

Chemistry 2281G

Inorganic Chemistry of the Main Group Elements

Winter 2026

Course Outline

1. Course Information

Course Information

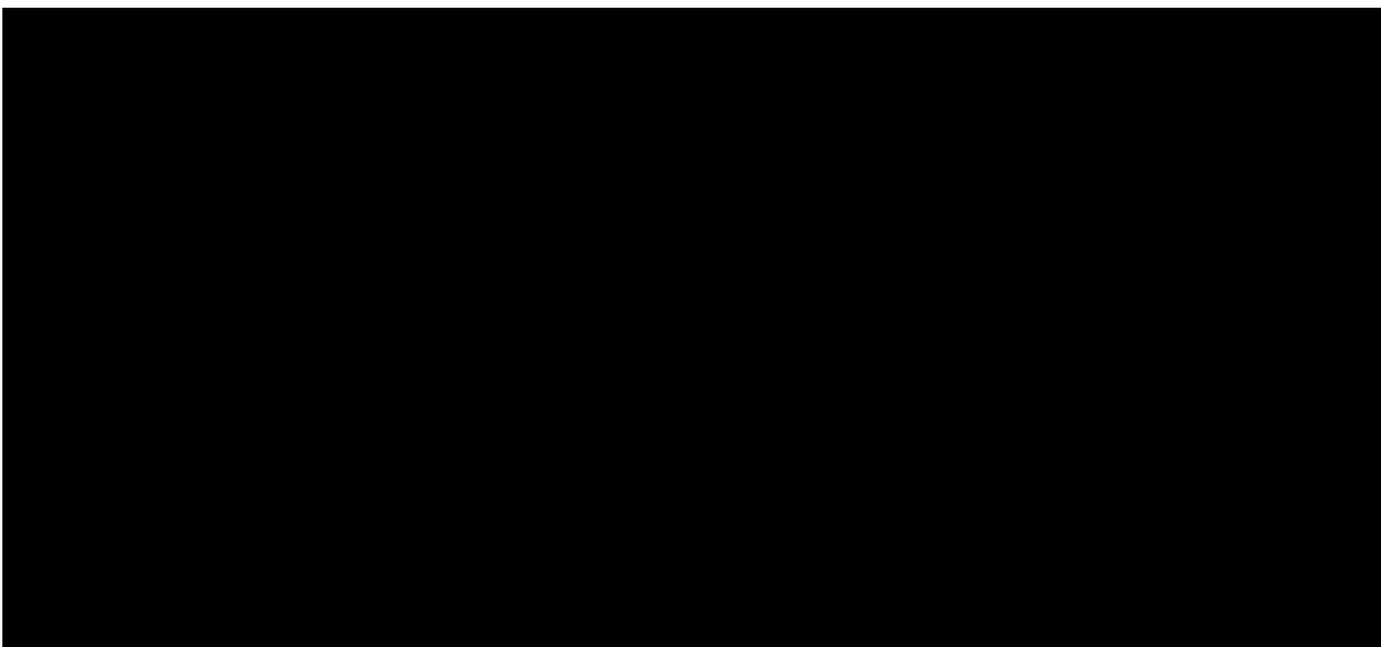
Lectures:



Prerequisite(s): [Chemistry 2271A](#) or [Chemistry 2211A/B](#) with a minimum grade of 80%.

Unless you have either the prerequisites for this course or written special permission from the Department of Chemistry to enroll in it, you may be removed and withdrawn from this course in accordance with university policy. This may be done after the add/drop deadline of the academic term, and the course will be marked as withdrawn (WDN) on your academic record. This decision may not be appealed.

2. Instructor Information



Students **must use their Western (@uwo.ca) email addresses when contacting their instructors.

3. Course Syllabus, Schedule, Delivery Mode

Course Description: Comparison of the structure and solution chemistry of the main group elements and their oxides, halides and hydrides; examples of these compounds in the world around us, with a discussion of the chemical principles involved; Molecular Orbital Theory of polyatomic molecules; metallic bonding and semiconductors. Extra Information: 3 lecture hours; 3 laboratory hours.

Course Topics

Course Content (from 2026 course calendar) - Introduction to Chemical Structure and Bonding

We will review some of the fundamental aspects of atomic structure and properties (and periodic trends) before proceeding with the examination of theories of bonding in molecules and the use of symmetry. *These subjects will be presented in a modified order* but are covered in the first few chapters in the textbook. This should only be treated as a guide, we may change the order or spend more/less time on a specific topic, should the need arise.

Lists of learning objectives will be provided for each section of the course. Use these to help to revise for the term test and final examination. As in first year, it is up to you to organize your time and make sure you keep on top of the material covered and know to solve different types of problems. Therefore, if you are having problems with constructing molecular orbital (MO) diagrams or discussing molecular symmetry (as examples), please arrange to discuss with Dr. Drover or a GA as soon as possible.

Molecular shape and symmetry

- Symmetry operations and elements
- Character tables & Point Groups
- Vibrational modes

Selected Experimental techniques

- Nuclear magnetic resonance (NMR) spectroscopy
- Photoelectron spectroscopy
- Vibrational spectroscopy

Bonding in polyatomics

- MO theory of polyatomics – application of group theory and symmetry
- Symmetry-Allowed Linear Combinations (SALCs)/Ligand Group Orbitals (LGOs)
- Delocalized & multi-center bonding

Main-Group Chemistry

- Lewis/acid base compounds
- Frustrated Lewis pairs

- Literature case studies
- Main-Group metallomimetic chemistry

Learning Outcomes

Upon completion of Chem 2281G, students *will be able to*:

1. Understand and identify the symmetry elements and operations to be able to assign the correct point group of molecules;
2. Apply the understanding of symmetry elements in molecules and operators for the construction of molecular orbitals;
3. Interpret and predict the chemical properties of main group elements/molecules in of the bonding theories typically used to describe them;
4. Conduct laboratory experiments safely and evaluate the potential impact of main group chemistry;
5. Prepare logical, organized, and concise written reports describing their experimental results in the areas of the preparation and characterization of main group complexes.

Important Dates

Jan. 5: Class 1 – <i>Classes begin</i>	Feb. 20 - <i>Reading Week</i>
Jan. 7: Class 2 -	Feb. 23: Class 19 -
Jan. 9: Class 3 -	Feb. 25: Class 20 -
Jan. 12: Class 4 -	Feb. 27: Class 21 -
Jan. 14: Class 5 -	Mar. 2: Class 22 -
Jan. 16: Class 6 -	Mar. 4: Class 23 -
Jan. 19: Class 7 -	Mar. 6: Class 24 -
Jan. 21: Class 8 -	Mar. 9: Class 25 - Midterm #2
Jan. 23: Class 9 -	Mar. 11: Class 26 -
Jan. 26: Class 10 -	Mar. 13: Class 27 -
Jan. 28: Class 11 -	Mar. 16: Class 28 -
Jan. 30: Class 12 -	Mar. 18: Class 29 -
Feb. 2: Class 13 - Midterm #1	Mar. 20: Class 30 -
Feb. 4: Class 14 -	Mar. 23: Class 31 -
Feb. 6: Class 15 -	Mar. 25: Class 32 -
Feb. 9: Class 16 -	Mar. 27: Class 33 -
Feb. 11: Class 17 -	Mar. 30: Class 34 -
Feb. 13: Class 18 -	Apr. 1: Class 35 -
Feb. 16 – <i>Reading Week</i>	Apr. 3 – <i>Good Friday</i>
Feb. 18 – <i>Reading Week</i>	Apr. 6: Class 36 -
	Apr. 8: Class 37 - (Classes end April 9)

4. Course Materials

All course material will be posted to OWL: <https://westernu.brightspace.com/>

Textbook and Other Learning Materials

Required textbook: This is a detailed introductory textbook for Inorganic Chemistry (also including Main Group, Transition Metal and Organometallic compounds) that will also be useful for students that will continue to study Chemistry.

Inorganic Chemistry, 5th Edition, Housecroft & Sharpe. Cost: 193.80 + tax.

Second-hand or older editions are sufficient.

A friendly reminder: It is extremely important, as with any course, to keep up with the required reading. One can become lost very quickly, and the pace of this course, combined with the fact that many of the topics discussed rely heavily on a firm knowledge of the prior materials, will leave you feeling behind and frustrated.

The **textbook is not mandatory**; however I will assign material to read from these books, and I will be posting suggested practice problems from the text. Students with regular access to a textbook and who read it generally do much better in this course than those who do not - the texts contain additional and sometimes helpful information that is not covered in the lectures.

Laboratory Manual: “Chem 2281G Main Group Chemistry”, Laboratory Manual, Winter 2026, \$47.00 + tax.

Laboratory Notebook: Laboratory Notebook (for in person labs), \$16.05 + tax. – A hard covered and bound laboratory notebook is needed for recording all data and observations in the laboratory. A partially filled one from another course will be fine. Be sure to clearly indicate where the Chem 2281 experiments begin. Do not use a notebook for a course you are taking concurrently with 2281.

Calculator: Only basic scientific calculators are permitted on all closed-book assessments. All other electronic devices (cell phones, laptops, tablets, cameras, etc.) are prohibited. Students found in possession of prohibited devices will receive a mark of ZERO for the entire assessment.

Molecular Model Kit: strongly recommended (from C1301A is fine)

Safety glasses and Lab coat: are always required when working in the laboratory. Students who normally wear prescription glasses must wear safety glasses or goggles over their regular glasses. Full details are in your laboratory manual.

Students are responsible for checking the course OWL site (<https://westernu.brightspace.com/>) regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL site, they can seek support on the [OWL Brightspace Help](#) page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Methods of Evaluation

Grading Scheme and Assessment Dates

C2281G comprises three lectures per week. There will be two mid-term examinations and one final examination.

The overall course grade will be calculated as listed below:

Laboratories (8)	25%
Midterm Exams**	30%
Final Exam**	45%
Total:	100%

**Assessment for the course consists of two closed book midterm examinations (60 min) and one closed book final examination (3 h).

Lab Reports: Each lab will be given a mark out of 10, except the formal report, which will be graded out of 20. Laboratory notebooks will be evaluated (write as you go) and a laboratory performance grade assigned by the TAs. Overall, the lab component will be marked out of 100, which will be converted to contribute to your overall mark for Chem 2281G (25% of course total).

Weight of laboratory components:

Lab performance (notebook, fluency, lab safety, and responsibility)	10%
Library Lab sheet	2.5%
Symmetry Lab sheet	2.5%
Pre-labs for each experiment (6 x 2.5%)	15%
All lab reports with data sheets (5 x 10%)	50%
Carbon Quantum Dots (formal lab report)	20%
Total	100%

Report Sheets: all but one of the labs will be “written up” in a report sheet style, where the sheets are included as a component of this lab manual. Don’t be afraid to fill in some of the answers as you go, if time allows. Work efficiently. The 2281G lab is supposed to enhance the class, not be a class unto itself.

Pre-lab, report sheet ‘write-ups’ and formal lab hand in. Pre-lab: All pre-labs will be completed before you attend your lab section for an experiment. Pre-labs should include all the necessary detail as described in the lab manual. If the pre-lab is not completed before a lab, then students will not be allowed to perform the lab and a mark of zero will be assigned for that lab.

Laboratory reports are **due one week** after completing the experiment at the start of the next lab.

For example, if you complete the silicone bouncing putty experiment on Tuesday Feb Xth then your report must be handed in by February (X+7)th. Any document that is handed in after the due date will be subject to the Chem 2281 late penalty. Laboratory reports should generally be marked by the next lab session after you hand them in.

Formal Laboratory Write-up: you are required to write one formal laboratory report, which will be on Carbon Quantum Dots. The report must be prepared using 12 pt, Times Roman font, with 2.54 cm margins around the whole page and 1.5 line spacing. Chemical drawings are to be done using ChemDraw, which is freely available to all Western students. This software is the industry standard for preparing chemical drawings for a formal document. Formatting and document presentation will be assigned 2 of the 20 marks. The report should include all the same things outlined above in the What to Include in your

Laboratory Notebook section, however the procedure must be written out in full, not point form and in your own words (**not using AI** – see below).

Laboratory Schedule:

Lab the Week of	Experiment	Due the Week of
<i>Jan. 19</i>	Library Lab	<i>Jan. 26</i>
<i>Jan. 26</i>	Symmetry Tutorial	<i>Feb. 2</i>
<i>Feb. 2</i>	Exp. 1: Synthesis of a Silicone Polymer - Bouncing Putty	<i>Feb. 9</i>
<i>Feb. 9</i>	Exp. 2: Positive Oxidation States of Iodine and the Interhalogens	<i>Feb. 23</i>
<i>Feb. 16</i>	Reading Week	
<i>Feb. 23</i>	Exp. 3: Oxidation States of Tin	<i>Mar. 2</i>
<i>Mar. 2</i>	Exp. 4: Carbon Quantum Dots from Lemon Juice	<i>Mar. 9</i>
<i>Mar. 9</i>	Exp. 5: Ammonia-Borane	<i>Mar. 16</i>
<i>Mar. 16</i>	Exp. 6: Synthesis of Triphenylphosphine-Chalcogenides Week 1	
<i>Mar. 23</i>	Exp. 6: Synthesis of Triphenylphosphine-Chalcogenides Week 2	<i>Mar. 30</i>
April 9 – Last Day of Classes		

Use of Generative AI Tools

AI tools (e.g., ChatGPT, Copilot, Gemini) are **prohibited** for use in any course-related submission.

General information about missed coursework

Students who are unable to meet their academic responsibilities due to medical or compassionate reasons may submit a request for academic consideration. For each missed piece of work, regardless of its weight in the total course grade, you must apply for such consideration by providing valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration.

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs*, posted on the Academic Calendar:

https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult [Accessible Education](#).

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage: https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within **48 hours** after the assessment date or submission deadline.

Missed tests. If a test is missed for valid reasons (see process for seeking academic consideration above) the weighting will be transferred to the final examination.

Laboratory. If a lab is missed and academic consideration is granted, the weight of the missed lab will be redistributed to the other labs.

Final Exam. If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you can do so. They will assess your eligibility to write the Special Exam (the name given by the university to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html). If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under Special Examinations).

All Academic Consideration requests must include supporting documentation; however, recognizing that formal documentation may not be available in some extenuating circumstances, the policy allows students to make one Academic Consideration request **without supporting documentation** in this course. However, the following assessments are excluded from this and, therefore, always require formal supporting documentation:

- Final examinations scheduled during official examination periods (Defined by policy)

When a student *mistakenly* submits their one allowed Academic Consideration request **without supporting documentation** for the assessments listed above or those in the **Coursework with Assessment Flexibility** section below, the request cannot be recalled and reapplied. This privilege is forfeited.

Evaluation Scheme for Missed Assessments

Late Submissions. All work is subject to a late policy of 10% per day, including weekends. Work more than three days late will not receive any credit. Late policies will be waived provided students have a valid reason that is supported by the academic counsellors from their home faculty.

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under [Special Examinations](#)), especially for those who miss multiple final exams within one examination period.

Essential Learning Requirements

Even when Academic Considerations are granted for missed coursework, the following are deemed essential to earn a passing grade.

- You *must* obtain a grade of at least 50% for the laboratory component of the course.
- You *must* submit at least 6 of the 8 labs reports.
- You *must* write the Final Exam.

Students who fail to meet any of these requirements will receive a course grade of not greater than 40%, even if the calculated grade is higher. A student who is unable to submit the required minimum number of lab reports for medical or compassionate reasons, and who wishes to complete the missed work, will need to apply for Incomplete Standing (a grade of INC) by submitting a written request to the Dean of the Faculty of Registration. If INC standing is granted, the student will be able to complete the missed items the next time the course is offered. A student who is unable to write the Final Exam must apply for permission to write a Special Final Examination (SPC Exam).

6. Additional Statements

6.1 Religious Accommodation

When a recognized religious holiday or observance conflicts with an examination, test, or other scheduled academic obligation, students must request accommodation via the University's Student Absence Portal (SAP). This request should identify the conflict and specify which course component(s) (e.g. test, midterm, exam) are affected.

Students are encouraged to submit the SAP request as early as possible, but no later than two weeks before any examination, or one week before any mid-term test or quiz, to allow sufficient time for adjustment.

The SAP request serves as official notification to both the course instructor and the Academic Advising Office, in accordance with University policy:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

The Faculty of Science considers religious accommodations as scheduling conflicts. Instructors should provide either a make-up exam or an earlier sitting of the same exam to accommodate the student.

For more information on recognized religious holidays, please visit the Diversity Calendar posted on the Equity, Diversity & Inclusion website - <https://www.edi.uwo.ca>

6.2 Academic Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf.

6.3 General Academic Policies

The website for Registrar Services is <https://www.registrar.uwo.ca/>.

Use of @uwo.ca email: In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

Requests for Relief (formerly known as “appeals”)

Policy on Request for Relief from Academic Decision:

https://uwo.ca/univsec/pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

6.4 Scholastic Offences

Policy on Scholastic Offences:

https://uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Undergraduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Use of Electronic Devices During Assessments

In courses offered by the Faculty of Science, the possession of unauthorized electronic devices during any in-person assessment (such as tests, midterms, and final examinations) is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, and wireless earbuds or headphones. **Unless explicitly stated otherwise in advance by the instructor, the presence of any such device at your desk, on your person, or within reach during an assessment will be treated as a *scholastic offence*, even if the device is not in use.** Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the assessment room. It is your responsibility to review and comply with these expectations.

Use of Generative AI Tools

Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is **not permitted** in the completion of any course assessments, including but not limited to: assignments, lab reports, presentations, tests, and final examinations. Using such tools for content generation, code writing, problem solving, translation, or summarization—when not explicitly allowed—will be treated as a **scholastic offence**. If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is your responsibility to seek clarification before using any AI tools in academic work.

6.5 Support Services

Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, requests for relief, exam conflicts, and many other academic-related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts, at:

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. If you have any questions regarding accommodations, you may also wish to contact Accessible Education at

http://academicsupport.uwo.ca/accessible_education/index.html

Learning-skills counsellors at Learning Development and Success (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.

7. Applications and Research Areas Related to Chem 2281G

Inorganic Chemistry is a broad field of science relating to the study and preparation of molecules and solids that contain a wide range of elements (other than carbon and hydrogen). They have a variety of uses and applications. If you are interested in obtaining research experience or getting your “feet wet”, feel free to reach out to faculty. <https://www.uwo.ca/chem/people/faculty/faculty_by_theme/synthesis.html>

- [Dr. Johanna Blacquiere](#) (Organometallic Chemistry)
- [Dr. Marcus Drover](#) (Main Group/Organometallic)
- [Dr. Joe Gilroy](#) (Main Group/Materials Chemistry)
- [Dr. Paul Ragona](#) (Main Group/Materials Chemistry)

8. Statement on Equity, Diversity, and Inclusivity

Western University and I are committed to a community and learning environment that embraces equity, diversity, and inclusivity including gender and gender-identity, sexuality, ethnicity, religion, culture, and national origins. This commitment is underscored by Western University being a signatory to the [Dimensions Program and Charter](#). Our community and learning are enhanced and enriched when diverse perspectives and experiences are recognized and respected, and all can contribute. In this class I hold that each student has the right to be addressed "in accordance with their personal identity" (*e.g.*, name, personal pro-nouns).¹ Please let me know how you wish to be addressed and how I can help to support you during this class, and I will do my best to do so.