Syllabus: G201 - Physical Geology

Portland Community College (Sylvania Campus)
Fall 2008

Course web site < http://spot.pcc.edu/~fgransha/G201 >

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Instructor Comments:

Welcome to G201 Physical Geology. Included with these comments is a schedule of the schedule for the course, my policies, and some other helpful information.

What you will be doing and how I grade…
Listed below is the work you will be handing in during the quarter and its value. I grade on the basis of accumulated points rather than on a curve. * Subject to change as needed.

Mid-term exam	100 pts	100 - 90% of max pts = A
Final exam	150 pts	89 - 80% of max pts = B
Labs	10 x 20 pts each = 200 pts	79 – 70% of max pts = C
Discussion activities	11 x 5 pts each = 55 pts*	69 – 60% of max pts = D
Total	530 pts (max.)*	Less than 60% max pts = F

Attendance, missed labs and exams, late work…

- Though I seldom take attendance and don't grade for it you are strongly encouraged to attend all lectures and lab.
- If emergencies come up that prevent you from attending a lab or exam, contact me as soon as possible to make arrangements to make-up what you missed. You will have one week to make-up the lab or exam.
- Late labs are discounted 15%. Labs more than one week late are not accepted.

If you have questions, concerns, or comments during the quarter, don't hesitate to contact me. I am here to help. Enjoy and good luck!

Text and other Required Materials:

- Chernicoff, S., and Whitney, D., 2007, *Geology, an Introduction to Physical Geology (Custom Edition for Portland Community College)*.
- Busch, R.M. and Tasa, D.; 2007; *Laboratory Manual in Physical Geology*; 7th edition;
- Pearson/Prentice Hall
- Tracing paper
- A set of colored pencils
- Ruler and protractor

Course Meeting Times and Places:

- *Lecture* – Monday and Wednesday 13:00 –14:20 in ST309
- *Lab* – Tuesday 11:00 -13:50 or 14:00 – 16:50 in ST317

Course Schedule

(Lecture, readings, labs, and exams)

Note – Lab write-ups are always due the week after they are assigned.

Week 1	*Topic:*	The science of geology
9/22	Reading:	Chernicoff and Whitney, chapter 1
	Lab:	Busch and Tasa, *Observing and measuring earth materials and processes*
Week 2	*Topic:*	Geologic materials and processes
9/29	*Reading:*	Chernicoff and Whitney. chapters 1 and 2 (pages 38-46)
	Lab:	Busch and Tasa, *Rock forming processes and the rock cycle*
Week 3	*Topic:*	Minerals and mineral formation
10/6	*Reading:*	Chernicoff and Whitney. chapter 2 (pages 46-68)
	Lab:	Busch and Tasa, *Mineral properties uses and identification*
Week 4	*Topic:*	Igneous Rocks and processes
10/13	*Readings:*	Chernicoff and Whitney, chapters 3 and 4
	Lab:	Busch and Tasa, *Igenous rocks and volcanic hazards*
Week 5	*Topic:*	Sediments and weathering
10/20	*Readings:*	Chernicoff and Whitney, chapter 5
	Lab:	Riegel, *Weathering* (Handout to be provided)

MID-TERM EXAM (Wednesday, 10/22)

Week 6	*Topic:*	Sedimentary rocks and processes (No class on Weds. 10/29)
10/27	*Readings:*	Chernicoff and Whitney, chapter 6
	Lab:	Busch and Tasa, *Sedimentary rocks, processes, and environments*
Week 7	*Topic:*	Metamorphic rocks and processes
11/3	*Readings:*	Chernicoff and Whitney, chapter 7
	Lab:	Busch and Tasa, *Metamorphic rocks, processes, and resources*
Week 8	*Topic:*	Earth structures
11/10	*Readings:*	Chernicoff and Whitney, chapter 9
	Lab:	No lab this week (Veteran's Day)
Week 9	*Topic:*	Earthquakes and the earth's interior
11/17	*Reading:*	Chernicoff and Whitney, chapters 10 and 11
	Lab:	Busch and Tasa, *Earthquake hazards and human risks*
Week 10	*Topic:*	Plate tectonics
11/24	*Reading:*	Chernicoff and Whitney, chapter 12
	Lab:	Busch and Tasa, *Plate tectonics and the Origin of Magma*
Week 11	*Topic:*	Geologic time
12/1	*Reading:*	Chernicoff and Whitney, chapter 8
	Lab:	*Granshaw, Geology and Time*

FINAL EXAM (Monday, 12/8 13:00-15:00)

Course objectives

(What you should be able to do upon completing this course)

Major Geologic ideas

1. Define geology.
2. Identify the principle questions geologists seek to answer and the steps they use to address these questions.
3. Identify at four instances in human affairs (your personal life and local affairs) where geology comes into play.
4. Identify two situations in which the methods used by geologists and other scientists might be applied to something in your own life.
5. Explain what a system is, distinguish between an open and closed system, and explain how material cycling and energy flows produce changes in systems.
6. Explain the role of earth systems theory, the concept of the geologic cycle, geomorphic change, evolution, and "deep time" in contemporary geologic thinking.
7. Explain plate tectonic theory, by doing the following:
    a. List the major concepts in the theory.
    b. List and explain the evidence for the theory.
    c. Describe the major types of crust in terms of thickness and composition.
    d. Describe the major types of plate boundaries in terms of types of movement and that occurs at each boundary and the landforms associated with them.
8. Explain the geologic (rock) cycle, by doing the following
    a. Explain what the concept says about the nature of the materials that make up the earth's crust.
    b. Identify and describe major types of material included in the cycle
    c. Identify and describe the processes that shape these materials.

Minerals

1. Define a mineral, by doing the following:
   a. Write a definition for a mineral
   b. List and describe the major physical and chemical properties of a mineral.
   c. Explain how each of these properties is tested.
2. List and describe the ways a mineral is formed
3. Explain how minerals are grouped according to chemical composition
4. Describe the crystalline structure of minerals in terms of crystal forms and atomic structure.
5. Distinguish between a mineral and a mineraloid.
6. Identify and classify the following minerals:
   Amphibole (Hornblende), Biotite, Calcite, Chalcopyrite, Chlorite, Dolomite, Fluorite, Galena, Garnet, Graphite, Gypsum, Halite, Hematite, Kaolinite, Limonite, Magnetite, Muscovite, Olivine, Opal, Plagioclase feldspar, Potassium feldspar, Pyrite, Pyroxene (Augite), Quartz, Serpentine, and Sphalerite.

Igneous Rocks

1. Define an igneous rock, by doing the following:
   a. Write a definition for a igneous rock
   b. Distinguish between an intrusive and extrusive igneous rock
   c. Distinguish between a felsic, intermediate, mafic, and ultramafic igneous rock.
2. Explain how an igneous rock is formed, by doing the following:

a. Draw a diagram that shows the major steps involved in the formation of an igneous rock.
b. Identify and describe the major volcanic and plutonic landforms
c. Determine what igneous rocks are associated with each type of landform.

3. Describe the various textures of an igneous rock. Use the texture of an igneous rock to interpret its history.
4. Identify the major rock forming minerals that makeup igneous rocks.
5. Identify and classify the following igneous rocks:
   Granite, rhyolite, diorite, andesite, gabbro, basalt, peridotite, obsidian, pumice, and tuff.

Sedimentary Rocks

1. Define a sedimentary rock, by doing the following:
   a. Write a definition for a sedimentary rock
   b. Distinguish between a detrital and biochemical sedimentary rock.
2. Explain how a sedimentary rock is formed, by doing the following...
   a. Create a diagram showing the major steps involved in the formation of a sedimentary rock.
   b. Identify the major types of sediments that makeup sedimentary rocks
   c. Identify the type of depositional environment corresponds with each type of sediment.
3. Describe the various textures of a sedimentary rock. Use the texture of a sedimentary rock to interpret its history.
4. Describe the various rock structures found in bodies of sedimentary rock. Use these structures to interpret the history of a body of sedimentary rock.
5. Identify and classify the following sedimentary rocks
   Sandstone, shale, mudstone, siltstone, conglomerate, breccia, limestone, dolostone, rock salt, rock gypsum, diatomite, and coal.

Metamorphic Rocks

1. Define a metamorphic rock, by doing the following:
   a. Write a definition for a metamorphic rock
   b. Distinguish between foliated and unfoliated metamorphic rocks
2. Explain how a metamorphic rock is formed, by doing the following:
   a. Write a description of the different mechanisms by which metamorphic rocks form.
   b. Construct a diagram showing the metamorphism of several major igneous and sedimentary rocks.
3. Describe the various textures of a metamorphic rock. Use the texture of a metamorphic rock to interpret its history.
4. Identify the following metamorphic rocks
   Schist, gneiss, phyllite, metaconglomerate, quartzite, slate, marble, and serpentinite

The structure of the earth's crust

1. Identify the following features on a series of ground photographs. Describe what each one is: Bed, dip, fault, fold, and strike.
2. Explain what a geologic map and cross-section are.
3. Identify the following features on a geologic map and cross-section: Describe what each one is: Anticline, normal fault, fault, slip-strike fault, thrust fault.
4. Distinguish between an open, asymmetric, overturned, and recumbent fold.
5. Distinguish between stress and strain.
6. Explain the three major stresses that act on rock bodies (compression, extension, and shearing) and relate each type of stress to the features listed in objectives 3 and 4.
7. Explain how the movement of crustal plates relates to these deformational stresses.

8. Distinguish between fold-and-thrust, fault-block, and upwarped mountain ranges. Relate these mountain types to crustal plate movement and the deformational stresses mentioned in objective 3.6.

Earthquakes and the structure of the earth's interior

1. Explain what an earthquake is.
2. Draw a block diagram of an earthquake produced by slippage along a fault. Identify and describe the following on this diagram: Body waves, epicenter, fault, fault trace, focus, and surface waves.
3. Distinguish between a body and a surface wave, and between an S and a P wave.
4. Describe the types of equipment used for measuring earthquake intensity and magnitude.
5. Explain how the Mercalli, Richter, and Moment-magnitude scales work.
6. Explain how to locate an earthquake epicenter.
7. Define the following types of damage done by an earthquake and explain what determines the extent of damage done in each case: Building destruction, flooding from tsunamis or seiches, liquefaction, slope failure.
8. List and identify the major techniques for identifying earthquakes.
9. Identify the earth's major earthquake zones on a map of the world and explain the relationship between these zones and movement of the earth's crust.
10. Explain how natural or artificial earthquakes are used to map the structure of the earth's crust and deep interior. In your discussion emphasize seismic reflection and refraction, as well as seismic tomography.
11. Describe the major regions of the earth's interior that has been mapped using earthquakes. Describe each region in terms of its size, composition, and physical properties (temperature, density, and pressure).

Plate tectonics

1. Distinguish between the theories of continental drift, seafloor spreading, and plate tectonics.
2. List and describe the evidence for each theory.
3. Explain how mapping hotspots and magnetic reversals, as well as satellite tracking is used to measure plate movement.
4. Explain the role that rifting, subduction, and shearing play in the development of ocean basins.
5. Explain the role that rifting, subduction, and shearing play in the development of continents.
6. Describe the major theories used to explain the movement of crustal plates. List the strengths and weaknesses of each theory.

Geologic Time and Dating

1. Describe the assumptions used by mainstream geologists to construct geologic histories.
2. Explain how stratigraphy (the shape and order of rock layers) is used to construct a geologic history for the area in which the layers are found.
3. Explain how radiometric dating, dendrochronology, lichenometry, fossil correlation, bracketing, and magnetic polarity are used to determine the approximate date of a geologic event or set of events.