STUDY GUIDE FOR EXAM 1 EOSC105L – NATURAL DISASTERS LAB
WEEK OF SEPT. 30TH – OCT. 2ND FALL 2019

REVIEW:

- **Introduction to mineral and rock chapters in lab manual**
- **Power point lectures on www.geoscirocks.com (Geotime, Plate Tectonics and Rock/mineral labs)**
- **Rocks and minerals in library** ask for EOSC105L boxes (reserve desk, 2 hr. limit) EOSC110 has samples on reserve also

GEOLOGIC TIME SCALE: p. 5 in reader, p. 14 in lab manual.

Be able to place the following on a blank time scale with this word bank: Cambrian, Cretaceous, Jurassic, Permian, Triassic, Quaternary, Tertiary, Cenozoic, Mesozoic, Paleozoic, Phanerozoic, Precambrian.

Know where to place the following age numbers on the time scale: 4.6 Ga**;** 542 Ma**;** 251 Ma**;** 66 Ma

CONVERSIONS AND SCIENTIFIC NOTATION PROBLEMS: there will be a few problems similar to the conversion exercise. See the following for help: http://serc.carleton.edu/mathyouneed/index.html

MINERALS AND ROCKS IDENTIFICATION: There will be roughly 20 mineral and rock samples to identify. The samples will be organized in sample bins with several samples per bin (sample sets). You will be asked a set of questions about each sample set. You will have to identify the sample (mineral or rock name). For mineral sets, you may also be asked questions concerning the physical properties of the mineral and what sort of rocks that particular mineral is most a common constituent. For the rock sample sets, you will also be asked to determine rock composition and/or rock texture, and give the rock classification (intrusive or extrusive igneous, sedimentary, metamorphic, and possibly answer a few more questions, see below under **ID portion.**

- **You can use the mineral/rock charts completed in lab ONLY** for the identification portion of the exam.

MINERALS:

- All minerals are classified under 2 categories. What are they? Why are the silicates more important?
- What are the 2 most abundant silicate minerals in Earth's crust? Which mineral is most abundant?
- What is the difference between dark and light silicate minerals: **1)** Iron (Fe) and magnesium (Mg) content? **2)** Amount of silicon and oxygen (SiO_2 amount)?
- **Know the basic rock forming minerals**. Know the common silicate minerals: quartz, k-feldspar, muscovite mica, plagioclase feldspar, biotite mica, hornblende (amphibole), augite (pyroxene), olivine.
- Be able to identify the minerals you looked at in lab by using physical tests (hardness, cleavage, color) **ID portion**

IGNEOUS ROCKS:

- Be familiar with the following terms: intrusive, extrusive, felsic, mafic, crystallization. **ID portion and other portion**
- What controls igneous texture (or size of minerals)?
- Know the 3 intrusive igneous rocks identified in lab (Granite, Diorite, Gabbro) and their extrusive equivalents.
- Be able to classify an igneous rock as intrusive or extrusive.**ID portion**
- Be able to identify textures (phaneritic, aphanitic, porphyritic, glassy, vesicular) and mineral composition (assemblage of minerals) in the igneous rocks. **ID portion.**
- **There will be a word bank for textures and Sample classification** *(see sample question on next page)*

SEDIMENTARY ROCKS:

- Know the sedimentary rocks identified in lab and their classification: Detrital or Biochemical (Organic)/Chemical. **ID portion**
- How are detrital sedimentary rocks classified?
- Know type of sediment that makes up each detrital rock. **ID portion**

OVER→

METAMORPHIC ROCKS:

- Know the metamorphic rocks identified in lab and their classification: foliated or non-foliated **ID portion**

- What are parent rocks for 1) gneiss 2) slate; 3) marble; and 4) quartzite? (put this info on your charts) **ID portion**

UNDERSTAND THE ROCK CYCLE: Be able to connect the 3 rock types and sediment with the correct processes: Weathering and erosion; Lithification (compaction); Heat and Pressure; Crystallization; Melting. See p. 40-42 in the lab manual.

PLATE TECTONICS

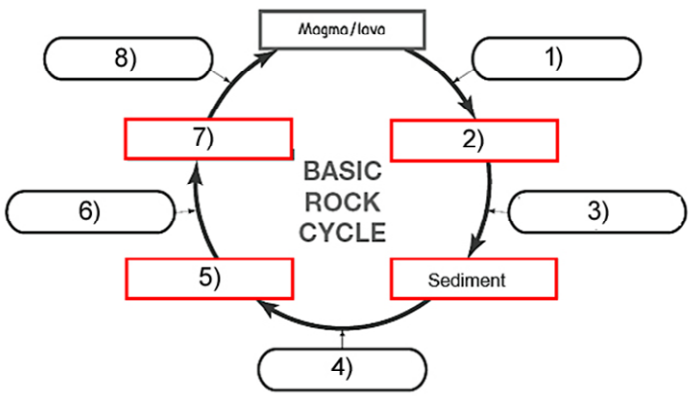
- Know **how to measure and calculate plate motion: Velocity (Rate) = Distance/Time** (***age of rock)***
- Know how to do simple **conversions, i.e.** miles to km, feet to m, m to mm. *(conversion chart will be given).*
- Be able to use scientific notation. 10,000 = 1.0×10^4 240 km= 24,000,000cm = 2.4×10^7 cm
- Understand relative motion along convergent, divergent, and transform plate boundaries.
- Remember compass direction: N, E, NW, etc…If you were asked a direction a plate is moving.
- 3 ways to calculate plate motion (refer to exercises): **1)** hot spot islands/volcanic rock, **2)** transform faults, **3)** magnetic anomalies on seafloor
- Know where the following are located on a plate tectonic map: 1) Ring of Fire, 2) East Pacific Rise, 3) Mid Atlantic Ridge: **ADDED SINCE POSTED ON Bb**
- Earthquake machine on next exam

NOTE: IMPORTANT TO COMPLETE THE 4 CHARTS (spreadsheets) YOU WORKED ON IN LAB (MINERAL, IGNEOUS, SEDIMENTARY, AND METAMORPHIC). STAPLE TOGETHER AND BRING TO EXAM. IF YOU FORGET, YOU TAKE THE EXAM WITHOUT. ALSO, YOUR MINERAL AND ROCK CHART SPREADSHEETS ARE A BIG PART OF YOUR LAB ACTIVITY GRADE, SO YOU WILL NEED TO TURN THOSE IN AFTER THE EXAM TO GET A GRADE FOR THEM.

EXAMPLE QUESTIONS CONCERNING THE THE ROCK CYCLE

Directions: Pick the correct lettered word choice for each of the numbered blank boxes and ellipses in the incomplete rock cycle chart below. The boxes represent the three general rock types, whereas the ellipses represent rock-forming processes. Your answers correspond to answer line numbers 1) through 8) on your scantron card.

a. Sedimentary Rock
b. Cooling/crystallization
c. Metamorphic Rock
d. Melting
e. Metamorphism
a. + b. Weathering/transport/deposition
b. + c. Igneous Rock
c. + d. Lithification



EXAMPLE QUESTIONS CONCERNING IGNEOUS ROCK CLASSIFICATION

Directions: Pick the correct lettered word choice for each of the numbered blank lines in the incomplete igneous rock classification chart below. Match the extrusive rocks to their intrusive equivalents and put in order from felsic to mafic. Your answers correspond to answer line numbers 1) through 8) on your scantron card.

a. Basalt
b. Granite
c. Rhyolite
d. Gabbro
e. Andesite
a. + b. Diorite

INTRUSIVE		EXTRUSIVE	
9)_____	=	12) _____	FELSIC
10) _____	=	13)_____	INTERMEDIATE
11) _____	=	14)_____	MAFIC

Example Questions of Geologic Timescale:

Multiple Choice: Directions: *Identify the letter of choice that BEST completes the statement or answers the question.*

15. Which of the following periods occurred during the Mesozoic?
a. Cambrian
b. Triassic
c. Paleogene
d. Permian
e. Silurian

16. Which of the following epochs did NOT occur during the Tertiary period?
a. Miocene
b. Eocene
c. Paleocene
d. Holocene
e. Oligocene

17. Which of the following ages is closest to the Mesozoic-Cenozoic boundary?
a. 840 million years ago
b. 540 million years ago
c. 230 million years ago
d. 63 million years ago
e. 12 million years ago

Example Questions of MINERAL RECOGNITION *and IDENTIFICATION*

Directions: *Identify the letter of choice that BEST completes the statement or answers the question.*

USE MICROSCOPE and HARDNESS TEST OFTEN!! Ask for a virtual acid test result for any sample in question.

SAMPLE SET 1

18. Name this trio of mineral samples (labeled "1A", "1B" and "1C"); not necessarily in respective order.
a. gypsum, muscovite & biotite; **b.** calcite, quartz & K-spar; **c.** olivine, augite & hornblende;
d. calcite, quartz & gypsum; **e.** plagioclase, K-spar &quartz; **a + b.** calcite, quartz & plagioclase;
b + c. augite, hornblende & olivine **c + d.** hornblende, quartz & garnet **d + e.** quartz, biotite & k-spar

19. What is the general hardness of these minerals? (hardness of 5 and less is considered soft)
a. all three are soft; **b.** all three are hard; **c.** one is soft; the other two hard **d.** two are soft; the other is hard

20. ALL THREE minerals (taken together - labeled "1A", "1B" and "1C") are most common in which major rock type?
a. Igneous; **b.** Sedimentary; **c.** Metamorphic

SAMPLE SET 2

21. Which of these three minerals is in the *mica* group?
a. Sample "2A"; **b.** Sample "2B" **c.** Sample "2C"

22. Which of these minerals is the most mafic?
a. Sample "2A"; **b.** Sample "2B" **c.** Sample "2C"

23. Name this trio of mineral samples (labeled "2A", "2B" and "2C"); not necessarily in respective order.
a. gypsum, muscovite & biotite; **b.** biotite, quartz & K-spar; **c.** olivine, augite & hornblende;
d. calcite, quartz & gypsum; **e.** muscovite, K-spar & quartz; **a + b.** calcite, quartz & plagioclase;
b + c. augite, hornblende & olivine **c + d.** muscovite, quartz & gypsum **d + e.** biotite, muscovite & augite

SAMPLE SET 3

24. What is the general hardness of these minerals?

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

25. ALL THREE minerals (labeled "3A", "3B" and "3C") are very abundant in which of the following rock pairs?

a. gabbro & basalt; **b.** granite & rhyolite; **c.** siltstone & shale; **d.** sandstone & quartzite;

e. limestone & marble; **a + b.** obsidian and diorite **b + c.** None of these pairs

26. Name these three mineral samples (labeled "3A", "3B" and "3C"); not necessarily in respective order.

a. gypsum, muscovite & biotite; **b.** biotite, quartz & K-spar; **c.** olivine, augite & hornblende;

d. calcite, quartz & gypsum; **e.** plag, K-spar & quartz; **a + b.** calcite, quartz & plagioclase;

b + c. augite, hornblende & olivine **c + d.** muscovite, quartz & augite **d + e.** olivine, biotite & garnet

Example Questions of ROCK RECOGNITION *and IDENTIFICATION*

Directions: *Identify the letter of choice that BEST completes the statement or answers the question.*

USE MICROSCOPE and HARDNESS TEST OFTEN!! Ask for a virtual acid test result for any sample in question.

SAMPLE SET 4

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

a. sandstone and siltstone; schist and gneiss; **b.** gabbro and granite; quartzite and marble

c. limestone and chert; diorite and andesite **d.** schist and gneiss; shale and sandstone

e. granite and gabbro; rhyolite and basalt **a + b.** sandstone and quartzite; limestone and marble;

b + c. basalt and gabbro; schist and gneiss; **c. + d.** basalt and gabbro; shale and sandstone

28. Name of rock sample "4A"?

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

29. The most abundant mineral in Samples "4C" and "4D" is _____.

a. Clay; **b.** Feldspar; **c.** Olivine; **d.** Gypsum; **e.** Muscovite; **a + b.** Quartz; **c + d.** Calcite

30. Select correct rock classification for samples "4D"

a. Intrusive Igneous; **b.** Extrusive Igneous; **c.** Silici-clastic detrital sedimentary; **d.** Bio-Chemical sedimentary;

e. Foliated metamorphic; ; **a + b.** Nonfoliated

SAMPLE SET 5

31. Name this trio of rock samples (labeled "5A", "5B" and "5C"), not necessarily in respective order.

a. sandstone, granite, and chert; **b.** gabbro, limestone, and granite; **c.** limestone, schist, and basalt;

d. schist, conglomerate, and gneiss; **e.** basalt, slate, and gneiss **a + b.** conglomerate; sandstone, and shale

b + c. marble, granite, and siltstone; **c + d**. quartzite, limestone, and diorite; **d + e.** slate, schist, and gneiss

32. Select most-likely rock "Parent" rock (original protolith) for rock sample "5A".

a. Basalt; **b.** Granite; **c.** Shale; **d.** Limestone; **e.** Quartz sandstone; **a + b.** Gneiss; **b + c.** Obsidian

33. Select correct rock classification name for all three of these rock samples.

a. Extrusive Igneous; **b.** Intrusive Igneous; **c.** Silici-clastic detrital sedimentary; **d.** Bio-Chemical sedimentary;

e. Foliated metamorphic; **a + b** Nonfoliated metamorphic

SAMPLE SET 6

34. Name this trio of rock samples (labeled "6A", "6B" and "6C"), not necessarily in respective order.

a. sandstone, granite, and chert; **b.** gabbro, limestone, and granite; **c.** limestone, schist, and basalt;

d. schist, conglomerate, and gneiss; **e.** basalt, slate, and gneiss **a + b.** conglomerate; sandstone, and shale

b + c. marble, granite, and siltstone; **c + d**. quartzite, limestone, and diorite; **d + e.** slate, schist, and gneiss

35. Which rock sample is mostly made of clay minerals?

a. Sample "6A"; **b.** Sample "6B"; **c.** Sample "6C"; **d.** All have the same amount of clay; **e.** None have clay

36. Which rock sample most likely deposited in the bottom of a deep lake or in deeper ocean (very quiet waters)?

a. Sample "6A"; **b.** Sample "6B"; **c.** Sample "6C"; **d.** All most likely **e.** None most likely

37. Which rock sample <u>most likely</u> deposited in <u>fast-moving, turbulent waters</u> (high-energy environment)?

a. Sample "6A"; **b.** Sample "6B"; **c.** Sample "6C"; **d.** All most likely **e.** None most likely

SAMPLE SET 7

38. Select correct rock classification for samples "7B" and "7D"

a. Extrusive Igneous; **b.** Intrusive Igneous; **c.** Silici-clastic detrital sedimentary; **d.** Bio-Chemical sedimentary;

e. Foliated metamorphic; **a + b** Nonfoliated metamorphic

39. Cooling history of the *magma* of Samples "7A" and "7B"is inferred to be relatively_____, whereas the cooling history of the *magma* of Samples "7C" and "7D" is inferred to relatively _____.

a. slow (1st blank); fast (2nd blank) **b.** fast (1st blank); slow (2nd blank) **c.** all four slow **d.** all four fast

40. Rock Sample "7A" <u>most likely</u> formed at which one of the three major plate boundary settings?

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

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

a. sandstone and siltstone; schist and gneiss;
b. limestone and chert; diorite and andesite
c. granite and gabbro; rhyolite and basalt
d. basalt and gabbro; schist and gneiss;
e. gabbro and granite; quartzite and marble
a + b. schist and gneiss; shale and sandstone
b + c. sandstone and siltstone; breccia and conglomerate;
c. + d. basalt and gabbro; shale and sandstone

Example Questions of Plate Tectonics Boundaries and Processes

Directions: *Match the geographic location (Capital Letter on located on map) with its associated tectonic feature or setting (small case letter(s)) in answer key)*. Note: For answers with two letters, bubble in two letters as a single answer.

a. convergent plate boundary with *oceanic-oceanic* subduction
b. convergent plate boundary with *oceanic-continental* subduction
c. convergent plate boundary with *continent-continent* collision
d. divergent plate boundary with seafloor spreading
e. divergent plate boundary with continental rifting
a. + b. transform plate boundary
b. + c. hot spot volcanism
c. + d. passive margin

____ **42.** Locality A **– Mariana Islands and Trench**

____ **43.** Locality B **– Mid-Atlantic Ocean underwater mountain belt**

____ **44.** Locality C **– Chilean Trench and Andes Mountain range**

____ **45.** Locality D **– Himalaya Mountains**

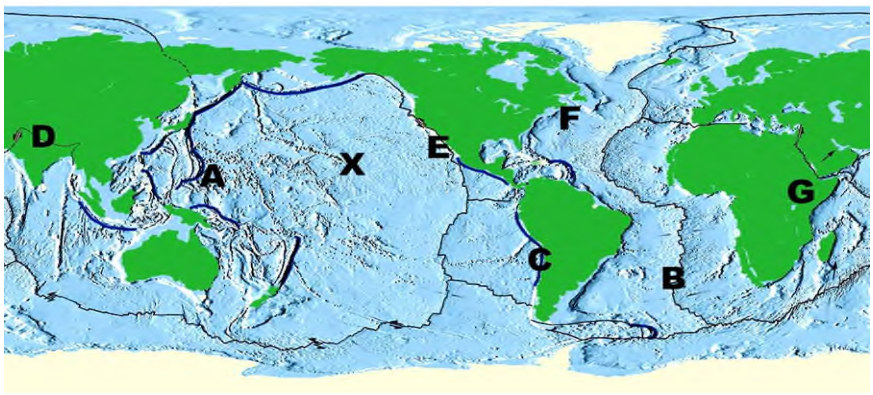
____ **46.** Locality E **– Southern California**

____ **47.** Locality F **– Northeast US seaboard**

____ **48.** Locality G **– East Africa Rift Valley**

____ **49.** Locality X **– Big Island, Hawaii**

Tectonic Plate Boundary Map



Example Questions of Plate Movement Over a "Fixed" Hotspot

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 below 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 (1×10^5) cm

1. What is **average speed** for the Pacific plate associated with the Louisville Hotspot?

- **a.** 10 cm/yr or greater
- **b.** Between 6 and 9 cm/yr
- **c.** Between 3 and 6 cm/yr
- **d.** Between 1 and 3 cm/yr
- **e.** Less than 1 cm/yr

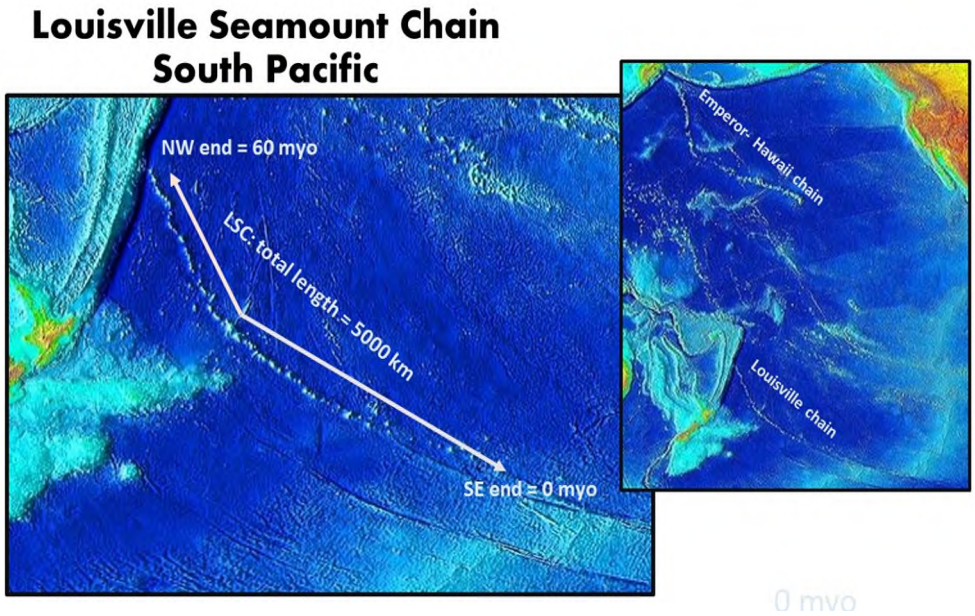
2. What's the **average direction** of motion of the Louisville Seamount chain (Pacific plate) over the hot spot?

a. North; **b.** Northeast; **c.** East; **d.** Southeast; **e**. South; **a.** + **b**. Northwest; **b.** + **c**. Southwest; **c.** + **d**. West;

3. 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 _____.

- **a.** be moving on the same tectonic plate.
- **b.** be moving on different tectonic plates
- **c.** have formed from the same hot spot.
- **d.** None of the above.



Example Questions of 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.

1. 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;

2. 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

3. What is the average direction of motion of the African plate(east (right-side) of ridge) - in relation to the ride axis - over the last 54 million years?

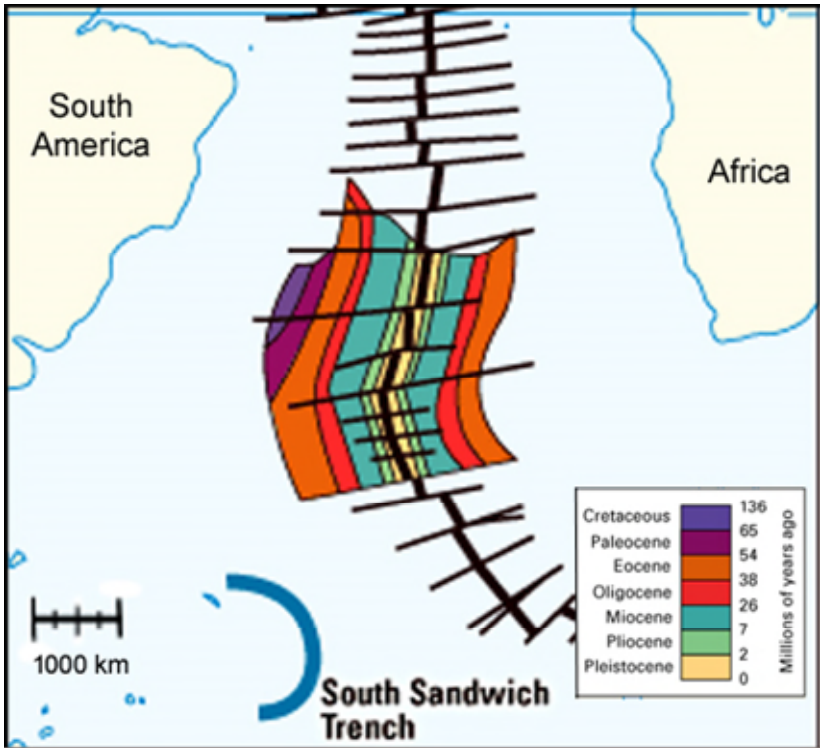
a. North; **b.** East; **c.** South; **d.** West;

4. 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

5. The South American and African plates are joined by a _____ plate boundary.

a. convergent
b. divergent
c. transform


South America
Africa
1000 km
South Sandwich Trench
Cretaceous
Paleocene
Eocene
Oligocene
Miocene
Pliocene
Pleistocene
136
65
54
38
26
7
2
0
Millions of years ago