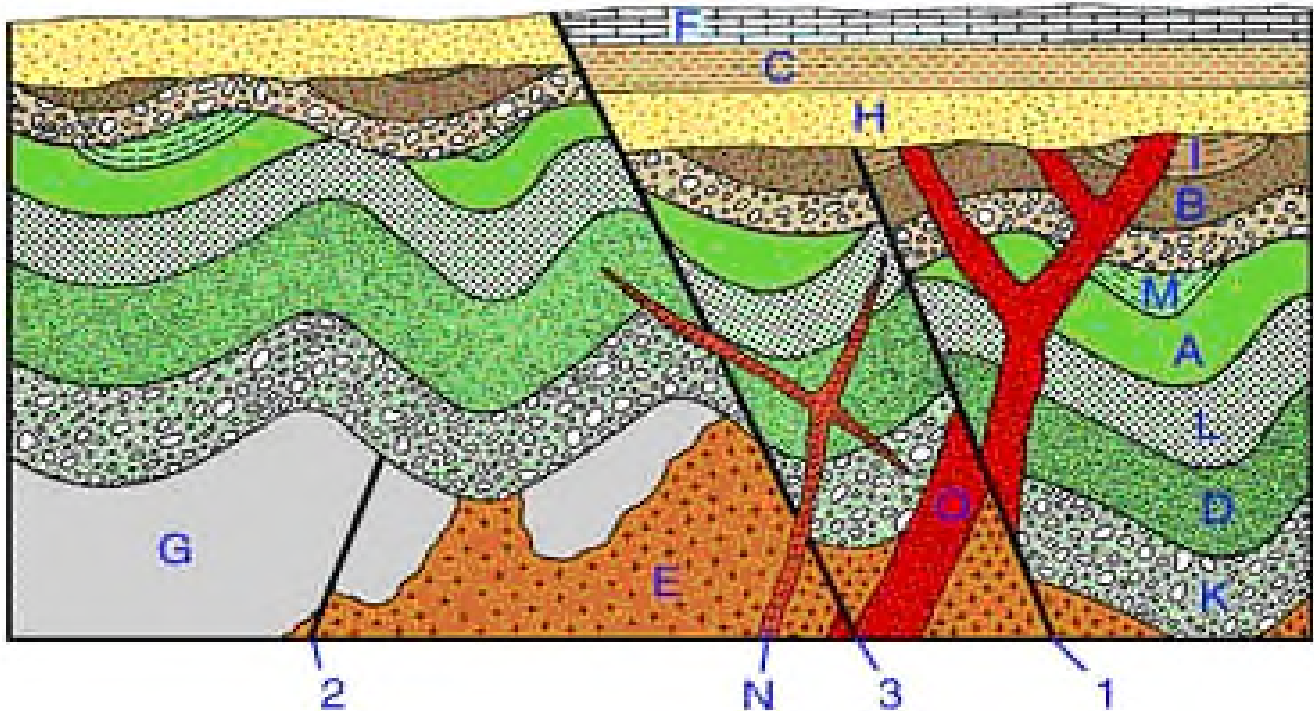


EOSC110 Laboratory - Preparatory Guide for the Midterm Exam

Introduction & Purpose: This study document is designed to simulate the midterm exam, both in material content and testing format. The actual test will have around 60 questions and be answered on a scantron card.

PART I. Relative Age - Geologic Block Diagram

Directions: Study the stratigraphic block diagram below. Use diagram below to answer questions 1 through 5.



1. The illustration above shows a geologic cross section. On a piece of paper, figure out the correct order, from oldest to youngest, in which the various rock units and faults were created. Choose the list from the selection below that has the correct temporal order of the seventeen lettered and numbered geologic features --- ordered from **OLDEST** (left end) to **YOUNGEST** (right end)

a.	E, G, 2, N, O, K, D, L, A, M, B, I, 1, H, C, F, 3
b.	E, G, K, 2, D, L, A, M, B, I, N, 1, O, 3, H, C, F
c.	F, C, H, O, 3, 1, N, B, I, M, A, L, D, 2, K, G, E
d.	G, E, 2, K, D, L, O, 1, H, C, A, M, B, I, F, 3, N
e.	G, E, 2, K, D, L, A, M, B, I, O, 1, H, C, F, 3, N
a. + b.	G, 2, E, K, D, L, 1, O, H, C, A, M, B, I, N, 3, F
b. + c.	B, I, O, 1, H, C, F, 3, N, G, E, 2, K, D, L, A, M
c. + d.	2, G, D, K, O, N, A, L, E, 3, F, C, H, 1, I, B, M
d. + e.	3, F, C, H, 1, I, B, M, A, L, D, K, O, N, 2, G, E

2. The key stratigraphic principle that you used to date geologic items K, D, L, A, M, B and I?

a.	Superposition
b.	Original horizontality
c.	Inclusion
d.	Cross-cutting

3. The key stratigraphic principle that you used to date geologic items 1, 2, 3, E, N, and O?

a.	Original horizontality
b.	Superposition
c.	Cross-cutting Inclusion
d.	Inclusion

4. The type of unconformity lying directly beneath layer H, in the region to the left of fault 3?

a.	Angular unconformity
b.	Disconformity
c.	Nonconformity
d.	Misconformity
e.	Angular incomformity

5. When did the folding event occur?

a.	After Formation H, but before Intrusion N
b.	After Fault 1, but before Intrusion O
c.	After Formation I, but before Formation H
d.	After Formation G, but before Formation I
e.	After Intrusion N, but before Fault 3

Part II. ISOSTASY: *MODELING CRUSTAL BUOYANCY WITH THE MANTLE*

Directions: The following set of questions pertains to a wood block floating in the water bath. Use the principles of isostasy and the density of pure water to answer the questions below. *Identify the letter of choice that BEST completes the statement or answers the question.*

6. Which of the following densities is closest to that of Block A? If density in between, choose higher

- a. Greater than 0.8 g/cm^3
- b. Between 0.6 and 0.8 g/cm^3
- c. Between 0.3 and 0.6 g/cm^3
- d. Less than 0.3 g/cm^3

7. Imagine if Block A was twice as thick as its present thickness. The thicker Block A would _____, compared to thinner Block A.

- a. Extend *higher* out of the water.
- b. Extend *lower* into the water.
- c. Still have the same percentages out and in the water as the thinner block.
- d. All of the above would be true.
- e. Both **b.** and **c.** are true

8. If the top 1/4 of Block A's thickness were removed, Block A would _____.

- a. rise out of the water.
- b. sink lower into the water
- c. just sit there - neither rise nor sink.
- d. start spinning like a top.

9. What happens when a continent undergoes a major ice cap glacial event?

- a. The continent will rise up out of the mantle.
- b. The continent will sink lower into the mantle.
- c. The continent will just sit there - neither rise nor sink.
- d. The continent will begin to move away from the pole toward the equator

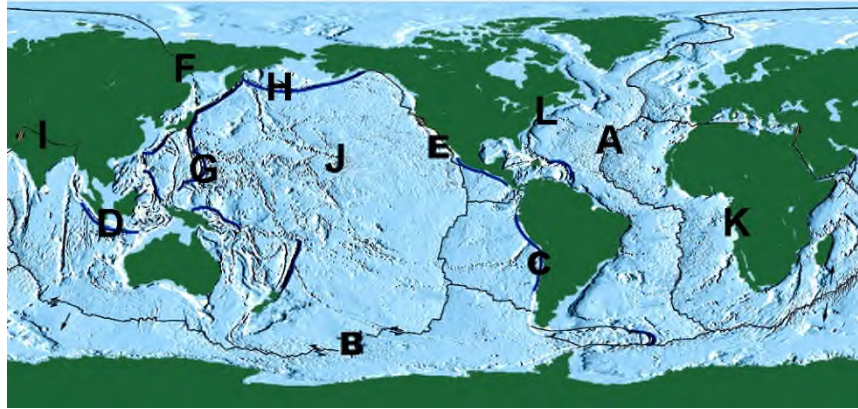
10. What happens after a major continental mountain building event ends, but heavy erosion continues?

- a. The continent will rise up out of the mantle.
- b. The continent will sink lower into the mantle.
- c. The continent will just sit there - neither rise nor sink.
- d. The continent will begin to move away from the pole toward the equator

Part III. Plate Tectonic Boundaries

Matching: Directions: Match the geographic location (Capital Letter) with its associated tectonic feature or setting (small case letter(s)).

- | | |
|--|--|
| a. Transform plate boundary | e. Hot spot volcanic center |
| b. Divergent plate boundary with oceanic seafloor spreading | a. + b. Convergent plate boundary with <i>oceanic-oceanic</i> subduction |
| c. Divergent plate boundary with continental rifting | b. + c. Convergent plate boundary with <i>oceanic-continental</i> subduction |
| d. Convergent plate boundary with <i>continent-continent</i> collision | c. + d. Passive margin |



11. A & B ____ 12. C & D ____ 13. E & F ____ 14. G & H ____ 15. I ____ 16. J ____ 17. K & L ____

Part IV. Plate Movement Over a "Fixed" Hotspot - Louisville Seamount Chain Hot Spot Track

Directions: The Louisville Seamount (LS) chain is found in the South Pacific Ocean and is one of the longest seamount chains in the world, rivaling the Emperor Seamount - Hawaiian Island (ES-HI) chain in the North Pacific. Assume that the Louisville Seamount chain was created by a stationary mantle hotspot – like the Hawaiian Island chain that you studied in lab. Below are several questions that address both of these oceanic volcanic chains, in terms of their inferred Pacific Plate movement, direction and speed. Use the Louisville Hot Spot Plate Motion Diagram to calculate the average plate speed and direction of the Pacific Plate.

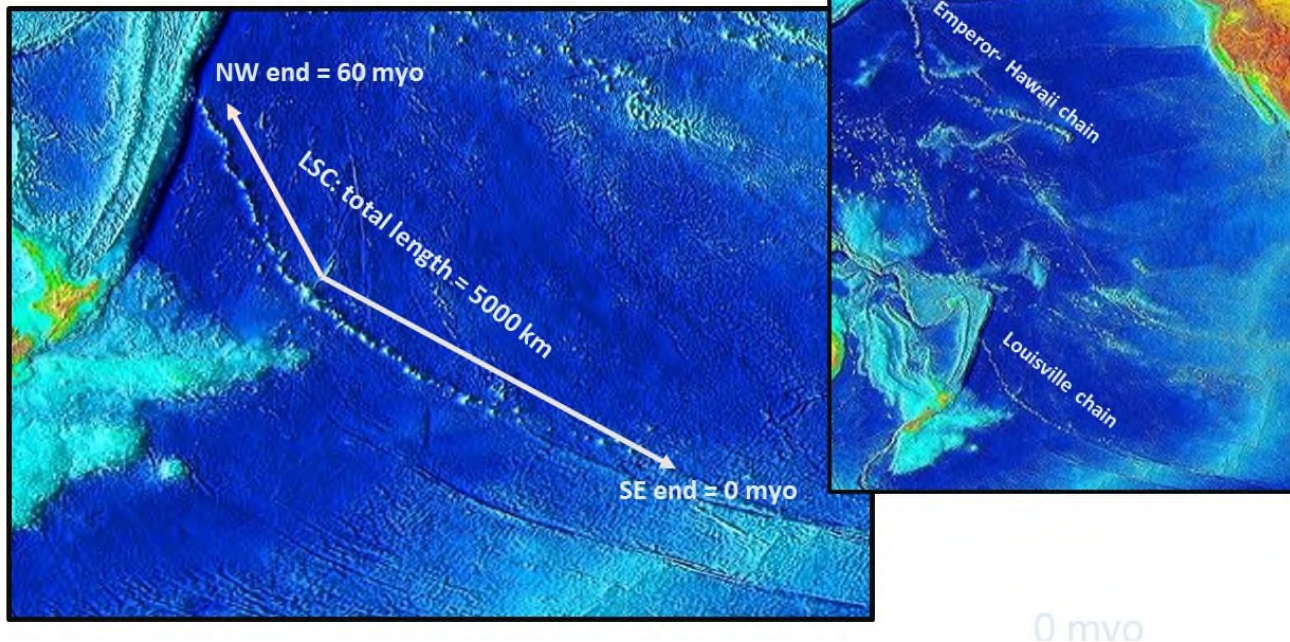
Speed Formula: Speed = distance/time (cm's/year) **Conversion Factor:** 1 km = 100,000 (1 x 10⁵) cm

18. What is **average speed** for the Pacific plate associated with the Louisville Hotspot?
- 10 cm/yr or greater
 - Between 6 and 9 cm/yr
 - Between 3 and 6 cm/yr
 - Between 1 and 3 cm/yr
 - Less than 1 cm/yr
19. What's the **average direction** of motion of the Louisville Seamount chain (Pacific plate) over the hot spot?
- North;
 - Northeast;
 - East;
 - Southeast;
 - South;
 - a. + b. Southwest;
 - a. + b. West;
 - a. + b. Northwest
20. How do the LS and ES-HI hot spot tracks compare, based on a comparison of hot spot **ages, directions and speeds**, in terms of whether they are on the same plate or on different plates?

The two hot spot traces appear to _____.

- be moving on the same tectonic plate.
- be moving on different tectonic plates
- have formed from the same hot spot.
- None of the above.

Louisville Seamount Chain South Pacific



Part V. Plate Movement Analysis of *Mid-Ocean Ridge and Seafloor Spreading*

Directions: The South Atlantic Mid-Ocean Ridge (SAMOR) joins the South American and African and tectonic plates. Below are several questions that address the rate of seafloor spreading between the South American and African plates, Use the **South Atlantic Magnetic Anomaly Map** to calculate the average plate (seafloor spreading) speed and direction of each of the plates over last 54 million years. Use the diagram below to answer the questions.

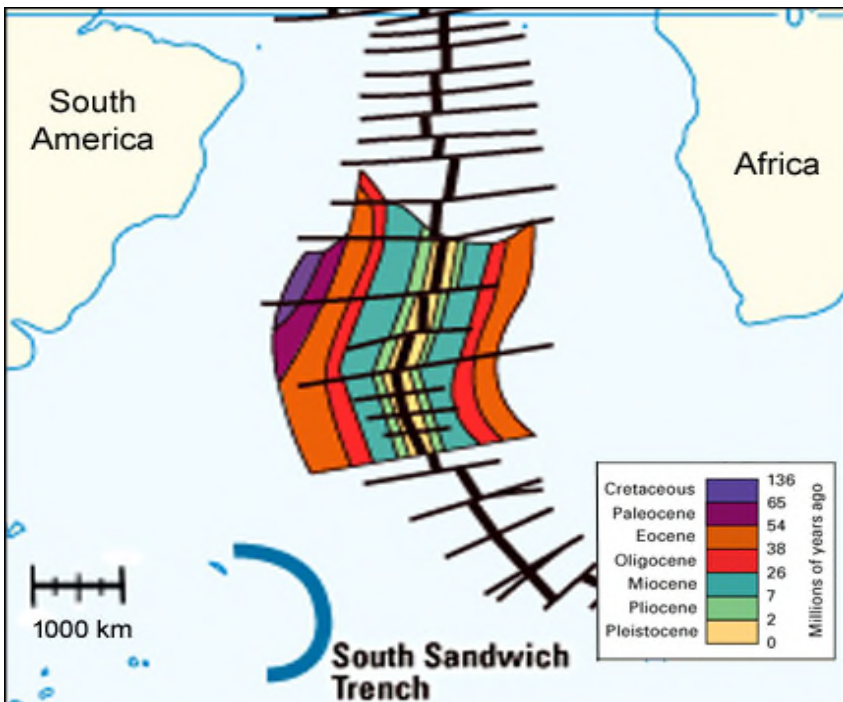
21. What is the average direction of motion of the South American plate (west (left-side) of ridge) - in relation to the ridge axis - over the last 54 million years?
 - a. North;
 - b. East;
 - c. South;
 - d. West;

22. What is the average speed for the South American plate over the last 38 million years as it moves away from the spreading ridge axis?
 - a. 8 cm/yr or greater
 - b. Between 8 and 6 cm/yr
 - c. Between 6 and 4 cm/yr
 - d. Between 2 and 4 cm/yr
 - e. 2 cm/yr or less

23. What is the average direction of motion of the African plate (east (right-side) of ridge) - in relation to the ridge axis - over the last 54 million years?
 - a. North;
 - b. East;
 - c. South;
 - d. West;

24. What is the average speed for the African plate as it moves away from the spreading ridge axis?
 - a. 8 cm/yr or greater
 - b. Between 8 and 6 cm/yr
 - c. Between 6 and 4 cm/yr
 - d. Between 2 and 4 cm/yr
 - e. 2 cm/yr or less

25. How do the calculated spreading rates on opposite sides of the ridge axis compare to each other?
- They have roughly the same spreading rates.
 - They have significantly different spreading rates.
26. The seafloor on opposite sides of the ridge axis appear to be ____
- all on the same tectonic plate.
 - on different tectonic plates.
 - No way to telling how many tectonic plate there are.
27. The dominant crustal stress along the South Atlantic Mid-Ocean Ridge to be is _____.
- compressional
 - sheer
 - tensional
28. The South American and African plates are joined by a _____ plate boundary.
- convergent
 - divergent
 - transform
29. The central axis along the South Atlantic Mid-Ocean Ridge appears to represent a _____.
- the interior of a single plate.
 - a divergent plate boundary.
 - a convergent plate boundary.
 - a transform plate boundary.
30. The plate tectonic process occurring along the South Atlantic Mid-Ocean Ridge is called _____
- subduction
 - seafloor collision
 - seafloor spreading



The South Atlantic Mid-Ocean Ridge (SAMOR) Map

PART V. MINERAL & ROCK RECOGNITION

Directions: *Identify the letter of choice that BEST completes the statement or answers the question.*
Use hand lens,, Microscope and Hardness Test OFTEN!!

SAMPLE SET 1 (Minerals)

31. Name these four mineral samples (“1A”, “1B”, “1C” and “1D”); not necessarily in respective order.
- a. gypsum, calcite, quartz & muscovite;
 - b. plag, K-spar, olivine & quartz;
 - c. calcite, biotite, muscovite & gypsum;
 - d. gypsum, calcite, halite & quartz;
 - e. halite, calcite, quartz & K-spar;
 - a+b. gypsum, augite, k-spar & hornblende;
32. What is the cleavage direction(s) for sample “1B”?
- a. None; b. 1 direction; c. 2 directions; NOT @ 90°; d. 2 directions; @ 90°;
 - e. 3 directions; NOT @ 90°; a + b. 3 directions; @ 90°; b + c. More than 3 directions
33. Give cleavage direction(s) or pattern for sample “1D”.
- a. None; b. 1 direction; c. 2 directions; NOT @ 90°; d. 2 directions; @ 90°;
 - e. 3 directions; NOT @ 90°; a + b. 3 directions; @ 90°; b + c. More than 3 directions
34. What is the general hardness of these minerals?
- a. all four are soft; b. all four are hard; c. one is soft; the other three are hard
 - d. two are soft; the other is hard e. two are soft; the other two are hard
35. **ALL THREE** minerals (labeled “1A”, “1B” and “1C”) are most common in which major rock type?
- a. Igneous; b. Sedimentary; c. Metamorphic

SAMPLE SET 2 (Minerals)

36. Name these four mineral samples (“2A”, “2B”, “2C”, and “2D”); not necessarily in respective order.
- a. augite, hornblende, olivine & biotite;
 - b. calcite, tourmaline, biotite & gypsum;
 - c. augite, hornblende, olivine & magnetite;
 - d. magnetite, augite, halite & tourmaline;
 - e. augite, hornblende, quartz & biotite;
 - a+b. calcite, halite, muscovite & gypsum;
 - c+d. biotite, augite, magnetite & quartz;
37. Give cleavage direction(s) or pattern for sample “2B”.
- a. None; b. 1 direction; c. 2 directions; NOT @ 90°; d. 2 directions; @ 90°;
 - e. 3 directions; NOT @ 90°; a + b. 3 directions; @ 90°; c + d. More than 3 directions
38. Which single physical property allows you to BEST differentiate between minerals “2A” and “2B”?
- a. color b. cleavage angle; c. hardness; d. fizzes with acid e. luster; a + b. magnetism
39. Which of these four minerals are **MAFIC** in composition?
- a. Only samples “2A”& “2B” are mafic; b. Only samples “2B”& “2C” are mafic;
 - c. Only samples “2C”& “2D” are mafic; d. All four samples are mafic; e. None of them is mafic

40. All four minerals are very common/abundant in which one of the following rocks?

- a. gabbro b. shale c. granite; d. quartzite; e. limestone; a+b. obsidian

SAMPLE SET 3 (Minerals)

41. Name these four mineral samples ("3A", "3B", "3C", and "3D"); not necessarily in respective order.

- a. quartz, plag, olivine & muscovite;
b. calcite, tourmaline, biotite & gypsum;
c. olivine, hornblende, k-spar & muscovite;
d. quartz, augite, halite & tourmaline;
e. augite, hornblende, quartz & biotite;
a+b. quartz, k-spar, plag & biotite;
c+d. biotite, augite, k-spar & quartz;

42. Which of these four minerals lacks cleavage?

- a. Samples "3A" & "3B" both lack cleavage; b. Samples "3B" & "3C" both lack cleavage;
c. Samples "3C" & "3D" both lack cleavage d. Only Sample "3A" lacks cleavage

43. What is the general hardness of these minerals?

- a. all four are soft; b. all four are hard; c. one is soft; the other three are hard
d. two are soft; the other is hard e. two are soft; the other two are hard

44. All four of these minerals in Set 3 are very abundant/common in which of the following rock pairs?

- a. gabbro & basalt; b. granite & rhyolite; c. siltstone & claystone; d. chert & quartzite;
e. limestone & marble; a + b. obsidian and peridotite b + c. None of these pairs

SAMPLE SET 4 (Rocks)

45. Name these four rock samples ("4A", "4B", "4C" and "4D"); not necessarily in respective order.

- a. shale, obsidian, limestone and marble;
b. granite, siltstone, schist and pumice
c. siltstone, basalt, quartzite and gneiss
d. sandstone, quartzite, limestone and marble
e. schist, gneiss, shale and sandstone
a+b. sandstone, marble, rhyolite and schist
c+d. quartzite, limestone, diorite and slate

46. Select the correct rock classification for samples "4A" and "4B".

- a. Intrusive Igneous; b. Extrusive Igneous; c. Silici-Clastic Sedimentary;
d. Bio Sedimentary; e. Foliated Metamorphic; a+b. Nonfoliated Metamorphic

47. Name of rock sample "4A"?

- a. breccia; b. marble; c. granite; d. gneiss; e. limestone; a+b. basalt; b+c. sandstone;

48. Select the correct rock classification for sample "4C".

- a. Intrusive Igneous; b. Extrusive Igneous; c. Silici-Clastic Sedimentary;
d. Bio Sedimentary; e. Foliated Metamorphic; a+b. Nonfoliated Metamorphic

49. Which of these four minerals reacts to acid?

- a. Only samples "3A"& "3B" react to acid; b. Only samples "3B"&"3C" react to acid;;
c. Only samples "3C"&"3D" react to acid; d. Only sample "3A" reacts to acid;

SAMPLE SET 5 (Rocks)

50. Name these four rock samples (labeled "5A", "5B", "5C" & "5D"), not necessarily in respective order.

- a. schist, gneiss, shale and granite
b. granite, shale, rhyolite and slate
c. basalt, obsidian, pumice and limestone;
d. obsidian, siltstone, schist and tuff;
e. granite, gabbro, rhyolite, and basalt
a+b. limestone, obsidian, diorite and andesite
c+d. gneiss, conglomerate, diorite and siltstone

51. Name of rock sample "5A"?

- a. breccia; b. marble; c. granite; d. gneiss; e. gabbro; a + b. rhyolite; b + c. sandstone;

52. Select correct rock classification for samples "5B" and "5D"

- a. Intrusive Igneous; b. Extrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
e. Bio-sedimentary; a + b. Foliated metamorphic; c + d. Nonfoliated metamorphic

53. Select correct rock classification for samples "5C"

- a. Intrusive Igneous; b. Extrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
e. Bio-sedimentary; a + b. Foliated metamorphic; c + d. Nonfoliated metamorphic

54. Rock sample "5A" most likely formed at which one of the three major plate boundary settings?

- a. Divergent; b. Convergent; c. Transform

SAMPLE SET 6 (Rocks)

55. Name these four rock samples (labeled "6A", "6B", "6C" & "6D"), not necessarily in respective order.

- a. schist, gneiss, shale and granite
b. slate, phyllite, schist and gneiss
c. basalt, obsidian, phyllite and amphibolite;
d. obsidian, siltstone, schist and tuff;
e. gneiss, shale, rhyolite, and pumice
a+b. slate, schist, diorite and quartzite
c+d. gneiss, tuff, schist and siltstone

56. Solid-state mineralization processes that change parent (protolith) rock into the daughter rock occurs under _____ conditions.

- a. igneous; b. sedimentary c. metamorphic;

57. Select correct rock classification for "Parent" (original protolith) for rock sample "6A".

- a. Extrusive Igneous; b. Intrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
e. Bio-sedimentary; a + b. Foliated metamorphic; b + c. Nonfoliated metamorphic

58. Which type of metamorphic foliation has distinctive light- and dark-colored layering or banding?

- a. Slaty; b. Schistosity; c. Gneissic d. None do; e. All four types have it.

59. Select correct rock classification name for all four of these rock samples.

- a. Extrusive Igneous; b. Intrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
e. Bio-sedimentary; a + b. Foliated metamorphic; b + c. Nonfoliated metamorphic

60. Name of rock sample "6C"?

- a. breccia; b. marble; c. gneiss; d. sandstone e. slate; a + b. granite; b + c. schist;
c + d. limestone; d + e. Quartzite

SAMPLE SET 7 (Rocks)

61. Name these rock samples (labeled "7A", "7B", "7C" and "7D"); not necessarily in respective order.

- a. shale, siltstone, schist and pumice;
b. gabbro, conglomerate, quartzite and diorite
c. conglomerate, sandstone, siltstone, and shale
d. schist, gneiss, shale and sandstone
e. conglomerate, sandstone, granite, and slate
a+b. basalt, obsidian, schist and limestone;
c+d. breccia, tuff, quartzite and rhyolite;

62. Which of these four rock samples has the highest percentage of clay minerals?

- a. Sample "7A"; b. Sample "7B"; c. Sample "7C"; d. Sample "7D"; e. None have clay

63. Which rock sample most likely deposited in fastest-moving, turbulent waters (highest-energy environment)?

- a. Sample "7A"; b. Sample "7B"; c. Sample "7C"; d. Sample "7D"; e. None most likely

64. Which rock sample in Set 7 is a silici-clastic rock?

- a. Sample "7A"; b. Sample "7B"; c. Sample "7C"; d. Sample "7D"; e. All are silici-clastic
a+b. None of them are silici-clastic

65. Which rock sample has the largest amount of clay?

- a. Sample "7A"; b. Sample "7B"; c. Sample "7C"; d. All have the same amount of clay;
e. None have clay

66. Which rock sample most likely has the highest percentage of quartz?

- a. Sample "7A"; b. Sample "7B"; c. Sample "7C"; d. All are quartz rich e. All quartz poor

67. Which rock sample most likely deposited in calm, quiet waters (low-energy environment)?

- a. Sample "7A"; b. Sample "7B"; c. Sample "7C"; d. None of them e. No way to tell

SAMPLE SET 8 (Rocks)

68. Name these four rock samples (labeled "8A", "8B", "8C" & "8D"), not necessarily in respective order.
- a. scoria, obsidian, shale and granite
 - b. granite, shale, rhyolite and slate
 - c. basalt, obsidian, pumice and limestone;
 - d. obsidian, siltstone, schist and tuff;
 - e. granite, gabbro, rhyolite, and basalt
 - a+b. limestone, obsidian, diorite and andesite
 - c+d. scoria, obsidian, tuff and pumice
69. Name of rock sample "8A"?
- a. breccia; b. marble; c. granite; d. gneiss; e. gabbro; a + b. rhyolite; b + c. scoria;
70. Select the correct rock classification for all four samples in Set 8
- a. Intrusive Igneous; b. Extrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
 - e. Bio-sedimentary; a + b. Foliated metamorphic; c + d. Nonfoliated metamorphic
71. Select the correct rock classification for samples "8C" and "8D"
- a. Intrusive Igneous; b. Extrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
 - e. Bio-sedimentary; a + b. Foliated metamorphic; c + d. Nonfoliated metamorphic
72. Cooling history of sample "8B" is inferred to be relatively _____
- a. slow b. fast then slow c. slow then fast d. fast e. very fast
73. Rock Sample "8A" most likely formed at which one of the three major plate boundary settings?
- a. Convergent; b. Divergent; c. Transform

SAMPLE SET 9 (Rocks)

74. Name these four rock samples (labeled "9A", "9B", "9C" & "9D"), not necessarily in respective order.
- a. shale, obsidian, limestone and marble;
 - b. granite, siltstone, schist and breccia
 - c. siltstone, basalt, quartzite and gneiss
 - d. sandstone, quartzite, limestone and marble
 - e. granite, schist, limestone and conglomerate
 - a+b. sandstone, marble, rhyolite and schist
 - c+d. diorite, limestone, diorite and slate
75. Name of rock sample "9A"?
- a. breccia; b. marble; c. granite; d. gneiss; e. gabbro; a + b. rhyolite; b + c. basalt
76. Cooling history of sample "9A" is inferred to be relatively _____
- a. slow b. fast then slow c. slow then fast d. fast e. very fast
77. Select correct rock classification for samples "9B"
- a. Intrusive Igneous; b. Extrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
 - e. Bio-sedimentary; a + b. Foliated metamorphic; c + d. Nonfoliated metamorphic

78 Which type of metamorphism did sample "9B" most likely undergo?

- a. Contact metamorphism b. Regional metamorphism c. Sample "9B" is not metamorphic

79. Select correct rock classification for samples "9C"

- a. Intrusive Igneous; b. Extrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
e. Bio-sedimentary; a + b. Foliated metamorphic; c + d. Nonfoliated metamorphic

80. Select correct rock classification for samples "9D"

- a. Intrusive Igneous; b. Extrusive Igneous; c. Detrital sedimentary; d. Chemical sedimentary;
e. Bio-sedimentary; a + b. Foliated metamorphic; c + d. Nonfoliated metamorphic

81. What is the level of clastic grain sorting in sample "9D"?

- a. Well sorted b. Poorly sorted c. Sample "9B" is not a clastic rock.