

Instructor: Roberta Flemming: B&GS room 0172, rflemmin@uwo.ca (office hours TBA)

Teaching assistants: Ricardo Rodriguez (rrodri2@uwo.ca) and Yaozhu Li (yli2889@uwo.ca)

Lectures: Mondays and Wednesdays, 9:30 am to 10:20 am, PAB 34 (Physics and Astronomy Building)

Laboratory: BGS 1069: Tuesdays 6:00-9:00 pm or Wednesdays 2:30-5:30 pm

Objectives: This course introduces students to minerals. We will examine their crystalline nature, chemical composition, physical and optical properties. Students will also develop an understanding of the connections between these phenomena. From a theoretical perspective, students will understand how the properties of minerals are a product of their crystalline nature and how mineral structures can be understood systematically. Practical laboratories will strengthen students understanding of the above concepts; students will become proficient at identifying minerals using physical and optical properties.

Corequisite: Earth Sciences 2200A or Enrolment in the Materials Science Program

		Course topics/themes - Tentative schedule	Reading in Text
Crystallography			Klein and Dutrow:
Week 1:	Sept 9, 11	Introduction, Physical properties of minerals; Point symmetry	Ch 1-2
Week 2:	Sept 16, 18	Six crystal systems: symmetry & axes; Crystal forms & Miller indices	Ch 6
Mineral Chemistry			Klein and Dutrow:
Week 3:	Sept 23, 25	Periodic table, radius ratio, coordination polyhedra, closest packing	Ch 3-4
Week 4:	Sept30, Oct 2	Chemical substitution, solid solution, immiscibility and ordering	Ch 3-5, 11, 12
Optical mineralogy			Nesse:
Week 5:	Oct 7, 9	Polarized light; optical properties of minerals	Ch 1, 3-5
Week 6:	Oct 14, 16	Thanksgiving , Uniaxial minerals (tetragonal, hexagonal)	Ch 6
Week 7:	Oct 21, 23	MIDTERM , Biaxial minerals (orthorhombic, monoclinic, triclinic)	Ch 7
Systematic mineralogy of rock-forming minerals			Klein and Dutrow:
Week 8:	Oct 28, 30	Structural principles of silicates; Orthosilicates & Ring silicates	Ch 18
Week 9:	Nov 4, 6	***** Fall Reading Week *****	
Week 10:	Nov 11, 13	Single vs double chain silicates: pyroxenes, amphiboles	Ch 18-19
Week 11:	Nov 18, 20	Sheet silicates: clays, serpentine, micas, chlorite	Ch 18-19
Week 12:	Nov 25, 27	Framework silicates: quartz, SiO ₂ polymorphs, and feldspars	Ch 18-19
Week 13:	Dec 2, 4	Non-silicate minerals: native elements, oxides, sulfides, carbonates	Ch 15-17

Laboratory topics:

Labs	Date	Crystallography/Optical Mineralogy	Quiz	Minerals
Week 1:	Sept 10	Physical Properties of Minerals	no	native elements, halides
Week 2:	Sept 17	Point symmetry operations; six crystal systems	yes	oxides
Week 3:	Sept 24	External morphology: crystal forms Miller indices	yes	sulphides
Week 4:	Oct 1	Closest packing and coordination	yes	carbonates, sulphates
Week 5:	Oct 8	Optical microscopy - plane & cross polarized light	yes	orthosilicates
Week 6:	Oct 15	Optical microscopy – Anisotropic - uniaxial	yes	ring & chain silicates
Week 7:	Oct 22	Optical microscopy – Anisotropic – biaxial	yes	sheet silicates
Week 8:	Oct 29	Optical microscopy – Rock forming minerals I	yes	framework silicates
Week 9:	Nov 5	***** Fall Reading Week *****		
Week 10:	Nov 12	Optical microscopy – Rock forming minerals II	yes	
Week 11:	Nov 19	Optical microscopy – Rock forming minerals III	no	
Week 12:	Nov 26	Review session (mock final exam)		mock mineral exam
Week 13:	Dec 3*	Final lab exam*		Final mineral exam*

* **NOTE: FINAL LAB EXAM** for **ALL STUDENTS** will be on the **SAME DAY** as decided by **CLASS VOTE**. Choices are either Dec 3: 5:30-9:30 pm or Dec 4: 3:30-7:30 pm (4 hr time slot is divided into 2 groups).

Course Materials:

- *Manual of Mineral Science*, 23rd Ed. (2008), by C. Klein and B. Dutrow, Wiley. (Required)
[Or you can use previous edition: *Manual of Mineral Science*, 22nd Ed. (2002), by C. Klein, Jr, Wiley.]
- *Minerals in Thin Section*, 2nd Ed. (2003) D. Perkins and K.R. Henke, Prentice Hall. (Optional)
- *Introduction to Optical Mineralogy*, 4th Ed. (2012) by W.D. Nesse, Oxford University Press (Optional).
[Or you can use the previous edition: *Introduction to Optical Mineralogy*, 3rd Ed. (2004) by Nesse]
- Supplementary material will be given weekly, at website <https://owl.uwo.ca>

Evaluation:

Midterm class test: (50 minutes)	Monday October 21 (in class)	20 %
Lab assignments:	Weekly (9)	20 %
Lab mineral quizzes:	Weekly (8)	10 %
Lab exam: (2 hours)	Dec 3 or 4 (by class vote)	20 %
Final exam: (2 hours)	Scheduled by the Registrar	30 %

No electronic devices may be used during tests/exams. Non-programmable calculators are acceptable.

Learning Outcomes:

Upon successful completion of this course the student will be able to:

1. Classify crystals into six crystal systems based on symmetry, name crystal forms, assign Miller indices.
2. Identify minerals in hand sample by their physical properties through mineral quizzes and a Lab exam.
3. Identify minerals by their optical properties, using a polarizing microscope, and recognize their formation environments (igneous or metamorphic) using mineral textures and associations.
4. Predict cation substitution in mineral structures using Pauling's first rule governing atomic coordination.
5. Relate the properties and stability of silicate minerals to the systematics of silicate crystal structures.
6. Use the chemical formula of minerals to predict their behavior and to write chemical reactions.

Course Website:

Students should check OWL (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis.

Academic Policies:

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Ethical Conduct: Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Plagiarism: Students must write their assignments in their own words. Whenever you take an idea, or a passage from another author, you must acknowledge this both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. **Plagiarism is a major academic offence.**

Accommodation and Accessibility:

Note that if documentation (medical or otherwise) is required, it can only be collected by the student's Dean's Office/Academic Counselling unit.

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in NCB 280, and can be contacted at scibmsac@uwo.ca.

Please note that for missed course components, the student is referred to the student's Dean's Office/Academic Counselling unit to get accommodation. This policy also applies to course components worth less than 10%.

If a student has received academic accommodation, missed components are treated on a case-by-case basis. In most cases, work may be submitted late without penalty, or in extreme cases missed components may be excused (so that the course is reweighted). If a student should miss the midterm test for any valid reason, there will not be a makeup test. Instead the final exam will be reweighted at 50%.

Further note about midterm test: It is Faculty of Science policy that a student who chooses to write a test or exam deems themselves fit enough to do so. Claims of medical, physical, or emotional distress after the fact will not be considered. However, if a student improves their grade in their final exam by 10% over their grade in the midterm test, the student may opt to have the final exam given full weight (50%) and the midterm grade discounted. (Note that this will not apply if the student fails to write the midterm exam.)

If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to 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).

For further information, please consult the university's policy on academic consideration for student absences:

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

Support Services

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. You may also wish to contact Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations.

The policy on Accommodation for Students with Disabilities can be found here:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

The policy on Accommodation for Religious Holidays can be found here:

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

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.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.

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

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

This course is supported by the Science Student Donation Fund, which has regularly funded new mineral specimens and crystal models. If you are a B.Sc. or B.M.Sc. student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing the online form linked from the Faculty of Science's Academic Counselling site. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the chair of the department or email the Science Students' Council at ssc@uwo.ca.