



**School of Arts & Science
CHEMISTRY AND GEOSCIENCE DEPARTMENT**

**GEOS 100-001
Physical Geology
Environmental Geology Emphasis
Winter 2009**

COURSE OUTLINE

The Approved Course Description is repeated here from the College web site

GEOS 100 Physical Geology

- (4 credits) F, W (3,3,0,0)

The origin, composition, age, and processes of Earth are introduced. We study mineral and rock composition, and properties, rock-forming processes, geologic structures, earthquakes, and the plate tectonic model. We apply this knowledge to the geology of BC. A weekend field trip is optional. Previous study of chemistry is an asset. (T)

Prerequisite(s): English 12 **or** assessment.

Ω Please note: this outline will be electronically stored for five (5) years only.
It is strongly recommended students keep this outline for your records.

1. Instructor Information

(a)	Instructor:	Dr. Tark Hamilton		
(b)	Office Hours:	11:30-12:20 M,W,F; 1:30-2:20 M,T,F;		
(c)	Location:	Fisher 344A (M-T-W-F)		
(d)	Phone:	250-370-3331	Alternative Phone:	
(e)	Email:	hamilta@camosun.bc.ca		
(f)	Website:	Under construction		

2. Intended Learning Outcomes

Upon completion of this course the student will be able to:

1. Analyze minerals for common physical properties.
2. Identify common rock-forming minerals on the basis of their properties.
3. Infer how samples of some rocks have formed.
4. Infer the relationship of rock-forming processes to plate tectonics.
5. Describe and interpret textural features of rocks.
6. Describe compositional features of rocks.
7. Classify common rocks based on texture and composition.
8. Apply techniques to determine the chronological order of events in Earth's history.
9. Calculate absolute ages of Earth materials and events.
10. Identify common geologic structures and use symbols to represent such structures on maps.
11. Identify, describe and interpret geological structures in three dimensions.

12. Determine the relationship of geological structures and plate tectonic boundaries.
13. Determine the location of an earthquake from seismic data.
14. Use seismograms to infer relative earth movements on faults.
15. Relate the nature and distribution of major earth features such as mountains, volcanoes and earthquakes to plate tectonics.

3. Required Materials

(a) Required Texts

Canadian Edition **Earth: An Introduction to Physical Geology**, E.J. Tarbuck, F.K. Lutgens, C.J. Tsujita & S. R. Hickock 2nd ed. Prentice Hall 2009. (Note: this is a new book with >40% new content and Canadian examples. All of my test questions are based on this text. The 1st edition without Hickock is also adequate)

Laboratory Manual in Physical Geology, AGI, 8th edition of Busch and Tasa

Recommended reading of other geology texts, a geological glossary (dictionary), a mineral identification book and web based research, readings, real and virtual field trips.

Earth: Animations Library on CD ROM (available in new packaged edition only)

(b) Other

Hand lens (needed in first 4 labs and field trips), protractor, drawing compass, coloured pencils (all needed for labs 4 onward for drawing and colouring).
2 half day weekend field trips are required on a Saturday or a Sunday, announced 2 weeks in advance. These integrate your course learning with field observations.

4. Course Content and Schedule

Instruction 14 weeks

Classroom 3 hours 10:30-11:20: Mon Wed & Fri F300

Lab 3 hours Tues – 2:30 am -5:20 pm F300 (**Lab attendance is mandatory, you must pass the lab to pass the course**)

Labs are due at the beginning of the following lab the week following their issue. If you ask in advance you might be able to attend my other lab section Thursday at 10:30-11:20 but be sure you ask as the 2 labs might be a week apart (either before or after this section). There are no make up labs. Access to F300 is limited, use your lab time efficiently, most labs require 1 hour of reading **prior to coming to the lab** and 2-3 hours after the lab on your own to complete the exercises.

Local Field Trips during lab time & 2 weekend 1 day trips **required** 2 weeks notice. One will be on a Saturday, the other on a Sunday.

5. Basis of Student Assessment (Weighting)

(Should be linked directly to learning outcomes.)

- (a) **Lab exercises** (due in lab at the beginning of the following lab period) 11 X 2.5% (out of 10). There will not be time to work on old labs as there will always be new work assigned.
- (b) **3 Lab tests (1 hour practicums in lab along with lab assignments in weeks 7, 11 and 14 covering: (mineral physical properties, formulas & identification), (rock identification and origin), and (tectonic, structural and seismic problems) 5%, 5%, 5%. Labs and lab tests combine to 25% of course**

- (c) **Written exams** Wk5: 10%, Wk9: 15%, Wk13: 25% covering lectures to week prior to test
- (d) **Weekly pop quizzes on assigned readings, new geological vocabulary terms and prior lecture notes may occur at beginning of each lab period or during Wednesday class.**
- (e) **Remedial short paper if needed on the science and technology in a pre- approved refereed geological journal article due wk8. 5%**
- (f) **Final exam cumulative as scheduled 25%. If there is no exam 3, the points will be added to the final.**
- (g) **I have a 1 test forgiveness policy for those who improve their test scores. For example, If you do better on the final exam than a prior exam I will replace the lower mark and its proportion with the mark from your final exam.**

6. Grading System

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at camosun.ca or information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy

E-1.5 at camosun.ca for information on conversion to final grades, and for additional information on student record and transcript notations.

7. Sequence of topics (subject to modification and repetition): Local field trips may occur in a given lab period on short notice.

Week 1: Lab 1 AGI Manual: Observations, Hypotheses, Specific Gravity, Isostasy and the Figure of the Earth.

Lectures from Ch1 in Earth + preface and CD ROM, Ch.1 (all) & Ch 20 (522-566)
Intro: Geo-hazards, Earth systems, environment and processes, Resources & population. Internal processes, heat engine and plate tectonics. External (surficial processes) Errors, Scales of Observations and Hypothesis Testing, The notion of "Deep Time", Isostasy, Planetary Geology and differences compared to other planets.

Week 2: Lab 2 AGI Manual: Plate Tectonics, Plate Motions and the Origins of Magma.

Lectures: complete Ch 1 and Ch 12 & portions of 11 (on the seafloor) and 13 (mountain building and isostasy)

Week 3: (Lab 3 –Minerals identification by physical properties, introduction to 50 common minerals)

Lectures: Complete Plate Tectonics (Ch 1, 12, 13) and Ch 2 (p.33-60) on Chemistry of the Earth. Matter & minerals: Elements, atoms, ions and isotopes, Mineral compositions, crystal structure & physical properties. Minerals versus ores, Mineral environments, assemblages, resources and uses

Week 4: (Lab 3 –Minerals identification by physical properties, introduction to 50 common minerals continued)

Lectures: Ch 2 & 20 Matter & minerals: Abundant rock forming minerals, silicates, Economic minerals & ores, gems. Mineral environments, assemblages & resources

Week 5: Midterm Theory Exam #1 (Covering Ch: 1, 2, 12 and portions of 11,13, 20) in 1st hour of lab and (Study 50 Minerals from last week, and do Lab 4 - Introduction to the 3 principal Rock types, their formative environments and the Rock Cycle)

Lectures: Ch 3, 4 & 20 (p. 523-530) Melting in the Earth, Igneous settings, Magma types & physical properties, Classification of Igneous rocks (textures & compositions), Naming volcanoes & plutons, and igneous mineral resources, Volcanism, influence on atmosphere, oceans and global cycles, volcanic activity & landforms, textures, hazards, Cascades Volcanic Arc, Juan de Fuca Spreading Centre, Hotspots & **Ch 20 p. 564** geothermal resources.

Week 6: Lab 5: Igneous Rocks and Volcanic Hazards

Lectures: Rocks and Water! Ch 5 Introduction to Weathering, Chemical & Mechanical, Weathering environments, Climates & soils. **Ch 14** Mass wasting & Geohazards, **Ch 15** Running Water & sediment transport. **Ch 16** Ground Water, aquifers, water table, flow, pollution & remediation.

Week 7: Lab Quiz 1 on 20 of 50 minerals in first part of 80 minutes of lab (No late comers or you will miss your chance to do the quiz). Complete and hand in Lab 5 Igneous Rocks and Volcanic Hazards on your own in remainder of period.

Lectures: Ch 6 & 17-19 inclusive Sedimentary processes, environments, sediments, facies, rock types and resources. Sediments to sedimentary rocks: compaction, dewatering & cementation. Fossils and fossilization. **Ch.8** Geologic time: relative and absolute, geologic dating techniques (***Lab 8 as home work on your own***)

Week 8: Lab 6 Sedimentary Rocks, Processes & Environments

Lectures: Ch 7 & Ch 20 p. 530, 531, 542 Metamorphism, Regional, Contact and Cataclastic, metamorphic rocks settings (continental shields, core complexes, plate margin mobile belts, aureoles, impacts & faults), Textures and tectonic environments, Naming metamorphic rocks, Importance of starting composition (protolith), pressure, temperature, volatiles & strain rate. Skarns, Hydrothermal Systems, Metamorphic resources.

Week 9: Midterm Exam 2 (Covering Ch: 3, 4, 5, 6 and portions of 14-19) in 1st part of lab followed by Lab 7: Metamorphic Rocks, Processes & Resources and a mapping exercise on local metamorphic facies from Victoria's Eocene Subduction zone.

Lectures: Ch 8 Geologic Time, The time scale, Fossils and ages, Relative Dating, Absolute Radiometric Dating, Radioactivity, Heat & Isotope Clocks, Datable materials and their age spans

Week 10: Demonstration of Radioactivity & Lab 8 Dating of Rocks, Fossils and Geological Events. Finish this lab and hand in by start of lectures the following week.

Lectures: Ch 9 Crustal Deformation, Geological Structures, Folds, Faults, Tectonic settings, Portions of Ch 11 on MOR's, Transform Faults, Accretionary Wedges and Trenches and Ch 13 on Mountain Belts and Orogens

Week 11: Lab Quiz 2 on 20 of 50 Rocks Thursday Nov 13. Do not be late, no late entries or you miss the quiz. Finish Lab 8 on your own and hand it in by Nov 13. Start Lab 10 on your own as you cannot finish it in lab next week.

Lectures: Ch 10: Earthquakes (types, recurrence, location, effects, tectonic settings, earthquakes in Western Canada) Seismology, Geophysics & the Earth's Internal Structure (layers, discontinuities, phase changes, heat transfer and mantle convection), Melt zones, Geomagnetism and the Core Dynamo, Magnetic Reversals.

Week 12: Lab 10: Geological Structures, Maps and block diagrams. There is a special map exercise on the Canadian Rockies that can only be done in lab period so leave an hour for this alone.

Lectures: Ch 10 continued. Geophysics of the Earth, The Cold War and the Plate Tectonics Paradigm shift, Building the New Tectonics from Continental Drift and Seafloor Spreading. Mantle Convection as the heat engine for geological processes.

Week 13 Midterm 3: Ch 7-10 inclusive. Lab 16 Earthquakes, Seismology and Hazards. Finish on your own and hand in by next lecture period.

Lectures: Complete text material and off book lectures and handouts for the development of the geology of Canada.

Week 14: Lab Quiz 3 on Time, Block Diagrams, Earthquakes and Tectonics

And Supplemental Lecture notes on: Canadian Geology, The Tectono-stratigraphic Terrane concept and the development of the geology of the Canadian Cordillera

Final Exam as scheduled by Registration Comprehensive on all course material.

8. Course purpose:

-To acquaint you with the physical make up of the solid mineral and rock matter and natural processes on and within the Earth with an emphasis on Canadian environments and resources. Always ask yourself what each topic has to do with: resources, hazards and the environment.

-To acquaint you with the vocabulary and processes of Earth science. You should learn to look at the world around you and see it with new critical and appreciative eyes. You should be able to appraise your local surroundings for intermittent and ongoing geological processes and hazards. You should be capable of hearing, seeing or reading scientific articles with understanding and appreciation.

-To make you a better informed citizen and capable of understanding Earth science issues as they relate to public policy, resource usage and the environment. What do you think about Canada being a net exporter of Conventional and Heavy Oil, Gas, Coal. Uranium, Iron, Copper, Asbestos? Should we export our fresh water? How does our resource extraction and use affect the environment? Should I buy vacation property at sea level on the West coast?

“Civilization exists by geological consent!” Mark Twain

Out of courtesy to people with asthma and other chemical sensitivities. No scented body products are permitted on the 3rd floor of Fisher. This is a scent free zone.

9. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College calendar, at Student Services or the College web site at camosun.ca.

STUDENT CONDUCT POLICY

There is a Student Conduct Policy **which includes plagiarism**. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, at Student Services and on the College web site in the Policy Section.