

Quest University Canada  
Earth Systems and Human Impacts: PHY 2207  
Spring Block 2 (February 2016)  
**Course Syllabus**

**Tutor:** Zion Klos  
**Time and location:** Daily 9:00am-12:00pm, Academic 1, Room 234

**Zion's Contact Information:**

Office: Red Tusk Suite  
Cell phone: 920-883-8617  
Email: [zion@uidaho.edu](mailto:zion@uidaho.edu)  
Websites: [www.zionklos.com](http://www.zionklos.com) [www.climateodyssey.org](http://www.climateodyssey.org)

**Office hours:** As an instructor I will be available most times during the day to answer questions and provide support however I can! On campus, feel free to call, text, or e-mail to arrange a time to meet; afternoons are good, but evenings are generally okay too; after class is probably the best.

**Course Description**

Students begin by focusing on the practices of geological inquiry while exploring content related to rock composition, mountain building, erosion, and long-term Earth cycles. They continue briefly into the methods of extracting economically valuable resources (e.g., petroleum or minerals) from rock formations. Environmental problems related to resource extraction are then considered, and methods of environmental science are presented. The course then moves to a substantive treatment of climate science and ends with special topics that may vary between different instructors. Core points of emphasis throughout the course are quantitative analysis of geological and environmental data and the creation of cogent arguments that use technical information. This course fulfills the Earth-Oceans-Space Foundation requirement.

**Course Narrative**

This course has been designed to (loosely) follow the life cycle of fossil fuels, most notably petroleum.

- In our first week, we'll focus on geology and the ways that geologists think.
  - Topics covered will include: rock identification; the rock cycle; plate tectonics; and petroleum genesis.
    - *These relate to how fossil fuels end up in the ground.*
- In our second week, we'll consider a series of environmental problems, most of which focus on pollution.
  - Topics covered will include: methods of extracting oil; modelling the life of an oil spill; and exponential decay.
    - *These relate to getting fossil fuels out of the ground and transporting them.*
- In our third week, the scientific basis for our understanding of climate change will be examined.
  - Topics covered will include: paleoclimates; the climate system; and climate change.
    - *These relate to the extraction and combustion of fossil fuels.*
- Our fourth week will constitute a large synthesis of the course to date.
  - At this point each phase of this course will be explicitly related to resource management and human impacts.
    - *This relates to what has been covered throughout the course.*

This is not a course about rocks, pollution, and/or climate – it’s a course about how physical scientists (particularly earth scientists, environmental scientists, and climate scientists) think. This course will mesh together content and habits of mind: I will attempt to narrate and clarify this amalgamation as we go. The content, although fascinating, really is not the focus. Also, there is simply too much material to cover in a very short period of time. There are many opportunities at Quest to explore most of the topics in much more detail in concentration classes. I sincerely hope that you leave this class inspired to learn more about what we have touched on.

## Course Objectives

The purpose of all courses satisfying the Earth-Oceans-Space (EOS) requirement at Quest is to focus on broad, observable Earth systems and to help students understand how scientists study these systems. In this way, an EOS course complements a course satisfying the Energy and Matter (EnMa) requirement. An EnMa course is designed to give students an understanding and appreciation of small-scale concepts such as chemical bonds and conservation of energy. EOS courses are designed to help students:

- understand that the practice of physical science is one in which hypotheses and theories are continually being tested;
- comprehend the use and proper practices of quantitative measurements and estimation in the physical sciences;
- foster a proper attitude towards answering relevant physical science questions (and other types of questions in the future) with evidence and observations, not opinion;
- appreciate the relevance of the course subject material in the context of everyday society;
- analyze multivariable concepts and place them in context of the interconnectedness of natural systems; and
- summarize and communicate physical science data and hypotheses to diverse audiences.

## Required Materials

There is no required textbook for this course, but you are encouraged to consider purchasing the reference material if you have a strong interest in geology: Reference Material: Understanding Earth, (fifth or sixth editions) by Grotzinger and Jordan on reserve in Library.

There will be multiple field trips so all students must have appropriate gear for typically winter weather in Squamish. (This includes proper clothing, decent shoes and something to write on.) Short of extreme weather (like a snowstorm or severe rainfall warning), field trips will NOT be cancelled on account of weather conditions!

## Course Evaluation

This course will have a total of eight assignments:

- 📁 **THREE** Technical assignments due on Friday of each week. These allow for you to expand on the material as we cover it in class. The idea is for you to work on these throughout the week.
- 📄 **TWO** Petroleum assignments due the Monday of weeks two and three. If you want your weekends off, get an early start on these!
- 📊 **ONE** excel assignment<sup>1</sup>
- 📄 **TWO** final assignments
- 📄 **ONE** final test

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<sup>1</sup> If you are familiar with excel you may elect not to complete this assignment.

A lot of the material and ways of thinking will be new to most of you. To reflect this, I am including a class participation and citizenship grade that reflects your willingness to commit to the material, discover new ideas and think deeply about them, and also be a respectful member of the class. Please volunteer your thoughts during discussions, lectures, and activities while also showing respect for our learning environment at all times. This is inherently subjective, but I don't think it will be too hard for you to figure out what I'm asking for.

The contribution of each grade to the final grade for the course will be:

Technical assignment week 1 (TA1)	15%
Technical assignment week 2 (TA2)	15%
Technical assignment week 3 (TA3)	15%
Petroleum Assignment 1 (PA1)	5%
Petroleum Assignment 2 (PA2)	5%
Excel assignment (EA)	5%
Final Assignment 1 (FA1)	10%
Final Assignment 2 (FA2)	5%
Final test (ZA-6000)	15%
Class Participation and citizenship	10%

## Grading

Your percentage total will be converted to a letter grade using the following breakdown:

<b>A</b>	<b>88-100</b>	<b>C+</b>	<b>68-72</b>
<b>A-</b>	<b>84-88</b>	<b>C</b>	<b>64-68</b>
<b>B+</b>	<b>80-84</b>	<b>C-</b>	<b>60-64</b>
<b>B</b>	<b>76-80</b>	<b>D</b>	<b>50-60</b>
<b>B-</b>	<b>72-76</b>	<b>F</b>	<b>49 and under</b>

*I may retroactively lower the grading requirements if appropriate, but I won't raise them.*

These grades translate generally as follows:

<b>A</b>	<b>Outstanding</b>	Your work was <b>exceptional</b> : you have truly mastered the material. You consistently demonstrated an excellent understanding of all aspects of the course. You went above and beyond the requested outputs and offered unique insights and ideas. Your work exceeds my expectations for what I believe a student should demonstrate.
<b>B</b>	<b>Good to very good</b>	You have <b>mastered the material</b> . Your work was clear and understandable, and you consistently showed a strong understanding of the material. Your work meets my expectations for what I want students to take away from this course.
<b>C</b>	<b>Satisfactory</b>	You <b>completed and understood the material</b> . You were able to grasp the majority of the concepts in the course, and demonstrated some ability to apply those concepts.
<b>D</b>	<b>Barely Satisfactory</b>	Your work in the class was <b>barely acceptable</b> . Either you failed to complete some assignments, or your grasp of the course material was weak and incomplete.
<b>F</b>	<b>Unsatisfactory</b>	Your work was <b>unacceptable</b> . You did not learn the material.

PLEASE understand that - although I try to be approachable and make classes fun - I have a responsibility to objectively evaluate your performance on assignments, quizzes and projects. The grade that you receive is not the grade that I want you to get - it is the grade you earn based on all of the class outputs and requirements. Your grade is NOT a reflection of your character or if I like you, and it does not even completely reflect your abilities in this subject.

**Doing the work does NOT guarantee you an 'A' or a 'B'!**  
**A 'B' is a very good grade and an 'A' is an exceptional grade!**

## Course Policies

**Presentation:** At Quest, we emphasize quality communication and presentation across the entire curriculum. Poorly communicated science is bad science. In all assignments there will be at least some grade allocation toward presentation -- good writing and neatness count! You have the dubious honour of taking EOS with an engineer whose main professional activity is writing. I WILL push you to improve your communications skills.

**Challenge:** You are all coming into this with a range of backgrounds and experiences (*not to mention you range from 1st to 4th year students!*), and a swath of learning objectives and topical interests. We are all learning in this course....myself included. If you are not finding this course challenging enough it is your responsibility to come to me and tell me: I will happily find harder topics or assignments for you to work on.

I reserve the right to hold unannounced quizzes if I feel that members of the class are not preparing adequately for the class.

**Handing in assignments:** The technical and final assignments are to be handed in as paper copies unless otherwise stated. Part of the assignment is navigating the printer, etc. and getting the material in on time, labelled correctly with your name and bound together (staple, paper clip, etc.) so that all the material that you have worked on can be easily accounted for. Late assignments are usually accepted; however, a penalty will be assessed.

**Late policy:** 10% deduction if not submitted by the due date and time (which is 9:00 am sharp at the start of class unless otherwise instructed); thereafter 1% per each additional hour late. Please inform me if you are not going to submit your report or assignment on time. Many assignments will not be accepted late as we will discuss them in that class – it is better to hand in SOMETHING so submit what you have done.

**Academic integrity:** Anyone caught cheating or plagiarizing papers or other assignments will receive an "F" for the course. *Presenting material as your own from books, newspapers, magazines, other students' work, or the internet is plagiarism/cheating.* If you are uncertain about this definition, see me and we will discuss it. Please be aware that I am pretty good at spotting academic dishonesty, and don't have much patience for it: I have caught students cheating at Quest. If you do well in an assignment and very poorly in the associate quiz or interview, I may suspect you of copying and will investigate further.

These are the same standards that are outlined in the Quest University Honour Principle: [http://www.questu.ca/current\\_students/honour\\_principle.php](http://www.questu.ca/current_students/honour_principle.php) For more details, please see the Quest [honour constitution](#) and *Forms of Writing*, 139-143.

**Participation:** A significant part of the course is class participation. Come to class every day and be prepared to talk about (and listen about) the material with your fellow students.

**Attendance:** Attendance is mandatory. If you miss a class without letting me know ahead of time with an acceptable reason you automatically receive a 3% deduction from your grade. If you miss a class with an acceptable reason you will still receive a smaller deduction from you grade, and you may not be able to make up the exercise or assignment. If you miss a class and want to make up lost participation marks it is up to you to contact me and see how this can be done. If you miss four classes you may automatically fail the class. Please bring a laptop or device to class.

**Field trips:** We will leave campus for several field trips in this course. It is expected that you treat the outdoor classroom with the same respect that you do the on campus setting. In addition, there is no rock climbing or other unnecessary recreational activity allowed on field trips. Come prepared for field trips with notebook, colored pencils, etc. as you would for class, in addition, proper footwear and clothing are required. If you are in doubt as to what to bring on a field trip it is your responsibility to ask. If you have a safety or health concern on a field trip it is your responsibility to notify me at an appropriate time. Please do not do things that are well out of your comfort zone because you think you have to, make sure to discuss any issues with me.

**Food policy:** No food in the classroom (closed drinks are permitted: library policies are in effect).

**Internet use:** There are a great variety and number of resources related to this course available on the internet. You are encouraged to take advantage of them, but please be judicious and discerning as you select references for your assignments. Try to keep in mind what biases your sources may hold.

### Schedule: Topics, Exercises and Assigned Readings

\*\*\* Please note that the syllabus is a living document and that it will change (especially the assigned readings) as the block progresses– I will notify you if changes occur. \*\*\*

<b>Date</b>	<b>Topics Covered</b>	<b>Reading(s) / assignments</b> <i>(readings should be completed by the start of the class)</i>
<b>Feb 8</b>	<ul style="list-style-type: none"> <li>● Introduction to geology:               <ul style="list-style-type: none"> <li>● The rock cycle</li> <li>● Rocks and minerals</li> </ul> </li> <li>● Introduction to course and to each other               <ul style="list-style-type: none"> <li>● How does a physical scientist think?</li> <li>● Observation and hypotheses</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ Read: syllabus</li> <li>➤ Read: Rock classification guides (moodle)</li> <li>➤ Optional background reading (moodle): Grotzinger and Jordan Chapters 4,5,6 (<i>spend more time on chapters 4 and 5 and just look briefly at chapter 6</i>)</li> <li>➤ TA#1 handed out</li> </ul>
<b>Feb 9</b>	<ul style="list-style-type: none"> <li>● Field trip:               <ul style="list-style-type: none"> <li>● Uplift and intrusion</li> <li>● Age relationships</li> <li>● Deformation</li> <li>● Weathering</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ Read: Grotzinger and Jordan Chapters 1,2,3</li> <li>➤ Read TA#1 and ask questions!</li> </ul>
<b>Feb 10</b>	<ul style="list-style-type: none"> <li>● Structure of the earth</li> <li>● Layers of the earth</li> <li>● Intro to plate tectonics_</li> </ul>	<ul style="list-style-type: none"> <li>➤ Read: Grotzinger and Jordan Chapter 7</li> </ul>
<b>Feb 11</b>	<ul style="list-style-type: none"> <li>● Rock folding and faulting</li> <li>● Introduction to cross sections</li> </ul>	
<b>Feb 12</b>	<ul style="list-style-type: none"> <li>● Discuss and takeup TA#1               <ul style="list-style-type: none"> <li>● How does oil get into the ground?</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>➤ TA#1 due at the start of the class (remember that it must be handed in as a hard copy)</li> <li>➤ Quiz! (this is Q4 of TA1)</li> </ul>
<b>Feb 15</b>	<ul style="list-style-type: none"> <li>● PA#1 discussion               <ul style="list-style-type: none"> <li>● Intro to environmental disasters</li> </ul> </li> <li>● Intro to the deepwater</li> </ul>	<ul style="list-style-type: none"> <li>➤ PA#1 due</li> <li>➤ Introductory reading: Oil Spill Report: <a href="https://www.gpo.gov/fdsys/pkg/GPO-">https://www.gpo.gov/fdsys/pkg/GPO-</a></li> </ul>

	horizon	<p><a href="#">OILCOMMISSION/pdf/GPO-OILCOMMISSION.pdf</a> (try to spend ~30 minutes scanning this – DO NOT read it all!)</p> <p>➤ TA#2 will be handed out</p>
<b>Feb 16</b>	<ul style="list-style-type: none"> <li>● Intro to variables and box models</li> <li>● Mount Polley discussion</li> </ul>	<p>➤ Excel assignment due (optional)</p> <p>➤ Sunderland et al. (moodle)</p> <p>➤ Missing documents regarding panel report: <a href="http://www.bctwa.org/MtPolley-PrRel-Feb1-2015.pdf">http://www.bctwa.org/MtPolley-PrRel-Feb1-2015.pdf</a></p> <p>➤ Panel report site on cause of tailings pond breach: <a href="https://www.mountpolleyreviewpanel.ca/final-report">https://www.mountpolleyreviewpanel.ca/final-report</a></p> <p>➤ Link to Main document: <a href="https://www.mountpolleyreviewpanel.ca/sites/default/files/report/ReportonMountPolleyTailingsStorageFacilityBreach.pdf">https://www.mountpolleyreviewpanel.ca/sites/default/files/report/ReportonMountPolleyTailingsStorageFacilityBreach.pdf</a></p> <p>➤ For your reference: updates on monitoring actions in Mount Polley: <a href="http://www.imperialmetals.com/s/Mt_Polley_Update.asp?ReportID=671668">http://www.imperialmetals.com/s/Mt_Polley_Update.asp?ReportID=671668</a></p> <p>➤ For your reference: Brian Kynoch (Imperial Minerals President) speaks with media following spill: <a href="https://www.youtube.com/watch?v=7ckTMc7ySjA">https://www.youtube.com/watch?v=7ckTMc7ySjA</a></p>
<b>Feb 17</b>	<ul style="list-style-type: none"> <li>● Exponential decay</li> <li>● Fukushima plant discussion</li> </ul>	<p>➤ Nuclear video: <a href="https://www.youtube.com/watch?v=JMaEjEWL6PU">https://www.youtube.com/watch?v=JMaEjEWL6PU</a></p>
<b>Feb 18</b>	<ul style="list-style-type: none"> <li>● Example hydro talks</li> <li>● Stories with Stone</li> </ul>	<p>➤ We will have interviews for TA#2 (questions 1 through 4) from 8:30-10:30 and a shortened class starting at 10:30am</p>
<b>Feb 19</b>	<ul style="list-style-type: none"> <li>● TA #2 discussion</li> <li>● Introduction to reactive transport</li> <li>● Reactive transport models</li> </ul>	<p>➤ TA#2 due (final version)</p> <p>➤ <i>Be ready to present Q7 from TA#2</i></p>
<b>Feb 22</b>	<ul style="list-style-type: none"> <li>● Discussion on PA#2</li> <li>● Discussion regarding hydrocarbon development, LNG, pipelines, oil etc</li> <li>● Climate change intro</li> </ul>	<p>➤ <i>PA#2 due</i></p> <p>➤ TA#3 will be handed out</p>
<b>Feb 23</b>	<ul style="list-style-type: none"> <li>● Climate change continued</li> </ul>	<p>IPCC synthesis report: summary for policy-makers: <a href="http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf">http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf</a></p>
<b>Feb 24</b>	<ul style="list-style-type: none"> <li>● Earth's atmosphere</li> <li>● Emissions</li> </ul>	<p>➤ Read at least 20 pages of the full IPCC synthesis report: <a href="http://www.ipcc.ch/report/ar5/syr/">http://www.ipcc.ch/report/ar5/syr/</a></p> <p>➤ For your reference: really good climate science basics overview: <a href="http://pics.uvic.ca/education/climate-insights-">http://pics.uvic.ca/education/climate-insights-</a></p>

		<a href="#">101#quicktabs-climate_insights_101=0</a>
<b>Feb 25</b>	<ul style="list-style-type: none"> <li>● FIELD TRIP</li> <li>● Climate change and climate impacts around Squamish</li> </ul>	➤ FA1 1 will be handed out
<b>Feb 26</b>	Climate Science cont'd	➤ TA3 due
<b>Feb 29</b>	<ul style="list-style-type: none"> <li>● Petroluem in Canada</li> <li>● Land auction</li> <li>● Final assignment discussion</li> </ul>	➤ FA1 due at the start of class
<b>Mar 1</b>	● Land auction part 2: responsible development	➤ FA2 due at 12:00pm
<b>Mar 2</b>	<ul style="list-style-type: none"> <li>● FINAL CLASS MEETING</li> <li>● Earth science and the future</li> <li>● Sound environmental policy</li> </ul>	➤ ZA-6000 ( <i>aka final quiz</i> )
<i>Happy b2 OoKbR EaK!</i>		

**Overview of due dates and field trips.**

(Note that this is only for your reference and may NOT be updated when changes are made to the syllabus – please refer to the detailed overview above!!!):

2016: Spring block 2: organized by days (1-18)						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
<b>1</b>	<b>2</b> FIELD TRIP	<b>3</b>	<b>4</b>	<b>5</b> TA1 due		
<b>6</b> PA1 due	<b>7</b> EA due	<b>8</b>	<b>9</b>	<b>10</b> TA2 due		
<b>11</b> PA2 due	<b>12</b>	<b>13</b>	<b>14</b> FIELD TRIP	<b>15</b> TA3 due		
<b>16</b> FA1 due	<b>17</b> FA2 due (in class)	<b>18</b> ZA-6000 (test)				

Week of Feb 8  
Week of Feb 15  
Week of Feb 22  
Week of Feb 29