

**Instructor:**

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**Prerequisite(s):** Earth Sciences 2200A or permission of the Department.  
Chemistry 1301A/B or the former Chemistry 020 or 023.

**Course Info:** 2 lecture hours, 3 laboratory hours, 0.5 course.

**Lectures:** Tuesday & Thursday 12:30 – 1:30 pm in CHB 9

**Lab:** Friday 10:30 – 1:30 in B&GS 0184

**Aims of the course**

Geochemistry is essential to all aspects of modern Earth Science. This course introduces essential geochemical tools of thermodynamics and kinetics, crystal chemistry, aqueous geochemistry, isotope geochemistry, and trace element geochemistry. It then takes an inside-out look at Earth from a geochemical perspective, and includes topics such as the formation of elements; formation of Earth and the Solar System; evolution of the crust, mantle, and core; weathering and stream chemistry; and ocean chemistry. During the course, students will be evaluated on these topics via weekly labs, homework assignments, a class report and presentation, a mid-term exam, a final exam, and participation in class.

**Texts used in class**

You are not required to purchase a textbook for this class. Instead, any required reading will be provided to you in PDF format on OWL Sakai.

Geochemistry (available by permission from Bill White)

**Further reading (should you need it!)**

Principles and Applications of Geochemistry 2 <sup>nd</sup> Edition, 1998 by G. Faure Publisher: Prentice Hall, N.J.	Geochemistry 2 <sup>nd</sup> Edition, 1996. by A. H. Brownlow Publisher: Prentice Hall, N.J.	Essentials of Geochemistry 2 <sup>nd</sup> edition, 2009 by John Walther Publisher: Jones & Bartlett
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**Grading Scheme**

1) Report (15%)	Due March 27, 2015
2) Presentation (10%)	Last couple of labs
3) Lab Assignments (20%)	Weekly
4) Mid-term Exam (15%)	February 12, 2015 (in class)
5) Final Exam (35%)	During the exam period
6) Class Participation and Pop Quizzes (5%)	

### **Presentation**

Students will work in groups and give a short presentation on a geochemical technique that is used to solve problems in the Earth Sciences. Presentations will be given during lab time in March.

### **Report**

The report will consist of a short paper based on the subject of your presentation. Your report will be no more than 10 pages, and is due March 27, 2015. Details will be provided to you in lab.

### **Lab Assignments**

Lab assignments will be handed out at the beginning of the lab and the due date will be indicated on the lab handout. Attendance promptly at the beginning of the lab period is mandatory. If you have exceptional circumstances, please contact your instructor, preferably in advance. Keep in mind that even though labs fall on a Friday, you are expected to attend!

### **Examinations**

The midterm exam will be held Thursday, February 12th, in class. The final exam will be scheduled by the Registrar's office during the April final exam period. Only calculators approved by the University of Western Ontario will be allowed during exams. All students are expected to attend examinations on time. Conflicts must be presented to your academic advisor well in advance of the examination period.

### **Make-up Policy**

Labs must be made up unless special arrangements are made. The policy for scheduling special exams is indicated in the *UWO Academic Calendar*.

### **Due Dates**

All lab assignments are due at the beginning of lab on their due date. If you are more than 10 minutes late, your assignment will be marked as one day late and mark deductions will apply. The report is due by 11:55 pm on March 27, 2015, and must be submitted successfully to OWL Sakai by that time (tip: submit well in advance to avoid any internet hiccups).

Assignments and reports handed in late will be **deducted 10% per day** after the due date (if you submit even one minute late on OWL Sakai, it is automatically marked as one day late). You will have plenty of time to write your report, so start early! If any exceptional circumstances arise, contact your instructor immediately. You may also visit your academic advisor for counsel.

### **Course Topics:**

1. Introduction
2. Causes of Geochemical Reactions: Laws of Thermodynamics, Entropy, & Enthalpy; Free Energy and Equilibrium; Thermodynamics of Solutions & Equilibrium Constants
3. Aqueous Geochemistry: Properties of Water; Solutions and Solubilities; pH, pE, Eh; Oxidation and Reduction; Acid-Base Reactions; Complexation.

4. Crystal Chemistry: Nature of Solids; Bonding Forces; Covalent and Ionic Radii; Solid Solutions; Trace Elements in Minerals; Phase Diagrams; Geothermometry; Reaction Kinetics; Diffusion; Surface Reactions; Diagenesis.
5. Isotope Geology: Nuclides and nuclear numbers; Radioactivity; Radioactive clocks; Dating of rocks and minerals; Stable isotope geochemistry
6. Elements, Molecules and the Earth: Electronic structure of atoms; The periodic table of the elements; Origin and abundance of the elements; Nucleosynthesis; Cosmic abundance; Meteorites; the Solar system; Nature & composition of the Earth (crust, mantle and core); Geochemical classification of the elements.

### Plagiarism

Plagiarism is a **serious academic offence**. The UWO Senate Academic Handbook defines plagiarism as "The act of appropriating the literary composition of another, or parts or passages of his writings, or the ideas or language of the same, and passing them off as the product of one's own mind." Students must write their assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt by using both quotation marks where appropriate and proper referencing such as footnotes or citations. For more information see Scholastic Offence Policy in the Western Academic Calendar.

**Please note:** When you write your assignments and report, you are **not** allowed to copy and paste **ANYTHING** (even if it's just a sentence!) from **ANYWHERE**. This includes websites, papers, books, other students, etc. You are not allowed to copy and paste paragraphs and then change several words. You must gather ideas for your report then **write the entire paper in your own words**. I cannot stress this enough. If any part of your paper is determined to be plagiarized, that part of your paper will **NOT** be marked, and you will be reported to the departmental Chair. **NO EXCEPTIONS!!**

### University Policies

1) *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](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)*

2) *Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.*

3) *All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com ( <http://www.turnitin.com> ).*

*4) If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see:*

*[http://www.uwo.ca/sci/undergrad/academic\\_counselling/final\\_exams.html](http://www.uwo.ca/sci/undergrad/academic_counselling/final_exams.html)*

*A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)*