

ERTH 1010: Our Dynamic Planet Earth Fall 2019 Course Outline

Why should you want to take a course in Earth Science? Here's why: nearly everything that we do is connected in some way to the physical Earth; its lands, oceans, atmosphere, plants and animals. The materials used for our homes and offices, the clothes that we wear, cellphones and computers, our sources of energy, our drinking water, the air that we breathe, and the food that we eat, are all in some way derived from our planet. The Earth Sciences offer an integrated and interdisciplinary approach to understanding Earth, and apply knowledge from biology, chemistry, physics, ecology, mathematics and computer science to tackle complex issues. If we wish to maintain and improve the quality of life on Earth, as its population approaches 8 billion people, then we are required to understand and appreciate the complex processes that control our planet.

Earth Science benefits everyone! Sedimentologists, paleontologists and ocean geochemists study climate patterns of the past in order to understand the causes of our current global warming event. Seismologists monitor earthquake activity in order to evaluate earthquake risk in populated areas and understand how and why faults occur. Hydrologists and geochemists study water quality and the availability of clean, long-term water sources. Volcanologists investigate the current and past activity of volcanoes to determine the risk to local populations that inhabit the fertile slopes of these edifices and to explore how the interior of the Earth melts to form the lavas erupted at volcanoes. Paleontologists study the record of life on Earth recorded as fossils in rocks, providing fundamental information on the condition of the planet and its effect on life through time. Resource specialists focus on finding and extracting the raw materials needed for modern industry and society, such as petroleum products, iron, copper, zinc, silicon, and talc. Understanding Earth Science empowers you to think globally and act locally. Only if you understand the Earth system can you make informed decisions about issues that impact our daily lives. Should I buy a house built along the shore of a river or at the top of a steep slope? If I am buying a car, should I get a diesel, gasoline, hybrid or electric vehicle? Where will the electrical power of the future come from? Why should I recycle plastic containers? If we have so much water in Canada, why are sources of drinking water difficult to find? Why is the mining of oil sands in Alberta such a controversial issue?

In December 2004, a huge earthquake ripped through the northwestern part of Indonesia, causing a tsunami (commonly but incorrectly called a tidal wave) that inundated the shores of Thailand, Sumatra, and India, among other countries. Tourists and local inhabitants alike ran to the beaches as the water receded from the shore just prior to the arrival of the 10-metre high wave. Ignorance of the fact that sea level drops locally in advance of a tsunami cost thousands of people their lives with the tsunami ultimately resulting in >225,000 fatalities. Ignorance of how the Earth works is the norm in North America and elsewhere in the world, placing most of us at risk. The more recent 2011 earthquake and tsunami at Sendai, Japan, further shows how humans do not prepare for the worst possible event. The tsunami resulted in the destruction of a nuclear power plant and the spread of radioactive particles into the environment which was completely preventable.

This course will provide you with a broad overview of the Earth system, giving you a clear view of how the lithosphere, hydrosphere, atmosphere and biosphere all interact. We will discuss the origin of the Solar System, the Earth and Moon, and how meteorites retain a record of the composition of the early Earth and planets; the Earth as a layered planet; geologic time and radiometric dating of rocks and minerals; minerals and how they form; the theories of continental drift, seafloor spreading and plate tectonics, or "Why our Planet is Mobile"; rocks, including the major igneous, sedimentary and metamorphic rock types; the physical properties of the Earth, including magnetism, gravity and heat flow; earth resources, including water, metals, and energy, their extent and limitations, and potential resources of the future; and finally the geology of Canada.

Course Pre-requisites:

This course is for students who are not enrolled in the Faculty of Science.

Course Evaluation:

The course includes two major components. Instruction consists of three lecture hours per week, via CUOL (T section: live stream during lecture MW 4:35-5:55 pm, video in Loeb D299, or Video-On-Demand). The second component involves completing weekly assignments available on cuLearn. These assignments will primarily be based on new advances in Earth Science or recent major events that have occurred around the globe that relate to Earth Science. *These assignments may not be directly linked to lecture material.* The goal of the assignments is to extend lecture content and demonstrate how Earth Science is important in our daily lives.

Students have the option to attend an Ottawa Geology fieldtrip along with students taking EARTH 1006 (details below) **OR** complete a video assignment on cuLearn. Both options are worth the same points (5%). If you wish to attend the trip, which I strongly encourage, *please contact your instructor by September 20, 2019.*

| | |
|---|------------|
| Lecture Midterm Exam | 32% |
| Lecture Final Exam | 32% |
| Ottawa Geology Fieldtrip or Video assignment | 5% |
| Weekly Exercises | 31% |

Grading Scale:

| | | | |
|----|---------|----|--------|
| A+ | 90-100% | C | 63-66% |
| A | 85-89% | C- | 60-62% |
| A- | 80-84% | D+ | 57-59% |
| B+ | 77-79% | D | 53-56% |
| B | 73-76% | D- | 50-52% |
| B- | 70-72% | F | <50% |
| C+ | 67-69% | | |

Ottawa Geology Fieldtrip:

The optional **Ottawa Geology fieldtrip** will be held on Saturday, October 5th from 8:30 am to 4:00 pm.

Video Assignment:

If you do not attend the fieldtrip, the video assignment is due November 15th, 2019.

Note: **IF** you wish to attend lectures in person you are more than welcome to. Empty seats are usually available after the second week of classes. Details are found below.

Lecture Details

Lecture Time: MW 4:35 pm – 5:55 pm

Lecture Location: SC 103

Office Hours: TR 1-2 pm via Big Blue Button

Instructor

Geoff Pignotta

Office: Herzberg 2102

Phone: 613-520-2600x3024

Email: geoff.pignotta@carleton.ca

Exams:

Since this is a CUOL course, the **lecture midterm exam** will be held **OUTSIDE OF CLASS TIME**, on Saturday November 2nd from 2:30 – 4:30 pm. The **lecture final exam** will be scheduled during the December exam period. Note each exam only covers material from prior to the exam, i.e., *final exam is not cumulative.*

Required Course Materials:

Textbook: Marshak, Earth: Portrait of a Planet 6th ed. W. W. Norton & Co, 2008 ISBN: 978-0393640137

Paper and digital versions are available in the Carleton University Bookstore.

Learning Outcomes:

By the end of the course, each successful student will acquire the following skills and knowledge sets from the lectures and assignments:

- Each student will demonstrate an understanding of the process of Earth formation and differentiation, the internal structure of Earth, and the origin of meteorites.
- Each student will demonstrate the ability to characterize fundamental Earth materials, including minerals and rocks, and to understand the physical, chemical and biological processes by which they formed.
- Each student will demonstrate a knowledge of how faults form, why motion on faults produces energy, the links between energy, seismic waves and earthquakes, and how seismic waves are used to investigate Earth's internal structure.
- Each student will demonstrate an understanding of gravity, magnetism and heat flow on Earth, why the Earth's gravitational and magnetic fields vary over the Earth's surface, and why these geophysical properties are useful in describing geological structures in the crust, mantle and core.
- Each student will demonstrate an understanding of the theories of continental drift and plate tectonics, the geophysical evidence supporting plate tectonics, and be able to describe how plate tectonics operates.
- Each student will demonstrate an understanding about Earth's natural systems (lithosphere, atmosphere, and hydrosphere) and its resources, and how resources impact the economy of Canada.

Course Behavior/Expectations:

I expect your behavior to reflect respect for all members of the course at all times. Outside of lecture, you are expected to spend 5-6 hours per week on this course with lecture readings, assignments, studying, etc.

Conflicts with Course Requirements:

Students with conflicts for **ANY** examination must have a note from an employer or a medical certificate (see below) in order to write the exam at another date. Unless caused by illness, all conflicts **MUST** be reported to the instructor **PRIOR** to the exam date. If an assignment is missed for a valid reason, contact the EARTH 1010 Teaching Assistant *immediately*. In the case of a serious illness, see the rules concerning deferral of an exam or assignment at <https://carleton.ca/registrar/special-requests/deferral/>.

No outside study aids (calculators, notes) will be allowed for any lecture-based exams. Any materials required for the lecture-based exams will be provided by the instructor.

Student Accommodation Processes:*Pregnancy obligation:*

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: <http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

Religious obligation:

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: <http://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

Academic Accommodations for Students with Disabilities:

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at <https://carleton.ca/pmc/> or 613-520-6608 or pmc@carleton.ca for a formal evaluation. Contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). *After requesting*

accommodation from PMC, contact and/or meet with your instructor directly as soon as possible to ensure accommodation arrangements are made.

Survivors of Sexual Violence:

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <http://carleton.ca/sexual-violence-support>

Accommodation for Student Activities:

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit:

<https://students.carleton.ca/course-outline/>

Plagiarism:

Plagiarism is presenting, whether intentionally or not, the ideas, expression of ideas, or work of others as one's own. Plagiarism includes reproducing or paraphrasing portions of someone else's published or unpublished material, regardless of the source, and presenting these as one's own without proper citation or reference to the original source. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, and material on the internet. This includes copying of material from websites or other publications that is incorporated into **assignments**, reports, or other submissions for grading. Borrowing someone else's answers, unauthorized possession of tests or answers to tests, or possession of material designed in answering exam questions, are all subject to university policy regarding instructional offences.

For this course (and all other courses at Carleton), it is extremely important to understand that you cannot copy and paste material from websites or publications into the assignment answer boxes on cuLearn. This is plagiarism, and it is easy to spot during grading of weekly assignments. When formulating an answer to an assignment question, be sure to reword the material from websites or publications into your own words, then type that into the answer boxes. Identification of plagiarised material in an assignment answer will result in an automatic zero points for that question. Repeated instances of plagiarism will result in harsher consequences that may include zero on entire an entire assignment, reduction of course final grade, withdrawal from course, letter of reprimand from the Dean of the Faculty of Science.

I encourage students to work together on assignments. **HOWEVER**, each student must submit answers to questions in their own words, not the words used by another student that you are working with. Be sure that you and your co-worker word your submitted answers differently. If the answers submitted by one student for an assignment are identical to those submitted by another student, *both students will be assigned a grade of zero for the question.*

Academic dishonesty, in whatever form, is destructive to the values of the university, and risks harming the university's reputation as place of learning and innovation. Furthermore, it is unfair and discouraging to those students who pursue their studies honestly. Additional details regarding the Carleton University Academic Integrity policy: <http://carleton.ca/secretariat/wp-content/uploads/Academic-Integrity-Policy.pdf>

Medical Certificates:

The documentation from your licensed health care professional must indicate that you were examined and diagnosed at the time of the illness and/or injury, *not after the fact*. A medical statement that merely confirms a report of illness made by you is not acceptable. A completed Medical Certificate (http://carleton.ca/registrar/wp-content/uploads/med_cert.pdf) must also clearly indicate that the problem was serious enough to have interfered with academic work, and, where appropriate, the ability to make suitable decisions about how best to address the impact on your studies. Only original medical documentation is acceptable and the health care professional's office may be contacted to verify the completion of the form.

Course Outline (*TENTATIVE SCHEDULE ONLY*)

| Date | Topic | Textbook Readings |
|--------------------|--|---------------------------------|
| Week 1 | | |
| 09/02 | <i>Labour Day – No lecture</i> | |
| 09/04 | Course introduction; Universe and Solar System | Chapter 1 |
| Week 2 | | |
| 09/09 | Earth formation and geochronology | Chapter 1, Chapter 12 |
| 09/11 | Physical mineralogy | Chapter 5 |
| Week 3 | | |
| 09/16 | Physical mineralogy; The Rock Cycle | Chapter 5, Interludes A & C |
| 09/18 | Igneous rocks and volcanic hazards | Chapters 6 & 9 |
| Week 4 | | |
| 09/23 | Igneous rocks and volcanic hazards | Chapters 6 & 9 |
| 09/25 | Weathering, erosion and sedimentary rocks | Chapter 7 |
| Week 5 | | |
| 09/30 | Weathering, erosion and sedimentary rocks | Chapter 7 |
| 10/02 | Metamorphic rocks | Chapter 8 |
| 10/05 | <i>Optional Saturday Fieldtrip – Ottawa Geology</i> | <i>8:30 am – 4:00 pm</i> |
| Week 6 | | |
| 10/07 | Earth's interior; Seismology | Chapters 2 & 10, Interlude D |
| 10/09 | Seismology; Earthquakes | Chapter 10 |
| Week 7 | | |
| 10/14 | <i>Thanksgiving – No lecture</i> | |
| 10/16 | Earth's gravity and heat flow | Interlude D, Boxes 1.4 & 2.3 |
| Week 8 | | |
| 10/21-10/25 | <i>Fall Study Break</i> | |
| Week 9 | | |
| 10/28 | Geomagnetism | Interlude D, Chapters 2 & 3 |
| 10/30 | Plate tectonics | Chapters 3 & 4 |
| 11/02 | <i>Lecture Midterm Exam 2:30 – 4:30 pm</i> | |
| Week 10 | | |
| 11/04 | Plate tectonics | Chapters 3 & 4 |
| 11/06 | Deformation and mountain building | Chapter 11 |
| Week 11 | | |
| 11/11 | Deformation and mountain building | Chapter 11 |
| 11/13 | The Hydrologic Cycle and Groundwater | Interlude F, Chapter 19 |
| 11/15 | <i>Video assignment due (if fieldtrip not attended)</i> | |
| Week 12 | | |
| 11/18 | Rivers and flooding | Chapter 17 |
| 11/20 | Energy resources | Chapter 14 |
| Week 13 | | |
| 11/25 | Mineral resources | Chapter 15 |
| 11/27 | Geology of Canada | Chapter 13, cuLearn |
| Week 14 | | |
| 12/02 | Geology of Canada | Chapter 13, cuLearn |
| 12/04 | Careers in Earth Sciences and Review | |