Weathering of Rocks

Summary

Students will learn the difference between mechanical and chemical weathering of rocks through 4 different simple experiments.

Time Frame

2 class periods of 45 minutes each

Group Size

Small Groups

Life Skills

Thinking & Reasoning, Communication, Systems Thinking

Materials

plaster of paris
water
small balloons
two empty pint milk cartons (bottom halves only)
a freezer

lemon juice
vinegar
pipettes
two pieces each of limestone, calcite, chalk, and quartz.

15 rough, jagged stones that are all about the same size
three containers with lids (like coffee cans)
three clear jars
Pens, markers, and paper
masking tape

three shallow dishes (or just use glass jars)
three pieces of steel wool
salt
water
gloves

Student Prior Knowledge

Students may want to know the three types of rocks and what the word "weathering" means in relation to rocks.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
    c. Make simple predictions and inferences based upon observations.
    d. Compare things and events.
    f. Conduct a simple investigation when given directions.

h. Use observations to construct a reasonable explanation.
3. Understand Science Concepts and Principles
a. Know science information specified for their grade level.
c. Explain science concepts and principles using their own words and explanations.

Instructional Procedures

Part 1: Mechanical Weathering.

Set up a "weathering" station with directions for the students.

Have students fill a balloon with water until it is the size of a ping-pong ball. Tie a knot at the end.

(Have the plaster of paris Pre-Mixed) Mix water with plaster of paris until the mixture is as thick as yogurt. Students can pour half of the plaster in one milk carton and the other half in the other.

Push the balloon down into the plaster in one carton until it is about 1/4 inch under the surface. Hold the balloon there until the plaster sets enough so that the balloon doesn't rise to the surface. Then let the plaster harden for about 1 hour.

Put both cartons in the freezer and take out the next day to make observations.

Follow up: What happened? How does this relate to what could happen outside? What should have happened: The plaster containing the balloon should have cracked as the water in the balloon froze and expanded. Explain that when water seeps into cracks in rocks and freezes, it can eventually break rocks apart.

Part 2: Mechanical Weathering

Students will need 15 rough, jagged stones that are all about the same size, three containers with lids (like coffee cans), three clear jars, a pen, paper, masking tape.

Have students separate rocks into 3 groups of 5. Label each group A, B and C.

Label each coffee can, A, B, and C and fill each can halfway with water.

Add rocks to each can with its proper label (A goes to A). All cans are going to sit overnight.

THE NEXT DAY have students hold Can A in both hands and shake it hard 100 times.

Remove the stones from Can A with your hands and pour the water into Jar A. Observe the stones and the water.

Do the same with Can B but shake it 1000 times! Students can rest between shakes.

Remove these stones and pour the water into Jar B. Observe the stones and the water.

Remove the stones from Can B to Jar B and observe.

Make comparisons between the three jars, are the stones different?

Follow-up Questions: How do the piles of stones differ? Why? Which pile acted as the control? Why? How do the jars of water differ? How does this show what happens to stones that are knocked about in a fast-moving river?

Part 3: Chemical Weathering

Set up a station containing: lemon juice, vinegar, pipettes, two pieces each of limestone, calcite, chalk, and quartz.

Remind students to LOOK and LISTEN every time something is added to the rocks and make observations in a journal.

Put a few drops of lemon juice on one of each of the four rock samples.

Put a few drops of vinegar on each of the other four samples.

Follow up Questions: What happened? Did the vinegar react the same or different than the lemon juice? Why or why not? What does this mean? What does this have to do with weathering?

What should have happened: Lemon juice and vinegar are both weak acids. The lemon juice contains citric acid and the vinegar contains acetic acid. These mild acids can dissolve rocks

that contain calcium carbonate. The lemon juice and vinegar should have bubbled or fizzed on the limestone, calcite, and chalk, which all contain calcium carbonate. There should not have been a reaction on the quartz, which does not contain calcium carbonate. Explain that water commonly contains weak acids that dissolve rocks containing calcium carbonate and other minerals.

PART 4: Chemical Weathering

Set up a table containing 3 jars, salt, measuring cups, measuring spoons, and water and GLOVES. Students will need to wear gloves here since steel wool can splinter off.

- Place a piece of steel wool in each jar.
- Using a measuring cups, pour equal amounts of water over the first TWO jars and leave the 3rd one dry.
- Sprinkle one wet piece with plenty of salt
- Students can make observations for about a week
- FOLLOW UP questions: What happened to each piece of steel wool? Which piece changed the most? Why do you think the steel wool changed? Which piece of steel wool acted as the control? What does this experiment have to do with weathering?

What should have happened: When iron gets wet, the water acts as an agent to speed up oxidation (oxidation occurs when oxygen combines with another substance). In this case, oxygen in the water combined with the iron in the steel wool to form an iron oxide, or rust.

Rust is a weaker material than the original metal and erodes quickly. When salt is added to the water, it speeds up the oxidation of iron. So, the steel wool in the salt water should have changed the most. The same thing happens to rocks that contain iron as happens to cars during northern winters when salt is put on the roads.

Extensions

An easy addition to mechanical weathering is to have students speculate when you put a glass with water in the freezer. Fill it completely and cap it tight and put it in a resealable plastic bag. (The glass will break so be sure to put it in a bag!)

If you have enough plaster of paris and milk cartons you could pre-soak a bean seed and place it in the plaster just under the surface and make observations for a few days. Could plants break rocks? What happens when trees grow in a crack of a rock?

Bibliography

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Authors

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