nothing quite so miserable as limping through a talk because of inadequate practice or because you're exhausted from working through the night to make last minute repairs!

- Avoid distracting motions while speaking, such as pacing, waving the pointer, etc. Talk to your audience, not to the podium or the overhead projector or screen.

- Do not chew gum. Take change out of your pocket, pens that click or anything that you might wind up fiddling with if you get nervous.

- A bit of humor can make your talk more interesting when appropriate, but avoid its overuse.

- Look for subtle (and perhaps not so subtle) cues from the audience that would indicate that you need to slow down, stand to the side of the overhead screen, etc.

- Be prepared to answer questions about anything you showed. When answering questions, do not try to fool the audience if you do not know the answer to a question, but avoid a quick and easy "I don't know" or "I did not read anything about that" if you possibly can. Think about the question, and consider how your previous training can be brought to bear on it. A capacity for thinking on your feet is an important component of your scientific training.

- Remember, the faculty and your peers are here to learn from you during your seminar. Because you have researched your topic, chances are you will know more about a given topic than the rest of us.

- Lastly, be as professional as you can in what you put on your slides and how you present yourself.

**Academic Honesty**

Any student who commits an act of academic dishonesty, such as cheating or plagiarism, will be subject to the penalties described in the Student Handbook and outlined in LVC’s “Academic Honesty Policy” (http://www.lvc.edu/catalog/acad-reg-procedures.aspx). Students who take part in academic honesty violations will be subject to a meeting with the
Associate Dean of Academic Affairs, who has the authority to take further action, up to and including expulsion from The College.

**Course Evaluation**

During one of the last several weeks of the course, you will have an opportunity to evaluate different aspects of this course. The College utilizes a standardized course evaluation instrument called IDEA. The IDEA evaluation will be administered through an on-line form that you will be asked to complete in a timely manner outside of class. I have chosen the following objectives for evaluation using IDEA:

1. Learning to *apply* course material (to improve thinking, problem solving, and decisions)

2. Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course

3. Developing skill in expressing oneself orally or in writing

**Disability Services**

If you have a physical, medical, psychological, or learning disability that is going to impact your attendance or require accommodation, please let me know. In order to ensure that your learning needs are appropriately met, you will need to provide documentation of your disability or medical condition to the Director of Disability Services. The Office of Disability Services will then provide a letter of verification of disability that describes the accommodations needed for this class. *Accommodations are not retroactive.* This office is located in the Humanities Building, room 04, and the Director may be reached by phone at 717‒867‒6071.
Research Thesis Grade Sheet  

Name: ______________________________

Title, Author List, and Abstract  

_____/10 points

Clear and succinct title given. All lab partners credited as co-authors. Concise summary of main points presented in abstract.

Introduction  

_____/10 points

Necessary background presented for reader to understand experimental goals. Relevant literature concisely summarized. Brief description of experiments performed given.

Experimental  

_____/15 points

Sufficient detail is given to allow duplication of experiments. Instrumentation or experimental apparatus is described fully. Any hazards or cautions are noted.

Results and Discussion, Conclusions  

_____/30 points

Main idea identified in the introduction is fully and carefully developed, and substantially supported through presentation and interpretation of experimental data. Succinct presentation of main conclusions given at end.

References  

_____/15 points

ACS format is used. References are cited properly in the body of the manuscript. No unacceptable sources are listed.

Clarity  

_____/10 points

The writing style is highly appropriate for a scientific audience and purpose with excellent word choice.

Organization  

_____/10 points

The thesis is well-ordered in a logical manner, with clear transitions between fully developed, effective paragraphs. The sentence structure is articulate, varied, and strong.

Grammar and Mechanics  

−_____ points

−1 point for each minor error, with no more than −4 points for repetitive errors
−2 points for each major error, with no more than −6 points for repetitive errors

Total  

_____/100 points
### CHM 510 Research Seminar Faculty Comment and Grading Sheet

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>Check one</th>
<th>Use the lines below for comments on the items at the left</th>
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</thead>
<tbody>
<tr>
<td><strong>PRESENTATION SKILLS</strong></td>
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<tr>
<td>The talk was of the appropriate length: 15 to 20 min; 30 to 40 min for honors.</td>
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<tr>
<td>The presentation was well organized.</td>
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<td>The presentation was well illustrated. Slides were easy to read.</td>
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<tr>
<td>Literature citations were given where needed and in a suitable format.</td>
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<tr>
<td>The speaker spoke clearly at a conversational pace without reading slides.</td>
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<tr>
<td>The presentation was professionally delivered.</td>
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<td>The speaker did not have any distracting or annoying movements/habits.</td>
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<tr>
<td><strong>DETAILS OF THE PRESENTATION</strong></td>
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<tr>
<td>Introduction: The speaker provided some but not too much background to the research project.</td>
<td></td>
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<tr>
<td>Experiments &amp; Data: The speaker outlined the goals and hypotheses for experiments that were performed.</td>
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<tr>
<td>Experiments &amp; Data: The speaker understood the methods used in the experiments.</td>
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<tr>
<td>Results &amp; Discussion: The speaker clearly understood the meaning of the data presented.</td>
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<tr>
<td>Experiments &amp; Data: The speaker clearly explained the context/relevance of the data presented.</td>
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<tr>
<td>Experiments &amp; Data: Reaction schemes, tables, and/or figures were used properly to convey information.</td>
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<tr>
<td>Experiments &amp; Data: There was no extraneous or irrelevant data presented.</td>
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<tr>
<td>Summary &amp; Discussion: The speaker was able to make appropriate conclusions about the results presented.</td>
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<tr>
<td><strong>AUDIENCE DISCUSSION</strong></td>
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<tr>
<td>Questions: The speaker responded well to questions dealing with basic chemistry that they are expected to know from their coursework.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questions: The speaker responded well to questions in which they were asked to interpret a piece of information or data in their talk.</td>
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</tbody>
</table>

Please add additional comments below or on back (Strong points, weak points, etc.):