**CHM 3540 – Introductory Inorganic Chemistry**

**Winter Quarter 2022**

**Course Meeting Times and Locations**

* Lecture: Tuesday/Thursday 8:45-11:00 AM, Bertona 5
* Lab: Wednesday 3:00-6:50 PM, Eaton Hall Laboratory 333

**Contact Information**

Professor: Nerissa Lewis, PhD Office Hours: Tuesdays: 1-3 pm; or by appointment

Office: Eaton Hall 308 Email Address: [lewisn2@spu.edu](mailto:lewisn2@spu.edu)

Phone #: 206-281-2712 Science Librarian: Carrie Fry ([cfry@spu.edu](mailto:cfry@spu.edu))

**Course Description**

This upper division course includes two lectures and one laboratory section each week focused on chemical principles as applied to inorganic chemistry.

As a component of the SPU chemistry major, CHM 3540 develops students:

* Understanding of fundamental concepts and theories associated with inorganic chemistry.
* Understanding of research methods and laboratory skills in synthesis, physical and instrumental methods, and analytical methods: making careful and thorough observations, documenting those observations in writing, and critically applying principles and concepts to the analysis of the accumulated data and observations.
* Ability to communicate scientific information and concepts clearly orally and in writing.
* Personal responsibility, independence, reliability, accurate reporting, and accountability.

Prerequisites: Successful completion (a C- or better) in CHM 1213, CHM 2213, and CHM 3373.

**Key Learning Outcomes**

Following successful completion of this course, students will be able to:

* Indicate the number and approximate location of protons, neutrons, and electrons in a given atom. Electron configurations and quantum numbers will be used to assign probabilities of finding electrons in each of the orbitals. Paramagnetism will be exemplified in a lab experiment.
* Describe the symmetry, geometry, and electronic structure of a molecule using valence bond theory and molecular orbital theory. Electronegativity, polarity, hybridization, resonance, delocalized bonding are all concepts that can aid the description.
* Predict whether optical, linkage, or coordination isomerism is possible within a molecule and describe the expected results of experiments that may be able to differentiate or describe the isomers. Lab experiments will explore a set of linkage isomers and a set of optical isomers.
* Employ crystal field theory, ligand field theory, and the spectrochemical series to anticipate the color and reactivity of coordination complexes. A lab experiment will explore the ligand exchange kinetics of a coordination complex and the UV-visible spectroscopy of a series of cobalt complexes.
* Describe solid state structure crystal packing and use lattice energy, trends in ionization energy and ionic radii to understand inorganic salt formation. Salts are often purified by recrystallization as carried out in the first lab experiment.
* Analyze experimental data to confirm the thermodynamics of reactions based on reduction-oxidation potentials and known constants. Also apply these redox potentials to describe the anticipated photovoltaic chemistry of various organometallic dye compounds in solar cells. A photovoltaic device will be constructed as the final lab experiment.

**Required Resources**

1. **Textbook**: Inorganic Chemistry. Catherine E. Housecroft and Alan G. Sharpe, 5th Ed.
2. **Scientific Calculator**:You will need a **NON-PROGRAMMABLE** calculator that is able to perform standard mathematical operations including exponentials and logarithms, and it must be able to handle scientific notation. Examples of calculators that meet this description are the Casio FX-115ES PLUS or the TI-30X IIS. Please remember to have your calculator ready to use for all exams. Cell phones may not be used during an exam. All cell phones must be turned off during exams.

**Canvas**

Course materials including the syllabus, lecture slides, example problems & solutions, laboratory protocols, etc. will be available on the Canvas course website. You can access this information by logging in with your student ID and password. Please check the website regularly for updated information.

**Course Standards**

* ***Use of Technology***

You are welcome to bring your laptop and smart phone to class to use as learning tools. The use of electronic devices (laptops, tablets, cell phones, etc.) will be allowed periodically during in-class activities. When you switch between class and personal work (e.g. texting, social media use), however, you cause a distraction to others around you (even if you think you are being discreet). Subsequently, using your phone or computer for any other reason besides purposes directly related to class is a violation of the practice of community.

* ***SPU email address***

It is expected that you will check your SPU email account daily for information about our class. If your SPU email address is not your primary email, then please set up your SPU account to automatically forward all messages to an email account that you check every day.

* ***Communication Policy***

My office hours this quarter will be held on Tuesdays 1-3 pm. I will be available during this time for questions and concerns, or you can send me an email to schedule an appointment at another time.

I will endeavor to respond to emails within 48 hours during the working week. However, if your question is of relevance to the whole group, I would invite you to post it in the course Q&A board on Canvas so that we can all be informed or take part in the discussion. Feedback on assignments will be provided within five working days.

* ***Class Format***

Students are required to complete all reading assignments prior to class. Most of our class time will be spent working on in-class learning activities, group discussions, and solving practice problems. Most of these learning activities will be collected and graded at the end of the class period.

* ***Class Participation***

I believe learning should be fun and engaging. Student participation allows for you to engage with the subject content, listen to the perspective of others, and be enlightened by the rich diversity of perspectives inherent in the classroom setting.

* ***Missing a Class***

If you miss a class period, it is your responsibility to go to Canvas, look at the date you missed, print all documents from that date, and complete any assignments by the respective due dates as outlined in the syllabus. Class material for the entire quarter is already posted on Canvas, so if you must be absent, please send a legibly scanned copy of your completed assignment on time by the due date to [lewisn2@spu.edu](mailto:lewisn2@spu.edu).

**Student Assessment**

Letter grades will be based on student performance on the following course components:

|  |  |  |
| --- | --- | --- |
| Midterm Exams | Jan. 20th, Feb 10th, March 03rd | 20% |
| Final Exam | March 16th @ 9-11 am | 20% |
| Homework Assignments | Seven Problem Sets | 13% |
| Laboratory | Exercises and Lab Reports | 20% |
| Research Paper | First Draft and Second Draft | 12% |
| Selected Activities and Student Participation (includes Student Evaluation) |  | 15% |
| **Total** |  | **100%** |

To receive course credit, students must complete all course components, including problem set assignments, lab reports, and exams. Letter grades will be calculated at the end of the quarter following this approximate distribution:

**Grade Scale**

At the end of the quarter a numeric % grade is calculated that is a weighted average of the course requirements listed above. A letter grade is then assigned based on the percentages listed below.

|  |  |
| --- | --- |
| % | Grade |
| 93-100 | A |
| 90-92 | A- |
| 87-89 | B+ |
| 83-86 | B |
| 80-82 | B- |
| 77-79 | C+ |
| 73-76 | C |
| 70-72 | C- |
| 67-69 | D+ |
| 60-66 | D |
| 0-59 | E |

The instructor reserves the right to adjust these percentage/letter grade equivalencies to accommodate extenuating class or individual circumstances.

Please note that the scale may be adjusted but will not shift to your detriment (If you earn 77% of the course points, I will not assign a grade below C+, but may adjust the scale to improve your grade).

**I will never increase a grade break above what is listed here**.

**Exams**

Each exam will be comprehensive, as the course material will build on itself. That said, the emphasis of the three midterm exams will be on the material covered in that segment of the course.

The final exam will be cumulative, with questions based on material covered throughout the quarter. To ensure that the exams are as fair as possible, all students are required to take the same exam at the same time. Please make sure your holiday travel plans will not prohibit you from taking the final exam at the assigned time.

**Course Policies**

1. ***Exam policy***: Exams cannot be rescheduled except in the case of mitigating circumstances which in my judgment warrant rescheduling the exam. If you will be absent for an exam due to an officially excused absence, please notify the instructor at least one week in advance and be prepared to provide documentation for the nature of your absence.
2. ***Submission of Assignments***: **All assignments** must be submitted by **midnight (Pacific Time) on the** **day assigned** (unless otherwise stated) to receive full credit. **Assignments must be submitted in pdf format**. While late work may be submitted, grades will be severely affected.
3. ***Course Success***: It is definitely possible to do well in this course. You are part of our departmental community both now and beyond SPU. As such, your success is very important to me. I am here to help, so *please* do not hesitate to contact me if you need assistance.
4. ***Disclaimer***:As the instructor of this course, I reserve the right to change the schedule of topics, the number and length of examinations and/or homework assignments, point distribution, requirements, and percentages required to better facilitate the learning process.
5. ***Grading Disagreements or Errors***: It is possible for me to make mistakes while grading. The good news is that these mistakes are usually addition errors, which can be easily fixed. If there is a non-addition grading mistake, a re-grade of the entire exam can be requested, within one school week of receiving the exam score.

**Laboratory Policies**

The lab portion of the course comprises 20% of your final grade and complements the lecture. You must complete all lab exercises and reports to obtain credit for the course. Students who are late to lab (more than 5 minutes) may be turned away as important safety information is delivered at the beginning of the class period. Unexcused late lab reports will receive no credit.

1. You must complete all the experiments and lab reports to obtain credit for the class.
2. Laboratories begin the **first week of the quarter**.
3. Purchase a pair of UV-protecting goggles and a knee length laboratory coat that must be worn **at all times in the lab**. Wear shoes that cover your entire foot. Wear pants that cover all of your legs.
4. You are required to attend the lab safety training. Read your copy of the laboratory safety rules. You will sign a form that indicates you have read, understand, and agree to abide by all the rules. Before you leave, make sure the instructor officially records that you have had lab safety training.
5. Labs are in Eaton Hall, Room 333.
6. All safety rules must be obeyed at all times. **Failure to obey all safety rules may lead to expulsion from the laboratory and/or receiving little or no credit for laboratory work**. Accidents do occur. No matter how small the accident, please report it immediately to the instructor so we can help you and make necessary changes to ensure better safety in the future.
7. If you are working with a piece of laboratory equipment, you must be trained to use it. Follow all safety rules associated with the equipment.
8. Please read the laboratory protocol, prepare your laboratory notebook for the exercise, and complete any pre-lab assignments prior to being admitted to the laboratory.
9. Follow the guidelines for developing a proper laboratory notebook. The guidelines are posted on the Canvas website with the lab schedule.
10. All laboratory reports must be turned in to obtain a passing grade in this class. Laboratory reports that are turned in late will be penalized according to the late policy announced in the laboratory class. Even if it is late, you **still must submit a report for every experiment to receive credit for the entire course**. This abides by the policy that a student must “do every lab” to receive credit for the course.

**Tentative Schedule of Assignments - Winter 2022**

***Lab Reports due on Tuesdays by 11:59 pm. Problem sets due on Sundays by 11:59 pm****.* ***Research Papers due Friday by 11:59 pm****.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Week** | **Tuesday** | **Thursday** | **Lab Experiment** | **Problem Set Due** | **Lab Report Due** |
| **1** | Jan. 4 | Jan. 6 | Jan. 5 |  |  |
|  | Syllabus/Introduction to Inorganic Chemistry  Chapter 1.1 | Chapter 1  Basic Concepts: Atoms | Lab Safety and Check in |  |  |
| **2** | Jan. 11 | Jan. 13 | Jan. 12 |  |  |
|  | Chapter 2  Basic Concepts: Molecules | Chapter 3  3.1-3.4  Intro to Molecular Symmetry | **Lab #1**  Purification | Problem Set #1 |  |
| **3** | Jan. 18 | Jan. 20 | Jan. 19 |  |  |
|  | Chapter 3.5-3.8  Intro to Molecular Symmetry | **Midterm #1** | **Lab #2**  Chromium Acetate | Problem Set #2 | **Lab #1** |
| **4** | Jan. 25 | Jan. 27 | Jan. 26 |  |  |
|  | Chapter 5  Bonding in Polyatomic Molecules | Chapter 5  Bonding in Polyatomic Molecules  **Research Paper Due (Summary Paper)** | **Lab #3**  Mo(arene) Synthesis | Problem Set #3 | **Lab #2** |
| **5** | Feb. 1 | Feb. 3 | Feb. 2 |  |  |
|  | Chapter 6  Structures of Metals and Salt | Chapter 7  Acids and Bases | **Lab #4**  Cobalt (III) Complexes | Problem Set #4 | **Lab #3** |
| **6** | Feb. 8 | Feb. 10 | Feb. 9 |  |  |
|  | Chapter 7  Acids and Bases | **Midterm #2** | **Lab #4**  Cobalt (III) Complexes | Problem Set #5 |  |
| **7** | Feb. 15 | Feb. 17 | Feb. 16 |  |  |
|  | Chapter 8  Reduction and Oxidation | Chapter 19  Coordination Chemistry  **Research Paper Due (Critique Paper)** | **Lab #4**  Cobalt (III) Complexes |  | **Lab #4 (First Draft)** |
| **8** | Feb. 22 | Feb.24 | Feb. 23 |  |  |
|  | Chapter 19  Coordination Chemistry | Chapter 20  Coordination Chemistry | **Lab #4**  Cobalt (III) Complexes | Problem Set #6 |  |
| **9** | Mar. 1 | Mar. 3 | Mar. 2 |  |  |
|  | Chapter 20  Coordination Chemistry | **Midterm #3** | **Lab #5**  Paramagnetism | Problem Set #7 | **Lab #4**  **(Final)** |
| **10** | Mar. 8 | Mar. 10 | Mar. 9 |  |  |
|  | Chapter 24  Organometallic Chemistry | Chapter 24  Organometallic Chemistry | **Lab #6**  Solar Cells |  | **Lab #5** |
|  | **Final Exam: Wednesday 16th March 2022 @9:00-11:00 am** | | | | |