

NAME _____ DATE _____

APES Standard 4 Land and Water Use

Soil Formation and Properties (Background Ch. 8)

Objectives: calculate the rate of weathering for different rock types, model soil structure and horizons, determine soil type, and determine bulk density and soil permeability

****Use the class set of the lab background as a reference.****

Lab Activity 1: Mechanical and Chemical Weathering

Materials

- 20 g. of granite
- 20 g. of basalt
- 20 g. of marble
- hand lens
- 3 small capped vials
- large beaker
- forceps
- scale

Procedure

A. Mechanical weathering

Write your prediction below: Which type of rock will undergo the most mechanical weathering and why do you think that?

1. Acquire about 10 g. of each granite, basalt, and marble; a hand lens; 3 small, capped vials; forceps; and a large beaker.
2. Fill the beaker with at least 200 mL of water.
3. Using paper towels, dab each rock so that there is no water dripping from it.
4. Weigh the granite, basalt, and marble samples. Record the "initial" weights in table 1.
5. Using a hand lens, inspect each group of rocks. in your lab notebook, make notes about surface texture sharp edges and general appearance.
6. Place the granite, basalt and marble samples in three separate small, capped vials.
7. Fill each vial with just enough water to cover the rocks.
8. Secure the lids to the top of the vials.
9. With your lab partners, shake all of the vials continuously for three minutes.
10. Using forceps, remove the rocks from the vials, towel them off, and reweigh each group. Record the weights in table 1 in the "3 min" column.
11. Place the rocks back in the vials. Add water if necessary, so that the rocks are submerged, and then shake the vials continuously for another three minutes. Record the weights in table 1 in the "6 min" column.
12. Repeat step 10 and step 11 two more times and record the results in table 1.
13. Using a hand lens, inspect each group of rocks. In your lab notebook, describe any changes in surface texture, edges, size or general appearance.
14. Plot the weight results for the granite, basalt, and marble samples on a line graph, showing weight changes over time.

B. Chemical weathering

Lab day 1

Write your prediction below: Which type of rock will undergo the most chemical weathering and why do you think that?

1. Acquire about 10 g each of presoaked granite, basalt, and marble; 3 small capped vials; and forceps.
2. Using paper towels, dab each rock so that there is no water dripping from it.
3. Weigh the granite, basalt, and marble samples. Record the "initial" weights in table 2.
4. Using a hand lens, inspect each group of rocks. In your lab notebook, make notes about surface texture sharp edges and general appearance.
5. Place the granite, basalt and marble samples in three separate small, capped vials.

- While wearing a lab apron, safety goggles, and gloves, pour enough hydrochloric acid (HCl) into each vial to cover the rocks. Observe results.
- Do not cap the vials immediately. After several minutes have passed secure the lids to the vials and place them in a secure area to be stored overnight

Lab day 2

- While wearing a lab apron, safety goggles, and gloves, carefully uncap the vials. Without disturbing the rocks, drain the acid into the sink. Turn on the faucet and wash the acid away with copious amounts of water.
- Wash the acid away from the rocks; fill the vials with water and, without disturbing the rocks, pour the acid into the sink. Repeat this to more times.
- Using forceps, remove the rocks from the vial and place them on a paper towel to absorb excess water.
- Once there is no water dripping from the rocks, reweigh each sample and record the results in the "final weight" column.
- Using a hand lens, inspect each group of rocks. In your lab notebooks, describe any changes in surface texture, edges, size, or general appearance.
- Plot the weight results for the granite, basalt, and marble samples on a bar graph, showing the mass before and after the rocks were weathered by the acid.

Table 1. Mechanical Weathering Weight Data.

| Rock Type | Physical Description (initial) | Initial Weight (grams) | 3min Weight (grams) | 6 min Weight (grams) | 9 min Weight (grams) | 12 min Weight (grams) | Physical Description (final) |
|-----------|--------------------------------|------------------------|---------------------|----------------------|----------------------|-----------------------|------------------------------|
| Granite | | | | | | | |
| Basalt | | | | | | | |
| Marble | | | | | | | |

Table 2. Mechanical Weathering Percent Change.

| Rock Type | % Change ((final weight – initial weight)/initial weight)*100 |
|-----------|---|
| Granite | |
| Basalt | |
| Marble | |

Graph 1. Change in weight over time for granite, basalt and marble.



Analysis:

- Explain why your prediction was supported or not for mechanical weathering.
- Explain why your prediction was supported or not for chemical weathering.
- Explain how the HCl model a real environmental issue?

Lab Activity 2: Soil Organization

Materials

- Sand Sample
- Clay Sample
- Humus Sample
- 3 Plastic Columns
- 3 Rubber Bands
- 3 Cups
- Scissors
- 3 One Inch Squares of Cheesecloth
- 3 Large Vials
- Bottle of Food Coloring
- Large Beaker
- 6 Twist Ties
- Measuring Spoon
- Pipet

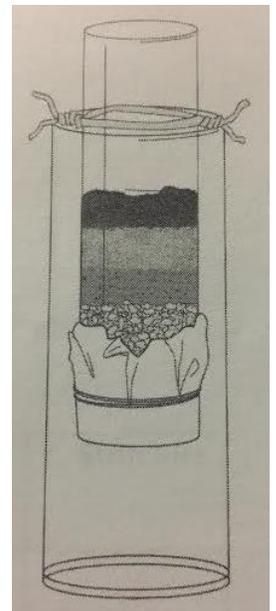
Procedure

1. Acquire 3 plastic columns, 3 large vials, cheesecloth (enough to cut three 1 inch squares), a pipet, a pair of scissors, 3 rubber bands, 6 twist ties, a large beaker, and a measuring spoon.
2. Fill the large beaker.
3. Cut a square of cheesecloth that will fit securely over the end of the plastic column. Secure the cheesecloth over the end of the plastic column with a rubber band. Use just enough cheesecloth to cover the end. Try to minimize the amount of water that will be absorbed by the cheesecloth. Repeat this procedure for the other two plastic columns.
4. Put samples of humus, clay, sand, into separate cups and take them to your workstation.
5. Create three different soil profile models: a desert, a temperate rainforest, and prairie. Use the sand, humus and clay to create the O,A,B, and C horizons. Mix the soil quantities shown in the soil profiles table to create each soil profile. **Important:** Work from the lowest horizon upward to the topmost. That is, create the C horizon first, then B, then A. Create the O horizon last.

Table 3. Soil Profiles for Predetermined Biomes.

| Habitat | Horizon O | Horizon A | Horizon B | Horizon C |
|-----------------------|-------------|---|--------------------------|-------------------|
| Desert | None | ¼ tsp sand | ¼ tsp sand ¼ tsp clay | ¼ tsp coarse sand |
| Prairie | ¼ tsp humus | ¼ tsp humus ¼ tsp sand ¼ tsp clay | ¼ tsp sand | ¼ tsp coarse sand |
| Temperate Rain Forest | ¼ tsp humus | ¼ tsp humus ¼ tsp sand ¼ tsp clay | ¼ tsp clay | ¼ tsp sand |

6. Refer to the diagram to the right. Use twist ties to suspend the columns in the vials. The cheesecloth end should be about 3 cm above the bottom of the vial.
7. Add one drop of food coloring to the top layer of each column. This simulates the polluted rainfall for each habitat.
8. Using a pipet, add 2 mL of water to each column. This simulates the rainfall for each habitat.
9. Observe the colored water as it penetrates each of the horizons.
10. Continue to add water to each column, 2 mL at a time, until water washes through the column and drips into the vial.
11. Record your observations below, and answer the lab questions.



Observations and Notes (time it took, color of water after):

Analysis:

1. Which of the three ecosystems' soil did the pollution (colored water) pass through most rapidly? Slowly? What is the reasoning behind your observations?
2. Explain which ecosystem would have the greatest potential for groundwater contamination.
3. Why do desert habitats have a larger C horizon than other habitats? Why are the A and B horizons similar? How does this relate to the yearly rainfall that deserts receive?