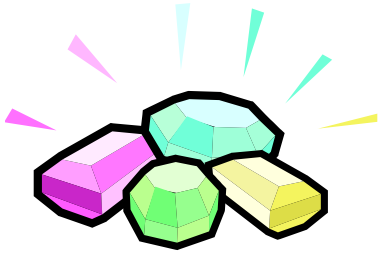
Rocks, Minerals, and Plate Tectonics



NAME:_____

Objective**:** The purpose of this lab is to introduce students to the basic features of rocks and minerals of the ocean. The importance of understanding rock composition and formation will be crucial to our understanding of seafloor sediments and beach processes.

DIRECTIONS: Print this lab out and bring it to class. All answers to this lab will be completed in class.

1. Rock Laboratory

(1.1) Each table should have a rock set to work with for this next section. In each rock set there should be three groups of rocks (if your set has a mineral section, you will use this for Part 3 of this lab). Based on your definitions and the rock cycle from Part 1 of this lab, identify each group of rocks as igneous, metamorphic or sedimentary.

Group 1: _____
Group 2: _____
Group 3: _____

(1.2) Explain what were the key features that you used to distinguish each group of rocks. Write your explanations below.

Group 1:_____
_____
Group 2:_____
_____
Group 3:_____
_____

2. Minerals

(2.1) What exactly are rocks? Simply defined, a rock is any solid mass of mineral or mineral-like matter that occurs naturally as part of our planet. This begs the question: What then, is a

mineral? A mineral is a naturally occurring inorganic solid that possess an orderly internal structure and a definite chemical composition. Most rocks occur as a conglomeration of many types of minerals. These are the crystal or crystal-like pieces that you can see by closely examining a rock.

Which type of rock goes through crystallization?_____

(2.2) The table below list some of the most common minerals found in rocks. Check the boxes of all the minerals that you have on your tray.

Mineral Name	**Description**	**Yes**
Galena	Silvery; very heavy; fairly soft; cubic shape	
Hornblende	Black to greenish black; fairly hard; forms 60º and 120º corners	
Olivine	Olive green; fairly hard; has small glassy grains	
Biotite	Dark brown to black; fairly soft; in thin sheets	
Feldspar	Salmon colored or white to blue-gray; fairly hard; forms almost 90º at the corners	
Quartz	Various colors; very hard; glassy appearance; can show diamond or gem shaped edges	
Calcite	White, yellowish to colorless; near cubic formation (75º edges); bubbles with drops of HCl	
Halite	White to colorless; forms 90º edges (cubic); salty taste	
Muscovite	Transparent and in thin sheets; light brown	
Talc	White, pink or green; very soft; forms in thin plates; soapy feel	

(2.3) Examine an igneous rock of granite that show good crystallization. Which of the minerals that you identified on your tray are found in the igneous rock?_____
_____
_____

(2.4) Now examine all the igneous rocks in your tray. Why do you think some igneous rocks show large crystals while others do not? In other words, knowing how igneous rocks form, what process would cause large crystals to form?_____
_____
_____
_____

(2.5) The two most important types of igneous rocks for oceanography are granite and basalt. Use your textbook to distinguish the difference physically and chemically between these two types of igneous rocks.

Granite:_____
_____

Basalt:_____

_____

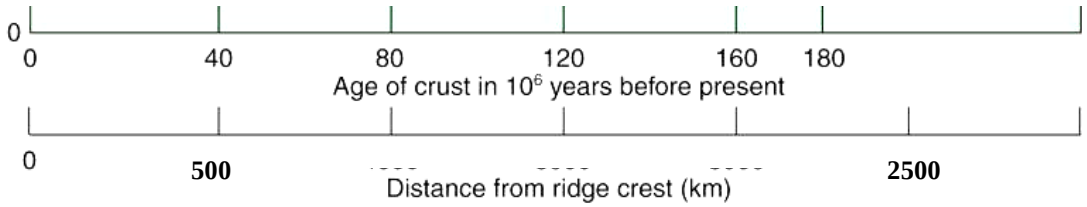
3. Seafloor Spreading

(3.1) As soon as new basaltic ocean floor forms at the mid-ocean ridge, sediment begins to accumulate upon it. From this information, what conclusions could you draw about the age of the sea floor and the thickness of sediments that cover it as it moves away from a ridge?_____

_____

(3.2) One way of estimating the rate at which new seafloor is being created is to determine the age of the oldest basalt crust as shown on the following page. This rate is called the **half-spreading rate**. In order to get the **total spreading rate** you would multiply the half-spreading rate by two. Can you think of why the total spreading rate is calculated in this manner?_____

_____



(3.3) Using the data lines above, calculate the half-spreading rate of the South Atlantic (distance / time = velocity in km/ million year) and your total spreading rate. Show your work.
Half Spreading Rate:_____
Total Spreading Rate:_____

(3.4) Estimate the distance between Brazil, Cape Sao Roque and Africa, Cameroon today. Use any source available (e.g., globe, atlas, textbook) to estimate the distance. What was your estimate and source?_____

(3.5) Using your distance estimate and your total spreading rate, calculate how long ago the South Atlantic began to form. (HINT: Set your problem up so that distances cancel and time is left as the divisor) Show your work.

_____

4. Measuring Density of a Solid

Materials needed: Your textbook, balance, ruler, 1000-ml graduated cylinder, various solids

(4.1) All matter has mass and volume. What are the usual units of measure for mass and volume?
Mass:_____
Volume:_____

(4.2) We define density (ρ) as the ratio of the mass of an object to the volume it occupies. The equation is given by: $\rho = M / V$. Here the symbol M stands for the mass of the object, and V the volume. What are the units of measure for density?
Density:_____

(4.3) Obtain a small block of wood and a small block of rock. Using a balance, measure their weight in grams.
Wood:_____
Rock:_____

(4.4) Measure the wood and rock volumes using a ruler and multiplying length x width x depth.
Wood:_____
Rock:_____

(4.5) Using the information you have, calculate the wood and rock's density (remember to add your units)
Wood:_____
Rock:_____

(4.6) How could you measure the volume of the wood and rock using a graduated cylinder full of water?_____
_____
_____

(4.7) What was the volume of the wood and rock using the graduated cylinder method?
Wood:_____
Rock:_____

(4.8) With the measurement of volume from the displacement method, re-calculate the density of the wood block and rock (use the same weight measurement from 4.3).
Wood:_____
Rock:_____

(4.9) Did you get the same density using both methods? If not, hypothesize why you may have got differences and speculate of which of the two methods is the most accurate?

_____
_____
_____

(4.10) What would happen if a 'tectonic plate' of granite collided with a 'tectonic plate' of wood much like a convergent plate boundary?

_____
_____
_____

(4.11) How does the question from (4.10) relate to what happens when two plates of different density collide on earth?

_____
_____
_____