Activity 1: Mechanical and Chemical Weathering

Procedure

A. Mechanical Weathering

1. Acquire about 10 g each of presoaked 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 rock 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.
15. Answer the Laboratory Questions for the "Mechanical Weathering" section.

Materials (per student group)

- 20 g of presoaked granite
- 20 g of presoaked basalt
- 20 g of presoaked marble
- hand lens
- 3 small, capped vials
- large beaker
- forceps
- paper towels
- lab coat
- gloves
- safety goggles

Table 1: Mechanical Weathering

Rock Type	Weight				
	Initial	3 min	6 min	9 min	12 min
Granite					
Basalt					
Marble					

B. Chemical Weathering

Lab Day 1

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.
6. While wearing a lab apron, gloves, and safety goggles, pour enough hydrochloric acid (HCl) into each vial to cover the rocks. Observe the results.

   Caution: Wear a lab coat, gloves, and safety goggles, and pour carefully when adding the acid to the vials. The acid may react with the rocks, resulting in bubbling and spray that could escape the vial. Any reaction will settle down after several minutes, at which time it will be safe to move and cap the vials.
7. 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

8. 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.
9. Wash the acid from the rocks; fill the vials with water and, without disturbing the rocks, pour the water into the sink. Repeat this step two more times.
10. Using forceps, remove the rocks from the vial and place them on paper towels to absorb the excess water.
11. Once there is no water dripping from the rocks, reweigh each sample and record the results in the "Final Weight" column.
12. Using a hand lens, inspect each group of rocks. In your lab notebook, describe any changes in surface texture, edges, size, or general appearance.
13. 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.
14. Answer the Laboratory Questions for the "Chemical Weathering" section.

Table 2: Chemical Weathering

Rock Type	Initial Weight	Final Weight
Granite		
Basalt		
Marble		

Laboratory Questions

A. Mechanical Weathering

1. In terms of mass and shape, which rock type seems most affected by mechanical weathering? Which seems least affected?

2. Calculate the mass of each rock type (granite, basalt, and marble) if the samples were shaken in the vials for 24 hours.

3. List some regions where mechanical weathering caused by water is likely to have a significant impact. What regions are less likely to experience this type of weathering?

4. What are some signs of mechanical weathering on rocks?

B. Chemical Weathering

1. In terms of mass and shape, which rock type seems most affected by chemical weathering? Which seems least affected?

2. Describe the difference between physical and chemical weathering of rocks.

Activity 3: Soil Organization

Procedure

1. Acquire 3 plastic columns, 3 large vials, cheesecloth (enough to cut three 1-in squares), a pipet, a pair of scissors, 3 rubber bands, 6 twist ties, a large beaker, and a measuring spoon.
2. Go to the sink and fill the large beaker with at least 100 mL water.
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 column with a rubber band. Use just enough cheesecloth to cover the end (you will need to be able to see the soil in the column). 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, and coarse sand into separate paper cups and take them to your workstation.
5. Create three different soil profile models: a desert, a temperate rainforest, and a prairie. Use the sand, coarse 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.

Materials (per student group)

- sand sample
- clay sample
- humus sample
- coarse sand sample
- 3 plastic columns
- 3 rubber bands
- 4 paper cups
- scissors
- 3 one-inch squares of cheesecloth
- 3 large vials
- bottle of food coloring
- large beaker
- 6 twist ties
- measuring spoon
- pipet

Soil Profiles

Habitat	Horizon			
	O	A	B	C
Desert	none	¼ tsp of sand	½ tsp of sand ¼ tsp of clay	½ tsp of coarse sand
Prairie	¼ tsp of humus	¼ tsp of humus ¼ tsp of sand ¼ tsp of clay	¼ tsp of sand	¼ tsp of coarse sand
Temperate Rainforest	¼ tsp of humus	¼ tsp of humus ¼ tsp of sand ¼ tsp of clay	¼ tsp of clay	¼ tsp of sand

6. Use twist ties to suspend the columns in the vials. The cheesecloth end should be about 3 cm above the bottom of the vial, as shown in Figure 3.
7. Add one drop of food coloring to the top layer of each column. This represents the organic nutrients available at the surface of 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. Continute 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 in your lab notebook, and answer the Laboratory Questions.

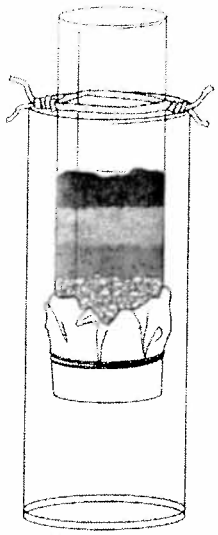

Figure 3. Column with soil profile suspended in vial.

Laboratory Questions

1. Which of the three habitats did the organic nutrients (blue water) pass through most rapidly?

2. What is the correlation between the speed in which the nutrients pass through the soil layers and the amount of rainfall each habitat receives?

3. Which habitat has the greatest potential for groundwater contamination, and why?

4. 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?

Table 5: Particle Size Distribution and Soil Type

	Depth of Clay Layer	Depth of Silt Layer	Depth of Sand Layer	Total Depth	% Clay	% Silt	% Sand	Soil Type
Collected Sample								

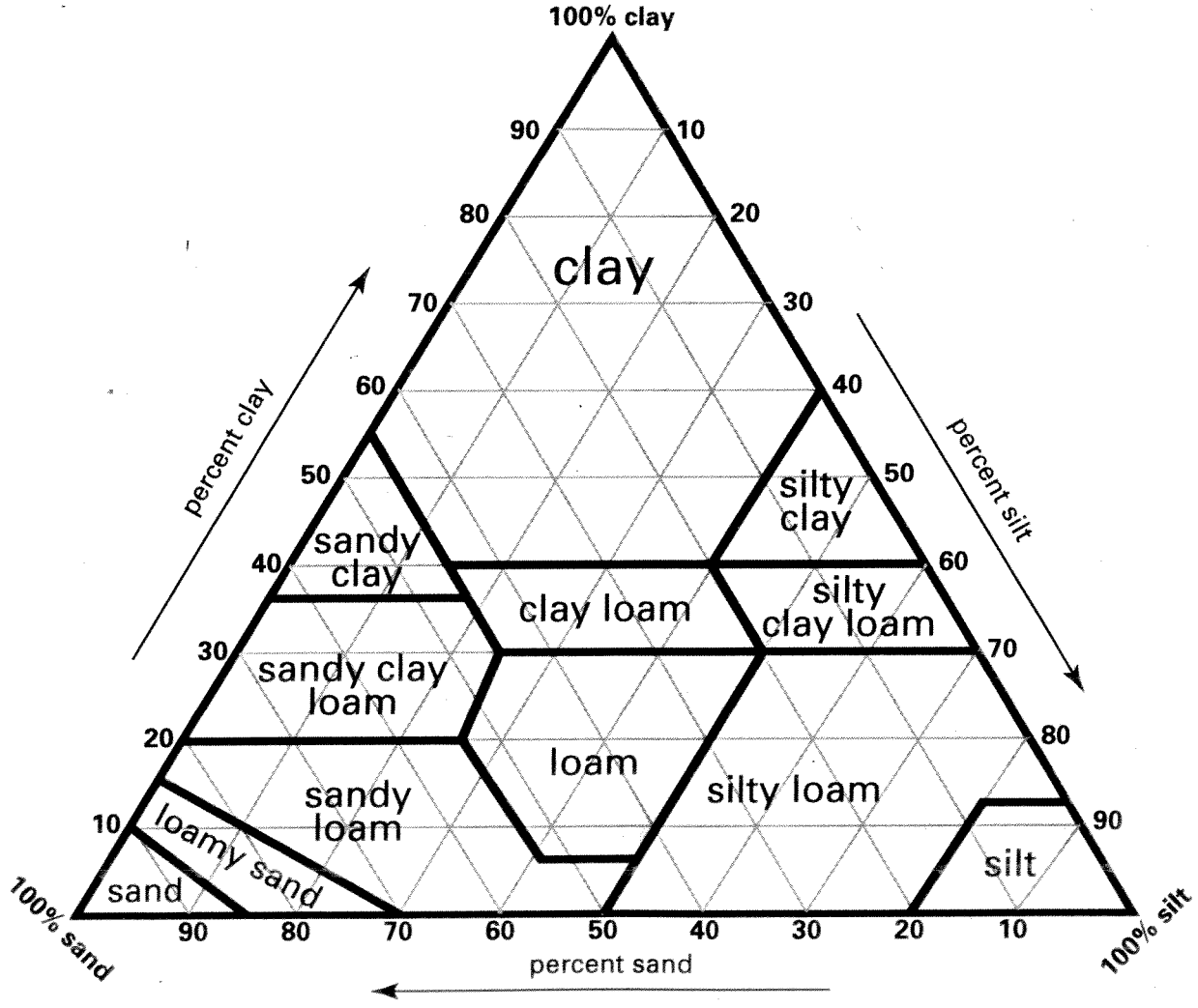

Figure 5: Soil Analysis Chart