

Chapter 1 – Introduction – Review of Rocks and Plate Tectonics Practice Exam and Study Guide

To be able to understand the material covered during this course you need to have a basic background in the kinds of rocks making up our planet. This section of the study guide is aimed at helping you gain that background.

1. What are the three major groups of rocks found on planet Earth?

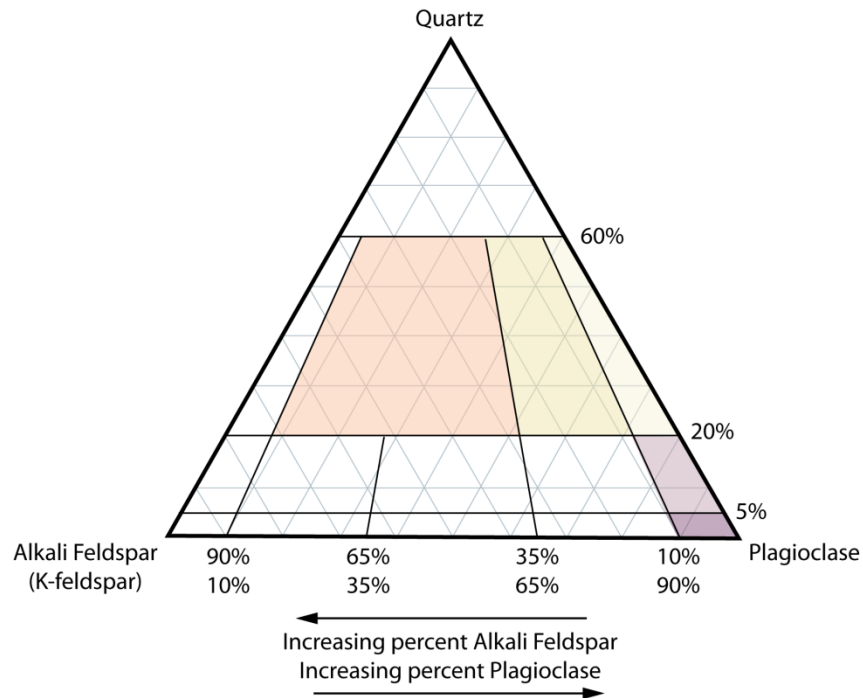
Igneous Rocks

2. Which of the following processes is associated with igneous rocks?
 - a. Solid-state recrystallization
 - b. Weathering and erosion
 - c. Transportation and deposition
 - d. Cooling a silicate liquid to a solid rock
 - e. The accumulation of granitic debris in a moraine
3. If a silicate liquid flows out along the Earth's surface or seabed, then it is called _____.
4. If a silicate liquid exists beneath the Earth's surface or seabed, then it is called _____.
5. Which of the following terms refer to *a body of magma or its solidified equivalent*?
 - a. Basalt
 - b. Sandstone
 - c. Gneiss
 - d. Pluton
 - e. Schist
6. If you can see the crystals making up an igneous rock with the naked eye, then the texture is described as
 - a. Pyroclastic
 - b. Phaneritic
 - c. Aphanitic
 - d. Porphyritic
 - e. Aphyric

7. In an aphanitic igneous rock can you make out the outlines of individual crystals with the naked eye? Yes or No
8. What type of igneous rock is the most volumetrically important on our planet?

Intrusive Igneous Rocks

9. Which of the following minerals contain Ca, Na, or K in their chemical formulae?
 - a. Olivine
 - b. Pyroxene
 - c. Plagioclase
 - d. K-feldspar
 - e. Muscovite
10. Which of the following minerals contain Fe and Mg in their chemical formulae?
 - a. Olivine
 - b. Amphibole
 - c. Biotite
 - d. Plagioclase
 - e. Muscovite
11. Using the following ternary diagram please plot the following composition: 40% Quartz, 15% Alkali Feldspar, 45% Plagioclase.



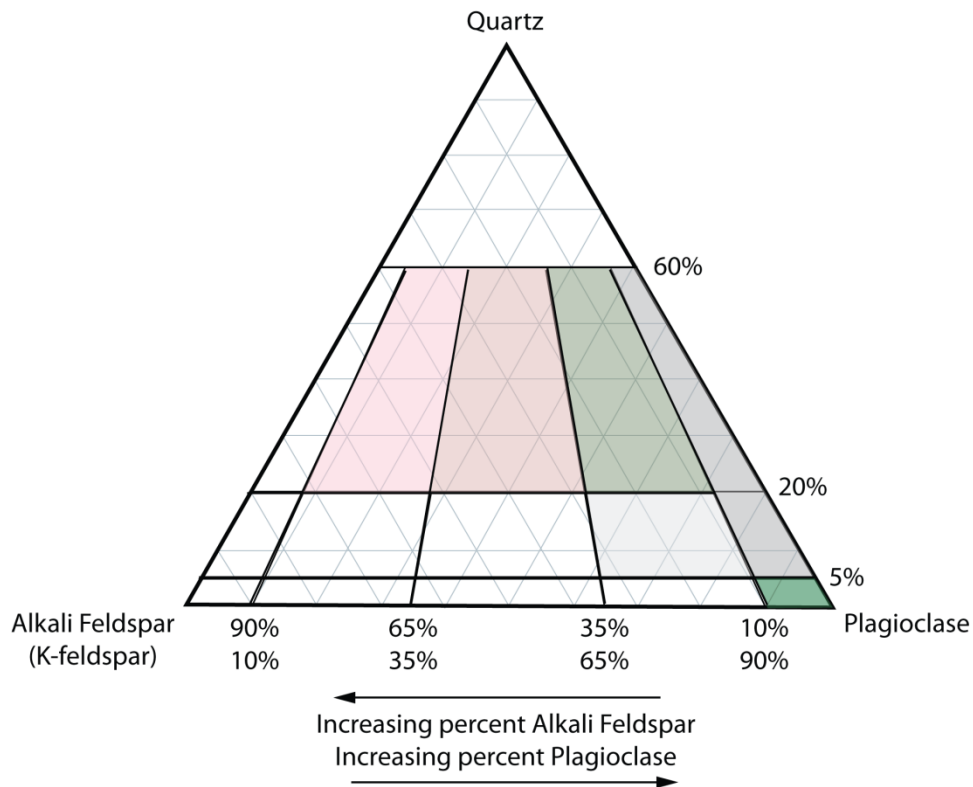
12. Based on the IUGS classification scheme, what is the name of the sample that you plotted in question #10?
13. Pick from the following list all the intrusive rock names.
- a. Olivine
 - b. Gabbro
 - c. Rhyolite
 - d. Granite
 - e. Granodiorite
14. All intrusive igneous rocks crystallized from _____.
15. The principal minerals used in the classification of intrusive igneous rocks are
- a. Quartz and plagioclase
 - b. Quartz, plagioclase, and alkali feldspar (K-feldspar)
 - c. Quartz, alkali feldspar, and amphibole
 - d. Olivine, pyroxene, amphibole, and biotite
 - e. None of the above
16. In the following list which intrusive igneous rock would have the highest quartz content?
- a. Gabbro
 - b. Diorite
 - c. Quartz diorite
 - d. Granite
 - e. None of the above
17. Relative to the total feldspar population (i.e., K-feldspar and plagioclase) which intrusive igneous rock in the following list would have the highest proportion of plagioclase?
- a. Tonalite
 - b. Granodiorite
 - c. Granite
 - d. Rhyolite
 - e. Rhyodacite

18. Relative to the total feldspar population (i.e., K-feldspar and plagioclase) which intrusive igneous rock in the following list would have the highest proportion of K-feldspar?
- Gabbro
 - Diorite
 - Tonalite
 - Granodiorite
 - Granite
19. Is gabbro darker or lighter in color than granite? If so, then why?
20. What is the color index used to differentiate gabbro from diorite?
- 20%
 - 30%
 - 40%
 - 50%
 - 60%
21. Why are granites, granodiorites, and tonalites lighter in color than gabbros and diorites?

Extrusive Igneous Rocks

22. All extrusive igneous rocks form from the cooling and solidification of _____.
23. What is the intrusive compositional equivalent of a basalt?
- Granite
 - Granodiorite
 - Tonalite
 - Gabbro
 - None of the above
24. What is the intrusive compositional equivalent of a rhyolite?
- Granite
 - Granodiorite
 - Tonalite
 - Gabbro
 - None of the above
25. Are basalts silicic, intermediate, or mafic in composition?
26. Are andesites silicic, intermediate, or mafic in composition?

27. Are rhyolites, rhyodacites, and dacites, silicic, intermediate, or mafic in composition?
28. Silicic intrusive and extrusive igneous rocks contain more than _____ wt % SiO_2 .
29. Intermediate intrusive and extrusive igneous rocks contain between _____ and _____ wt % SiO_2 .
30. Mafic intrusive and extrusive igneous rocks contain between _____ an _____ wt % SiO_2 .
31. Using the following ternary diagram please plot the following composition: 10%Quartz, 5% K-Feldspar, 85% Plagioclase.

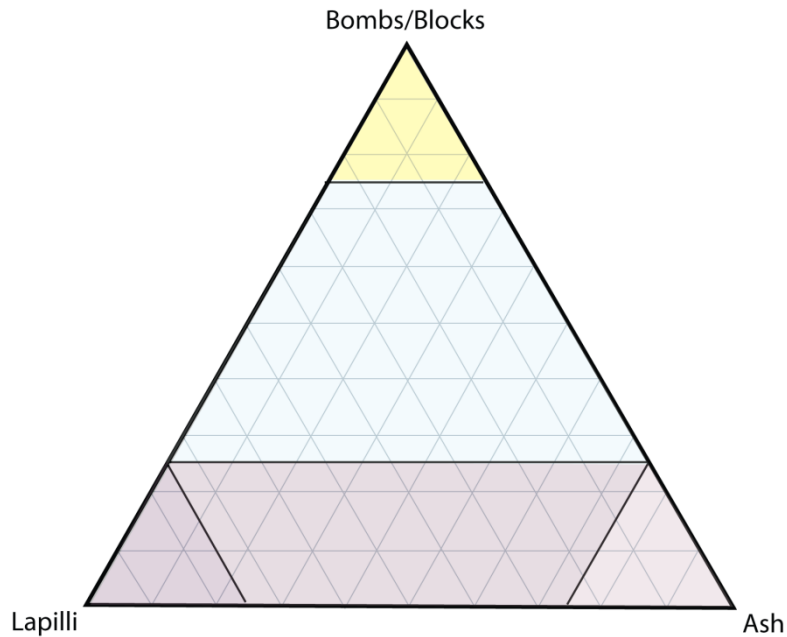


32. Based on the IUGS classification scheme what is the name of the sample that you plotted in question #26.

Pyroclastic Volcanic Rocks

33. Material blown out of a volcano is called _____ or _____.

34. Please plot the following composition on the ternary diagram provided below: 60%Ash, 10%Blocks, 30% Lapilli.



35. How would you classify the pyroclastic rock that you plotted in question #34?

36. Pick from the following list all of the pyroclastic rocks.

- a. Tuff breccia
- b. Tuff
- c. Lapilli tuff
- d. Agglomerate
- e. Volcanic breccia

37. Bombs and blocks are larger than _____ mm in size.

38. Ash is less than _____ mm in size.

39. Lapilli are between _____ mm and _____ mm in size.

40. A tuff breccia would contain between _____ % and _____ % blocks.
41. A pyroclastic rock composed predominately of bombs would be classified as
- Tuff breccia
 - Agglomerate
 - Volcanic breccia
 - Lapilli tuff
 - Tuff
42. Are bombs solid or plastic-like and poorly solidified when expelled from a volcano?
43. Large (>64 mm) solid angular blocky pieces of the walls of a volcano that are caught up and expelled as tephra during an explosive eruption are classified as _____.

Sedimentary Rocks

44. Pick from the following list all of the clastic sedimentary rocks.
- Sandstone
 - Limestone
 - Conglomerate
 - Mudstone
 - Siltstone
45. Clastic sedimentary rocks differ from igneous and metamorphic rocks by being composed of weathered and eroded particles derived from previously existing Earth material. True or false?
46. The weathered and eroded particles found in clastic sedimentary rocks are sometimes called _____.
47. Which of the following represent the size range for clay?
- 0.06 mm to 2.0 mm
 - 0.004 mm to 0.06 mm
 - < 0.004 mm
 - 2.0 to 64 mm
 - 64 mm to 256 mm.
48. Which of the following represent the size range for silt?
- 0.06 mm to 2.0 mm
 - 0.004 mm to 0.06 mm
 - < 0.004 mm
 - 2.0 to 64 mm
 - 64 mm to 256 mm

49. Which of the following represent the size range for sand?
- a. 0.06 mm to 2.0 mm
 - b. 0.004 mm to 0.06 mm
 - c. < 0.004 mm
 - d. 2.0 to 64 mm
 - e. 64 mm to 256 mm.
50. Which of the following represent the size range for gravel?
- a. 0.06 mm to 2.0 mm
 - b. 0.004 mm to 0.06 mm
 - c. < 0.004 mm
 - d. >2.0 mm
 - e. None of the above
51. A rock composed of rounded gravel is called
- a. Sandstone
 - b. Mudstone
 - c. Claystone
 - d. Siltstone
 - e. Conglomerate
52. A clastic sedimentary rock composed of angular pieces of gravel would be classified as a _____.

Metamorphic Rocks

53. If a rock is derived from the solid-state recrystallization of an older previously existing rock, then it is a _____ rock.
54. Pick from the following list the metamorphic rocks.
- a. Granite
 - b. Diorite
 - c. Gneiss
 - d. Conglomerate
 - e. Slate
55. What is the geothermal gradient?
56. What is the geobarometric gradient?
57. In the crust, would low grade metamorphic rocks lie above or below intermediate and high grade metamorphic rocks?

58. Which of the following formed under the lowest grade conditions? Slate, Schist, Gneiss

59. Which of the following is the coarsest? Slate, Schist, Gneiss

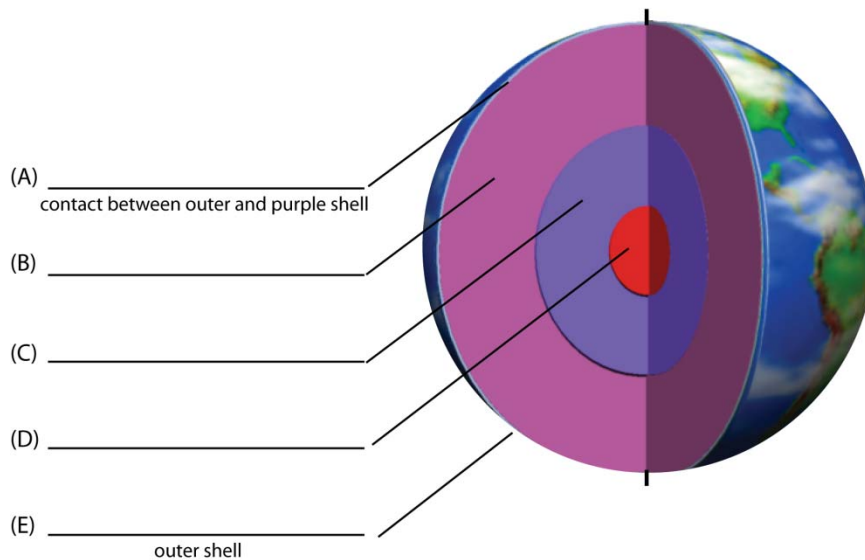
60. What is a typical geotherm in the middle of a continent?

- a. 50° - 60° C/km
- b. 40° - 50° C/km
- c. 30° - 40° C/km
- d. 20° - 30° C/km
- e. None of the above

Because plate motions produce many of the natural disasters that we will study, you will need a sound background on plate tectonics. The following questions will help you gain that background.

Plate Tectonics

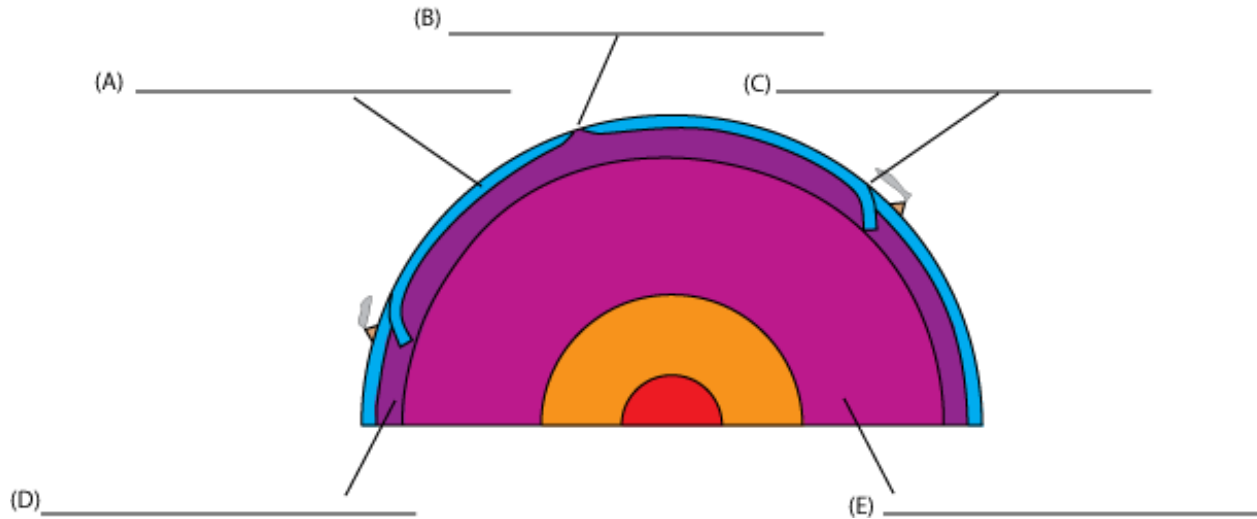
61. In the following illustration please fill in the missing labels.



62. What is the importance of the Earth's magnetic field to life on Earth?

63. Using the following list (word bank), please fill in the missing labels:

- divergent margin or mid-ocean ridge
- convergent margin or subduction zone
- lithosphere
- asthenosphere
- mesosphere.



64. What is the average thickness of continental lithosphere and oceanic lithosphere?

65. Which type of lithosphere has the thicker crustal component?

66. As newly formed oceanic lithosphere forms at mid-ocean ridges is it denser than the underlying asthenosphere?

67. As newly formed oceanic lithosphere forms at mid-ocean ridges is it negatively or positively buoyant?

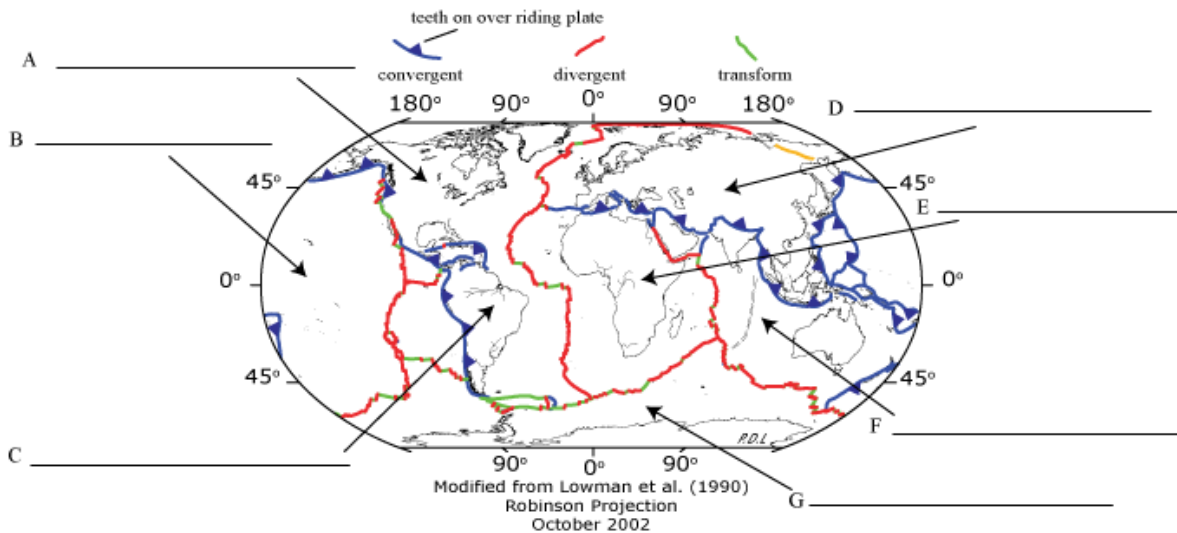
68. Today, as newly formed oceanic lithosphere *moves away* from its site of origin at a mid-ocean ridge what happens to it?

69. What is ridge push?

70. What is slab pull?

71. What is top-down convection?

72. Please provide the labels for the seven major lithospheric plates shown in the following illustration.



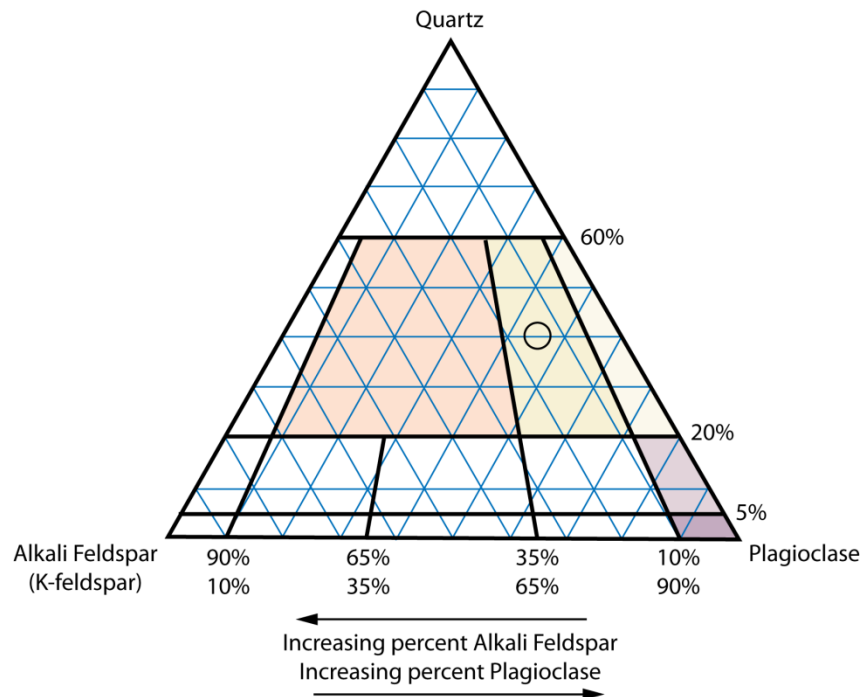
73. What major lithospheric plate is composed primarily of oceanic lithosphere?

74. If an island arc is embedded in oceanic lithosphere, then it is classified as an _____ island arc.

75. If an island arc is embedded in continental lithosphere, then it is classified as a _____ island arc.

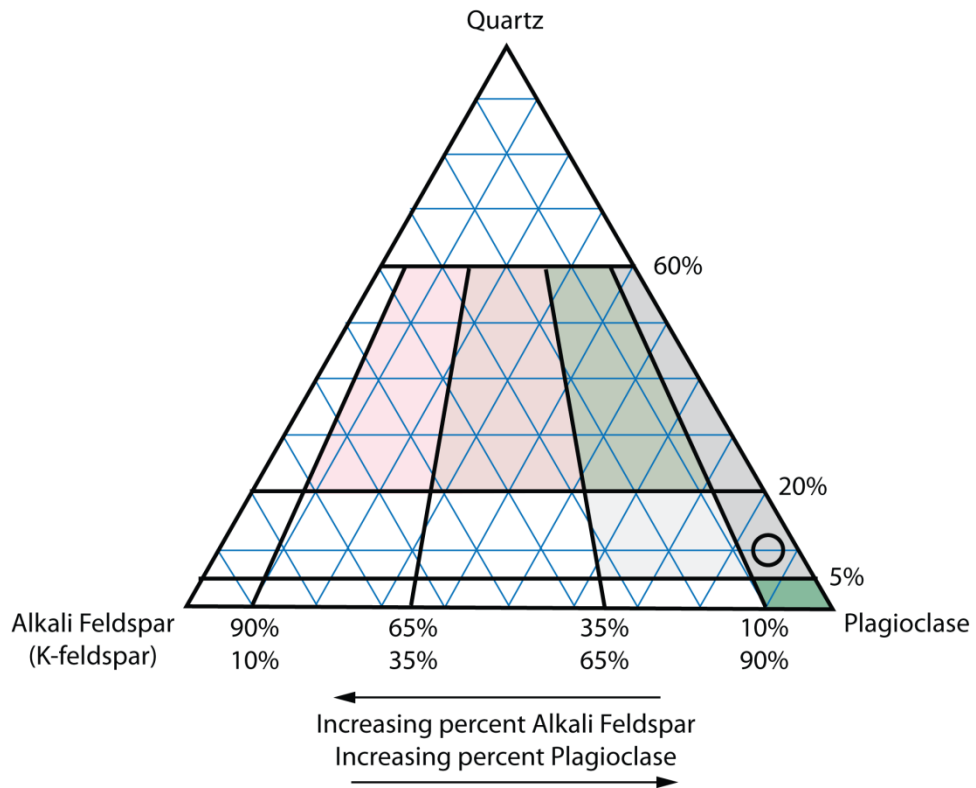
Answers

1. Igneous, sedimentary, and metamorphic
2. d. cooling a silicate liquid to a rock.
3. lava
4. magma
5. d. Pluton
6. b. Phaneritic
7. No
8. peridotite
9. c. Plagioclase, d. K-feldspar, e. Muscovite
10. a. Olivine, b. Amphibole, c. Biotite
11. The answer to question number 11 is provided below



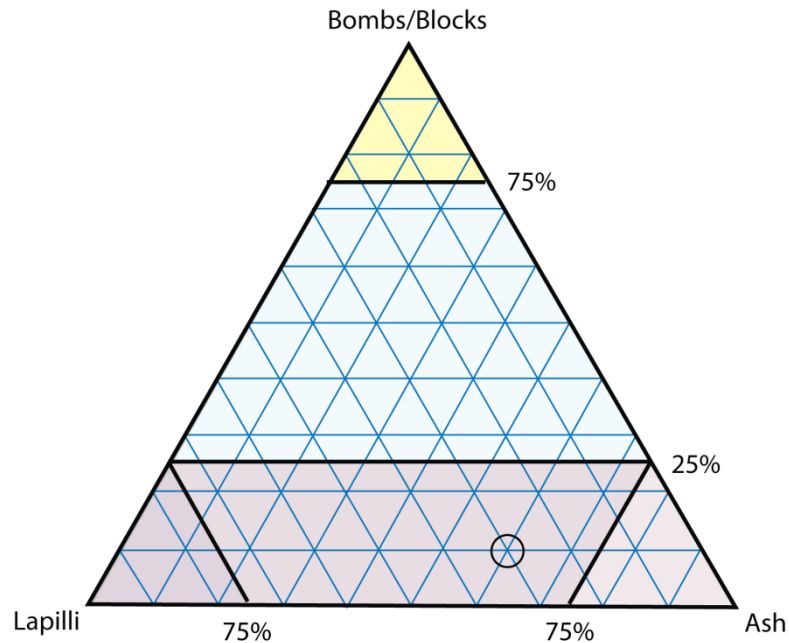
12. granodiorite
13. b. Gabbro, d. Granite, e. Granodiorite
14. magma
15. b. Quartz plagioclase alkali feldspar (K-Feldspar)
16. d. Granite
17. a. Tonalite
18. e. Granite
19. Darker – it contains a significantly greater proportion of the dark-colored minerals such as amphibole and pyroxene
20. 40%
21. They are composed mostly of the light-colored minerals quartz, plagioclase, K-feldspar, and muscovite

- 22. lava
- 23. gabbro
- 24. granite
- 25. mafic
- 26. intermediate
- 27. silicic
- 28. 63
- 29. 55, 63
- 30. 45, 55
- 31. Below is the answer to this questions



- 32. Quartz andesite
- 33. Tephra, pyroclasts

34. The following is this answer to this question



35. Lapilli tuff

36. a. through e. are all pyroclastic rocks

37. 64 mm

38. 2 mm

39. 2, 64

40. 25, 75

41. b. agglomerate

42. Plastic-like and poorly consolidated

43. blocks

44. a. Sandstone, c. Conglomerate, d. Mudstone, e. Siltstone

45. true

46. detritus

47. c. < 0.004 mm

48. b. 0.004-0.06 mm

49. a. 0.06 – 2.0 mm

50. d. > 2.0 mm

51. e. Conglomerate

52. breccia

53. metamorphic

54. c. Gneiss, e. Slate

55. the change in temperature with depth

56. the change in pressure with depth

57. above

58. slate
59. gneiss
60. d. 20°-30°C/km
61. (A) Moho, (B) Mantle, (C) Outer core, (D) Inner core, (E) Crust
62. The Earth's magnetic field allows for a sustained atmosphere and oceans, two essential components for life.
63. (A) Lithosphere, (B) Mid-ocean ridge and divergent margin, (C) Subduction zone and convergent margin, (D) Asthenosphere, (E) Mesosphere
64. 100-125 km
65. Continental crust is significantly thicker than ocean crust
66. No, it is less dense
67. Positively buoyant
68. It's density increases and it becomes negatively buoyant
69. Ridge push occurs as hot asthenosphere rising beneath a mid-ocean ridge inflates, pushing the plates on opposite sides of the ridge apart.
70. Slab pull occurs when the leading edge of subducting lithosphere having reached such a great depth beneath an island arc has become very dense, and as a result pulls the subducting lithosphere down ward.
71. Top-down convection is the type of convection produced when cold, rigid, dense lithosphere sinks and is pulled downward displacing lower hot asthenospheric mantle which then spreads laterally and eventually rises upward at mid-ocean ridges.
72. A. North American, B. Pacific, C. South American, D. Eurasian, E. African, F. Indian-Australian, G. Antarctica
73. Pacific
74. intraoceanic
75. continental, margin