San José State University
CHEM 146, Spring 2013
Physical-Inorganic Techniques

Instructor: Dr. Ron Painter
Office Location: Duncan Hall 005A (in the basement)
Email: ron.painter@sjsu.edu (preferred method of contact)
Office Hours: Fridays, 4:00 pm to 5:00 pm
Class Days/Time: Fridays, 9:00 am to 4:00 pm
Classroom: Duncan Hall 010
Prerequisites: CHEM 100W, 101, 145, 155, and 161A (with grades of "C" or better; "C-" not accepted).

Course Description (from SJSU Course Catalog)

Application of advanced instrumental and preparative techniques to the study of structure, reactivity and spectroscopy of inorganic and organic substances including materials. This is a capstone course.

Course Goals and Student Learning Objectives

The main student learning objectives for CHEM 146 students are as follows:

- To be able to independently design, implement, and report the results of a semester-long research project, with appropriate guidance from the instructor as needed;
- To demonstrate proficiency in literature searches and use of database resources as a tool for designing and implementing their semester-long project;
- To be able to independently execute synthetic and analytical experimental procedures found in the scientific literature in physical and inorganic chemistry safely and efficiently;
- To reinforce concepts previously learned in physical, analytical, and inorganic chemistry courses by applying them in a laboratory setting;
- To recognize potential shortcomings in a scientific procedure and develop alternate plans in the face of unsuccessful procedures; and
- To demonstrate the ability to present the results of a project, both in an oral presentation and in a written journal-style scientific paper.

CHEM 146 covers Program Learning Objectives #1, #4, #6, #7, #9, and #10.
Chemistry Program Learning Objectives
**Required Texts/Readings**

There is no textbook or lab manual for CHEM 146.

However, students are expected to demonstrate proficiency in developing appropriate experimental procedures based on use of literature and database search techniques. Students are also expected to learn and understand appropriate concepts behind their semester-long projects based on journal articles, supplemented by undergraduate inorganic and physical textbooks as needed.

**SJSU Library: Chemistry-related resources** – *Inorganic Syntheses* and the various inorganic chemistry journals (*Inorganic Chemistry*, *Organometallics*, *Journal of Organometallic Chemistry*, etc) are all potentially useful for this course.

**Useful physical chemistry textbooks**

**Useful inorganic chemistry textbooks**

**Dropping and Adding**

Students are responsible for understanding the policies and procedures about add/drops, academic renewal, etc.

Instructions for adding or dropping a class are available at:
[http://my.sjsu.edu/students/student_tutorials/index.html](http://my.sjsu.edu/students/student_tutorials/index.html).

The deadlines for adding or dropping a class are available at [http://www.sjsu.edu/registrar/calendar/2132/index.html](http://www.sjsu.edu/registrar/calendar/2132/index.html).

Information about late drops is available at: [http://www.sjsu.edu/aars/policies/latedrops/](http://www.sjsu.edu/aars/policies/latedrops/).

SJSU registrar deadlines for Spring 2013:

- **Dropping a course** Monday February 4, 2013
- **Adding a course** Monday February 11, 2013
- **Changing grading basis**
- **Withdrawing** Tuesday April 23, 2013
Assignments

Overview of course requirements:

Graded work will include a total of two written and oral reports, a short project proposal, four written progress reports, two lab notebook checks, a literature search problem set, a written final exam, and an instructor evaluation. It is also expected that students will perform literature searches and reading of relevant journal articles as needed to further develop their semester project research aims and/or devise experimental procedures.

Written reports:

There will be two main written reports – one midterm lab report, and one final lab report. These are intended to be formal, scientific written reports of your semester project aims, theoretical background, and results midway through the semester, and at the end of the semester, respectively. Full adherence to ACS journal guidelines (Inorganic Chemistry) is expected, including footnote citations. Detailed information, including grading rubrics, will be given later in the semester. All written reports must be submitted in both electronic and paper form by the report deadline.

The four written progress reports are intended to be short updates of your projects. Please do not give detailed experimental or calculation details in these reports; simply present a summary of the results achieved between progress report deadlines, and an outlook of what needs to be done over the next two or three weeks. All data analyses prior to the deadline of a progress report are expected to be complete, and the results presented in the progress reports. The progress reports should be approximately a page each, including references.

Oral presentations:

There will be two oral presentations in CHEM 146. The scope of the oral presentations is similar to that of the written progress reports – an overview of your project aims and relevant theoretical background, and a summary of your progress and results. The midterm oral presentation will be 6-8 minutes long each; the final oral presentation will be 8-10 minutes long each. Rubrics and guidelines for the two oral presentations will be distributed in class later in the semester.

Miscellaneous assignments:

A literature search problem set will be distributed at the first class meeting of the semester. You will be expected to demonstrate your competency in using SJSU library databases and literature search techniques to uncover various synthetic targets and answer mechanistic questions based on the scientific literature.

A short project proposal is required prior to beginning lab work on the semester project. I will provide you with a target complex for you to synthesize; I expect that this synthesis will take two or three lab periods to complete. Thus, this proposal will provide a summary of your plans of how to make the complex and what you are interested in studying with this complex as well as how to execute this study. This plan will probably change over time, but you need to start thinking about how you can use the complex that you will be making in interesting ways sooner rather than later.
Two random and unannounced **notebook checks** will be performed throughout the semester. Specific notebook-keeping guidelines will be given during the first class meeting, and these guidelines must be adhered to at all times. Above all, a lab notebook needs to be neat and organized, with all significant experimental details recorded as the experiment is being performed. Not everyone’s lab notebook will be checked in the same lab period, but all students’ notebooks and recordkeeping practices up to that point in time will be checked twice throughout the semester.

There will be a **final exam** at the end of the semester. Approximately 60% of your final exam will be based solely on your semester project topic, with the rest covering your classmates’ semester projects. Consequently, you are expected to take notes and learn from your classmates’ projects during their midterm and final presentations, as well as be aware of what your classmates are doing throughout the semester. The final exam will only test your general knowledge of the topics that are covered by the various semester projects in CHEM 146 – it will not ask “tricky” questions or ask about specific experimental details.

Finally, an **instructor evaluation** will be given at the end of the semester. This instructor evaluation will assess the following:

- adherence to departmental safety guidelines
- your ability to work independently and collaboratively with your classmates
- progress of your project throughout the semester (quantity ≠ quality)
- general lab attendance and performance

**Grading policy**

The course points are broken down as follows:

<table>
<thead>
<tr>
<th>Grading item</th>
<th>Points</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Midterm written lab report</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm oral presentation</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Final lab report</td>
<td>200</td>
<td>40%</td>
</tr>
<tr>
<td>Final oral presentation</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Semester project proposal</td>
<td>40</td>
<td>10%</td>
</tr>
<tr>
<td>Four progress reports</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Final examination</td>
<td>100</td>
<td></td>
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<tr>
<td>Literature search problem set</td>
<td>50</td>
<td>20%</td>
</tr>
<tr>
<td>Notebook checks</td>
<td>50</td>
<td></td>
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<tr>
<td>Instructor evaluation</td>
<td>100</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1000</strong></td>
<td></td>
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</table>

The grading scale is below; your grade is assigned based on the percentage of points earned out of the total possible points for the course.

<table>
<thead>
<tr>
<th>%</th>
<th>Grade</th>
<th>%</th>
<th>Grade</th>
<th>%</th>
<th>Grade</th>
<th>%</th>
<th>Grade</th>
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<tbody>
<tr>
<td>97-100</td>
<td>A+</td>
<td>87-89</td>
<td>B+</td>
<td>77-79</td>
<td>C+</td>
<td>67-69</td>
<td>D+</td>
</tr>
<tr>
<td>94-96</td>
<td>A</td>
<td>84-86</td>
<td>B</td>
<td>74-76</td>
<td>C</td>
<td>64-66</td>
<td>D</td>
</tr>
<tr>
<td>90-93</td>
<td>A-</td>
<td>80-83</td>
<td>B-</td>
<td>70-73</td>
<td>C-</td>
<td>60-63</td>
<td>D-</td>
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<tr>
<td>&lt; 60</td>
<td>F</td>
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CHEM 146-specific policies

All CHEM 146 students must take and pass a written safety quiz administered during the second week of the semester, with a score of 80% or better. The safety quiz may be retaken one more time, during the third week of the semester. Failure to pass the safety quiz a second time will result in a zero for the instructor evaluation given at the end of the semester.

The expected workload for CHEM 146 is consistent with that for a five-unit course: for every unit, three hours per week are to be devoted to lab time, course preparation, literature searches, and other related course activities. This means that you are expected to spend, on average, eight hours per week outside of the lab for CHEM 146. Peak periods where written and/or oral deliverables are due are unavoidable, but this should average out with other weeks where no deliverables are due.

Collaborative work is required due to limitations with respect to reagents, lab space, fume hood space, instrument availability, and other factors. In addition, it is expected that every lab member within a group will contribute equally to the assigned semester project. If there is evidence that one group member is not contributing significantly to the project, that group member will suffer a major decrease in their lab evaluation score. Each group member will be held accountable for the data and results in their semester project, and will be required to demonstrate knowledge of the project in their written and oral deliverables, as well as in the final exam for the course.

Late submissions will be accepted, but at a 10% penalty per school day. No work may be submitted after the date of the final exam (Tuesday May 21). The final exam cannot be made up under any circumstances.

Requests for reagents for a specific Friday lab period must be made by 5:00 pm on the preceding Monday. If a request for reagents is not received by that time, it will be assumed that no additional reagents are needed other than those already available in the lab. Every effort will be made to honor all reagent requests. However, the lab instructor has the right to make substitutions as needed, or request an alternate experimental procedure from the student should a reagent be unavailable, or deemed too hazardous or inappropriate for CHEM 146 students to handle in the laboratory.

The lab attendance policy for CHEM 146 students is as follows: students are allowed to miss up to two lab periods without penalty. Further absences will result in a grade of F for CHEM 146. Please keep in mind that missing two lab periods amounts to missing out on 14 hours of lab work that cannot be made up – any further absences will significantly retard your progress throughout the semester.

No makeups of missed labs will be given. No additional lab work outside of the CHEM 146 lab period will be permitted. I have office hours for one hour after the regular lab period, so I will be present until 5 pm every Friday in case you need to work past 4 pm on a given lab period. Occasionally, reactions will need to be run overnight; decisions on whether to run such a reaction will be made with the instructor on a case-by-case basis.
Unauthorized experiments are prohibited! I am personally responsible for the safety of every student in the lab, and, because of this, authorization for every lab procedure that you undertake from me is required. If I decide that you are not permitted to perform a lab procedure because of logistical, safety, or equipment limitations, this decision is final.

If a project involves the use of expensive or precious compounds, it is expected that students will be judicial with regards to handling these reagents to minimize waste. Students are also expected to perform the reaction at no more than a 250 mg scale.

Finally, my role in this course is twofold. First, I will encourage you to take initiative on independently developing your project scope and direction. I will not tell you what to do; instead, I will make suggestions or ask questions to encourage you to think about your project in different ways. Second, I will provide guidance and advice on appropriate lab techniques or instrumentation that you can use to advance your project aims. It will, however, be your responsibility to design your own experiments. I may caution you on specific safety hazards or reagent handling, but it is generally not my place to tell you whether I think a reaction will work or not. Science is not perfect, and some experiments will likely fail. We as scientists must live with this fact, and work around it or move on.

University, College, and Department Policies

Students in this course are expected to be familiar with and follow various policies developed by the University and the Chemistry Department. The important policies are:

- Academic Integrity
- Campus Policy in Compliance with the Americans with Disabilities Act
- Emergencies and Evacuations
- Chemical Safety
- Expected Workload
<table>
<thead>
<tr>
<th>Lab period</th>
<th>Date</th>
<th>Key events (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan. 25</td>
<td>Course introduction, safety, literature search, check-in</td>
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</table>
| 2          | Feb. 1     | **Problem set due, safety quiz**  
Discussion of semester project and assignments made  
**Proposal of synthesis for initial target due by Feb. 4 at 5 pm** |
| 3          | Feb. 8     | Begin semester project                                                            |
| 4          | Feb. 15    |                                                                                   |
| 5          | Feb. 22    |                                                                                   |
| 6          | Mar. 1     | **Progress report 1 due**                                                          |
| 7          | Mar. 8     |                                                                                   |
| 8          | Mar. 15    |                                                                                   |
| 9          | Mar. 22    | **Progress report 2 due**                                                          |
|            | Have class on March 29 – Spring recess                                            |
| 10         | Apr. 5     | **Midterm presentation**  
**Midterm lab report due**                                                             |
| 11         | Apr. 12    |                                                                                   |
| 12         | Apr. 19    | **Progress report 3 due**                                                          |
| 13         | Apr. 26    |                                                                                   |
| 14         | May 3      |                                                                                   |
| 15         | May 10     | **Progress report 4 due**  
Last day for performing lab work, check-out                                             |
|            | May 17     | **Final presentations at 12 noon to 2:30 pm (tentative)**                          |
|            | May 21     | **Final examination, 10 am to 11:30 am (tentative)**                               |