

G 445/545

Geochemistry

CRN 44418 (G445) / 44419 (G545)
4 credits, Winter 2023

Location: Portland State University,
CH 283
12:40-13:50 MWF

Instructor: Alex Ruzicka
CH 17K, 503-725-3372
email: ruzickaa@pdx.edu
Office hours: By Arrangement,
but I will plan to make 10-11 MWF
regularly available.



Course Description: The course provides an overview of geochemistry with a focus on how quantitative measures can be used to better understand geological processes. Topics will include mass balance, equilibrium partitioning, element transport, geochronology, stable isotopes, thermodynamics, crystal chemistry, and cosmochemistry. Examples will be given to illustrate how geochemical principles and methods are being used to learn about the Earth and the solar system.

Text: Geochemistry, 2nd Edition, by Arthur H. Brownlow. Used copies of the Textbook can be purchased online (used hardback prices as low as \$1.88 via Amazon), and free PDF downloads are offered by some online vendors. **See Course Website for recommended additional readings.**

Problem sets: Three problem sets will be assigned during the semester using the Canvas Assignments module. These will include problems assigned to both G445 and G545 students, as well as more elaborate problems assigned to G545 students alone. Problem sets should be submitted either at the start of class or via the Assignment dropbox in Canvas.

Exams: There will be three in-class mid-term Exams at regularly scheduled class times in addition to a Comprehensive Final. Students should plan on having writing implements, calculators and a copy of the periodic table available on Exam days.

Presentations: Three class periods have been allocated for required oral presentations by graduate students on any topic of interest related to geochemistry, petrology, mineralogy or similar topic. Details about what will be expected for presentations will be provided in class.

Website and D2L: A Course Website (see <http://web.pdx.edu/~ruzickaa/G545/>) will contain a copy of this syllabus, a list of resources, and any relevant announcements. The PSU-provided Canvas learning management platform (see <https://canvas.pdx.edu>) will host all other materials, including handouts, problem sets, answer keys, grades and possibly other information. PSU login is required to access the course Canvas shell.

Grades: Grades will be determined from performances on:

G445:

Problem sets (10% each).....	30%
Mid-term exams (10% each)	30%
Final Exam.....	40%

G545:

Problem sets (10% each).....	30%
Mid-term exams (10% each)	30%
Final Exam	30%
Oral Presentation	10%

Grading will be assigned based on scores as follows: 95% or above = A, 90-94.99% = A-, 87-89.99% = B+, 83-86.99% = B, 80-82.99% = B-, 77-79.99% = C+, 73-76.99% = C, 70-72.99% = C-, 67-69.99% = D+, 63-66.99% = D, 60-62.99% = D-, less than 60% = F. Letter grades will conform to the standards given in the PSU course catalog (A = excellent, B = superior, C = average, D = inferior, F = failure). I generally avoid giving "I" grades. **Curves will be used at my discretion.**

Policies: (a) A culture of professionalism and mutual respect is expected. Any incident of discrimination or discriminatory harassment, including sexual harassment, can be reported to the Office of Equity and Compliance, or the Office of the Dean of Student Life. For resources, see <http://www.pdx.edu/sexual-assault/get-help>. (b) If you have a disability and need an accommodation, please arrange with the Disability Resource Center office (503-725-4150, drc@pdx.edu). (c) It is the responsibility of the student to arrange both with the Instructor any tests requiring accommodations or make-ups. (d) It is expected that work submitted by students represents that done by the individual student themselves. Work copied from others in the class will result in zeroes for the assignment. (e) In general, late work will *not* be accepted, unless accompanied by a note for a doctor for illness, or unless extenuating circumstances merit exceptions from the Instructor. (f) Students who stop attending class for a long period may be withdrawn by the Instructor.

Class schedule: The tentative schedule* with Brownlow chapters is as follows (see Course Website and Canvas for updates):

Week 1

- 1/9 Introduction (Ch. 1)
- 1/11 Properties of elements (Ch. 1, parts of Ch. 5)
- 1/13 Mass balance and equilibrium (parts of Ch. 3, 8)

Week 2

- 1/16 NO CLASS, MLK Holiday
- 1/18 Equilibrium partitioning (parts of Ch. 5, 8)
- 1/20 Element transport

Week 3

- 1/23 Isotope geology; geochronology part 1 (Ch. 2)
- 1/25 Isotope geology; geochronology part 2 (Ch. 2)
- 1/27 Isotope geology; stable isotopes (Ch. 2)

Week 4

- 1/30 **Problem Set 1 due 12:40 PM Monday at the start of class**
- 1/30 Thermodynamics 1; Gibbs function, reactions, P-T space (Ch. 3)
- 2/1 Thermodynamics 2; solutions, activities, equilibrium constant (Ch. 3, parts of Ch. 5)
- 2/3 **Midterm Exam 1 12:40-13:50 (covers Weeks 1-3)**

Week 5

- 2/6 Thermodynamics 3; Phase Rule and Phase Diagrams
- 2/8 Crystal chemistry 1 (Ch. 5)
- 2/10 Crystal chemistry 2 (Ch. 5)

Week 6

- 2/13 Igneous rocks and magmas 1; phase diagrams (Ch. 8)
- 2/15 Igneous rocks and magmas 2; melting and crystallization (Ch. 8)
- 2/17 Igneous rocks and magmas 3; isotopic studies (Ch. 8)

Week 7

- 2/20 **Problem Set 2 due 12:40 Monday at the start of class**
- 2/20 Sedimentary rocks and weathering 1; chemical weathering (Ch. 7, 4, 6);
- 2/22 Sedimentary rocks & weathering 2; water chemistry (Ch. 7, 4, 6)
- 2/24 **Midterm Exam 2 12:40-13:50 (covers Weeks 4-6)**

Week 8

- 2/27 Metamorphic rocks 1; variables of metamorphism, reactions (Ch. 9)
- 3/1 Metamorphic rocks 2; facies, petrogenetic grid, examples of regional metamorphism (Ch. 9)
- 3/3 Cosmochemistry 1; conceptual framework, framework, condensation, molecular cloud chemistry (parts of Ch. 1)

Week 9

- 3/6 Cosmochemistry 2; solar system chemistry, meteorite intro, oxygen isotopes
- 3/8 Cosmochemistry 3; meteorites
- 3/10 **Student presentations 12:40-13:50**

Week 10

- 3/13 **Problem Set 3 due 12:40 Monday at start of class**
- 3/13 **Student presentations 12:40-13:50**
- 3/15 **Student presentations 12:40-13:50**
- 3/17 **Midterm Exam 3 12:40-13:50 (covers Weeks 7-9)**

Finals Week

- 3/23 **Final Exam 12:30-14:20 Wednesday**

* This schedule liable to change, especially if we have technical or weather problems. Check Course website and Canvas for Announcements.

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ACKNOWLEDGMENT OF SYLLABUS RECEIPT

I have received a copy of the course syllabus for this class, and the instructor has discussed its contents.

NAME (please print)

Last

First

MI

Signature _____

Date _____

A phone number where you can be reached: _____

And/or an e-mail address: _____

Please list your previous geology courses (if any):