

CHANGING STREAMS

Prep Time: 30 minutes
Teaching Time: 2.5 hours

Science Concept:

Earth's surface changes.

Objectives:

The student will:

- describe ways the water cycle leads to changes in Earth's surface;
- design, conduct, and analyze data from a controlled experiment; and
- communicate experimental results.

GLEs Addressed:

Science

- [8] SD1.2 The student demonstrates an understanding of geochemical cycles by applying knowledge of the water cycle to explain changes in the Earth's surface.
- [8] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct repeatable investigations in order to record, analyze (i.e., range, mean, median, mode), interpret data, and represent findings.

Math

- [8] S&P-2 The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating, making predictions, describing trends; drawing, formulating, or justifying conclusions) by using information from a variety of displays or analyzing the validity of statistical conclusions found in the media.

Vocabulary:

delta – the triangular or fan-shaped piece of land made by deposits of mud and sand at the mouth of a river

deposition – the action or process of depositing <the deposition of silt by a stream>

erosion – the act of wearing away by or as if by the action of water, wind, or glacial ice

speed – distance per unit of time; the act or state of moving swiftly

Materials:

- 2 foot long section of rain gutter (one per group)
- Stop watch or clock with a second hand
- Water
- Sand, to fill bottom of rain gutter to one-half inch thickness
- Aquarium gravel
- Silt or very fine grained soil
- Gallon milk bottles
- Scale
- Ruler
- Plastic plates
- Plastic collecting box or sink
- Paper towels
- Markers
- STUDENT WORKSHEET: "Experiment Report Sheet"

Optional References:

- Bush, L. (2006). Are you a river keeper? *Learning to Give*. Retrieved March 3, 2008 from <http://www.learningtogive.org/lessons/unit5/>.
- Nauticus, (2006). *Nauticus: Online Teacher's Resources*. Norfolk, VA. Retrieved March 3, 2008 from <http://www.nauticus.org>

Activity Preparation:

1. Mark the side of each gallon milk bottle to indicate approximately half-full.
2. Line the rain gutter section with sand to resemble a river bed. It should be about one-half inch thick.
3. Weigh an empty plastic plate and record the weight.

Activity Procedure:

Please refer to the assessment task and scoring rubric located at the end of these instructions. Discuss the assessment descriptors with the class before teaching this lesson.

Gear Up

Process Skills: observing and predicting

1. Raise one end of the rain gutter by four inches. Place the other end on top of a plastic plate, and put it in a sink or other container to catch water. Recruit several student volunteers to hold the gutter, hold the collecting container, and monitor the length of time it takes to pour the water.
2. Fill a gallon milk jug half full of water and pour the water down the gutter, so it resembles the flow of a river. Hold the mouth of the bottle about one inch above the gutter end. Time it so the bottle is emptied in 90 seconds.
3. Collect the sand that flows out of the gutter onto the plate.
4. Weigh the sand, subtract the plate's weight, and write the results on the board.
5. Discuss with students what part of the water cycle is represented by the water being poured.

Explore

Process Skills: observing and predicting

6. Divide students into small groups. Provide each group with rain gutter, stop watch or clock with a second hand, sand, aquarium gravel, silt or very fine grained soil, gallon milk bottles, scale, ruler, a plastic plate, a plastic collecting box or sink, paper towels, and markers.
7. Allow students approximately ten minutes to make their own river bed with the materials. After they pour water down the gutter, ask them to record two observations and make diagrams of what he or she observed. Ask students to write down any questions they might have.

Generalize

Process Skills: communicating and predicting

8. Ask students the following questions and discuss as a class:
 - a. How does the rate or speed at which the water was poured affect the amount of sediment deposited on the plate? What does the rate of poured water represent in the natural world?
 - b. How does the angle or steepness of the stream affect the amount of sediment deposited on the plate? What does the angle of the gutter represent in the natural world?
 - c. How does the type of material used affect the amount of sediment deposited on the plate?
 - d. What effects would the speed of pouring water, the angle, and/or the type of materials used have on the shape of the streambed through the gutter?
9. Help students to write at least two testable questions based on the exploration.

Experiment

Process Skills: *observing, measuring, controlling variables, collecting data, and experimenting*

10. Distribute the STUDENT WORKSHEET: "Experiment Report Sheet." Ask groups to form at least one hypothesis that will answer one of their testable questions resulting from the Generalize activity. Instruct groups to design a controlled experiment to test their hypothesis. Students should design their experiments to test only one variable at a time. Review experimental designs for appropriateness and safety a before groups begin. At least four repetitions are recommended for each variable.

Interpret

Process Skills: *communicating, interpreting data*

11. Invite a spokesperson from each group to describe the variable they chose to test and their hypothesis.
12. Ask students how to discuss differences/similarities in hypotheses. Instruct students with similar hypotheses to share and discuss their data.
13. Ask students to discuss the following questions within their groups:
 - a. Does the data collected show a clear and obvious difference from the control for each variable change?
 - b. How could the experiment be improved?
 - c. What conclusions can you think of based on your results?
 - d. Have you ever seen anything in the real world that resembles the experimental results?
 - e. How might global climate change affect real world examples?

Apply

Process Skills: *communicating*

14. Instruct students to answer the following question in writing:
 - b. What affect(s) could global climate warming have on streams and their sediment loads in the real world?

Answers:

Answers will vary.

CHANGING STREAMS

RUBRIC

Assessment Task

Ask students to write responses to the following questions in their science journal or notebook:

1. How is pouring water in the rain gutter related to the water cycle in the natural world?
2. Describe three or more ways the water cycle leads to changes in Earth's surface.
3. Describe your experiment and your hypothesis:
 - a. Was your hypothesis correct or incorrect?
 - b. How do you know if your hypothesis was correct or incorrect? Answers should include analysis of data collected.
 - c. What conclusions can you state based on the results of your experiment?
 - d. How might global climate change relate to your conclusion(s)?

Rubric

Objective	GLE	Below Proficient	Proficient	Above Proficient
The student identifies ways that the water cycle is responsible for changes in Earth's surface.	[8] SD1.2	The student does not describe that rain, as a part of the water cycle, leads to change in Earth's surface.	The student describes at least one way rain, as a part of the water cycle, leads to change in Earth's surface.	The student describes two or more ways rain, as a part of the water cycle, leads to change in Earth's surface.
The student analyzes data and uses findings to support a conclusion.	[8] SA1.2	The student states his or her own observations or recorded data from a group-designed experiment, but his or her interpretation and/or analysis, if any, does not support the conclusion.	The student states his or her own interpretation and analysis of recorded data from a group-designed experiment and uses the findings to support a conclusion.	The student states his or her own interpretation and analysis of recorded data from a group-designed experiment and uses the findings to support more than one possible conclusion.
The student analyzes the validity of statistical conclusion(s) based on experimental data.	[9] S&P-2	The student states a conclusion, but analysis of statistical validity is incomplete or missing.	The student analyzes the validity of statistical conclusion(s) drawn based on experimental data.	The student analyzes the validity of statistical conclusion(s) drawn based on experimental data and critically describes the margin of error and/or other weaknesses in the data.



NAME: _____
EXPERIMENT REPORT SHEET

1. Testable Question: _____
2. Hypothesis: _____
3. How will your experiment test your hypothesis? (draw and explain below)

4. Complete the data sheet below during your experiment:

Variable Tested	Results of experimental trials				Range of results from the four trials	Average result of the four trials (total sum divided by four)
	1st trial	2nd trial	3rd trial	4th trial		
Control						

Conclusion

5. Was your hypothesis correct or incorrect? _____
6. How do you know if your hypothesis was correct or incorrect? This should include analysis of data collected.

NAME: _____
EXPERIMENT REPORT SHEET

STUDENT WORKSHEET
(page 2 of 2)

7. What conclusions can you state based on the results of your experiment? You may include more than one conclusion as well as a description of errors in the experiment.

8. How might global climate change relate to your conclusion(s)?

9. Describe three or more ways that the water cycle leads to changes in Earth's surface.
