

Study Guide: Unit 1

The purpose of this study guide is to help you prepare for the first exam by focusing your studying and providing example essay questions. You will not be asked to submit this study guide for a grade.

In the **Focus On** section you will find the primary ideas that you should understand as you prepare for the first exam. The second section of this Study Guide is a set of example questions for the exam. We will use some of these questions as in-class problems for group work.

The crossword puzzles at the end may be helpful to study the terms. You can try the crossword puzzle as a test to see if you know the terms after reading the text. (The crossword puzzles are pretty primitive compared to the ones in the newspaper, but you may find them to be a helpful review. Answers that have more than one word are noted in the puzzle clues. There are no spaces between words)

PART I: Focus on:

Ch. 1:

- What are the three major types of plate boundaries?

Ch. 3 and 4:

- characteristics of basaltic, andesitic, and rhyolitic lavas and their viscosities
- the factors which control the viscosity of lavas/magmas. You should be able to apply those factors to help explain the characteristics of volcanic eruptions.
- interaction between the viscosity of a magma and the release of volcanic gases.
- relationship between the amount of silica in a magma and the tendency to form lava and/or pyroclastics
- connections between the types of volcanic rocks and the types of volcanoes
- similarities/differences between magma and lava
- the rock types in the volcanic (extrusive) group and the rock types of the plutonic (intrusive) group. For example, you should be able to recognize that basalt and gabbro originate from the same magma, but differ in the way they crystallize.
- characteristics of pyroclastic flows and the hazards they pose to people and property near a volcano
- cooling structures within lava flows, for example, columnar structures, pillows, and lava tubes. Should be able to explain how they form.
- fractional crystallization-- how does one magma generate volcanic eruptions with different silica contents?
- what happened at Mt. St. Helens in 1980? (The events that preceded the major eruption and what triggered the eruption.)
- when a mountain such as Rainier is dormant, is there a way to predict when it will erupt next?
- What was the main point of the movie and videotape footage shown in class?
- Use the in-class problems as a means to prepare for the questions on the exam. Make sure you understand the main point of the questions.

Ch. 5:

- what controls the amount of chemical and mechanical weathering
- the effects of different temperatures on hydrolysis
- the basic hydrolysis reaction presented in class
- differences and similarities between chemical and mechanical weathering
- rates of chemical weathering in various climates
- in the common igneous rocks types (such as granite, gabbro, rhyolite, basalt) which will weather fastest/slowest?
- hydrothermal alteration (such as the mudpots in Yellowstone and the alteration of andesite at Mt. Rainier)

PART II: Sample questions to prepare for the essay part of the first unit exam

These questions will help you prepare for the first exam. They are listed roughly in the order we will cover them in-class.

- 1. How does viscosity of the magma affect the nature of a volcanic eruption?
- 2. What is the role of the gases in magma in determining the character of an eruption?
- 3. In class we observed a movie about the Heimaey eruption in Iceland and a typical Hawaiian eruption. The Icelandic eruption had much more tephra and was more explosive than the Hawaiian eruption. Both of these eruptions were basaltic. Explain how two basaltic eruptions could be so different.

4a. What type of volcano is illustrated in the photograph to the right?

4b. How would you characterize a typical eruption from this volcano?

4c. What is the most likely silica content of this volcano?

(USGS photograph)



5. In class, we made the generalization that basaltic magmas normally form low viscosity lava flows and only minor amounts of tephra. However, most cinder cones are built of basaltic tephra. Explain the conditions under which basalt can erupt enough tephra to form cinder cones. (There should be two answers to this question.)

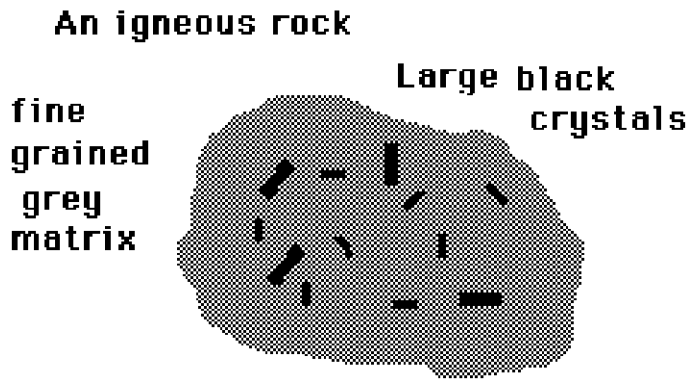
6. Complete the following chart:

Name	Silica content	Color	Viscosity
rhyolite	high		
basalt		darkest	lowest

7. Explain how you can determine whether an igneous rock cooled deep within the Earth or whether the rock cooled at or near the Earth's surface.

8. Why is it somewhat uncommon to find the plutonic equivalent of a mafic magma?

9. The illustration below is an igneous rock. What is the texture of this rock? If the groundmass of the rocks is gray and fine-grained, what type of rocks is this? What does this texture tell you about the cooling history of this rock?



10. What type of volcano is illustrate in the photograph to the right?

b. Describe a typical eruption from this type of volcano

c. What would be the most common silica content erupted from this type of volcano?



11. Explain how an intermediate lava flow could be erupted from a magma that was initially mafic in composition.

12. Volcano X started erupting 100,000 years ago. Its early eruptions were basaltic. About 50,000 years ago, the composition of the lavas and tephra erupted was andesite. A recent eruption (10 years ago) was a dacitic plug dome. Other than the introduction of different magmas, what reasons can you suggest to explain the change in composition of the volcanic materials erupted from Volcano X through time?

13. How might a person determine if an exposed layer of igneous rock is a sill or a lava flow covered by a later of rock?

14. Basalt may be found in dikes and sills. Is this statement true or false? Explain your choice.

15. You are on a vacation trip. In the distance you see a steep-sided conical hill which is about 600-800 feet higher than the land around it. You suspect this to be a volcano. What type of volcano do you think it is? Since you cannot go up to it and take a sample of the rock, what features could you look at through your binoculars to confirm that the hill is a volcano? (You should also be able to answer the same type of question using a topographic map!)

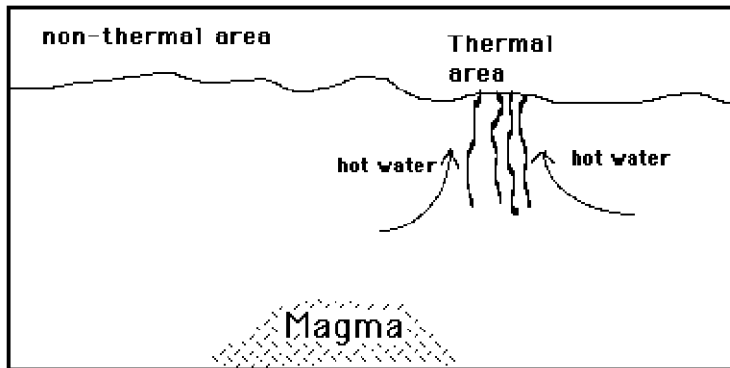
16. How are pyroclastic flows and lahars similar? different?

17. Volcano X started erupting 100,000 years ago. Its early eruptions were basaltic. About 50,000 years ago, the composition of the lavas and tephra erupted was andesite. A recent eruption (10 years ago) was a dacitic plug dome. Other than the introduction of different magmas, what reasons can you suggest to explain the change in composition of the volcanic materials erupted from Volcano X through time?

18. List and explain the series of events from March, 1980, to the catastrophic eruption of Mt. St. Helens on May 18, 1980. Which of the events would have been the best predictor of the major eruption on May 18th?

19. A friend of yours is moving here from Kansas and wants to live in the vicinity of Mt. Rainier (outside of the National Park, of course). What kind of information can you provide your friend about the volcanic hazards of Mt. Rainier?

20. In Yellowstone National Park there are numerous "mudpots" in the thermal (geyser) basins, but none in the non-thermal areas. The mud is actually clay in which gases bubble through creating the illusion that the mud is boiling.



a) The clay in the mudpots apparently has formed from the rhyolitic rock in the Yellowstone caldera. Explain the process that creates this clay.

b) The mudpots are found in "hydrothermal" regions, but none in the non-thermal areas. (Rhyolite occurs throughout the park.) Explain why we find these mudpots in the thermal areas and not in other parts of the park.

c) If the predominate rock type in Yellowstone was basalt rather than rhyolite, would the mudpots be smaller or larger, assuming all other conditions to be the same?

21. In the table below indicate the relative rate (slow, moderate, high) of the types of weathering in each climate. Consider only the natural climate and not other factors, such as pollution.

	Rate of hydrolysis weathering (slow, moderate, or high)	Rate of mechanical weathering (slow, moderate, or high)
_windward side of Hawaii (50 to 85 degrees F, 150-200 inches precip.)		
_Antarctica (-70 to 35 degrees F, dry)		
_Columbia Basin (10-110 degrees F and dry)		
_Cascade Mountains, WA (0 to 80 degrees F, 60 to 100 inches precip.)		

22. Mt. Rainier may be one of the most rapidly **weathering** places in the United States because the weathering is occurring faster on the inside than the outside of the mountain. Explain how the steam from hot rocks inside the volcano and volcanic gases are causing this very rapid **weathering**. Be as specific as possible.

23. A map of volcano X is below. The lines are rivers running from the mountain. Cross sections were taken at stations A through J. Answer the following questions from the cross-sections and the map: (the numbers in the parentheses on the cross sections are the ages of the layers)

- a) Using the information **from the cross-sections**, what type of volcano is illustrated? What makes you think this?
- b) The deposits around the mountain may be from previous eruptions of volcano X and other non-volcanic events. Which of the types of deposits are from volcanic events and which deposit may be from a non-volcanic event?
- c) From the various cross sections, construct a single list of the dates that this volcano has **erupted**.
- d) What physical characteristic would tell us the "biggest" eruption from a volcano? Which of the volcano X eruptions was the "biggest using your definition?
- e) For the 6600-year eruption, determine the direction the wind was blowing at the time of the eruption. Is there a predominate wind direction?
- f) When will the volcano erupt next?

