

CHAPTERS 4 & 5: IGNEOUS ROCKS

1. How does the rate of cooling affect crystal growth and size during crystallization of a magma or lava?
2. Describe the textures of igneous rocks that tell us whether an igneous rock cooled quickly (at or near the surface of the Earth) or slowly (deep beneath the surface of the Earth). You may wish to make a table of intrusive versus extrusive textures.
3. Describe the characteristics of the following igneous rock families. For each family be sure to include such characteristics as magma temperature, viscosity, gas content, silica content, minerals, overall color, and the names of the rocks that would be produced when the magma cools (give both the intrusive and extrusive names). You may want to make a table with each family as the head of a column and each row labeled with the characteristics just mentioned.
 - 3a. Ultramafic
 - 3b. Mafic
 - 3c. Intermediate
 - 3d. Felsic
4. Describe the various types of volcanoes and lava flows produced by each of the magma types above in terms of their names, shapes, sizes, and eruptive violence. (You may simply want to continue the table that you made in the previous question and add a few rows).
5. Komatiites found on Earth are over 2 billion years old. There are no modern komatiites. What hypothesis do geologists favor to explain this observation?
6. What types of rock bodies form from magma that does not reach the surface? You may wish to draw a cross section of the Earth into which magma has intruded and cooled. In your drawing, illustrate and label the following bodies.
 - (6a) dike
 - (6b) sill
 - (6c) batholith
 - (6d) stock
 - (6e) laccolith
7. Describe the plate tectonic significance of igneous rocks. That is, which family or families are dominantly associated with which plate tectonic setting (divergent boundaries, subduction boundaries, and hot spots)? (Again, you may simply want to continue the table that you made previously and add another row).
8. The Bowen's Reaction Series tells us about stability, melting temperatures and crystallization temperatures of the rock-forming silicate minerals. Using the Bowen's reaction series, address the following problems:
 - (8a) in a basaltic magma, which minerals will crystallize first during cooling?
 - (8b) in a solid granite, which minerals will melt first?
9. The asthenosphere is estimated to be around 1200-1500°C and most probably composed of peridotite. On the Earth's surface, peridotite will melt (or at least mostly melt) at such temperatures. Yet all available evidence indicates that the asthenosphere behaves as a "gooey" solid. Why isn't the asthenosphere molten, in spite of its high temperature?
10. What causes the asthenosphere to melt at each of the environments in which we find present-day igneous activity (hot spots, subduction boundaries, divergent boundaries including continental rifts)?

CHAPTER 6: WEATHERING & SOIL

11a. Give at least three examples of mechanical weathering.

11b. Give at least three examples of chemical weathering.

12. How does climate affect weathering? I.e. In which climates will rocks weather the fastest/slowest?

13a. Of all the Bowen's reaction series silicate minerals, which will chemically weather the fastest/slowest?

13b. Of all the minerals we've studied, which will dissolve most easily?

14. Describe the three major types of soil and the environments in which they are formed.

15a. How does the clay content of soil affect man-made structures?

15b. Briefly describe some of the things that you might do or not do to ensure that your house foundation is not damaged by soil with high clay content.

CHAPTER 7: SEDIMENTARY ROCKS

16. List and briefly describe the processes (or steps) involved in the formation of a sedimentary rock- from start to finish!

17. What are products of weathering? I.e. what are the main kinds of sediment?

18. What are the main agents of erosion and transport of sediment?

19. What are the common cements of detrital sedimentary rocks?

20. For each of the following sedimentary rocks, tell whether the rock is detrital, chemical or biochemical. In addition, give a possible common depositional environment.

20a. conglomerate

20b. sandstone

20c. limestone

20d. rock salt

20e. coal

20f. chert

20g. shale

21. List and briefly describe 5 different sedimentary structures or environmental indicators. For each, tell exactly what the structure or environmental indicator tells us about the environment of deposition. (For example, asymmetric ripple marks are sedimentary structures that indicate one-directional current or wind direction).

22. For each of the following depositional environments, describe the sedimentary rock(s) that would be formed and the sedimentary structures and/or environmental indicators that would be characteristic of that environment.
- 22a. Glacier & glacial lake deposits
 - 22b. Alluvial fan
 - 22c. Playa lake
 - 22d. Desert dune field
 - 22e. Rivers systems
 - 22f. Swamps
 - 22g. Beaches
 - 22h. Shallow marine shelf
 - 22i. Deep marine abyssal plain
23. Describe the two major processes that affect global sea level relative to the continents and discuss how each of them works. Under what conditions, for example, is sea level high and low for each process?
24. Describe the layers of sedimentary rock that would be produced during a marine transgression and those that would be produced during a regression.

CHAPTER 8: METAMORPHIC ROCKS

25. Every metamorphic rock has a parent. For each of the following metamorphic rocks, give a possible parent rock.
- 25a. Slate
 - 25b. Marble
 - 25c. Quartzite
 - 25d. Metaconglomerate
 - 25e. Gneiss
 - 25f. Schist
 - 25g. Greenstone
26. Give an example of local (contact) metamorphism and regional metamorphism.
- 27a. How is foliation created during metamorphism?
 - 27b. Why is that some rocks (shales) become foliated and other rocks (i. e. limestones and sandstones) do not?
 - 27c. If the orientation of the foliation trends north-south, what was the direction of the stress that produced it?
 - 27d. Name the types of foliation in the order of increasing metamorphic grade (temperature)

GENERAL ROCK KNOWLEDGE AND SYNTHESIS: IGNEOUS, SEDIMENTARY & METAMORPHIC ROCKS

28. Name and briefly describe the three major types of rocks and the subcategories (if any) of each type. (You should have already answered this question for Exam 1).
29. In the song "Blowin' in the Wind", Bob Dylan wrote: "How many years can a mountain exist before it is washed to the sea?" What geologic processes and concepts are implied in his question? *[Think about it- there are many and you don't need to know the song to think of them.]*

30. Every rock tells a story. What story would be told by _____?

All of the rocks we have studied are fair game here including: granite, rhyolite, diorite, andesite, gabbro, basalt, peridotite, komatiite, obsidian, pumice/scoria, tuff/volcanic breccia, sedimentary breccia, conglomerate, quartz sandstone, arkose, graywacke, mudstone, limestone/dolostone, chert, rock salt, rock gypsum, coal, gneiss, schist, phyllite, slate, marble quartzite, metaconglomerate, and greenstone.

Your answer should include:

- (30a) What kind of rock is it (intrusive igneous, extrusive igneous, detrital sedimentary, chemical sedimentary, or biochemical/organic sedimentary, foliated metamorphic, or nonfoliated metamorphic)?
- (30b) If the rock is igneous you should also include how it formed (quickly or slowly), possible rock bodies or volcanoes, and plate tectonic environment).
- (30c) If the rock is sedimentary you should also give an example of its environment of deposition.
- (30d) If the rock is metamorphic you should also include its parent and how it was metamorphosed (temperature alone or with directed pressure).