EAS1600 - INTRODUCTION TO ENVIRONMENTAL SCIENCES

Fall, 2014

Exam 4 – 11/24/14

- **Answer all questions**
- **Show all your work and be sure and report units where appropriate**
- **Place your name on each page**
- **This is a closed-book exam; all are expected to comply with Georgia Tech Honor Code**

I am aware and in compliance with the Georgia Tech Honor Code and I agree to abide by the grading policies of this class.

Signature: _____

Print Name: _____

Lab Section: _____

B

Answer the following multiple choice questions (1 – 5) by circling the best answer.

1. The Hawaiian Islands were formed by what process? (5 points)

a) ocean-ocean plate convergence
b) The pacific plate passing over a hot spot
c) ocean-ocean plate divergence
d) ocean-continent plate convergence

2. What type of rock below is metamorphic? (5 points)

a) granite
b) limestone
c) basalt
d) marble

3. Which of the following pieces of evidence did Wegener use to promote his theory of Continental Drift? Circle all that apply (5 points)

a) Evidence of previous glaciers in regions that are currently warm.
b) The similarity of fossils across continents.
c) The close fit of the coast lines of South America and Africa
d) The magnetic striping of rocks on the bottom of the ocean

4. Which of the following minerals would you expect to weather the most rapidly? (5 points)

a) Calcite
b) Halite
c) Quartz
d) Olivine

5. Which of the following is formed due to Ocean-Ocean plate convergence? Circle all that apply. (5 points)

a) The Himalayas
b) Hawaiian Islands
c) Aleutian Islands
d) The Andes Mountains

6. For the following compounds state the oxidation number of the C and also state if the compound is organic or inorganic. (10 pts)

Compound	Oxidation#	Organic/Inorganic
CH_3COOH	_____	_____
$C_{12}H_{24}O_{12}$	_____	_____
HCO_3^-	_____	_____
CO_2	_____	_____
C_8H_8	_____	_____

7. True or False. Mark each statement below as True or False (2 pts each)

a. The location of an earthquake epicenter can be determined by using 2 seismographs. _____

b. The Himalaya Mountains are not volcanic. _____

c. The pH of the rainwater is effectively buffered by CO_2 dissolving from the atmosphere. _____

d. India and Australia are on different tectonic plates._____

e. As atmospheric CO_2 increases, rock weathering is more rapid. _____

f. Iceland is situated above a hot spot and is also divided by the mid-Atlantic ridge._____

g. The Aleutian Islands are formed due to hot spots. _____

h. Stone Mountain is made out of basalt. _____

i. Hawaii is made out of granite. _____

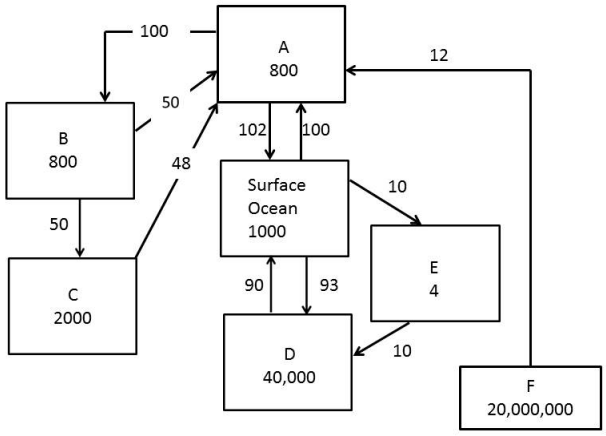
j. The pH of the ocean is neutral. _____

k. Basaltic lava flows can travel large distance as they are very fluid._____

l. The pH of rain even in unpolluted environments is acidic._____

8. A seismograph records an earthquake with an epicenter that is at a distance of 1000 km. The difference in arrival times of the S and P waves are 60 s. assuming the S wave travels at 4 km/s what is the P wave velocity? (6 pts)

9. Answer the following questions about Earth's short term Carbon Cycle (i.e. a time scale of decades to centuries) based on the diagram below. All reservoir amounts are in Gtons of C and all fluxes (arrows) are in Gtons/yr. (20 pts)



a) Identify the reservoirs labeled A, E, and F.

b) What is the residence time of carbon in the Living Land Biosphere?

c) Identify two reservoirs that are composed of primarily organic carbon.

d) Write out a chemical reaction that removes carbon from the atmosphere.

e) Identify two reservoirs that are composed of primarily inorganic carbon.

f) What is the process that connects the ocean biosphere to the deep ocean?

10. Calculate the pH of the aqueous solutions below. (15 pts).

a) Estimate the pH of a rain if there is enough CO_2 in the atmosphere to produce 1.6×10^{-5} mole/l of carbonic acid (H_2CO_3) in aqueous solution. (5 pts)

b) A solution of 0.11 mole/l of bicarbonate (HCO_3^-) and 0.1 mole/l of hydrochloric acid (HCl). (5 pts)

c) A solution of 0.1 mole/l of bicarbonate (HCO_3^-), 0.1 mole/l of carbonic acid, and 0.3 mole/l of hydrochloric acid (HCl). (5 pts)

Formulas, facts, and constants you may find useful:

1. K_a of carbonic acid (H_2CO_3) = 4 x 10^{-7}
2. The expression for an acid equilibrium constant for a generic acid (HX) is $K_a = \frac{[H^+][X^-]}{[HX]}$