

Science Concept:

Precipitation and run off change the surface of Earth through transport of rocks and soil.

Objectives:

The student will:

- describe how precipitation changes Earth's surface;
- infer and generalize the relationship between the flow rate of water and the transportation of different materials; and
- create and label a poster to inform and describe using captions.

GLEs Addressed:

Science

[9] 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.

[9] SA1.1 The student demonstrates an understanding of the process of science by asking questions, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

Writing

[9] W4.2.2 The student writes for a variety of purposes and audiences by writing in a variety of nonfiction forms (e.g., letter, report, biography, autobiography, and/or essay) to inform, describe, or persuade.

Vocabulary:

alluvial fan - a fan-shaped deposit of sand and mud formed by a stream where it slows down, as at the mouth of a ravine or at the foot of a mountain

barrier island - a broadened barrier beach, or sand ridge that rises slightly above the surface of the sea and runs roughly parallel to the shore, from which it is separated by a lagoon, habitable in places, that provides a measure of protection for the mainland, as during hurricanes and tidal waves

braided stream - (1) a stream that divides into a network of channels branching and reuniting, separated by islands. (2) A complex tangle of converging and diverging stream channels (Anabranches) separated by sand bars or islands. Characteristic of flood plains where the amount of debris is large in relation to the discharge

erosion - removal of material by water, wind, or ice. As soon as a rock particle (loosened by weathering) moves, by some flowing agent such as air, water or ice, it is erosion

landslide - a collapse of a mass of earth, mud, and/or rock from a mountain or cliff

mudslide - a condition where there is a river, flow or inundation of liquid mud down a hillside usually as a result of a dual condition of loss of brush cover, and the subsequent accumulation of water on the ground preceded by a period of unusually heavy or sustained rain. A mudslide may occur as a distinct phenomenon while a landslide is in progress

precipitation - falling products of condensation in the atmosphere, as rain, snow, or hail; the amount of rain, snow, hail, etc., that has fallen at a given place within a given period, usually expressed in inches or centimeters of water

river delta - a nearly flat plain of alluvial deposit between diverging branches of the mouth of a river, often, though not necessarily, triangular

runoff - that portion of precipitation that moves from the land to surface water bodies; that portion of precipitation which is not intercepted by vegetation, absorbed by the land surface or evaporated,

LET IT RAIN

and thus flows overland into a depression, stream lake or ocean

sand bar - a bar of sand formed in a river or sea by the action of tides or currents

sand dune - a usually asymmetrical hill of wind-deposited sand

sediment - the word geologists use for loose, uncemented pieces of minerals and rock that come in all sizes and go by common names like sand, boulders, clay, silt, pebbles, and cobbles

slope- ground that has a natural incline, as the side of a hill; inclination or slant, especially downward or upward; deviation from the horizontal or vertical

talus (scree) - pile of rock rubble below a cliff, slope, or chute. "Talus slope" is a common usage although it is redundant because the term "talus" actually includes the concept of a slope

Materials:

- Sand (two cups per group)
- Soil (two cups per group)
- Pea gravel (two cups per group)
- $\frac{3}{4}$ " gravel (two cups per group)
- Salt (two cups per group)
- Water, in larger pitcher or container (one liter per group)
- Styrofoam or paper (two or three cups per group)
- Large tray or shallow box (one per group)
- Items for making holes (i.e. compass point, nail, stick pin, tack) (one per group)
- Ruler (one per group)
- Stopwatch (one per group)
- Science journal
- OVERHEAD: "Sediment Transport"
- STUDENT WORKSHEET: "Precipitation Exploration"

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, inferring and communicating

1. Ask students to brainstorm a list of erosion processes and list responses on the board. Be sure water, wind, and gravity are elicited from students.
2. Show OVERHEAD: "Sediment Transport," which includes images of the following: braided stream (water transport), sand dune (wind transport), river delta (water transport), alluvial fan (water and gravity), talus or scree slope (gravity), barrier island (water), balancing rock (water and wind), and Grand Canyon (water and gravity). For each feature ask students what transport process caused the feature.
3. Ask students to write a response in their journal for each picture.

Explore***Process Skills: investigating, designing, and developing models***

4. Tell students they will be learning more about how precipitation and run off change the surface of Earth through transport of rocks and soil.
5. Divide students into small groups and distribute the following materials to each group: STUDENT WORKSHEET: "Precipitation Exploration," 2 cups sand, 2 cups soil, 2 cups pea gravel, 2 cups three quarter-inch gravel, 2 cups salt, 1 liter of water in a pitcher, two or three cups, one tray, one compass point, one nail, one stick pin, one tack, a ruler, and a stopwatch.
6. Instruct students to complete the procedure and collect data on each material type.
7. Circulate among the groups and ask the following guiding questions:
 - a. How would a change of slope affect what happens?
 - b. How would a change in flow rate affect what happens?
 - c. Is this what you expected?
 - d. What else can you do to the model?
 - e. What else might cause change(s) other than slope and flow rate?

Generalize***Process Skills: describing, inferring, comparing, and making generalizations***

8. Ask students the following questions and discuss as a class:
 - a. What happened to each of your hills?
 - b. Why do you think this happened?
 - c. How did your results compare with other groups?
 - d. How did the size, shape, or slope of your hill affect your results?
 - e. How did the material grain size affect your results?
 - f. Identify any material(s) that reacted differently than you expected. What was different?
 - g. What would have happened if you started with wet materials?
 - h. What would have happened if your rain cup were held higher or lower?
 - i. What would have happened if the holes in your rain cup were larger or smaller?
 - j. What would happen with additional rainfalls?
 - k. Which variables are affecting your results?

Apply***Process Skills: inferring, describing, predicting, and communicating***

9. Instruct students to complete their worksheets.

Assessment Task:

In your group, create a poster that illustrates the changes in two or more of Earth's surface materials caused by runoff and erosion. The poster should include labels and captions that include at least one inference and one generalization about the flow rate of water and the transportation of different materials. Correct spelling and proper vocabulary should be used.

Rubric:

Objective	GLE	Below Proficient	Proficient	Above Proficient
The student describes how precipitation changes Earth's surface.	[9] SD1.2	The student describes how one of Earth's surface materials is changed by erosion and runoff.	The student describes how two of Earth's surface materials are changed by erosion and runoff.	The student describes how more than two of Earth's surface materials are changed by erosion and runoff.
The student infers and generalizes the relationship between the flow rate of water and the transportation of different materials.	[9] SA1.1	The student makes an inference or a generalization about the flow rate of water and the transportation of different materials.	The student makes an inference and a generalization about the flow rate of water and the transportation of different materials.	The student uses identified variables or quantified data to support two or more inferences and generalizations about the flow rate of water and the transportation of different materials.
The student creates and labels a poster to inform and describe using captions.	[9] 4.2.2	The student creates a poster without captions or labels.	The student creates and labels a poster with short and descriptive captions.	The student creates and labels a poster with short and descriptive captions using correct spelling and introduced science vocabulary.

NAME: _____
PRECIPITATION EXPLORATION

Materials:

- Large tray
- 2 cups sand
- 2 cups silt soil
- 2 cups pea gravel
- 2 cups $\frac{3}{4}$ " gravel
- 2 cups salt
- 1 Liter of water in a large container or pitcher
- 2-3 Styrofoam or paper cups per group
- 1 large tray or shallow box
- 1 compass point
- 1 each of nail, stick pin, tack
- 1 ruler
- 1 stopwatch

Procedure:

STEP 1. Build a dry hill on a large tray using one to two cups of a single material.

STEP 2. Poke holes in the bottom of paper or Styrofoam cup.

STEP 3. Hold the cup over your hill and pour water into the cup to make it "rain" on your hill.

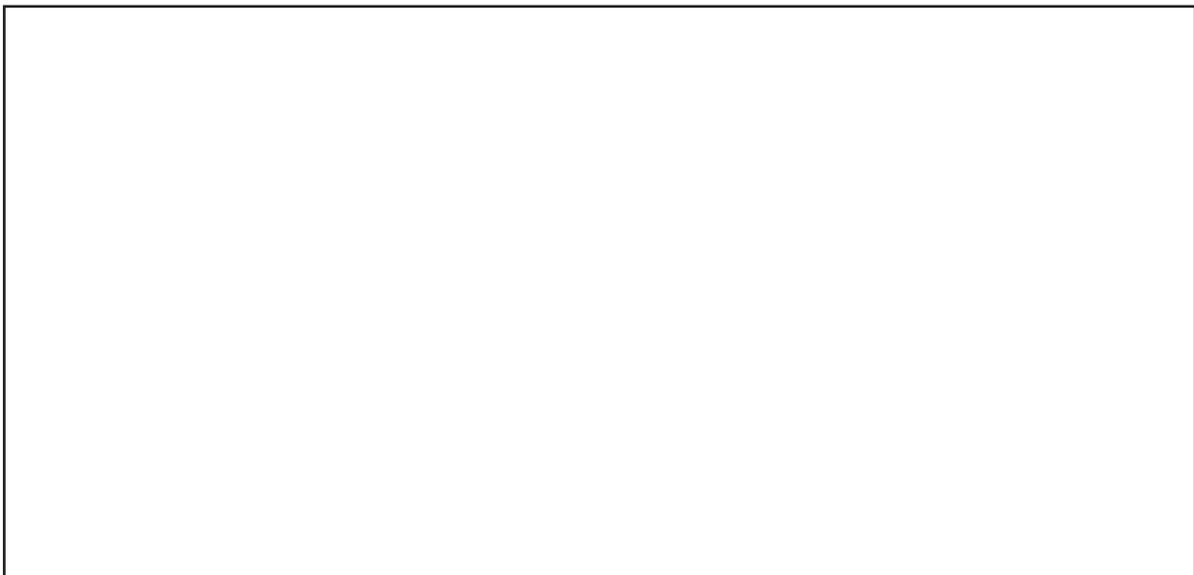
STEP 4. Take measurements with the ruler and stopwatch. Record observations by describing and drawing what happens.

STEP 5. Repeat STEP 1-4 with each of the other materials.

Data:

For each material type, draw and describe your observations:

Sand



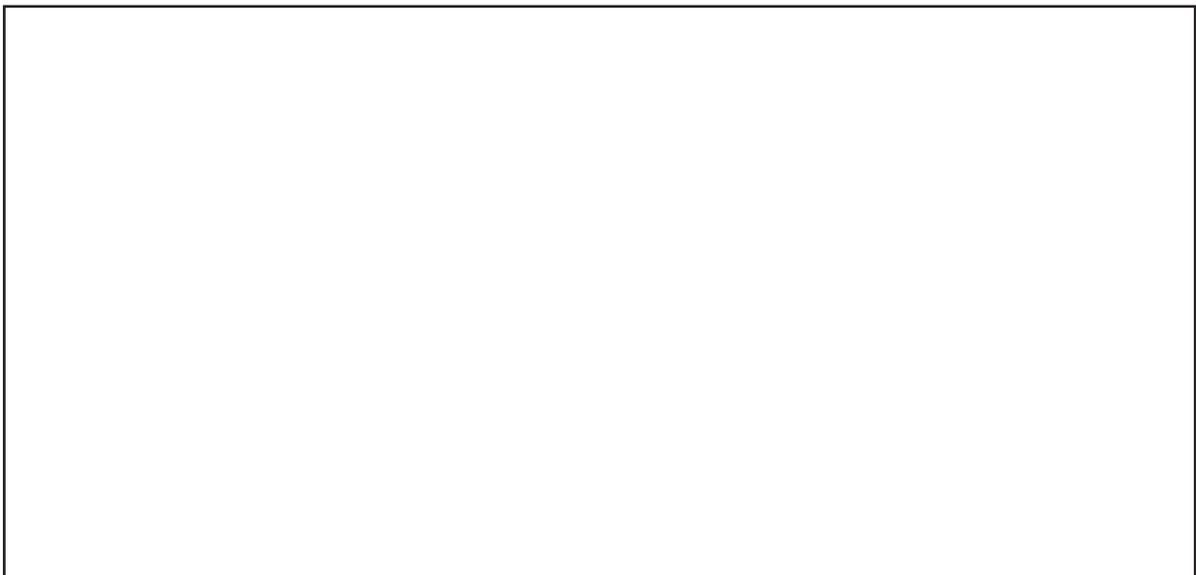
NAME: _____
PRECIPITATION EXPLORATION

STUDENT WORKSHEET
(page 2 of 4)

Soil



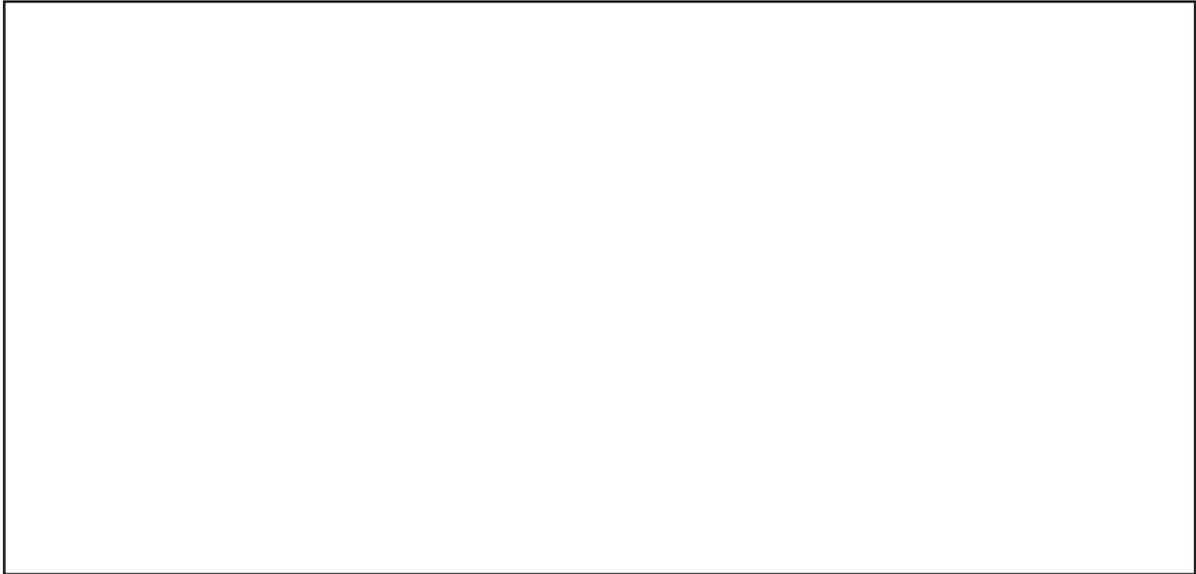
Pea Gravel



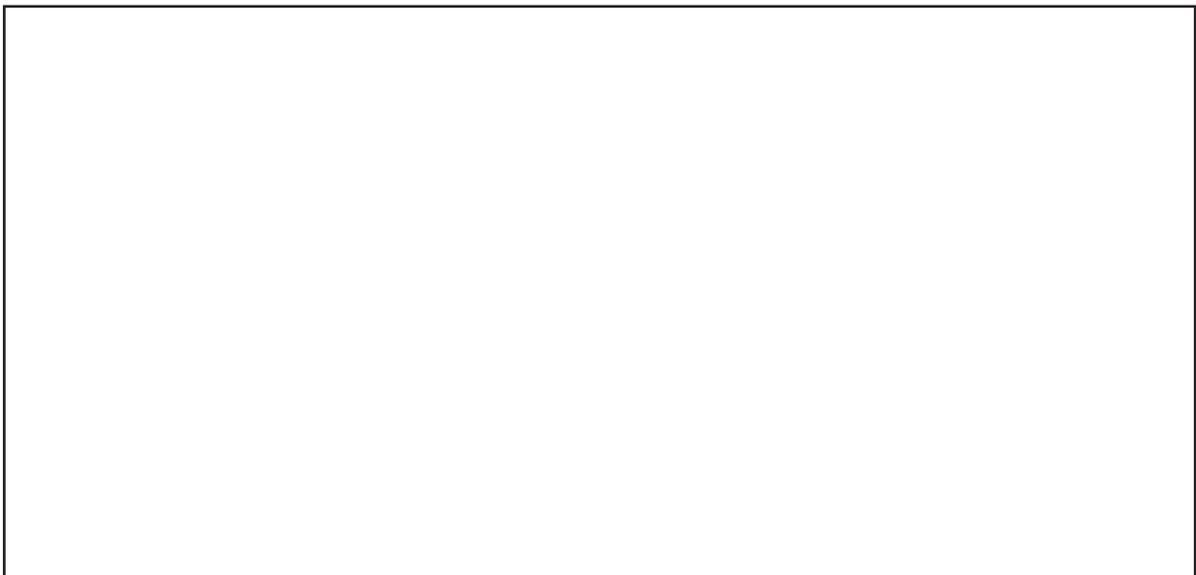
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PRECIPITATION EXPLORATION

STUDENT WORKSHEET
(page 3 of 4)

3/4" Gravel



Salt



Questions

Answer the following questions.

1. For each of the following surfaces your produced, where have you seen those surfaces in nature?
 - a. Sand _____
 - b. Soil _____
 - c. Pea gravel _____
 - d. $\frac{3}{4}$ " gravel _____
 - e. Salt _____

2. Can the effects of rain be changed? How?

3. What would happen to the Earth's surface if changes were only caused by rain?

4. Explain why we have mountains.
