Chemistry 145 – Spring 2021

Inorganic and Organometallic Chemistry with Laboratory

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*This syllabus is subject to change. Please check Canvas for the latest edition.*

* **Course description**

This is an introductory course of inorganic chemistry. The first part of the semester focuses on atomic structure, bonding, and symmetry. The second part of the semester emphasizes coordination chemistry of the transition metals. Assessments in this course are conducted through reading assignments, problem sets, oral exams, and a semester project. You must also take the associated lab component to complete the course.

* **Books, supplies, and fees**

Required

1. Textbook: Inorganic Chemistry, 5th edition. Gary Miessler, Paul K. Fischer, Donald A. Tarr. ISBN-13: 9780321917799

*A weekly reading quiz will be assigned to help you preview and review course content. You must have a textbook to be able to complete this weekly quiz.*

1. Bound laboratory notebook. Your lab grade is mostly based on what you write in your laboratory notebook. You must have a permanently bound notebook to record your lab work that will be used for grading.
2. Lab coat for working in the lab. Must completely cover your arms and upper body.
3. Hand-held Scientific Calculator. Capable of ln, log, 10x, and ex functions, preferably with xy and A TI 30 series or similar calculator is suggested (consider TI 30XA, ~$10-$15). Bring your calculator to every lecture and every lab.
4. Access to Mills Canvas website for CHEM 145. Lecture handouts will be online in Canvas. All lecture materials, assignments, and exams will be posted on Canvas. I will not email any assignments to you. All of your completed work must also be submitted through Canvas*.*

Recommended

1. iPad or other touchscreen devices. Through the Student iPad Initiative, students can borrow an iPad or purchase one at 50% of the normal price (<https://www.mills.edu/covid-19/students/index.php>)
2. Google Docs and Google Jamboard apps. If you are using a laptop you just need access to Google Drive for all of these.
3. Students may find it useful to have Microsoft Office – Office 365 can be for free obtained through Mills College for a personal or for a college iPad as long as you are a student at Mills (<https://inside.mills.edu/student-life/information-technology/microsoft-office-365.php>)
4. An activated Mills Zoom account. In your Mills G-mail, click on the square of 9 dots in the upper right corner of the screen. Scroll down through the menu of icons that appears to find the Zoom icon, which is a multi-color square. Click on that icon and follow the instructions.

* **Meeting times**

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|  | Meeting time | Location |
| **Synchronous Zoom Lecture** | **MW** 9:00 am – 10:15 am | <https://millscollege.zoom.us/j/97621510164> |
| **In-person Lab** | **F** 2:30 pm – 6:30 pm | NSB Room 201 |
| **Office hours** | **Mon** 4:00 pm – 6:00 pm (appointment required)  **Wed** 4:00 pm – 6:00 pm (appointment required)  **Fri** 9:00 am – 10:00 am  Schedule an appointment [here](https://calendar.google.com/calendar/u/0/selfsched?sstoken=UUpNNDJXWTJibTkxfGRlZmF1bHR8NTEzMDA4NGRiMjRhZmRkZDAyNWQwNmZkNWM1MzA3ZDc). | <https://millscollege.zoom.us/j/94430182677> |

* **Accommodations due to learning differences**

I am committed to providing an accessible and equitable learning environment to all my students. All accommodations should officially go through the Student Access & Support Services (SASS) (<https://inside.mills.edu/academic-resources/advising-tutoring-accessibility/student-access-support-services/index.php>). If you need extra time on assignments or exams, please note that *I am not legally allowed to provide it to you until I get an official notice from SASS*.

If religious observance or unusual personal circumstance gives rise to a conflict with an exam or quiz date, please inform the instructor as soon as possible.

* **Learning as a part of a team in an online environment**

*Attendance of synchronous Zoom sessions*

You are required to attend all synchronous lectures and labs held on Zoom. Please connect on time and be prepared. **Students that do not regularly attend synchronous Zoom sessions should expect to receive poor grades (C or lower) due to lack of engagement.** Your attendance throughout the semester will be recorded and a percentage grade will be assigned as extra credit. You will be asked to speak and share your video during discussions. The classroom environment is what each and every one of you make of it. If you are professional and engaged, you will be treated by your classmates and instructors with the same courtesy. If you are disruptive or do not pay attention, your classmates and instructors will also not grant you attention when you need it.

*In-class discussions*

Learning in an online environment is very new to most of us and can seem difficult to impossible at times. That is why it is extra important to connect with your teammates by engaging in discussions. You will have a lot of opportunities to learn from each other by discussing in smaller groups during lecture. I expect that every member of the team to come prepared with the knowledge in the pre-lecture activities in mind or have it close to you for quick reference and contribute to the intellectual conversation going on within the team.

Whenever you feel comfortable, turn on your mic and camera. If you only feel comfortable using the mic that is ok. If you do not feel comfortable using either, you can engage in the conversation by typing in the chat box on our video conferencing platform. You will also be given worksheets on Google Docs or Google Jamboard to work on. Complete the Google Doc as a team. There are multiple ways to connect and learn as a part of a team and you should do whatever is right and comfortable for you, as long as you stay engaged.

*Uploading assignments to Canvas as pdfs*

All assignments will be handed in on Canvas. To respect the integrity of your academic records, I will not accept assignments handed in via email. Uploading your work to Canvas is the most efficient way to get your work submitted. For written assignments, if you do not have a touchscreen device use the Adobe Scan App (free for download on any Android or iOS device) to scan and upload your work as .pdfs. Here is a tutorial for that (<https://youtu.be/DkukqpdjBMI>).

You are responsible for ensuring your work was submitted completely and without mistake. Often, students submit an image file that is either too large to be processed by Canvas or has a file extension that cannot be read on my computer. For these reasons you must submit your work as pdfs. Another common mistake is that students miss a page on their assignments. If these situations arise, you will only be graded on the parts that was properly uploaded. The missing parts will receive no credit.

* **Assignments and grading**

Course total > 90.0% A– or better

Course total > 80.0% B– or better

Course total > 70.0% C– or better

Course total > 60.0% D– or better

Students must earn 50.0% of the course points and 50.0% of lab points to pass

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| **Exam or Assignment** |  | **Points** |
| Pre-lecture reading assignments | 15 readings @ 10 pts each | 150 |
| Worksheets | 5 worksheets @ 30 pts each | 150 |
| Lab notebook | See lab syllabus | 150 |
| Lab discussion | See lab syllabus | 50 |
| Project | 1 project | 150 |
| Problem sets | 2 sets @ 50 pts each | 100 |
| Oral mid-term exams | 2 exams @ 25 pts each | 50 |
| Final problem set and oral final |  | 200 |
| **Total** |  | **1000** |
| Extra credit: 1-on-1 meetings | 1 pt per meeting | 10 |
| Attendance | Scored based on percentage | 10 |
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**Pre-lecture reading assignments**

There is assigned reading each week. The texts are selected from the textbook, online resources, and primary literature. The assignment will be graded on Perusall, which you can access from Canvas. This is to help you review past knowledge or to help build new concepts that you will need for that week’s lecture. **The assigned reading is part of the lecture**. You will be tested on these materials in the exams, though I may not cover them again in detail during the synchronous lectures. Why do we do it this way? Written literature is one of the most powerful method that humans have developed to transfer knowledge. Think of all the things you can learn if you can read all the pages that show up on Google search regarding a specific topic! However, it takes practice to read efficiently and effectively. This is why we ask you to read every week.

Reading assignment grades are based on the accuracy of your answers to the instructor questions, the quality of other comments, the amount of time you engage with the material, and whether your comments solicit others to respond. Start early to get more points! The more comments and the more time you spend on it the higher the scores. You can continue to interact with the material after the due date but the scores will be scaled down linearly.

Reading assignment late policy: The scores are scaled down linearly based on how late you interact with the assignment. The latest you can keep adding comments to the assignment is 9 am Friday.

**Worksheets**

There are 5 worksheets throughout the semester. Worksheets are due at the end of the week (Friday 11:59 pm). Due dates are given at the end of this syllabus. Please submit .pdf documents – other file types will not be accepted. Each worksheet is worth 30 points. The key to the worksheet will be made available on Canvas within 2 or 3 days.

You are encouraged to work in groups on worksheets. If you work in with others, you should write the names of your co-workers on your assignment. Each student must turn in an individual assignment. If you work as part of a team, remember that you will learn more if you are an active participant. In traditional tutoring, the tutor learns more than the person being tutored!

Worksheet late policy: Late worksheets are accepted at a penalty of 3 pts per day and will not be accepted once the key is made available, typically two or three days after the due date.

**Lab notebook and lab discussion**

Please see lab syllabus for more details.

**Problem sets**

Two mid-term problem sets worth 50 pts each will be given during the semester. You should spend no more than 1 h on these problem sets that combine all the concepts learned in the previous 4 – 5 weeks. You will have one day or more to complete it. They are typically due on a Wednesday at 10:00 am.

**Oral mid-term exams**

Once your problem sets are submitted, you must meet with me individually for the oral mid-term exam. I will ask you to walk through your thought process for one or two problems on the problem set and ask conceptual questions related to those problems. These are worth 25 pts each. You will be given a rubric before the first oral exam.

**Final problem set and oral final exam**

The final problem set pertains to all the topics discussed throughout the semester. You should spend no more than 3 h on this final problem set. It is worth 150 pts. Once you have submitted the final problem set, you will take an oral final exam with me. I will ask you to walk through your thought process for three or four problems on the problem set and ask conceptual questions related to those problems. This is worth 50 pts. The final problem set and oral final is worth a total of 200 pts.

**Project**

See project guide for details.

**Extra credit**

*You can increase your total grade by up to 2 % points using the extra credit opportunities. Up to 20 % of my students in the past have increased a grade point by completing extra credit assignments.*

Extra credit 1-on-1 meetings: each time you meet with me during office hours you will receive 1 pt. You can accumulate up to 10 pts for these.

Attendance: your attendance for the entire semester will be recorded, and a percentage score will be assigned to your final grade.

* **Graded assignments and regrade requests**

Graded assignments will be returned online through Canvas. Despite efforts taken while grading, it is acknowledged that errors in interpretation or calculating score totals can indeed occur, thus necessitating re-grades. Upon a re-grade request, the entire assignment will be re-graded and re-grading can therefore result in a higher or a lower score. Requests for re-grades must be turned in to your lecture or laboratory instructor within one week of receiving the graded assignment.

* **Incompletes**

Rarely, unforeseen circumstances may warrant an “Incomplete” for the course. An “Incomplete” can be given only if 2/3 of total course work has been completed with passing scores. Generally, all work save for the final exam must have been completed with a score of 70% or better to be eligible for an “Incomplete”.

* **Academic integrity**

You are encouraged to work with your teammates on your take-home assignments. However, working together **does not mean copying and plagiarizing**. If this behavior is observed (including, but not limited to, identical answers among teammates, similar wording to online resources), a 0 will be awarded for that assignment to all that are involved. Any incident of academic misconduct will be reported.

**All materials and recordings for this course are for use *only* by those involved in the course and may not be shared with anyone who is not enrolled in or formally auditing the course or a member of the teaching team (professors &TAs). Sharing course materials, particularly class recordings, with others will be considered a violation of the Mills Honor Code.**

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| **Monday** | **Wednesday** | **Lab** |
|  | 1/20 | 1/22 |
|  | Syllabus  Atomic structure (Ch. 2) | **Meet online**  In-person lab logistics  Introduction to semester project  Introduction to Perusall  **Due: Reading assignment 1 (11:59 pm)** |
| 1/25 | 1/27 | 1/29 |
| **Due: Reading assignment 2 (9 am)**  Molecular orbitals (Ch. 5) | Molecular orbitals (Ch. 5) | Experiment 1: Redox agents |
| 2/1 | 2/3 | 2/5 |
| **Due: Reading assignment 3 (9 am)**  Symmetry and group theory (Ch. 4) | Symmetry and group theory (Ch. 4) | **Due: Worksheet 1 (11:59 pm)**  Experiment 2: Dissolving metal reduction – 1 |
| 2/8 | 2/10 | 2/12 |
| **Due: Reading assignment 4 (9 am)**  Symmetry and group theory (Ch. 4) | Symmetry adapted linear combinations (SALCs) (Ch. 5) | Experiment 2: Dissolving metal reduction – 2 |
| 2/15 | 2/17 | 2/19 |
| PRESIDENT’S DAY  *No lecture* | **Due: Reading assignment 5 (9 am)**  Acid-base/donor-acceptor concepts (Ch. 6) | **Due: Worksheet 2 (11:59 pm)**  Experiment 3: Weakly coordinating ions |

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| **Monday** | **Wednesday** | **Lab** |
| 2/22 | 2/24 | 2/26 |
| **Due: Reading assignment - 6 (9 am)**  Acid-base/donor-acceptor concepts (Ch. 6) | **Due: Problem set 1 (10:00 am)**  Oral exams  *No lecture* | Experiment 3: Weakly coordinating ions |
| 3/1 | 3/3 | 3/5 |
| **Due: Reading assignment 7 (9 am)**  Structures of coordination complexes (Ch. 9) | Bonding of coordination complexes (Ch. 10) | Experiment 4: Synthesis of DMSO complexes and IR spectroscopy |
| 3/8 | 3/10 | 3/12 |
| **Due: Reading assignment 8 (9 am)**  Bonding of coordination complexes (Ch. 10) | Electronic spectra of coordination complexes (Ch. 11) | **Due: Worksheet 3 (11:59 pm)**  **Due: 1st draft of written project (11:59 pm)**  Experiment 5: Thermal isomerization of [Co(en)2Cl2]Cl |
| 3/15 | 3/17 | 3/19 |
| **Due: Reading assignment 9 (9 am)**  Electronic spectra of coordination complexes (Ch. 11) | Peer-review of 1st draft of written project | Experiment 6: Synthesis of magnetic moment of copper acetate |
| 3/22 | 3/24 | 3/26 |
| Spring break | | |
| 3/29 | 3/31 | 4/2 |
| **Due: Reading assignment 10 (9 am)**  Reaction and mechanisms of coordination complexes (Ch. 12) | Reaction and mechanisms of coordination complexes (Ch. 12) | **Due: Completed written project (11:59 pm)**  **Due: Worksheet 4**  Experiment 7: Spectrochemical series |

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| **Monday** | **Wednesday** | **Lab** |
| 4/5 | 4/7 | 4/9 |
| **Due: Reading assignment 11 (9 am)**  Bioinorganic chemistry (Ch. 16) | **Due: Problem set 2 (10:00 am)**  Oral exams  *No lecture* | Experiment 8: Synthesis of an organometallic model of vitamin B12 |
| 4/12 | 4/14 | 4/16 |
| **Due: Reading assignment 12 (9 am)**  Organic ligands and the 18-electron rule (Ch. 13) | Organometallic chemistry (Ch. 13) | Experiment 9: Synthesis and catalytic activity of Wilkinson’s catalyst |
| 4/19 | 4/21 | 4/23 |
| **Due: Reading assignment 13 (9 am)**  Organometallic chemistry (Ch. 13) | Organometallic reactions and catalysis (Ch. 14) | **Due: Worksheet 5**  **Due: Slide deck 1st draft**  **Meet online**  Peer review of 1st draft of slide decks |
| 4/26 | 4/28 |  |
| **Due: Reading assignment 14 (9 am)**  Organometallic reactions and catalysis (Ch. 14) | Organometallic reactions and catalysis (Ch. 14) |  |
| 5/3 | 5/5 |  |
| **Due: Reading assignment 15 (9 am)**  **Presentations** | **Presentations** |  |

**\*\* Chem 145 Final problem set and oral exam \*\***

**Problem set is Due Tuesday, May 11th at 11 am**

**Oral exams will be scheduled for May 11th – May 12th**