

# Chemistry 321: Intermediate Inorganic Chemistry Laboratory

## SQ2025

**Instructor:** Dr. Kyle A. Grice  
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Office hours: TBD (do the survey!)  
Fridays 9:40-10:40 in MGS 321C  
Conflicts with these times? Schedule an appointment at a different time via email! I can also meet via zoom for office hours/etc.

**Teaching Assistant:** Name:  
Email:  
Office hours: TBD

**Meetings:** M 1–5 pm in McGowan South Room 333

### **Textbook and Materials:**

#### **Required:**

1. Hayden-McNeil Laboratory Notebook (spiral bound), ISBN 1-930882-74-2. Available at the bookstore.
2. Laboratory Instructions and Report rubric. Downloadable from the course website under the Content tab. See <https://d2l.depaul.edu>.
3. Laboratory Safety Goggles or safety glasses. Available at the bookstore.
4. Calculator
5. Black or blue ink pens

#### **Highly Recommended:**

1. Lab Coat (see information about safety and proper attire below). Available at the bookstore.
2. *The Organic Chem Lab Survival Manual, 7th Ed.*, by J. W. Zubrick. ISBN 9781118083390. Available at the bookstore.
3. A reference manager like Zotero or Mendeley. Here's info on Zotero: <https://libguides.depaul.edu/c.php?g=1315145&p=9669682>
4. A SciFinder-n account (**FREE to DePaul Students**). Instructions to activate your account: <http://libguides.depaul.edu/c.php?g=253449&p=2461948>

**Prerequisite:** A C- or higher in CHE234/CHE235 or CHE238/239

**Co-requisite:** CHE320 (see CHE320 D2L site and syllabus for more information)

### **General Course Objectives**

This course is designed to expand your familiarity with experimental inorganic chemistry and to provide hands-on experience with some of the concepts you will learn during lecture. Due to the complex nature of inorganic chemistry, the lecture and lab will **not be synchronized** in terms of

their content. The labs consist of synthetic and analytical experiments involving inorganic compounds. Particular emphasis will be placed on chemical problem solving, especially the reaction behavior of transition metals. These experiments are intended to put you in the position of a research chemist who must synthesize and identify compounds, record data, and interpret the results of the experiment. The laboratory experiments and reports will be used to measure your performance as a research scientist. At completion of this laboratory course, you will be able to:

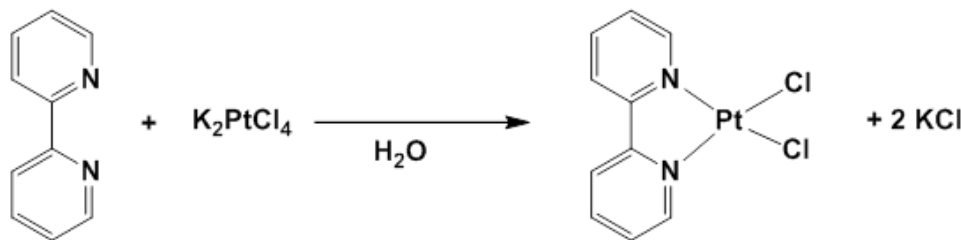
1. Comprehensively review and relate key published work that has been found using modern search and retrieval library methods.
2. Safely conduct experimental operations involving organic and inorganic compounds.
3. Collect and correctly analyze the results of chemical experiments with respect to inorganic complexes.
4. Demonstrate laboratory efficiency and time management.
5. Effectively communicate clear rationale for experimental conclusions in a written form.

### Attendance:

Attendance is required at each laboratory session. *Make up labs will not be given.* The laboratory period will begin and end promptly. **You will need to budget your time carefully to complete experiments successfully in the time allotted.** Due to the nature of the laboratory experiments, additional time outside the laboratory period may be given for some experimental work or online work. If a health or family emergency occurs that results in missing a day, please contact me as soon as possible. Any issue not explicitly discussed here will be handled at my discretion. Even if you miss a day of a lab, you will still be required to submit a report. **Missing more than one day without contacting me to discuss the situation may lead to getting a failing grade in the course.**

### Laboratory Notebooks:

Prepare your lab notebook prior to coming to class with the necessary information to complete the lab. Each experiment should have a title, date, short purpose/overview, and a space to include data and observations. Include tables of necessary equipment. When doing a synthesis, create a **balanced reaction scheme hand drawn out above a table for the reaction that includes:** Reactants or reagents, molar mass, amount used, mmol, equivalents, and notes (useful information such as densities, boiling points, color, etc.). An example is shown below:



Reagent	Molar mass (g/mol)	Amt used	mmol	equiv.	Notes
$K_2PtCl_4$	415.09	99.0 mg	0.239	1.00	Red solid, new batch
2,2'-bipyridine	156.18	41.0 mg	0.263	1.10	Tan solid, recrystallized
Water		10 mL			DI from tap

Below the table you should have a **safety note** describing the safety hazards with each experiment. For example, for the table above, include the fact that platinum salts and bipyridine are hazardous. ***If you don't know the hazards for a compound or solvent, look them up! You are expected to be familiar with how to read and understand an SDS and other safety information.***

Follow the safety note with the explanation of how the reaction was performed and your observations. Always record all of your observations in your notebooks, include times of reactions, observed changes, reaction setups, and reaction data such as masses, percent yields, and melting points. ***Improper notebook keeping will result in a deduction from your lab report grade.*** Leave 2 blank pages before starting a new experiment on days when you are doing multiple experiments.

### **Laboratory Reports:**

*For labs with reports*, a typed report (approximately 6 – 8 pages, double-spaced, *not including spectra and references*) for each experiment is due by 1 pm one week after the experiment has been completed (see the schedule in the syllabus for specific due dates). All laboratory reports must be submitted by **both** of the following methods:

1. a hard copy given to the instructor upon entry into the lab
2. via d2l.com to the drop-box allocated for each laboratory experiment **by the due date** (Hand-written mechanisms/equations do not need to be submitted electronically.)

*Failure to follow this protocol will automatically result in a 20-point deduction in your laboratory report grade. Electronic copies of reports will not be graded if a hardcopy is not also handed in.* Failure to deliver the hard copy of your report to the instructor will result in a score of zero for that laboratory report. Please note that all laboratory reports submitted electronically will be examined using *Turn-It-In* technology in order to ensure that the work is your own creation based on your work in lab during this quarter. In instances of a valid absence from lab, you must make every effort to deliver your report on time. If it is impossible to deliver a hard copy of the report on time, the instructor must be notified, and an electronic version must be uploaded onto D2L before the start of the lab. A hard copy must then be delivered as soon as possible to the laboratory instructor (or placed in the instructor's mailbox in the chemistry department office), and it must match the electronic version, otherwise it will not be graded. The hard copy of the report must be received on the **Friday** before the next laboratory period (this may be changed due to extenuating circumstances, but only after discussion with the instructor).

It is your responsibility to ensure that the instructor receives your laboratory reports. It is recommended that you keep a copy of all spectra for yourselves. Reports should follow a similar flow and style to journal articles in a journal such as *Inorganic Chemistry*. Reports should follow the format given below with the indicated point distribution.

1. (5 pt) Cover page: Your name, experiment title, and date centered on the cover page.
2. (10 pt) Abstract: The abstract is the first section of the report, but I recommend that it be the last section that is written. Your abstract must contain a statement about the problem under investigation. It must contain a brief statement of the experimental methods used or the reaction studied. The essential results must be present in summary form, and the abstract must contain a conclusion. The abstract, as with the entire report, should be written in past tense, passive voice, using scientific phrasing.
3. (15 pt) Introduction: Briefly describe the purpose of the experiment and include balanced equations for the experiments performed. Search the literature for background information about your product, reaction type, and/or experimental method, and provide the information here in your own words with reference numbers.
4. (10 pt) Experimental: Briefly describe your experimental procedure in your own words. Be sure to include the setup of the reaction, specific information such as time of reaction and

observations, as well as purification methods. Include your yield(s) and melting point determination here. The actual journal article on the laboratory experiment must be referenced, *not the handout*. Do not copy the text from the lab handout, as that is an example of plagiarism.

5. (50 pt) Results and Discussion: This is a key part of the lab report. Restate the goal of the experiment, and clearly explain your conclusions and how you have arrived at them.
- Results: Describe your data/results. Even if you have presented data in tables (see below) you must state key results in the narrative.
  - Discussion/Conclusion: Analyze/interpret your data, and explain how they support your conclusions.
  - Questions: There will be questions for you to consider as you perform the experiment and analyze your data. Your responses to these questions should be stated clearly and concisely. These questions are prompts, and your answers should flow well in the narrative.
  - Figures and Tables: Sometimes IR and NMR data are listed in the Experimental section. However, in this course, important spectroscopic features and their assignments must be listed in the Results and Discussion section as well. Attach graphs, spectra and tables either as Figures in the text of your report *or* to the back of your typed laboratory reports. Each must have a title, sequential title number, caption, and all major spectroscopic features must have assignments within the figures.
  - Calculations: *Report special calculations only*. At this level, you are expected to know how to calculate percentage yield, etc., therefore, do not include this type of standard calculation.
6. (10 pt) References: Your introductory section must contain 3-7 references, which should be listed here. References may also be used in the discussion. **At least three** of your references must be journal publications (that is, 3 different journal articles, not the same article 3 times). Do not cite the laboratory syllabus/handouts, class notes, or Wikipedia. In general, course texts are not good references.

**Grading:** Each lab report is worth 100 points. Overall lab participation (being safe, ethical, prepared, professional, and responsible in lab each week) accounts for 5% of your grade. Any questions regarding grading must be addressed within one week after the graded material has been returned, in person with the lab report in hand.

Lab participation: 5%

Non-CURE Lab Reports: 20% (10% each)

CURE Project: 75%, broken down as follows:

-Discussion posts: 5%

-Project proposal: 10%

-Mid-class report: 15%

-Final report: 25%

-Final poster: 20%

I will provide rubrics for the lab reports, and info and a template for the poster (you don't have to use the template, feel free to use your own design/style!).

**Grading Scale:**

Percent range	Grade
100 – 92.5	A
92.4 – 90.0	A-
89.9 – 87.5	B+
87.4 – 82.5	B
82.4 – 80.0	B-
79.9 – 77.5	C+
77.4 – 72.5	C
72.4 – 70.0	C-
69.9 – 67.5	D+
67.4 – 60.0	D
< 60.0	F

**General Guidelines and Laboratory Rules:****Personal Safety**

1. If you are pregnant, you must obtain a letter from your obstetrician that states that it is safe for you to conduct experiments during the quarter and you must submit this letter to your lab instructor.
2. Safety glasses/goggles must be worn at all times in the lab. Contact lenses are prohibited; wear prescription glasses instead.
3. Do not enter the laboratory without wearing appropriate clothing. You must wear shoes that are closed toe; open toed-shoes, ballet flats and other types of shoes that leave skin exposed are forbidden in the lab. You must wear full-length pants or the equivalent. Shorts, skirts, tights, short-sleeved shirts, tank tops, and excessively loose or flowing clothes are forbidden in the lab. No skin between the shoe and ankle should be exposed. You must adhere to the lab attire rules described herein and posted near the laboratory or you will be asked to leave the lab.
4. Long hair must be tied back or confined so that it does not obstruct your vision or fall around your face when you lean forward.
5. Wear appropriate gloves when the potential for contact with toxic materials exists. Do not touch your face with your gloved hands. It is also important to note that gloves degrade over time, so they should be replaced as necessary to ensure adequate protection. You should always wash your hands after each lab because no glove is impervious to all chemicals.
6. Lab coats or aprons are recommended but not required.
7. Report all personal injuries to the instructor who will assess the wound, summon professional help if necessary and report the incident.
8. Know the locations of the safety shower, eye wash stations, and first aid kit in the lab.
9. Know the exits from the lab and the building and the emergency exit plan for your section.

**Preparation**

1. Be prepared for the experiment before you arrive to the lab.

2. Manage your time wisely so that you do not rush or take short cuts.

**Experimental Practice**

1. Always assume that the chemicals are dangerous unless you are told otherwise by your instructor.
2. Never use your mouth to pipette a liquid; use a pipette bulb.
3. Work only with clean equipment and glassware (dry) on a clean bench top.
4. Never leave experiments unattended.
5. Carefully handle and measure appropriate quantities of the reagents needed in the experiment.
6. Use the right chemicals – pay attention to the names of the chemicals before each use. You could cause a serious accident if you mix the wrong chemicals.
7. Save all solutions and solids until you have successfully completed the experiment.
8. Never return excess chemicals to the stock bottle.
9. Dispose of waste in the appropriately labeled containers ONLY.
10. Clean up after yourself. Clean your part of the laboratory bench at the end of your stay in the lab. Points will be taken off the lab report grade if the balance room or the laboratory is left untidy.
11. Always return equipment in its original condition and to its original location.
12. Record all data in ink in your laboratory notebook while you work! Do not write data on scraps or other pieces of paper, even temporarily. Make sure your data is complete. Make sure to record the date or the unknown number, if any.

**Behavior in the Lab**

1. The use of cell phones in the laboratory is strictly forbidden. Your cell phone must be turned off for the duration of the laboratory period. However, you may use your cell phone to take pictures of compounds/apparatuses *only with the instructor's specific permission for each instance*.
2. Smoking, eating, drinking, gum chewing, and applying cosmetics in the lab are prohibited.
3. If you do not know or are unsure about any aspect of your experiment, ask the instructor or the TA.
4. **If you fail to adhere to the safety rules you will not be allowed to remain in lab. Behavior that is deemed by the instructor to be unsafe to yourself or to others will result in your dismissal from that week's experiment. You will not be allowed to finish the lab at a later time.**

**Website:** You can access the Desire2Learn website for this course at: [d2l.depaul.edu](http://d2l.depaul.edu). You should routinely check this website for announcements, reading assignments, handouts, solutions, exam cover sheets, and additional course information that will be posted there.

**Intellectual Responsibility:** DePaul University is a learning community that fosters the pursuit of knowledge and the transmission of ideas within a context that emphasizes a sense of responsibility for oneself, for others and for society at large. Violations of academic integrity, in any of their forms, are, therefore, detrimental to the values of DePaul, to the students' own development as responsible members of society, and to the pursuit of knowledge and the transmission of ideas. Violations include but are not limited to the following categories: cheating; plagiarism; fabrication; falsification or sabotage of research data; destruction or misuse of the university's academic

resources; alteration or falsification of academic records; and academic misconduct. **Using generative AI such as ChatGPT to write your reports is considered an academic integrity violation.** If you want to use AI to help with grammar and spelling, please discuss with me ahead of time. Conduct that is punishable under the Academic Integrity Policy could result in additional disciplinary actions by other university officials and possible civil or criminal prosecution. Please refer to your Student Handbook or visit the following website for further details: <http://academicintegrity.depaul.edu>.

**Students with Disabilities:** Students who feel they may need an accommodation based on the impact of a disability should contact me privately to discuss their specific needs. All discussions will remain confidential. To ensure that you receive the most appropriate reasonable accommodation based on your needs, contact me as early as possible in the quarter (preferably within the first week of class), and make sure you have contacted the Center for Students with Disabilities (Lincoln Park Student Center room 370, 773-325-1677).

**Incompletes:** According to the *DePaul Student Handbook*, grades of IN(complete) are granted when a “student has a satisfactory record in work completed, but for unusual or unforeseeable circumstances not encountered by other students in the class and acceptable to the instructor is prevented from completing the course requirements by the end of the term. An incomplete grade may not be assigned unless the student has formally requested it from the instructor, and the instructor has given his or her permission for the student to receive an incomplete grade. At the end of the second quarter (excluding summer) following the term in which the incomplete grade was assigned, remaining incompletes will automatically convert to "F" grades. Ordinarily no incomplete grade may be completed after the grace period has expired. Instructors may not change incomplete grades after the end of the grace period without the permission of a college-based Exceptions Committee.” Any incomplete must be discussed with the instructor prior to requesting an IN grade and it will be handled at the discretion of the instructor.

**Valid Absence Policy:** **Valid** reasons for an absence include: absence due to participation in a DePaul University varsity sporting event, an illness that keeps you from attending school, or a death in the family. I must be notified **in advance** about an absence due to participation in a varsity sporting event. An illness or a death in the family will be verified by a signed letter from the Dean of Students. This process is initiated by completing the form that can be found at <http://studentaffairs.depaul.edu/dos/forms.html>. In all cases, I should be notified as soon as possible. Any issue not explicitly discussed here will be handled at my discretion. Even if you miss a day of a lab, you will still be required to submit a report. **Missing more than one invalid day will result in a 0 for the course. Missing one valid and one invalid day will result in a 0 for the course. Missing more than two valid absences will also result in a 0 for the course.**

**Tentative Outline of the Course:** An outline of the topics that will be covered in this course appears below.

**Tentative Outline of the Course:**

<b>DATE (week)</b>	<b>Laboratory #</b>		<b>EXPERIMENT (LABORATORY REPORT DUE)</b>
<b>Mar 31 (1)</b>	<b>Lum</b>		<b>CURE</b>
<b>Apr 7 (2)</b>		<b>Por</b>	
<b>Apr 14 (3)</b>			<b>Lum</b> - Preparation and Luminescence Thermochromism of Tetranuclear Copper(I)-Pyridine-Iodide Clusters <b>(Due Apr 14)</b>
<b>Apr 21 (4)</b>			<b>Por</b> - Bioinorganic Coordination Chemistry: Metal(II) Tetraphenylporphyrinates <b>(Due Apr 28)</b>
<b>Apr 28 (5)</b>			<b>CURE</b> – Biomimetic complexes for catechol oxidase catalysis chemistry
<b>May 5 (6)</b>			Assignments: <ul style="list-style-type: none"> <li>• Weekly discussion posts</li> <li>• Project Proposal (<b>Due April 14<sup>th</sup></b>)</li> <li>• Mid-class report (<b>Due May 19<sup>th</sup></b>)</li> <li>• Final Report and Poster (<b>due Finals week</b>)</li> </ul>
<b>May 12 (7)</b>			
<b>May 19 (8)</b>			
<b>May 26 (9)</b>	<b>University Holiday</b>		
<b>Jun 2 (10)</b>			
<b>Jun 9</b>	<b>Final Poster Session: 2:30-4:45 pm June 9<sup>th</sup></b>		

**I reserve the right to make changes to this schedule, as necessary. Any changes will be announced in class and posted on the D2L site.**