



molecular and solid state model kits.

### **Expectations**

This course represents your total academic load for Interim, comparable to a normal load of 15 credits during a regular semester, i.e., equivalent to a full time job. It is expected that during the four weeks of Interim, you will spend about 20-25 hours per week outside of class efficiently studying - reading the text, working the recommended problems, and preparing for exams. Interim moves quickly, so you need to start today and work diligently each day.

Working problems, not just watching someone else do it, is essential for learning chemistry, so problem solving should be a regular and significant part of your study time for this course - set a goal of working 2-3 lecture problems and 1-2 lab problems each day. You are encouraged to work in small groups on the recommended problem sets.

In the lab, practice in problem solving is represented by analyzing unknowns: a time-consuming activity, but with careful work, it can be an enjoyable experience with quite reliable results. The lab procedures in Lagowski-Sorum are quite explicit, detailed, and reliable, but there is little learning in blindly following a recipe. As you work in lab strive to connect what you do and what you observe to the chemistry involved - solubility rules, stability of complexes vs. precipitates, pH effects, redox, kinetics, LeChatelier's Principle when conditions are changed, etc.

### **Course Materials on the Web**

The syllabus, power points and other handouts will be located on the Moodle site. Past exams for this course are posted on the Web at <http://faculty.augie.edu/~dew>. Recognize that this interim is a revamp of previous Chem 222 (or Chem 135), so prior exams may be less helpful. The most useful information will be about the qualitative analysis scheme.

## **COURSE POLICIES**

### **Attendance**

If you must miss lecture or lab, call or email, preferably, before any absences. If you miss a lecture, YOU are responsible for finding out about any announcements, obtaining class notes from a classmate, *etc.*

### **Communication with the Class**

The instructor will use your Augie e-mail addresses (@ole.augie.edu) for class announcements and general communication with the class and with individuals; check your e-mail daily.

## **UNIVERSITY POLICIES**

### **Accessibility**

Augustana welcomes students with disabilities to participate in all of its courses, programs, services, and activities. If you have a documented disability and are requesting accommodations, please contact Susan Bies, Director of Accessibility and Academic Support. Her office is located in the Student Success Center (Edith Mortenson Center, Suite 100) and she may be reached at 605-274-5503 or [susan.bies@augie.edu](mailto:susan.bies@augie.edu).

Chemistry, by its very nature, involves handling of potentially hazardous substances. The labs in this course will teach you how to handle these substances properly while minimizing the range of exposure. However, exposure effects vary from person to person. So, if you have asthma, allergies, are pregnant, or have other special circumstances, please inform your lab instructor so we can plan appropriate accommodations for your safety.

### **Honor Code**

As a community of scholars, the students and faculty at Augustana University commit to the highest standards of excellence by mutually embracing an Honor Code. The Honor Code requires that examinations and selected assignments contain the following pledge statement which students are expected to sign:

“On my honor, I pledge that I have upheld the Honor Code, and that the work I have done on this assignment has been honest, and that the work of others in this class has, to the best of my knowledge, been honest as well.”

Faculty members are responsible for investigating all instances involving any student who does not sign the Honor Pledge or who bring forward an academic integrity concern. The complete Honor Code can be found at [www.augie.edu/honor](http://www.augie.edu/honor).

### **Academic Integrity – from the Augustana University Undergraduate Catalog**

Academic Integrity is vital to the academic environment at Augustana because it involves the search for and acquisition of knowledge and understanding. Evaluation of each student's level of knowledge, understanding, and ability to synthesize and integrate materials requires tangible assessment via reports, examinations, and homework. Any willful misrepresentation of the relation between the work being evaluated and the student's actual state of knowledge is an act of academic dishonesty. The following is a partial list of examples:

- Plagiarism
  - Using the exact language of someone else without the use of quotation marks and without giving proper credit to the author
  - Rearranging another's ideas or material and presenting them as though they are one's original work without giving appropriate acknowledgment
  - Submitting a document written by someone else as one's own work
- Paying for or obtaining another's work and submitting it as one's own
- Giving or receiving answers to an exam
- Copying, with or without another person's knowledge, during an exam
- Doing class assignments for someone else
- Submitting a paper that has been purchased from a commercial research firm or the web
- Fabricating items on a bibliography
- Obtaining an unauthorized copy of a test in advance of its scheduled administration
- Using unauthorized notes during an exam
- Collaborating with other students on assignments when it is not permitted
- Altering answers on a scored test and submitting it for a re-grade
- Accessing and altering records in a grade book
- Stealing class assignments from other students and submitting them as one's own
- Fabricating laboratory or research data
- Destroying, stealing or sabotaging the work of other students
- Resubmitting a previously graded assignment for a different course

### **Commitment to Diversity**

Augustana University is committed to creating and fostering a learning and working environment based on open communication and mutual respect. This is an integral part of the academic mission to enrich our students' educational experiences and prepare them to live in and contribute to a global society. If you encounter sexual harassment, sexual misconduct, sexual assault, or discrimination please contact the Title IX Coordinator at 605-274-4044 or [belam@augie.edu](mailto:belam@augie.edu). If you make a report of this nature to a faculty member, they must notify the Title IX Coordinator about the basic facts of the incident (you may choose whether you or anyone involved is identified by name). For more information about options at Augustana, please visit [www.augie.edu/titleix](http://www.augie.edu/titleix).

## **COURSE ACTIVITIES DETAILS**

### **Recommended Problems**

To help you focus on appropriate problems, a set of recommended problems supportive of the lecture and the lab are available as handouts or come from the textbook. These problem assignments are for your benefit and will **NOT be collected or graded**. Pace yourself, working a few problems every day, and take good advantage of these opportunities to **think chemistry**. The worked out solutions for the problem sets will be posted on the Chem 222 Moodle site.

### **Exams**

- Three unit exams will be given, one on each Monday, during the first hour of the lecture period.
- Comprehensive, over material covered in lecture and lab to date.
- If you have to miss any of the hour exams, please notify the instructor, preferably before the absence.
  - If you have an acceptable excuse for missing an hour exam and the exam cannot be rescheduled conveniently before the exam is returned to the class, more weight will be placed on your final exam (combination of both parts) to cover the missed exam.
  - If you do not present an acceptable excuse, you will receive a zero for the exam.

- No phones, graphing calculators, or alphanumeric calculators are allowed during exams.
- **Final Examination** is given in two parts:
  - ACS Qualitative Analysis Exam - in class on next to last day from **9:30 – 11:30 AM!!!**
  - ACS Inorganic Chemistry Exam - in class last day from **9:30 – 11:30 AM!!!**
  - Attendance at these exams is mandatory.
  - If your average on the two final exams is higher than your lowest unit exam, the lowest unit exam score will be replaced by the final.
  - The table of formulas and constants provided on the ACS General Chemistry exam will also be provided for the hour exams.
  - Points for the ACS Exams are scaled to the national norms.

*Why use a standardized exam?*

The rationale for using a standardized exam includes several aspects:

- Assessment tool for the Chemistry Department as it evaluates its curriculum.
- Comparison tool for you and the Chemistry Department to see how you and the class as a whole “stack up” against your counterparts across the nation.
- National norms provide a yardstick for determining a consistent grading scale.
- True mastery of a concept implies an ability to apply it in new situations. Exams prepared by someone other than the instructor provide new contexts and formats to test this ability. Or as John W. Moore wrote in an editorial in *The Journal of Chemical Education* **1998**, 75(2), 135:
 

In a world in which change is the norm, only an educated student has been properly equipped to prosper. This means that students need to be able to identify and define problems, to solve them imaginatively, and to apply the chemistry they learn in a variety of contexts in other disciplines.
- Students gain experience/practice in taking standardized, multiple-choice exams often used as a “hurdle” for many post-college endeavors (e.g. MCAT for medical school, OAT for optometry school, DAT for dental school, GRE for graduate schools, Nursing Boards, Bar Exam, CPA certification, etc.)

*Strategies for Preparation:* A common myth propagated among students is that studying for standardized exams is a fruitless endeavor. **THIS IS ABSOLUTELY NOT TRUE.** If you have a firm understanding of the *material covered in class*, you can score quite well on these exams. So, **PREPARE** by focusing on the material we have covered in class. Also make use of the guidebook *Preparing for Your ACS Examination in General Chemistry - The Official Guide* (ACS publication).

#### **Lab work is permitted only during the scheduled lab period.**

- Lab work should **not** begin until the instructor arrives and must be terminated each day at the designated time.
- It is your responsibility to make sure you complete all lab projects by the end of the last lab period.
- With organized, careful work and diligence, it is possible to complete the qualitative analysis lab work early; providing yourself some less hectic days toward the end of Interim.

#### **Qualitative Analysis Portion of the Lab**

- Work individually and proceed at your own rate.
- You are strongly encouraged to set up **collaborative groups** of 3-4 to compare and consult as you go.
  - Think together about reactions and results.
  - Rely on each other to help interpret results. Your group will provide a sounding board for questions like: Is there a precipitate here or not? What color is this? Is this the right color for a positive test? Ooh, that’s a weird test result, what does it mean? Does this unknown conclusion make sense? What kind of alternate or blanket test could I run to verify a conclusion?
  - Provides more opportunity to experience the chemistry, more experience in how chemistry (science) is done, and a way to build your confidence in your lab skills and your understanding.
- Review the “Helpful Hints” and “Safety and Locations” handouts each day to ensure you don’t miss essential details.
- General instructions for the lab are given on pages 154-158 of Lagowski & Sorum, with specific directions for each project presented in the subsequent pages.

#### **Lab Notebook for the Qualitative Analysis Portion of the Lab**

- Keep track of your progress in lab in a bound **lab notebook**. (You can use blank pages in a notebook from another course if you wish). There is no specified format for the lab notebook, but it must contain the following information:

- initials and date on each page.
- flow charts and all reactions in the flow scheme for that group known.
- observations and notes on the analysis of the known (may be incorporated into the flow chart).
- **unknown number** - If forgotten, either guess and take your chances or do a new unknown. A new unknown costs you 10% (same as requesting more unknown).
- flow chart, observations, and notes for the first attempt on the unknown, including ID of ions present and absent.
- documentation of subsequent attempts on unknown, including discussion of the evidence for changes in your ID report.

### Qual Lab Projects

- Six Lab Projects (see list in lab schedule below with their respective allotted points). Lab Projects must be completed sequentially in the order given.
  - **Four Cation Groups**
    - Analyze a known solution containing all the ions of that group.
    - Analyze an unknown solution for that group.
  - **Anion Analysis**
    - Complete the preliminary (blanket) test for anions summarized on pp. 245-254 of Lagowski & Sorum. Record observations in your notebook, not in the text.
    - Run the **blanket tests** on an unknown for anions to deduce the possible anions present.
  - **Single Salt Unknown**
    - Analyze a solid containing a single cation and a single anion as summarized on pages 285-287 of Lagowski & Sorum.

### Procedure for obtaining and reporting qualitative unknowns

- To *obtain* an unknown for a Lab Project you must complete the known and present your notebook with completed flow chart and reactions for the known to the instructor.
- For the Lab Projects without a known, the instructor will issue you an unknown when you have completed the prior projects.
- Be sure to specify which unknown (group) you want from the instructor.
- You will be issued sufficient unknown to complete all the tests at least three times. Additional unknown may be requested, but it will cost you 10% of the total points for that Project. Take good care of what you receive and use it wisely.
- Remember to record your unknown number in your notebook.
- To *report* your results on an unknown, fill out the yellow Report Card (on front desk) and present it along with your notebook to the instructor.
  - Be prepared to defend your decision using the evidence recorded in your notebook - random guessing will not be permitted.
  - If your report is not completely correct, the instructor will also tell you if you are missing some, have extras, or both. **Score = Pts Poss • (#ions correct/#ions in group). For the single salt - Score = 30 pts – (8pts for each ion incorrectly identified) (2 possible ions).**
- After you have completed all the projects, you may make second attempts on any of the previous projects to “redeem” up to half of the points you missed on the first attempt. Preserve and label original unknown and prior tests for use in any second attempts (additional unknown still costs you 10%).
  - **Score = Score from 1<sup>st</sup> attempt + Pts Poss/2 • (Δ#ions correct/#ions in group)** - note it is possible to *lose* points on the second attempt.
  - Making a second attempt is your option; you can accept the score from the first trial.
- If time permits, after you have *completed all* the projects (correct identification or completed two attempts), you can repeat a project to improve your score. For repeating any of the cation groups, a *general cation unknown* (ions from all 4 groups) will be issued. You can recover all points on the repeat.

### Structures and Synthesis Labs

- To be done on the assigned days.
- Record all data on the data sheets provided.
- More details to be discussed in lab.

CHEM 222 TENTATIVE LECTURE AND EXAM SCHEDULE		
Date (Jan.)	Topic	MFT Chaps (S&L Chaps)
3-4	Atomic structure	2
4-5	Simple bonding theory and molecular geometry	3
<b>8</b>	<b>Monday - Exam 1</b>	
8-9	Molecular orbital theory	5
9-11	Acid-base chemistry	6 (3, 4)
12	Structure and Bonding in Solids	7
<b>15</b>	<b>Monday - Exam 2</b>	
15-16	Structure and Bonding in Solids	7
16-18	Transition Metal Chemistry - nomenclature, bonding, isomers, crystal field theory	9, 10 (5)
19	Electrochemistry - redox reactions and cells	(6)
<b>22</b>	<b>Monday - Exam 3</b>	
22-23	Electrochemistry - redox reactions and cells	(6)
23-24	Aqueous equilibrium - $K_{sp}$ and buffers	(3, 4)
<b>25</b>	<b>Qual Scheme Final Exam 9:30-10:40 AM (50 questions, 70 minutes)</b>	S&L
<b>26</b>	<b>Inorganic Final Exam 9:30-11:20 AM (60 questions, 110 minutes)</b>	MFT
There will be 1 hour for non-ACS exams and the second hour of class will be lecture.		

TENTATIVE LABORATORY SCHEDULE*			
*This is a schedule that allows you to finish in a timely manner. To allow for unforeseen snags, I strongly suggest that you make full use of all lab periods. It is far better to finish the lab early by working efficiently each period than to not get finished because you didn't use lab time early in the Interim.			
# Days	Topic	Pts	Ch: pp.
1	Lab check in and silver group	25	9: 159-169
2	Copper-arsenic group	30	10: 171-199
3	Aluminum-nickel group	30	11: 201-225
1	Barium-magnesium group	25	12: 227-237
3	Anions (blanket tests)	30	14: 245-283
1	Single salt	30	9-15: 159-287
R† Week 1	Molecular geometry lab	30	Ch. 3 (MFT)
RF† Week 2	Solid state packing lab	30	Ch. 7 (MFT)
RF Week 3	Trans. Metal synthesis lab	20	Ch. 9 & 10 (MFT)
Last Day Week 4	Checkout		
<b>Make sure you regularly consult Qual Scheme Helpful Hints handout as you proceed.</b>			
†I may split the lab to perform the labs with our limited equipment.			

List of handouts available on Moodle:

- Syllabus
- Safety & Locations
- Text errors list
- Symbols & Charges
- Solubility Rules
- Helpful Hints
- Stock Acids (concentrations, etc.)
- Redox Table
- $K_a$ /indicators Table
- Flame Spectra with a Spectrometer
- Ligand Nomenclature
- MFT Study Guides
- Molecular Structures Lab
- Solid State Models Lab
- Synth and Optical Resolution of  $\text{Co(en)}_3$  Lab
- Answers to Recommended Problems
- Lecture PowerPoints