Move it!

Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by the soil.

Objective 2:

Explain how the processes of weathering and erosion change and move materials that become soil.

Intended Learning Outcomes:

1. Observe simple objects and patterns and report their observations
2. Compare things and events.
3. Conduct a simple investigation when given directions

Content Connections:

Social Studies VI-1; Identify physical features of Utah

Science Standard III

Objective 2

Connections

Background Information

When water, wind and ice move rock, soil or another material it is called erosion. Erosion is the mover and weathering is the breaker. Helping students understand the differences between erosion and weathering is important.

The three simplest causes of erosion are wind, water, and glaciers. Wind carries away loose bits of soil and rock, particularly in dry areas with no plants to cover and protect the land. Water can erode in several different ways. Flowing water carries soil and rock particles down streams, rivers and into lakes and oceans. Ocean waves pounding the shore and ocean currents can also carry particles away. Finally, glaciers, massive slow moving rivers of ice, gouge the land beneath them and scrape away particles and rocks away.

The scientific investigations in this activity will demonstrate three different types of erosion. They can either be presented as individual whole class investigations or as centers with small rotating groups. Four plastic boxes will be used: the stream and wave box will demonstrate water erosion, and the wind and glacier boxes will represent their respective types of erosion.

The following activities will allow the students to simulate the four types of erosion listed above. Students will follow the directions on task cards at each station and record their observations in their student journals.

Materials

- ❑ Toy dump truck
- ❑ Toy hammer
- ❑ Hard hats
- ❑ Cookies
- ❑ *What Happens to Rock*
- ❑ Plastic boxes
- ❑ Block of wood
- ❑ Water
- ❑ Play sand
- ❑ Flexi-straws
- ❑ Cornstarch
- ❑ Small pebbles
- ❑ Overhead grid
- ❑ Cotton twine
- ❑ Diatomaceous earth
- ❑ Condiment bottle
- ❑ Sprayer bottle
- ❑ Washers
- ❑ Nut
- ❑ Student journals
- ❑ Goggles
- ❑ Lab Cards
- ❑ Clothes hanger
- ❑ Overhead marker
- ❑ Bowl scraper
- ❑ Pipettes

Research Basis

Chesbro, R., (2006). Using Interactive Science Notebooks for Inquiry-Based Science. *Science Scope*. 29(3) 30-34.

The interactive science notebook is an opportunity for students to create and use a notebook that represents their science learning throughout the year. Interactive science notebooks enhance learning by encouraging students to write across the curriculum and promote personal connections to learning.

Klentschy, M., (2005). Science Notebook Essentials. *Science & Children.*

This article focuses on the effective components of student science notebooks and their use as an effective teaching tool to assist students in developing a deeper *understanding of science content.*

Invitation to Learn

Two volunteers will act out a skit that illustrates the differences between weathering and erosion. Each actor will wear a hard hat labeled with "Weathering" or "Erosion." Different types of cookies representing the different types of rocks—sandwich cookies to represent sedimentary rocks, gingersnaps to represent metamorphic rocks and chocolate chip cookies to represent igneous rocks—will be used to illustrate how the rocks are broken up and transported away. A toy dump truck will represent erosion and a toy hammer will represent weathering. Write the analogy "Weathering is to a hammer as erosion is to a dump truck."

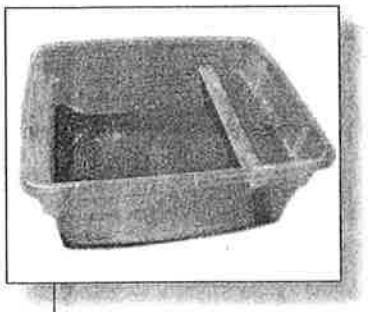
Read to the students from the book *What Happens to Rock.* Emphasize throughout the reading that weathering is the breaking action of rocks and erosion is the moving action of the particles.

Instructional Procedures

Prepare Erosion Boxes

- **Wave Box** – Place 4 cups of play sand at one end of a plastic box. Prop up that end of the box approximately 2 to 3 cm with a book or some other stable object. Use a piece of wood 26cm x 13cm x 1cm and place it at the opposite end of the box from the sand. Pour water into the box until it touches the sand (see diagram). Reproduce lab card.
- **Stream Box** – Prop up one end of a plastic box approximately 4-5 cm with a stable object. Carefully pour diatomaceous earth into the box. (Diatomaceous earth is a fine-grained powder that

is used in swimming pool filters. Even though it may look soft like flour, it is actually very abrasive and eye protection should be used when in close contact with it.) Thread the cotton string through the nozzle of the condiment lid and tie the nut to the string so the nut will be inside of the bottle if the lid is attached. Next tie the washer to the other end of the string. Using a bent hanger, suspend the condiment bottle over the high end of the inclined box so the string end with the washer touches the bottom of the box and is covered by the diatomaceous earth. Use the sprayer bottle and wet down the diatomaceous earth until it is damp. Fill the condiment squirt bottle with water and replace the lid. Place it in the hanger support and let the water drizzle down the string and into the diatomaceous earth. Continue adding water to the condiment bottle as needed.



Wave Box

- **Glacier Box** – Duplicate the centimeter grid onto an overhead transparency and tape it to the outside bottom of the box. Pour the 16-oz box of cornstarch into a container and add water slowly until it is the consistency of toothpaste. Be careful that the mixture is not too runny. Raise one end of the box between 2 to 4 cm. Have bowl scraper and glass pebbles on hand for the students.
- **Wind Box** – Place the rocks inside the last plastic box. Pour sand over the top of the rocks so they are completely covered (there should be 3-4 inches of sand in the box. Have the bendy straws available for student use.

Stream Box

Erosion stations

Group the students so that 3 to 4 of them will be at a station at a time. Explain that they will need to follow the Investigation Procedure listed on the card and then discuss with their small group the Investigation Questions on the opposite side of the card. Have them complete the required questions, and if time permits, the optional questions.

Assessment Suggestions

- Teacher observation of activity and discussion.
- Journal Entry using a rubric you and your students have made or the *Take a Tumble Journal Rubric.*

Curriculum Extensions/Adaptations/ Integration

- If more small groups are needed, you can use the "Rock Stars" and "Earth Mover" articles listed in the additional resources. These readings can offer a non-hands-on inquiry opportunity.

Additional Resources

Books

Sand, by Ellen J. Prager; ISBN 0-7922-7104-1

Kids Discover: Glaciers, by Stella Sands; ISSN 1054-2868

What Happens to Rock big book by Fred & Jeanne Biddulph; ISBN 0-7802-2794-8

Articles

"Rock Stars", by Beth Geiger. *National Geographic Explorer*, National Geographic Society; Vol 7, No. 5, March 2008; pp. 10 17; ISSN 1541-3357

"Earth Movers", by Lesley J. MacDonald. *National Geographic Explorer,* National Geographic Society; Vol 6, No. 2, Oct 2006, pp. 18-23; ISSN 1541-3357

Web sites

http://magma.nationalgeographic.com/ngexplorer/0501/quickflicks/

http://topsoil.nserl.purdue.edu/nserlweb/weppmain/overview/ersn.html

http://www.newtonsapple.tv/TeacherGuide.php?id=1657

https://imrcms.nps.gov/hrca/forteachers/earthsystemactivity12.htm

http://3dparks.wr.usgs.gov/

Organizations

Minerals Management Service, 1849 C Street, NW Washington, D.C. 20240, http://www.mms.gov/mmshome.htm , gary.strasburg@mms.gov

Wave Box Investigation Procedure

Description: For this investigation you will be simulating erosion caused by waves. Carefully drain the water from the box. Use the bowl scraper to move the sand to one end of the box. Place the two rocks somehwere on the sand. Raise one level of the box between 2-4 cm. Put the piece of wood in the box and pour in enough water to reach the sand.

Predictions: Make a written predictions in your journal about what you think you will observe and what you think will happen.

Procedure

1. Tilt the box and use the bowl scraper to move the sand to one end of the box.
2. Raise one end of the box the box between 2-4 cm and place it on a stable support.
3. Insert the board in the box and add enough water so that it touches the sand
4. Have a member of the group keep track of time.
5. Have a member of you group simulate waves by tipping the board at regular smooth movements.
6. Observe what happens as the waves wash across the sand.
7. Follow the discussion guidelines on the other side of this card.

Stream Box Investigation Procedure

Description: For this investigation you will be simulating a stream using diatomaceous earth. Diatomaceous earth can cause eye irritation, so each make sure to wear goggles and avoid touching the white powder.

Predictions: Make written predictions in your journal about what you think you will observe as to what will happen.

Procedure

1. Put on goggles.
2. Make sure the condiment bottle is filled with water. If you need to fill the bottle, unscrew the lid and leave it at the box, fille the bottle and screw the lid back on.
3. Place the bottle into the holder.
4. Observe what happens as the water dribbles down the string.
5. Have a member of the group keep track of time.
6. Observe what happens to the simulated stream after 5 minutes.
8. Follow the discussion guidelines on the other side of this card.

Wave Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Could you make some generalizations about the movement of the different sand particles?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Did the profile of the sand take a specific shape.

Stream Box Investigation Questions

Stream Box Investigation Questions Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Could you make some generalizations about the stream shape?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?

Glacier Box Investigation Procedure

Description: For this investigation you will be using a mixture of cornstarch and water. This mixture has some interesting properties that will allow us to simulate an actual glacier. Glaciers, though slow moving, can move large quantities of rock material; some very small and others very large. It is OK to touch the cornstarch mixture, but be sure to let it flow naturally.

Predictions: Make written predictions in your journal about what you think you will observe and what you think will happen.

Procedure:

1. Tilt the box and use the bowl scraper to move the cornstarch mixture to one end of the box.
2. Lay the box flat and place the colored stones at different places on the box near the cornstarch.
3. Have one of the members of your group carefully pick up the box while another member of your group uses the overhead marker to draw a circle for each location of the colored rocks on the overhead transparency taped to the bottom of the box.
4. Raise one end of the box the box between 2-4 cm and place it on a stable support.
5. Have a member of the group keep track of time.
6. Observe what happens to the simulated glacier.
7. After 5 minutes, pick up the box and mark the ending location of the colored rocks.
8. Remove the overhead transparency.
9. Follow the discussion guidelines on the other side of this card.

Wind Box Investigation Procedure

Description: For this investigation you will be simulating wind erosion. You will use a bendy drinking straw, but instead of sucking through the straw you will blow through it. In addition, you wont be putting your mouth near the bendy end of the straw. You will place your mouth at the end furthest from the bendy part. This will let you simulate wind blowing across the sand rather than down on it.

Predictions: Make written predictions in your journal about what you think you will observe about what you think will happen.

Procedure:

1. Put on goggles.
2. Have a member of the group keep track of time.
3. Blow across the sand with your straw.
4. Observe what happens.
5. Stop after 5 minutes.
6. Throw away your straw so someone else won't use it.
7. Follow the discussion guidelines on the other side of this card.

Glacier Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Did all the colored stones move at the same rate?
- Could you make some generalizations about the movement of the colored rocks?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you had observed.

Extension: If you have time, choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Could you calculate the rate at which the rock moved? Were there some rocks that moved faster than others? Why do you think this happened?

Wind Box Investigation Questions

Discussion: Discuss with your group members what you observed. Respond to the following questions:

- Did the simulation do what you had expected?
- Was there something unexpected that happened?
- Did all the colored stones move at the same rate?
- Could you make some generalizations about movement of the sand?

Journal Entry: Choose one of the questions above and respond to it in writing in your journal. Make a sketch or graph of what you observed.

Extension: If you have time choose one or more of the following tasks:

- If you were to do this investigation again, what would you change or do differently?
- Could you calculate the rate at which the rock moved? Were there some rocks that moved faster than others? Why do you think this happened?

Name _____ Date _____

Take a Tumble Journal Rubric

	4	3	2	1
Measurements	Includes mass, width, length, and volume measurements.	Is missing one measurement.	Is missing two measurements	Is missing more than two measurements.
Visual Description	Includes specific visual characteristics of shape, color, and identifying marks. Uses complete sentences.	Includes specific visual characteristics of two of the three categories. Most sentences are complete.	Includes general visual characteristics of two or more categories. Some sentences are complete.	Includes visual description of one characteristic. Most sentences are fragments.
Predictions/ Observations	Includes a specific prediction of how the rock will change, and a specific observation of the actual changes.	One prediction/ observation is specific. The other is general.	Both the prediction of change and the observation of change is general.	Includes either a prediction or an observation of change but not both.