UNIVERSITY OF CALGARY

DEPARTMENT OF GEOSCIENCE
COURSE OUTLINE

1. **Course:** GLGY 503, Aqueous Geochemistry

   Lecture Sections:

   L01: TuTh, 15:30-16:45, KNB 126
   Dr. B. Mayer, Office: ES 506A, Ph. 403-220-5389, bmayer@ucalgary.ca, Office Hours: Wednesday 15:00-15:45 or by appointment

   Course website or Desire 2 Learn (D2L) tbd
   Geoscience Department ES 118, 403-220-5841, geoscience.ucalgary.ca, geoscience@ucalgary.ca

2. **Prerequisites:** Geology 323. See also Geology Course Descriptions of the University Calendar.

3. **Grading:** The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Lab Assignments (10)	25%	
Midterm test	30%	(October 16, 2014)
Final Examination	45%	(To be scheduled by the Registrar)

A passing grade on the final exam is necessary to pass the course as a whole.

Each piece of work (assignment, laboratory report, midterm test of final examination) submitted by the student will be assigned a percentage score. The student's average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade, bearing in mind that an F grade will result if the student does not pass the Final Examination. The conversion between course percentage and letter grade is given below.

Letter Grade	Percent	Letter Grade	Percent
A+	95-100	C+	65-69
A	90-94	C	60-64
A-	85-89	C-	56-59
B+	80-84	D+	53-55
B	75-79	D	50-52
B-	70-74	F	0-49

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in Section 3.6. It is the student's responsibility to familiarize himself/herself with these regulations. See also Section E.6 of the University Calendar

5. **Course Materials:** "The course content is based on the following recommended textbook: Appelo, C.A.J., and Postma, D., *Geochemistry, groundwater and pollution* (2nd ed., 2005, available at UofC bookstore; Gallagher Library: TD420.A67 2005)

   Other useful reference books:
   - Langmuir, D., *Aqueous environmental geochemistry*, Prentice Hall, 1997 (GB855.L36 1997).
   - Stumm, W., and Morgan, J., *Aquatic chemistry* (3rd ed.), Wiley, 1996 (GB697.S78 1996)
   - Drever, J.I., *The geochemistry of natural waters* (2nd ed.), Prentice Hall, 1988 (GB855.D73 1988)

   The course D2L site contains the lecture material and the lab assignments, as well as other resource material that you might find useful. Students are advised that reading the course blackboard page is not a substitute for attendance at lectures. The lectures provide an interactive environment that embellishes on, and provides a context

for, the material in the textbook, whereas blackboard is a live site that allows for tailoring and updating of the course material during the term.

6. **Examination Policy**: Calculators and rulers are permitted, but no textbooks or course notes. Students should also read the Calendar, Section G, on Examinations.

7. **Writing across the curriculum statement:** In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also Section E.2 of the University Calendar.

8. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

   (a) Academic Misconduct: (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K. Student Misconduct to inform yourself of definitions, processes and penalties

   (b) Assembly Points: In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.

   (c) Academic Accommodation Policy: Students with documentable disabilities are referred to the following links: Calendar entry on students with disabilities and Student Accessibility Services.

   (d) Safewalk: Campus Security will escort individuals day or night (http://www.ucalgary.ca/security/safewalk/). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

   (e) Freedom of Information and Privacy: This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also http://www.ucalgary.ca/secretariat/privacy.

   (f) Student Union Information: VP Academic Phone: 220-3911 Email: suvpaca@ucagary.ca.
   SU Faculty Rep. Phone: 220-3913 Email: sciencerep@su.ucalgary.ca; Student Ombudsman

   (g) Internet and Electronic Device Information: You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

   (h) At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

Information on lecture and lab outline: see attachment.

Department Approval: ORIGINAL SIGNED Date: September 5 2014

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DEPARTMENT OF GEOSCIENCE
COURSE OUTLINE

1. **Course:** GEOLOGY 503, Aqueous Geochemistry

   Lecture Sections:

   L01: TuTh, 15:30-16:45, KNB 126; Instructor: Dr. Bernhard Mayer Office: ES 506A Tel. No. 220 5389 e-mail address: bmayer@ucalgary.ca, Office Hours: Wednesday: 15:00-15:45

   The course website can be found on D2L (tbd).
   Departmental Office: ES118, 403-220-5184, geoscience@ucalgary.ca

2. **Prerequisites:** Geology 323 (see http://www.ucalgary.ca/pubs/calendar/current/geology.html#9734)

3. **Syllabus:** The aim of this course is to provide a comprehensive introduction to aqueous geochemistry. The students will learn the processes that determine the quality (chemical constituents) of surface water and groundwater to understand interactions between anthropogenic activities and the natural environment. The first part of the course will focus on hydrology, measurements and sampling techniques. Applications of environmental tracers (e.g. isotopes) will be presented, followed by chemical principles used in aqueous geochemistry, including acid/base equilibria, salts and solutions. The next part will focus on mineral dissolution and chemical weathering, including silica and carbonate systems. Chemical weathering and redox reactions, acid mine drainage and other case studies will complete aqueous geochemistry concepts.

   This course is accompanied by weekly lab sessions that will help the students to conduct geochemical calculations and visualisation of geochemical data. The lab also includes geochemical modelling, providing hands-on computer experience. Isotope applications and case studies will emphasize the understanding of geochemical concepts.

   The topics covered in the course are given in the table below. This is intended as a general guideline and the schedule of topics may change slightly as the course progresses.

Week	Dates	Lecture topic(s)	Lab
1	9/11 September 2014	Introduction, Groundwater Quality	No lab
2	16/18 September 2014	Hydrology – Rainwater, Groundwater, Isotopes	Lab 1: Water Chemistry and Analytical Results
3	23/25 September 2014	Water Chemistry Controls, GW Dating, Mineral Solubility	Lab 2: Balancing geochemical reactions
4	30 Sept/ 2 Oct 2014	Acitvity/SI/Kinetics	Lab 3: Measuring field parameters
5	7/9 October 2014	Carbonates	Lab 4: Measuring alkalinity
6	14 October 2014 16 October 2014	Carbonate Systems/CO2 **Midterm Examination: Oct 16**	Lab 5: Ionic strength/ Activity coefficients part 1
7	21/23 October 2014	Carbonate System	Lab 6: Ionic strength/Activity coefficients part 2, GWB
8	28/30 October 2014	Carbon Dioxide Dissolution	Lab 7: Geochemist's Workbench
9	4/6 November 2014	Ion Exchange and Sorption	Lab 8: Geochemist's Workbench
10	13 November 2014	Adsorption & Chemical Weathering	Lab 9: Silicate Weathering
11	18/20 November 2014	Silicate Weathering	Lab 10: Redox Diagrams
12	25/27 November 2014	Redox Reactions	Lab 11: Redox with Geochemist's Workbench
13	2/4 December 2013	Case studies & Course Review	No lab
	To be scheduled	**Final Examination: tbd**	