Weathering & Erosion - 3 Rock Types

Summary

Mechanical and chemical weathering are explored. Sandstone, marble, and granite, are compared. Students conclude which rock type weathers the most easily. Students conduct an erosion demonstration to observe erosion in action.

Time Frame

1 class periods of 60 minutes each

Group Size

Small Groups

Materials

- Pictures of Weathering and Erosion PDF
- Types of Weathering - Student Questions PDF

6 plastic 8 oz. cups per group
vinegar
marble -- purchase a bag of landscaping marble from Home Depot
granite -- purchase a bag of landscaping granite from Home Depot
sandstone -- the sandstone from Home Depot is very tough and resists weathering. It is best to find a natural, larger piece of sandstone for flooring or landscaping and use a hammer to break it into pieces. A true sandstone should weather more quickly than the other two types of rock.
white and black paper
3 large containers to hold the rocks for each group
three plastic jars with caps for each table, vitamin jars work well just be sure and remove the cardboard insert in the caps before the experiment
a towel for each group in case the jars leak when shaking
100 ml graduated cylinder for each group
3 paper plates per group
6 small containers that were filled to the brim with water, the lids closed, and placed in a freezer. Start them at least 24 hours earlier than the lesson and make sure the lid pops off to show that the ice cracked the lid open.
sand
6 - 9" x 13" aluminum pan, old lasagna pans from Costco work great

Background for Teachers

Weathering is the group of forces that change the physical and chemical make up of rock near the Earth's surface. It is the breaking down of rocks and minerals, which change how the surface of the earth looks. The materials left over after the rock breaks down combined with organic materials creates soil. Weathering is a long and very slow process. Weathering occurs through physical or chemical means.

Chemical weathering is the destruction of rock due to water and acids. This changes the chemical make up of rocks. Many times water and rain contain weak acids which react with calcium carbonate found in some rocks and break it down into salt and carbon dioxide.

In mechanical weathering the rocks don't change in their chemical makeup, just their size. The breaking down of rocks due to repeated cycles of freezing and thawing of water in its cracks is weathering. Rocks that are rubbed together by wind or water will weather. Plant roots growing up

through a rock can also split and weather the rock. Once rock is weathered and broken down into smaller pieces erosion takes place.
After rocks are weathered and broken down into small pieces, it is easier for them to erode away. Erosion is the picking up or physical removal of rock particles by wind, or water in a stream or river. Animals can also cause erosion by moving from place to place.

Intended Learning Outcomes

1a. Observe simple objects, patterns, and events and report their observations.
1d. Compare things, processes, and events.
1i. Use data to construct a reasonable conclusion.
3a. Know and explain science information specified for the grade level.
4b. Describe or explain observations carefully and report with pictures, sentences, and models.
4c. Use scientific language in oral and written communication.
5a. Cite examples of how science affects life.

Instructional Procedures

Pre-lab discussion:
Ask the students if rocks last forever. Discuss how weathering and erosion change the surface of our earth. Explain to students that in class they are going to greatly speed up geological time and weather rocks immensely during one class period. Look at the pictures of weathering and erosion and discuss how these processes occur naturally in our world.
Instructional procedure:
I. Chemical weathering

Place one rock of each rock type into a separate cup. Just cover the rock with vinegar. Vinegar is a mild acid and will break down some minerals. Vinegar should cause bubbles (carbon dioxide) to be released from the marble. Vinegar does not react with granite and depending on the sandstone source, shouldn't react with the sandstone either.

Observe what you see happening in the cup. Let it sit until the next experiment is over and check the cups again.

II. Mechanical weathering
A. Dry abrasion of rocks

Within a group, have different students responsible for each rock type. Take two pieces of rock of the same type and rub them together with your hands as hard as you can over the paper for 1 minute. (Use white paper for granite and sandstone, black paper for marble.) Do not bang the rocks together from a distance.

Record your observations on the student sheet. How easily does each rock disintegrate? How much of the rock appears on the paper as dust? Which rock mechanically weathered the most in that 1-minute?

B. Wet abrasion of rocks - Each group will focus on one type of rock. Be sure that all 3 rock types are represented within the class. Make sure that when the students are shaking the jars they are all shaking them equivalently hard or else the results will be skewed.

Place 5 rocks, of the group's specified rock type, into each of three jars labeled A, B, and C. Fill each jar with 200 ml of water. Take all three jars and a towel outside because the next part is very noisy.

Do not shake jar A. This is your control.

Shake jar B hard 100 times. One student can do the whole 100 shakes. Have them shake it from top to bottom. Students can help the student shaking to count to 100 by counting the shakes in groups of 10.

Shake jar C 1000 times. Students can shake in 100 shake batches with everyone taking multiple

turns.

After returning to the classroom, empty the liquid into plastic cups marked A, B, and C. Empty the rocks onto paper plates marked A, B, and C.

Compare the water in each of the three cups as well as the edges of the rocks on the three plates.

Have students walk around the classroom and observe each group's experiment.

What should be observed: The water in the three containers should become much cloudier as the amounts of shakes increased. The rocks in the three containers should become more rounded and broken up as the number of shakes increased. Sandstone should break down the most, then marble, then granite. However, this depends on your source of rocks and whether the students were consistently shaking between the different groups.

III. Freeze -- thaw weathering

Look at the containers that were filled with water and frozen. Why did they crack or the lids pop off? When water freezes it expands. This expansion causes the lids to pop or containers to break when frozen.

What this causes in nature: Rocks are mechanically broken down due to temperature. When rocks warm up they expand and when they cool down they contract. This repeated cycle causes the rocks to crack. When water seeps into the cracks it freezes, expands, and makes the cracks larger. This eventually breaks the rocks into smaller pieces.

IV. Erosion

Using a pan, make a sand pile at one end and pour 2 cups of water to the other end. Slide the pan back and forth very slowly to create wave movement. Observe what happens to the sand. How does this process change the soil on our earth's surface?

What this causes in nature: When ocean water continually laps against a beach or land outcropping, the soil is picked up by the water and deposited in another place. This causes erosion of the land near water.

Use some of the rocks from the earlier experiment and try and slow the effect of erosion. Could you do it?

What should be observed: If the students build a rock wall between the sand and the water, less erosion of the sand should occur.

Extensions

Examples can be kept overnight or longer for further observations of weathering.

Assessment Plan

typesofweathering-studentquestions PDF Collect students worksheets

Bibliography

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