

Grays Harbor College
Syllabus

Geol& 101 - Physical Geology
5 Credits

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I. Course Description:

Geology 101, Physical Geology, 5 Credits

Prerequisites: Math 095 or placement in Math 098.

Recommended Preparation: English 095 or placement in English 101

A study of the Earth, its materials, the development of land forms and the geologic processes involved. Common rocks and minerals, and topographic maps are studied in the laboratory. Satisfies science or lab area D distribution requirement or specified elective for the AA degree.

4 lecture hours; 2 lab hours

II. Aims and Objectives:

The major aims and objectives of this course are as follows:

- A. To develop critical thinking skills and to expose students to the scientific process and the scientific method.
- B. To help provide students the skills needed to continue learning throughout their lives.
- C. To introduce the student to basic concepts of the terrestrial environment. These include its age, composition, structure, and the processes that continually shape the surface of the planet.
- D. To develop an awareness and appreciation of our natural surroundings.
- E. The identification of common rocks and minerals the use of geologic maps, earthquakes and geologic structures are major topics studied in the lab.

III. Desired Student Abilities:

1. Competency in the discipline

Many students take this course to fulfill a science requirement or as an elective. However, there are a few students in geology and related fields (for example, natural resources and forestry) who will use the material learned in this course in their future studies or careers. For these students it is clearly important to cover the material in a physical geology course. In addition, as noted above, it is hoped that all students will learn something about the terrestrial environment and gain a greater appreciation of our natural surroundings. The various areas which are studied are noted in the section on course content below. These all relate to this area of desired student abilities.

2. Literacy

Several areas of the course relate to this desired ability. While the use of math in this course is not extensive, there are areas where math is used (particularly in the discussion of radiometric dating). These provide students some practice in developing their mathematical skills. These labs, quizzes, and tests will all require short written answers to questions. These should help students develop their literacy skills in making concise, organized, and logical written arguments.

3. Critical thinking

Of all the desired abilities, critical thinking is perhaps the area which can be best addressed in a science course for nonscience majors. While technically this course is a majors course, as noted above, most of the students taking this course take it as an elective or to satisfy a science distribution requirements. With the nonscience majors in mind (but also useful for the science majors) in the course, one of the major themes of the course is how the scientific process works and the scientific method. In many ways thinking scientifically is to think critically and thus the study of the scientific process and scientific method provides students exposure to critical thinking. In this course two specific studies of the “scientific method in action” are discussed in the course (examining the origin of the moon and the development of plate tectonics). In addition to these specific examples the scientific method and how geologists have used it to determine what we know about the Earth underlies our study of many areas of the course. All of these studies provide examples of examining a phenomenon critically and hopefully will help develop such critical thinking skills in the students.

4. Social and personal responsibility

In this class students are required to turn in various assignments on time and to be courteous of their fellow students (a small portion of the grade is based on “class citizenship” as noted below). In addition students will in general work with one or more lab partners in the lab portion of this course. These lab exercises will give students experience working with others.

5. Use of resources

It is not anticipated that this course will make extensive use of resources outside the class. However students will be expected to find information in their textbooks. In addition extra credit assignments where students find and summarize interesting articles on geology may be given.

IV. Technique of Instruction:

This course will meet for 4 one-hour lecture sessions per week and one 2 hour lab. Most classes will be taught using a lecture format. Student questions will be encouraged. However, geology is a visual science. Thus, slides will be used in numerous class sessions. A field trip to Mt. St. Helens is planned for the fall quarter. In lab rocks and minerals will be studied as will topographic maps. In addition, a walk around campus exploring the geology we see on campus is planned. Field trips to local geologic features may also be done. A midterm and final will be given. Quizzes will be given about once a week and will be announced ahead of time.

V. Organization of Course Content:

A. Introduction

1. Overview of the Earth
2. Historical development of geology—ideas of James Hutton.
3. The Scientific Method in Action:
 - Formation of the Earth–Moon system.
 - Historical development of the theory of plate tectonics.

B. Minerals

1. Characteristics which define minerals.
2. Atoms and different bonds seen in minerals.
3. Characteristics used to identify minerals.
4. Properties of common minerals
 - Silicates
 - Nonsilicates

V. Organization of Course Content continued:

C. Rocks

1. Major categories of rocks—the rock cycle
2. Igneous Rocks and processes
 - Creation and solidification of magma—Bowen's Reaction Series
 - Classification of igneous rocks
 - Volcanism
 - Volcanic landforms
 - Volcanic processes and products
 - Intrusive igneous structures
 - Shallow features—Sills and dikes etc.
 - Deep intrusive structures
 - Viscosity of magma/lava and how it controls the structures we see.
3. Sedimentary Rocks and Processes
 - Weathering
 - Mechanical
 - Chemical
 - Soils
 - Transportation and erosion
 - Lithification of sedimentary rocks
 - Classification of sedimentary rocks
 - Stratigraphy and reading geologic history from sedimentary structures.
4. Metamorphic Rocks and Processes
 - Factors which promote metamorphism
 - Pressure
 - Temperature
 - Chemically active fluids
 - Types of metamorphism
 - Classification of metamorphic rocks

D. Geologic Time

1. Relative dating
 - Principle of uniformitarianism
 - Principle of original horizontality
 - Principle of superposition
 - Principle of cross-cutting relationships
 - Principle of inclusions
 - Principle of faunal succession
 - Unconformities
 - Nonconformities
 - Angular unconformities
 - Disconformities
 - Correlations
2. Absolute Dating Techniques
 - Radiometric dating
 - Other dating techniques
3. The geologic time scale
4. Age of the Earth

V. Organization of Course Content continued:

E. Structures

1. Stress and strain
2. Processes of deformation of rocks.
3. Folds
4. Faults
 - Strike-slip faults
 - Normal faults
 - Reverse faults

F. Earthquakes

1. Generation of seismic waves
2. Seismology and the interior of the Earth
3. Locating earthquakes

G. Plate Tectonics

H. Rivers

1. Transport and erosion of material by rivers
2. River landscapes and their development
3. Concept of the graded river
4. River types—Braided and meandering
5. Patterns and types of drainage systems
 - Superposed streams
 - Antecedent streams

I. Geology of the Olympic Peninsula

VI. Methods of Evaluation

The course grade will be determined based on the weekly quizzes, lab assignments, a midterm, final and “class citizenship.” Students will be guaranteed of getting at least the grades corresponding to the following percentage scores, they may be given higher scores:

		84–87%	B+	74–77%	C+	60–65%	D+
90–100%	A	80–84%	B	70–74%	C	50–60%	D
87–90%	A–	77–80%	B–	65–70%	C–		

The weight given to each area is as follows:

Quizzes(20%): Weekly roughly 20-25 minute quizzes will be given except during the week of the midterm and the week following the midterm. These will usually be on Mondays (or Tuesday if Monday is a holiday—if not the date will be announced ahead of time). The two lowest quiz scores will be dropped. Because the two lowest scores will be dropped no make-ups will be given. Students are allowed to earn an extra credit point for each quiz by submitting a proposed multiple choice question for the quiz by the Friday before the quiz is given. In case of duplicate submissions, the student submitting the question first will receive the bonus point.

Laboratory Exercises(20%): This portion of the grade will be determined from your laboratory reports and exercises.

Midterm(20%): One midterm will be given. The exact date will be announced ahead of time. The midterm is closed-book. However, you will be allowed to bring one 4" × 6" note card containing any information you wish to the test. If you cannot make the midterm, arrangements can only be made for a make-up test if you contact me *prior* to the exam (or if you miss the midterm due to an unforeseen circumstance as soon as possible). Students can earn up to two extra credit points on the midterm by submitting up to two proposed multiple choice problems for the midterm by the Friday before the midterm is given. In case of duplicate submissions, the student submitting the question first will receive the bonus point(s).

VI. Methods of evaluation continued:

Final(34%): The final will be comprehensive (covering all areas in the course). As with the midterm the final is closed-book but you may bring two 4" × 6" note cards containing any information you wish. Students can earn up to two extra credit points on the final by submitting up to two proposed multiple choice problems for the final by Friday, December 7. In case of duplicate submissions, the student submitting the question first will receive the bonus point(s).

Office Hour Visit Assignment (1%): In an effort to better serve you, I would like to meet with everybody one-on-one sometime during the second to third week of the course. I hope this will allow me to get to know you (and you me) better and for me to better understand what you hope to get out of the course and to discuss any difficulties you may be having or suggestions you have to improve the course.

“Class Citizenship” (5%): This portion of the grade will depend on a number of factors. First and foremost it is expected that you will be considerate of your fellow students and me. You won't come to class late, will be prepared when you arrive and won't engage in behavior which disturbs the class hindering your fellow students' ability to learn. You have all paid for the opportunity to be in this class, if you decide not to avail yourself of the opportunity to come to class, fine (attendance is not required), but do not prevent others from getting their money's worth! If I have to warn you twice during a class to be quiet I will ask you to leave for the day. If I have to warn you three times during the quarter I may ask you to not come back to class permanently.

In addition to the above, cheating will not be tolerated. If you are caught cheating you may lose class citizenship points and at the very least you can expect to get a zero on the assignment and quite possibly for the course. Depending on the infraction additional disciplinary action may be sought.

Review Problems: During the quarter I will be providing you with review problems on the material we will be covering. I encourage you to examine these as they will be helpful in preparing for the tests and quizzes. As additional incentive, I will collect these often (2-3 times per week). While it is possible to get 100% in the course without turning in the review problems, turning these in can only improve your grade and will reduce the importance of the tests and quizzes in this course. For example, if you got 100% on all of these review sheets the total percent of the grade would be reduced from 74% to 61.5% with the review sheets accounting for the remaining 12.5%. Performing less of the exercises will result in a smaller reduction in the importance of the tests. The exact procedure used is described on the next page.

Procedure for determining influence of review sheets on the grade

Without the review sheet questions, the average score based on the quizzes, midterm, and final would be given by:

$$\text{Total Test \% score} = \frac{0.20 \times \%_{\text{Quiz}} + 0.20 \times \%_{\text{Midterm}} + 0.34 \times \%_{\text{Final}}}{0.20 + 0.20 + 0.34}$$

If a student has turned in review sheet questions this average will be calculated as follows:

$$\text{Total Test \% score} = \frac{0.20 \times \%_{\text{Quiz}} + 0.20 \times \%_{\text{Midterm}} + 0.34 \times \%_{\text{Final}} + 0.15 \times \%_{\text{Review Sheets}}}{0.20 + 0.20 + 0.34 + 0.15 \times (\%_{\text{Review Sheets}}/100)}$$

In essence work on the review sheets will be averaged into the test and quiz scores as a 100% score worth up to as much as 3/4 the midterm. Let us look at an example: You have done all the review sheets (earning 100% on these) but have unfortunately struggled on the tests (earning an average of 50% on these). In this case your % score on the tests and quizzes would become:

$$\text{Total Test \% score} = \frac{0.20 \times 50 + 0.20 \times 50 + 0.34 \times 50 + 0.15 \times 100}{0.20 + 0.20 + 0.34 + 0.15 \times (100/100)} = 58.4\%$$

The table below shows some further examples. To read the table find the column corresponding to the review sheet score and read down to the row corresponding to the tests & quiz score.

		% Score on Review Sheets				
		0	25	50	75	100
% Score on Tests & Quizzes						
	50	50.0	52.4	54.6	56.6	58.4
	75	75.0	76.2	77.3	78.3	79.2
	85	85.0	85.7	86.4	87.0	87.5

As can be seen the lower ones test and quiz scores the larger the benefit in doing the review sheets.