Lab Series: Mechanical or Chemical Weathering?

**Dates**  
October 24-26, 2011

**Organizing Topic**  
Investigating Water

**Overview**  
Students observe the effects of water and acid rain on the environment and classify the effects as mechanical weathering or chemical weathering.

**Related Standards of Learning**  
6.5c

**Objectives**
The students should be able to
- design an investigation to model the action of freezing water on rock material (lab 1)
- design an investigation to model the action of acidified water on building material such as concrete, limestone, or marble (labs 2 & 4)
- chart, record, and describe evidence of chemical weathering in the local environment (extension)

**Reference:**  

**Materials**

**Lab 1: Rock Freeze**
- rocks with small cracks
- hand lens
- eyedropper
- beaker of water
- ruler
- marker
- plastic bag
- freezer
- milk carton

**Lab 2: It’s Raining**
- chalk
- long nail
- beaker of vinegar
- empty beaker
- eyedropper
- pH paper
- goggles

**Lab 3: The Ground Under Our Feet**
- 2 milk cartons
- diatomaceous earth
- small beaker of water
- 2 spoons
- marker
- large beaker
- freezer
- lamp with 100-watt bulb

**Lab 4: What “Wool” It Do?**
- 1 dry piece of steel wool in a zip-top bag
- 1 water-wet piece of steel wool in a bag
- 1 vinegar-wet piece of steel wool in a bag
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**Instructional Activity—Day 1**

Conduct a brief review of weathering (PowerPoint demonstration). Explain each lab to the students. Tell the students that they will work in small groups to conduct labs 1 and 2 today. Lab 1 will be completed over a 3 day period.

Prepare the pieces of steel wool for Lab 4, which will need to sit overnight for the students to observe on Day 2. Gather three small pieces of steel wool and three zip-top plastic bags, and place one piece in one of the bags. Soak another piece of steel wool in vinegar and the third piece in water for 10 minutes, and then place these pieces in zip-top bags and seal.

Divide students in small groups (4 to 5 students per group). Have students start Lab 1, and complete “Day 1” of this lab sheets. As groups finish Lab 1, have them start Lab 2. Lab 2 can be completed in one day. Students should have sufficient time to conduct the experiment and answer all of the questions.

Students are to submit Lab 1 sheet for completion later in the week and Lab 2 for grading.

If students finish before the period ends, they can begin working on their homework assignment.

Note: Lab 1 is conducted over 3 days and Lab 3 over 2 days. Labs 2 and 4 can be completed in 1 day.

**Instructional Activity—Day 2**

Review the procedures for Labs 1, 3 and 4. Conduct Labs 3 and 4 as a whole group. After conclusion of labs 3 and 4, submit students Lab 3 sheet for completion later in the week and Lab 4 for grading. Students break into their groups from Monday to complete “Day 2” of Lab 1.

**Instructional Activity—Day 3**

Conclude Labs 1 and 3. Discuss the results of the three labs.

**Assessment**

Competed lab sheets. Assess lab sheets based on level of effort and general understanding of the concepts.

**Extension**

If there is sufficient time, have students design an experiment to determine the effects of acid rain on plants. Plants will be sprayed with different concentrations of vinegar and water, while the control group will be sprayed with water only. This experiment will have to last several weeks with students making observations daily.
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Name: __________________________________ Date: ___________ Class: ____________

LAB 1: ROCK FREEZE

Materials: rocks, hand lens, eyedropper, beaker of water, ruler, marker, plastic bag, freezer, milk carton

Day 1
1. Choose one rock from the pile, and examine it. Use the hand lens. Measure the rock and the crack(s). What makes this rock unique from all the other rocks?
   
   Record your observation: ____________________________________________________________

2. Turn the rock so that a crack in it will hold water. Using the eyedropper, put water in the crack.
   
   Count and record the number of drops that will fit in the crack: ________

3. Use a marker to label a plastic bag with your group number. Place the rock, crack side up in the plastic bag (don’t let the water spill out). Carefully place bag and rock in a milk carton so that the water does not spill out. Your teacher will place the carton in the freezer at the end of the class.

4. Form a hypothesis based on what you did in the experiment (what will happen): ______________
   ______________

Day 2
5. After your rock has been out of the freezer for a while and the ice has melted, take the rock out of the plastic bag, and examine it as you did yesterday. Is it different in any way? ________
   
   Record your observations: __________________________________________________________

6. Using the eyedropper, put water in the crack again. Count and record the drops: ________
   
   Does the rock hold more drops today than it did yesterday? ________
   
   Why, or why not? _____________________________________________________________

7. Place the rock in the bag and milk carton again so it can be frozen one more time.
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Day 3

8. Take the rock out of the bag once again, and examine it as you did yesterday. **Is it different in any way?** ________ **Record your observations:** ____________________________________________

9. Using the eyedropper, put water in the crack again. **Count and record the drops:** ________
   **Does the rock hold more drops** today than it did yesterday? ________
   **Why, or why not?** ____________________________________________________________

10. What **type of weathering** is this, physical or chemical? ________________

11. **Was your hypothesis correct?** ________
    **Write a conclusion:** ____________________________________________________________
Lab 2: It’s Raining

Materials: chalk, long nail, beaker of vinegar, empty beaker, eyedropper, pH paper, goggles

1. Vinegar is an acid of similar strength to the acid in “acid rain.” Use the pH paper to determine the pH of the vinegar. Record pH level. ______

2. Chalk is limestone. Use the nail to carve a design in the chalk.

3. Form a hypothesis based on what you know. What will vinegar do to the limestone?
   Write a hypothesis: ________________________________________________________________

4. Use the eyedropper to drop single drops of vinegar (“acid rain”) on the chalk. Record your observations as you continue to add drops of acid rain: ____________________________________________

5. What type of weathering is this, physical or chemical? ____________________________

6. Was your hypothesis correct? ______ Write a conclusion: ____________________________

7. How might acid rain affect buildings made of limestone having limestone on the exterior?
   ______________________________________________________________________________

8. What is the cause of acid rain? __________________________________________________

9. Why should we be concerned about acid rain?
   ______________________________________________________________________________

10. What can we do to inhibit the effects of acid rain?
    ______________________________________________________________________________
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Name: _______________________________ Date: ____________ Class: ____________

LAB 3: THE GROUND UNDER OUR FEET

Materials: Two small containers, diatomaceous earth, small beaker of water, two spoons, marker, large beaker, freezer, lamp with 100-watt bulb

Day 1

1. Watch as the teacher carefully place diatomaceous earth in each milk carton. The teacher, while stirring, will slowly add just enough water to form a paste or clay.

2. Record your observations of diatomaceous earth.
   
   **Dry earth:** __________________________________________________________
   
   **Wet earth:** _________________________________________________________

3. The teacher will place one carton under the light and the other carton in the freezer.

4. Form a hypothesis based on what you know. What will happen to each carton of earth?
   
   **Hypothesis (earth under light):** ______________________________________
   
   **Hypothesis (earth in freezer):** _______________________________________

Day 2

5. Tear away each of the cartons, revealing the earth. How has it changed? Write your observations of each.
   
   **Earth from freezer:** _________________________________________________
   
   **Earth under light:** _________________________________________________

6. If the earth from the freezer is still frozen or moist, mark the side of it, and place it under the light. Check it at the end of the bell or tomorrow.

7. What type of weathering is this, physical or chemical? ________________

8. Was your hypothesis correct? ________ Write a conclusion: __________________________
   
   ______________________________________________________________________
   
   ______________________________________________________________________
   
   ______________________________________________________________________
LAB 4: WHAT “WOOL” IT DO?

Materials: One dry piece of steel wool in a zip-top bag, one water-wet piece of steel wool in a bag, one vinegar-wet piece of steel wool in a bag

1. The teacher has placed a piece of dry steel wool in a plastic bag. The teacher has soaked one piece of steel wool in water, then sealed it in a plastic bag. The teacher has soaked a third piece in vinegar, and sealed it in a plastic bag. Each piece of steel wool has been in its bag for the same length of time. **Form a hypothesis** about what you think did happen overnight to each piece of steel wool.
   - Dry: __________________________________________________________
   - Water-wet: _____________________________________________________
   - Vinegar-wet: ____________________________________________________

2. Examine each bag with steel wool, and **record your observations**.
   - Dry: __________________________________________________________
   - Water-wet: _____________________________________________________
   - Vinegar-wet: ____________________________________________________

3. What **effect did the water** have on the steel wool? _______________________________________________________________

4. What **effect did the vinegar** have on the steel wool? _______________________________________________________________

5. If vinegar represents acid rain, **what does this tell you about acid rain?** ________________________________________________________

6. What **type of weathering** is this, physical or chemical? __________________

7. **Was your hypothesis correct?** _______ **Write a conclusion:** _______________________________________________________________

______________________________________________________________