Science Unit: ***The Earth Around Us: Air, Water & Soil***

Lesson 2: ***Weathering***

School year:	2007/2008
Developed for:	Carnarvon Elementary School, Vancouver School District
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Grade level:	Presented to Grade 2; appropriate for grades 1 – 7 with age appropriate modifications.
Duration of lesson:	1 hour and 15 minutes
Notes:	Students should be familiar with the concept that the air we breathe is a mixture of gases (oxygen, carbon dioxide, nitrogen). This will help them understand the extension activity on rusting.

Objectives

1. Learn about different types of weathering.
2. Relate weathering to the water cycle (Lesson 1).
3. Practice observing changes and recording observations.

Background Information

Weathering is the process of breaking down rock. The two major types of weathering are physical weathering and chemical weathering. Physical weathering is the breaking down of rock into smaller particles. In the context of the water cycle this can occur via frost wedging and any time rocks move against one another (during a rockslide or landslide, while being jostled in a stream or ocean, as a result of glacial movement etc.). It is important not to confuse weathering with erosion (the movement of particles) as they generally occur, and thus are often thought of, as simultaneous forces. The second type of weathering is chemical weathering in which rocks are broken down by a chemical reaction. This occurs when specific types of rock are exposed to water (or water vapor), carbon dioxide or oxygen. Examples of this include rusting and the erosion of limestone (especially statues and buildings) by acid rain.

Vocabulary

Weathering:	The physical or chemical destruction of rock.
Physical weathering:	The breaking down of rock into smaller pieces with no changes in composition.
Chemical weathering:	The decomposition of rocks due to exposure to water or water vapor, carbon dioxide or oxygen. The rocks are changed from their original state.
Rust:	The chemical decomposition of metal due to exposure to oxygen and water vapor.

Materials

- Small, sturdy leak-proof plastic containers to shake rocks in. 1 per group
- Small pieces of unglazed terracotta (smash a large terracotta pot into pieces)
- Water (1 small cup per group)

- worksheets to record observations
- jar of sand
- small jar of gravel and sugar cubes
- magnifying glasses if available
- clean/shiny metal piece
- fist size piece of rock
- rusty metal piece

In the Classroom

Introductory Discussion

1. Have a fist-sized chunk of rock, a glass jar of sand, a shiny piece of metal and a rusty piece of metal on the table for this introduction. Hold up the rock and ask the class what it is. Then hold up the sand and repeat the question. Do the same thing with the shiny metal and then hold up the rusty metal and ask what the orange substance it. Someone will answer rust. Next inform the class that today they are going to learn how rocks are transformed into sand and nails and other metals rust.

    - Ask the class to help you brainstorm how rocks might be transformed into sand. How are rocks and sand different? Write their ideas on the board. After you have gathered a few help the class come to a consensus that the main difference is that sand is smaller (i.e. sand is small rocks). How do you think the sand was made? Get a few suggestions.

    - Demonstrate the creation of sand with a gar of gravel and sugar cubes. The gravel represents hard rocks and the sugar cubes softer rocks. Screw the lid on tight and shake the jar rapidly for a minute or so. Pour out the contents so that the students can see the sugar sand that has been created. Explain that the “sugar rocks” have been broken into smaller pieces but other than that are identical to whole sugar cubes. This process of breaking down rocks into smaller pieces without changing them is called physical weathering. Write vocabulary on the board.

    - Ask the students to think about places in the water cycle where this may occur. They will likely deduce that similar processes occur in streams and oceans as rocks tumble around.

2. Short description of other items to discuss or review.

    - If it has not been done previously quickly review the process of science (The Scientific Method)

3. Briefly describe science experiment/activity.

    - The students will observe the process of weathering by repeatedly shaking a container of water and small brick pieces.

4. Students will record a testable hypothesis before starting the activity, they will record their observations throughout the activity, and they will discuss the results as a class and come to any conclusions. The main focus for the students will be observation.

5. Briefly describe safety guidelines.

    - keep the lids on tightly at all times, hold the containers securely with two hands while shaking them, do not shake them near to or in the direction of anyone’s face.

Activity Title: Turning rocks into sand

Purpose of Activity: To explore the process of weathering.

Experimental Observations: Shaking the brick pieces in the jar will simulate the process of weathering in a stream or tidal area. Students will observe the changes that occur to both the bricks and the water. (changes to the water will lead to next week’s lesson on erosion)

Prediction or Hypothesis: What do you think will happen to the bricks after they are shaken with the water for 10 seconds? For several minutes? What do you think will happen to the water?

Methods and Instructions:

Set-up prior to experiment: Smash several terracotta bricks into dime sized pieces. Prepare a tray for each group with a container of water and a small pile of brick fragments. If available magnifying glasses should also be used.

Brief description of how students will work in groups or pairs.

1. Give each group a plastic container filled with water and a small container of brick pieces.
2. Have the students record their predictions and initial observations of the water and rocks (i.e. brick pieces). (clear water, sharp corners, rough edges)
3. Have the first student in each group shake the rocks and water for one minute.
4. Have the students record their observations.
5. Repeat this process until each group member has had a chance to shake the jar. (final observations will likely include rounder edges/corners on the bricks and murky water with visible sediment).
6. At each observation point, students will draw a picture of the brick pieces as well as add some descriptive words or a short sentence. The worksheet will allow space for a prediction (fill in the blank) as well as several lines for a 1-2 sentence conclusion.

Closure Discussion

1. What happened to the rocks? Why are river rocks smooth?
2. What happened to the water? Did the weathered brick (sediments in the jar) change in any way? How is sand formed? This topic will link into next week's lesson on erosion. *Can filter the water or leave the jars to settle for 20-30 minutes to more clearly see the "sand" that has formed.
3. Introduce the Extension Activity - rusting experiment (chemical weathering)

    - Use the water cycle to introduce the concept of chemical weathering. Ask if anyone has ever left their bike out in the rain. What happened? (it got rusty). Ask if anyone has ever seen anything REALLY rusty? What was it like? (it helps if you have a piece of rusty metal as an example) The goal is to have the students realize that the rust is actually the metal changing composition, not a separate substance. Explain that the decomposition of metal or rocks is known as chemical weathering. This is like the weathering they just observed but the substance being weathered is actually eaten away. You can demonstrate this with chalk and coca cola. This is analogous to limestone statues and buildings being destroyed by acid rain. Write the vocabulary/definition on the board.
    - Ask what the students think causes rust. Brainstorm ideas on the board. You should hopefully come up with water and air. Ask how we can determine which one it is, or if both are necessary (exclude all variables except one and see if rust forms).
    - Beforehand prepare 3 labeled jars each containing a clean iron nail (with no anti-rust coating):
        - Nail with no oxygen or water (desiccate the jar and purge it with nitrogen in the lab beforehand).
        - Nail with water only (purge with nitrogen beforehand)
        - Nail with water and oxygen

- The jars will be left (with worksheets) for the students to observe until the next visit (1 week).

References

1. Christopherson, Robert W. 2002. Geosystems: an introduction to physical geography. Prentice, Hall.

Extension of Lesson Plan

1. Set up the rusting experiment for the students to observe over time. You can discuss the results on your next visit.

Closure Discussion

What happened to the nails? Discuss the results and determine the conditions necessary for rust to form. Help the students discover that rust actually decomposes (and changes) the metal; this is how chemical weathering differs from physical weathering.

Scientist: _____

Date: _____

How does metal rust?

For our experiment we will see which metal rusts best:

1. Metal in water with no oxygen
2. Metal with no oxygen or water
3. Metal with water and oxygen

Hypothesis

The metal with _____will rust the best.

Observations

Record your observations each day:

Day	**Jar 1** **water only**	**Jar 2** **oxygen only**	**Jar 3** **water & oxygen**
Wed			
Thurs			
Fri			
Mon			
Tues			

Conclusions

Which piece of metal rusted the best?

_____

The process or rusting is called _____

Scientist: _____

Date: _____

How do rocks turn into sand?

Hypothesis

After the rocks are shaken with the water for 5 seconds _____

_____

After the rocks are shaken with the water for 4 minutes _____

_____

For our experiment we will put some rocks in a jar of water and shake them. Every 1 minute we will record our **observations**.

Draw your experimental jar and write a short description:

Before the experiment:

_____

_____

_____

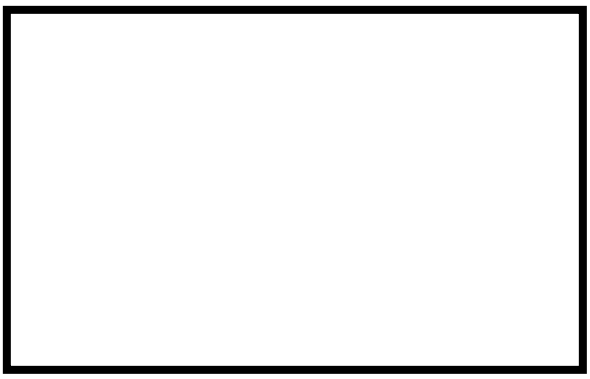
After 1 minute of shaking:

_____

_____

_____

After 2 minutes of shaking:



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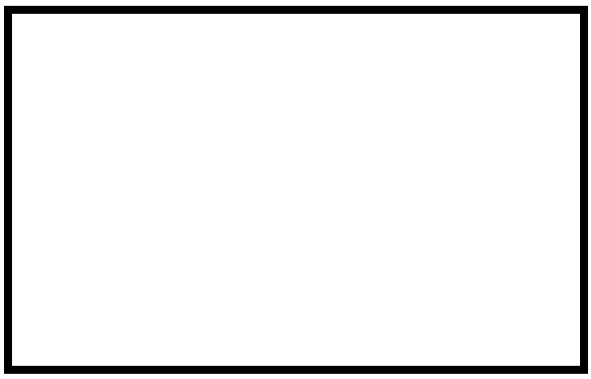
_____

After 3 minutes of shaking:



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After 4 minutes of shaking:

_____

_____

_____

Conclusions

How did the rocks turn into sand?

_____

_____

_____

This process is called _____