Activity 4
Rock Races

Objectives

Students investigate another factor affecting erosion caused by moving water—the size of the particles being carried by the water.

The students

- measure, record, and compare the rates at which different-sized particles (samples of gravel, sand, and soil) settle in water

Schedule

About 30 minutes

Vocabulary

deposition
particle

Materials

Ready & waiting in Lab

For each student

1	Activity Sheet 4

For each team of two

1	cap, for tube
1	label
1	*stopwatch, or other timepiece that indicates seconds
1	tube, plastic

For the class

4	containers, 1-L
1 bag	gravel
1 bag	sand
1 bag	soil, clay
1 bag	soil, potting
4	spoons, measuring, 1-Tbsp
	*water, tap

*provided by the teacher

Preparation

1. Make a copy of Activity Sheet 4 for each student.
2. Open the four bags of material and place them at a distribution station. Place a measuring spoon next to each bag. Fill four containers with tap water and place them at the station as well.
3. Each team of two will need a plastic tube, a cap for the tube, a label, a stopwatch or other timepiece that indicates seconds, 1 Tbsp of one of the four materials (gravel, sand, clay soil, or potting soil), and some tap water.

Background Information

A *particle* is a small bit of material. The force of moving water carries particles of the earth's crust and causes erosion. Sir Isaac Newton discovered that in the earth's atmosphere, all particles—no matter how heavy they are—fall at the same speed. Particles falling through water, however, are affected not only by gravity but by the force of the moving water as well. Because of this, different-sized particles will settle out of flowing water at different rates.

The force, and therefore the speed, of moving water is affected by many factors—including the depth and width of the streambed, the slope of the terrain, and the

number of objects (such as boulders) obstructing the path of the water—all of which can change as the water flows downstream.

In fast-moving water, even heavy particles are carried along. But when the fast-moving water enters areas where the speed—and therefore the force—of the water is reduced, the larger, heavier particles settle to the bottom. As the water's force continues to decrease (such as when it reaches its base level) even the smallest, lightest particles settle to the bottom. The process in which particles settle to the bottom of a liquid is called *deposition*.

In this activity, the students will conduct experiments to demonstrate the relationship between particle size and rate of settling.

Name _____ Activity Sheet 4

Rock Races

1. Record the amount of time it took for the particles of each type of material to settle.

Time in Seconds				
	Sand	Potting Soil	Clay Soil	Gravel
Trial 1				
Trial 2				

2. Find the average time required for each particle type to settle. (Hint: Add together the times recorded for each particle and divide by two.)

sand 3.5 seconds potting soil 40–50 seconds
clay soil 1–2 minutes gravel 1 second

What can you infer about the size of a particle and where, along the path of a stream, it is likely to be deposited?
A heavier particle will be deposited sooner (closer to the origin or a stream) than a smaller, lighter particle.

How would a lake bottom look as you moved farther away from the mouth of the stream that feeds the lake? What size particles would you find in the sediment near the mouth of the stream? Near the middle of the lake? Why?
The particles on the bottom of the lake will be smaller as you go toward the middle of the lake. The largest particles will be at the mouth of the stream because the moving water loses its force (and drops the bigger particles first) when it meets the lake.

Teaching Suggestions

1

Write the words *particle* and *deposition* on the board. Explain to the students that a particle is a small piece of a material and that particle size varies.

Explain that the size and weight of a particle help determine where, along a streambed or riverbed, the particle will settle to the bottom. This process of material settling to the bottom is called deposition.

Ask, **How do you think the size and weight of particles in a stream affects where the particles settle out?**

2

Tell students that in this activity, they will discover how particle size relates to rate of deposition.

Explain that there are four types of material to be tested. ~~Each team will add only one material to their tube and label the tube~~

Additional Information

Many students may say that larger particles will settle out before smaller particles will.

~~with the name of the material. Different teams will use different materials, and teams will swap tubes so that all teams get a chance to experiment with all four materials.~~

Each table will have all 4 of the different material tubes.

~~Distribute a label, a plastic tube, and a cap to each team of two. Make sure that each team has access to a stopwatch or some other timepiece that displays seconds.~~

~~Have one member from each team come up to the distribution station and put 1 Tbsp of one kind of material into a tube, fill it with water, and place the cap on the tube. Have the other team member write the type of material on a label, affix the label to the tube, and then hold the tube still to allow the particles of material to settle to the bottom.~~

3

All will be provided.

> ***Note:*** *The samples of soil, sand, and gravel should not be mixed together, and each team should test only one material at a time.*

Explain the procedure. Tell teams that they are experimenting to find out how long it takes each type of material to settle, and which materials settle faster or slower than others. One team member will time the experiment; the other will shake the tube. Both will record the results on Activity Sheet 4.

Explain that one team member should shake the tube gently until the material inside is distributed throughout the water. He or she should then set the tube down and say "go," at which time the other team member should start timing. When the particles have settled to the bottom of the tube the first team member should say "stop," and the second should stop timing. The timekeeper should then note the amount of time that passed between "go" and "stop"—the time required for the particles in the tube to settle.

practice with the timer. starting, stoping, and reading.

4

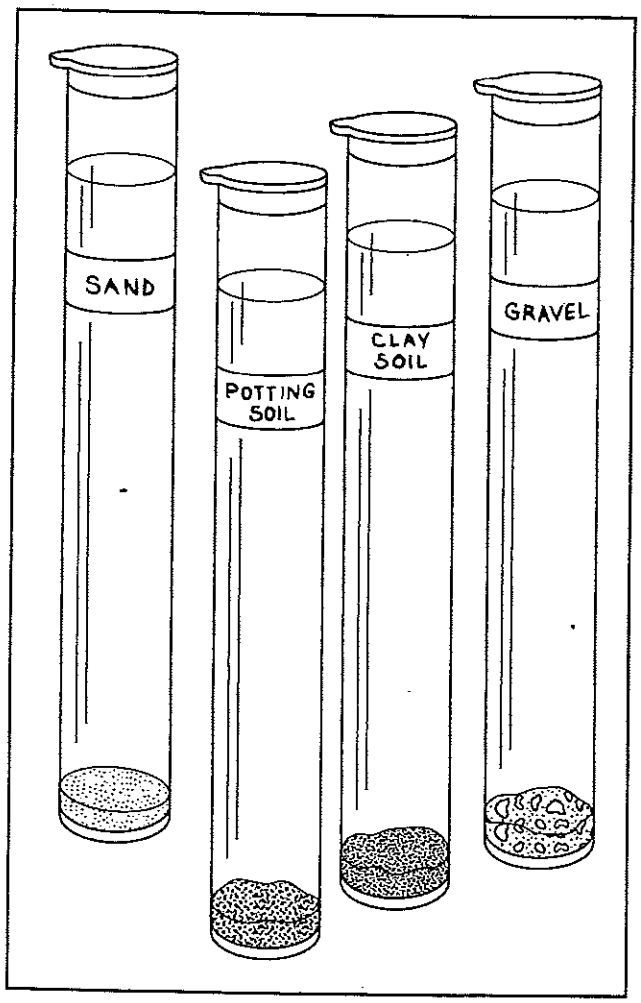

Figure 4-1. The four tubes of material.

Distribute a copy of Activity Sheet 4 to each student. Tell teams to begin timing the material in their tube as soon as they are ready.

5

Tell students to enter the settling time in the chart on Activity Sheet 4. Have each team repeat the procedure and record their results on the activity sheet. (Students should share the timing and tube-shaking tasks.)

You will have the 4 tubes.

~~Teams should then swap tubes and conduct two more trials, continuing in this way until every team has experimented with, and recorded results from, all four materials.~~

> ***Note:*** *You may want to forewarn students that neither soil type—clay nor potting—will settle out completely. However, students should observe many more suspended particles in the clay soil tube than in the potting soil tube after one minute.*

Tell students that this activity illustrates the variations in the settling rates of different-sized particles in water that is not moving. Ask, **What do you think would happen to a piece of gravel and a grain of sand if you dropped them at the same time into a fast-moving stream or river?**

6

You may get many answers.

Explain that both particles would be carried downstream, but that the piece of gravel would settle to the bottom before (be deposited further upstream from) the grain of sand.

Ask, **When a fast-moving stream or river enters a lake, what size particles do you think settle out first?**

7

The larger particles settle out first.

Ask, **What conditions, other than particle size and weight, help determine the deposition of sediment along a river or stream?**

Students' responses may include the shape or contour of the streambed and the speed of the water.

Fill in Assessment – Section 2

Draw a line from each tube to the site where it was most likely found. The fastest moving particles will be upriver. The slowest will be closest to the lake.

Name _____ Activity Sheet 4

Rock Races Answer Sheet

1. Record the amount of time it took for the particles of each type of material to settle.

Time in Seconds				
	Sand	**Potting Soil**	**Clay Soil**	**Gravel**
Trial 1				
Trial 2				

2. Find the average time required for each particle type to settle. (Hint: Add together the times recorded for each particle and divide by two.) Write average time.

sand 2nd potting soil 3rd

clay soil slowest 4th gravel fastest 1st

What can you infer about the size of a particle and where, along the path of a stream, it is likely to be deposited?

A heavier particle will be deposited sooner (closer to the origin or stream) than a smaller, lighter particle.

How would a lake bottom look as you moved farther away from the mouth of the stream that feeds the lake? What size particles would you find in the sediment near the mouth of the stream? Near the middle of the lake? Why?

The particles on the bottom of the lake will be smaller as you go toward the middle of the lake. The largest particles will be at the mouth of the stream because the moving water loses its force (and drops the bigger particles first) when it meets the lake.

Name Answer sheet

Assessment – Section 2

3. Draw a line from each tube to the site where it was most likely found.