GEOL 1010 - INTRODUCTION TO GEOLOGY  
COURSE STUDY QUESTIONS  
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If you want to turn these in, please be sure to answer them on separate sheets of paper and staple everything together! Note that if you score below C- on the exam you can receive points equivalent to a C- by doing these questions AND the suggested problems from the back of the appropriate chapters AND the suggested web problems AND turning them all in before the end of the testing period. The suggested chapter and web problems are listed on the course syllabus.

1. What type of plate boundary has the largest earthquakes? Which boundary type has medium sized earthquakes? Name a place on the earth with the type of plate boundary that has the really huge earthquakes.
2. List at least three geologic observations or phenomena that are explained by the theory of plate tectonics (such as the way the North and South American and African coastlines fit together like pieces of a jigsaw puzzle).
3. What is a scientific hypothesis?
4. How does a scientific hypothesis become a theory?
5. Carefully draw a picture of the Earth. Label the spheres and the radius of the spheres of the solid Earth.
6. What is a hot spot?
7. How do the atoms of different elements differ from each other?
8. Why is gold more dense than hydrogen?
9. Why are covalent bonds stronger than ionic bonds?
10. How does a mineral’s crystal structure lead to cleavage?
11. Why are silicates the most common minerals in the Earth’s crust?
12. What are the common ferro-magnesian minerals, listed in order of decreasing Fe (iron) & Mg (magnesium) abundance (relative to Si, silicon) in them?
13. What are the common non-ferro-magnesian minerals?
14. How do all igneous rocks form (as different from sedimentary and metamorphic rocks)?
15. Does olivine occur in silicon-rich or silicon-poor rocks?
16. If an igneous rock has quartz in it, is the rock silicon-rich or silicon-poor?
17. If a rock contains pyroxene, hornblende and a calcium-rich plagioclase and it has a fine-grained texture, what would you name it? Is this rock felsic, intermediate or mafic?
18. What kind of rock is coarse-grained and contains quartz, potassium-feldspar, sodium-rich plagioclase and biotite? Is this rock felsic, intermediate or mafic?
19. Why do mafic igneous rocks result from upward movement of the mantle under midocean ridges (i.e., why does melting happen, and why does the melting produce magma/lava that is mafic in composition).
20. Why are igneous rocks that are rich in magnesium and iron called mafic?
21. In relation to the types of plate boundaries, where do intermediate igneous rocks tend to form?
22. In relation to the types of plate boundaries, where do mafic igneous rocks tend to form?
23. What types of igneous rocks compose seafloor crust?
24. How long had life forms existed on Earth before complex life forms evolved?
25. How long has there been a crust on the Earth?
26. What is the difference between the crust and the lithosphere?
27. What kind of bond does silicon and oxygen make in silicate minerals?
28. About how hot is magma?
29. Name two ways magma can form in the Earth (natural processes that cause melting).
30. What process causes magma to form under Hawaii?
31. What process causes magma to form under mid-ocean ridges?
32. What process causes magma to form under Mt. Rainier (which is over a subduction zone)
33. What kind of volcano is Mt. St. Helens? How about Hawaii?
34. Is felsic or mafic lava more viscous (less ‘runny’)?
35. Why is the one more viscous than the other?
36. Is felsic or mafic lava more likely to be erupted explosively?
37. What causes lava to shoot out of the ground fountain-like, or even to explode?
38. Mt. St. Harry is a composite volcano, and Harriet Island is a shield volcano. Which is bigger? Which probably has steeper sides? Which is more likely to explode and blow your new cabin to smithereens?
39. Is Mt. St. Harry likely to be near a plate boundary? What kind of plate boundary? How about Harriet?
40. If you had to guess, at which of the following location do you think there might be a batholith forming: under Utah with it’s Wasatch fault or western Oregon, which is over a subduction zone?
41. Why do hot air balloons rise into the air?
42. Why does magma tend to rise through the crust?
43. Name a batholith. What I mean is, right down the name of a batholith that someone else named. Where is the batholith you named, and about how big is it? (Now you can give it a name of your choosing, if you wish).
44. About how long did it take for the batholith you named above to form (i.e., thousands of years, hundreds of thousands, millions to tens of millions, billions of years)?
45. How does a dike differ from a sill?
46. Are there any plutons in the Wasatch Mountains? Where could you find one?
47. How can you distinguish an intrusive igneous rock from an extrusive igneous rock?
48. Which happens first - erosion or weathering?
49. What are the two main effects of chemical weathering?
50. What type of mineral is a common product of chemical weathering?
51. What common rock type is particularly susceptible to being dissolved by water?
52. Why is water such a powerful solvent?
53. Is quartz susceptible to chemical weathering?
54. Explain the relative susceptibility of the common igneous minerals to chemical weathering in relation to their position on Bowen’s Reaction Series.
55. Name 4 main causes of mechanical weathering.
56. What are the 5 things that happen to make a sedimentary rock (list them in order)?
57. What are the two main ingredients in soil?
58. Explain why soils in rain forests are poor soils for farming and how the methods commonly employed for converting the forests to farmland exacerbate the problem.

59. Where would you want to establish your family’s farm - in an area with more weathering or more erosion?

60. When you look up at Mt. Timpanogas, how can you discern which sedimentary layers in the mountain are most and least resistant to weathering and erosion?

61. Is there likely to be more erosion and transport of sediment in a dry climate or a wet one? Why?

62. What is the difference between a sandstone and a conglomerate?

63. What is the difference between siltstone and mudstone?

64. As you walk along a sedimentary bed (one layer of rock formed at the same time by the same process), you notice that the large sand grains get more and more angular. Are you getting closer or further from where the sand grains were eroded?

65. Above the sedimentary bed of sandstone mentioned above (which clearly formed near an ocean beach, since it contains marine clam fossils) you find a pair of thick layers of salt (NaCl) and gypsum (CaSO₄·H₂O). What do those rocks tell you probably happened in the past (how did the salt and gypsum layers probably form?).

66. Above the salt and gypsum, you find a layer of rock that contains boulders as well as sand and even flour-sized grains. The boulders are moderately well rounded. What sort of environment was the layer formed in?

67. The Entrada sandstone is a thick layer/horizon of sandstone in Arches National Park tell us that was deposited as sanddunes. What features would you suspect are present in the Entrada sandstone that indicate that it was deposited as sanddunes?

68. List 3 depositional environments (other than the ones described above), and list some sedimentary rock features that would be indicative of deposition in each of the environments.

69. What happened to the sand in the Entrada to make it be a sandstone instead of sand in a sand dune?

70. Briefly describe what a sedimentary basin is, and give an example of one.

71. Explain the formation of coal. Include the depositional environment as well as events that happen subsequent to deposition.

72. Explain the formation of oil. Include the depositional environment as well as events that happen subsequent to deposition.

73. What are the basic factors that cause metamorphism? (Rocks are tough, why do they ever change?).

74. What are the three types of change that can occur in rocks during metamorphism?

75. Which one of the three types of change can form rocks rich in gold, silver and copper (among other elements)?

76. About how hot are the rocks 10 km below where you are sitting right now?

77. Which is higher grade - a schist or a slate?

78. What aspect of metamorphic rock best indicates the temperature (and pressure) at which it was metamorphosed?

79. What are the two main types of metamorphic foliations, and how do they differ?

80. Draw a sketch of a schist that was squeezed and flattened (as much as a canned ham under a steam roller) horizontally (i.e., it was much wider in the horizontal direction than it is now, as you draw it). Be sure to draw the texture of the rock correctly in relation to the direction that the rock was squeezed and flattened.

81. What causes the minerals to become aligned in a schist?

82. What are the two main types or settings in which metamorphic rocks are formed?
83. What are the three main types of regional metamorphism, where do they occur, and what kinds of rocks do they produce?
84. What are paired metamorphic belts and what do they tell you about the geologic history of the region where they are present? Where could you find paired metamorphic belts in the U.S.?
85. What is deformation? How does brittle deformation differ from ductile deformation?
86. What conditions promote brittle deformation? Ductile deformation?
87. Where in the Earth’s crust is brittle deformation the predominant type of deformation?
88. Draw and label an anticline and a syncline.
89. Draw a left-lateral strike-slip fault offsetting a road, and label it with motion arrows.
90. Draw and label a normal fault.
91. Draw and label a thrust fault.
92. Draw a side view sketch of Wasatch fault, including Utah Valley and the Wasatch mountains. Label the hanging wall and footwall, and use arrows to indicate the relative motion of the hanging and footwall blocks.
93. What kind of plate boundary is typified by strike slip faults?
94. To what U.S. state would you go to find a good example of a strike-slip fault?
95. What kind of fold can trap oil?
96. Is the crust under the Himalaya mountains thicker than the crust under Kansas? What is the rationale for your answer?
97. If a 5 mile thick layer of rock were placed over the entire state of Kansas, what would happen to the level of the current ground surface of Kansas over time (i.e., would it perhaps rise or sink)?
98. If a 900 foot deep lake were to form over much of Utah, what would happen to the level of the current ground surface (which would be under the lake)?
99. If the 900 foot deep lake were to disappear in a large flood, what would happen to the ground surface?
100. Why is the ocean shallower over mid-ocean ridges compared to most of the rest of the oceans (i.e., why are there ridges at divergent plate boundaries/sea-floor spreading centers)?
101. Where is the Basin and Range?
102. What kind of faulting is responsible for the formation of the Basin and Range?
103. What direction is Sacramento California slowly moving relative to Park City as a result of the ongoing deformation in the Basin and Range (note that the San Andreas fault is west of Sacramento)?
104. Draw a side-view picture of the Wasatch Mtns, Utah Valley and the Lake Mountains, which are on the west side of Utah Lake, and the upper crust under them. Show how faulting has formed the two mountains ranges and the valley.
105. What are the factors that control whether a landslide happens?
106. Name the two most common changes that lead to landslides.
107. How does a slump differ from a debris flow?
108. Name a type of mineral that is weak and does not hold up steep hillsides.
109. In what type of climate are debris flows most common?
110. About how much does a granite boulder 1 cubic yard in size (i.e., a cube 1 yard on each side) weigh?
111. Describe four ways people attempt to prevent or stop landslides.
112. Why do snow avalanches tend to happen during and soon after snowstorms (in terms of the ‘controlling factors’ of mass wasting)?

113. What often happens to make avalanches less likely a few days or more after a big snowfall - again in terms of the controlling factors?

114. Let’s say that it snowed 4 feet yesterday, after not having snowed for over 3 weeks. You and your friend are trying to decide whether to go backcountry snowmobiling/skiing/boarding/snowshoeing (take your pick) either today or in 3 days (the forecast is for no storms for days). What do you do? When will the snow be most stable and safe? Why? [But no matter what you decide, don’t forget to call the Utah Avalanche Forecast Center at 801.364.1581!, or visit their website via www.avalanche.org].

115. What is an earthquake?

116. What causes most earthquakes?

117. Name the kinds of seismic waves in the order in which they arrive at a seismometer.

118. How is the Richter magnitude of an earthquake determined?

119. How much bigger are the waves from a magnitude 6 earthquake than a magnitude 5?

120. How much longer does the M6 (magnitude 6) last than the M5 (magnitude 5)?

121. So how much more energetic is the M6 than the M5?

122. How about an M8 compared to an M7?

123. How about an M8 compared to an M5?

124. How is the distance to the epicenter of an earthquake determined from a seismogram?

125. What is liquefaction, what characteristics of the ground make it likely to happen, and where are these characteristics prevalent in Utah Valley and/or the Salt Lake Valley?

126. What information do geologists use to estimate the possible size of future large earthquakes on the Wasatch fault?

127. What information do geologists use to estimate the likelihood of a future earthquake on the Wasatch fault?

128. How do geologists obtain information on past earthquakes on hazardous faults?

129. How does river meandering lead to the formation of oxbow lakes and abandoned meanders?

130. How does gradient affect a river’s capacity to carry sediment?

131. What kind of rivers make V-shaped valleys?

132. What is the hydrologic cycle? Explain it, draw a sketch.

133. In terms of the hydrologic cycle, and probably in actuality, from where did the water in the snow on my car windshield probably originate?

134. How does the Great Salt Lake fit into the hydrologic cycle? How is it different from the typical pattern of the hydrologic cycle?

135. What is the water table?

136. What is groundwater recharge?

137. Where is the main recharge location for the groundwater under Utah Valley?

138. Why does the water flow from the recharge location to under UVSC?

139. What is porosity? Name a porous earth material and a relatively non-porous rock.

140. What is permeability, and how does it differ from porosity?
141. Are porous rocks always permeable?
142. Do you want to wear a relatively permeable or impermeable jacket in the rain?
143. How do artesian wells form?
144. What is a cone of depression?
145. What are the zones of saturation and aeration? Is there water in the zone or aeration?
146. What is a common, widespread groundwater problem in the West (especially in Las Vegas, San Juaquin Valley of California; not pollution), and how can it be resolved?
147. What is the difference between a glacier and a snowfield?
148. Why do glaciers flow?
149. Explain how ice flow, the zone of accumulation and the zone of wastage interact in a mountain glacier.
150. How is it that glaciers retreat? Do they flow back up their valleys?
151. How do medial moraines form?
152. The next time you drive up Big Cottonwood canyon, what two things can you look for to be able to tell how far down the canyon the glacier moved in the last ice age? (Hints: how do glacially carved valleys typically differ from river-cut valleys? And what do glaciers leave behind at their point of farthest advance?)
153. What might cause the climate, and thus the amount of glaciation on Earth, to vary every 100,000 years? (the answer to this is in the study guide above and in the text)
154. Explain how in the geologic past there could have been glaciers in tropical India at the same time parts of Africa at the same latitude (north-south position) were a desert?
155. When was the peak of the last ice age?
156. Approximately when did the last ice age end in Utah?
157. What feature that is not here today was present in Utah Valley during the last ice age?