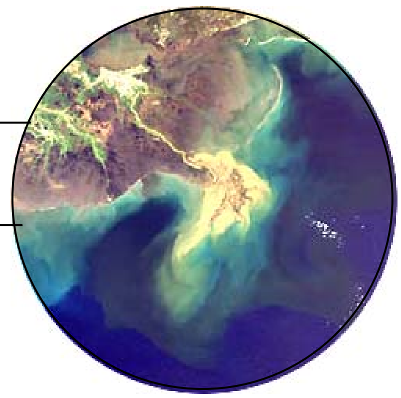
Mixing Soil and Water

LET'S SETTLE THIS



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Activity Overview

Deposition of sediment over the last 7,000 years created Louisiana's coastal wetlands. Along with water, the Mississippi River carries billions of metric tons of sediment to the river's mouth each year. This sediment is made up of soil that enters the river due to erosion and runoff from surrounding land. As the river reaches sea level near the coast, the currents slow, and the sediment is deposited to form new land.

In this activity, students will perform an experiment to simulate sediment deposition in still water. They will examine the settling of sediment from two different types of soil; sandy soil and potting soil. After mixing each type of soil with water in clear bottles, students will investigate how sediment particles settle. They will measure the amount of light passing through the water as particles settle using a Light Sensor connected to a TI CBL 2™ or Vernier LabPro and a TI-73 Explorer™. Students will make connections between the sediment settling in the experiment and the process by which sediment settles out of the Mississippi River to form coastal wetlands.

Conclusions: As sediment settles, the water clears up, and more light passes through the water. Sediment from sandy soil settles faster. At the mouth of the Mississippi River the currents slow down and the larger sand particles settle at the bottom. The smaller clay particles can remain suspended much longer in slower currents and are carried further out into the ocean.

Activity at a Glance

Grade:	6–9
Subject:	Science
Category:	Physical Science, Earth Science
Topic:	Sedimentation, Deposition, Soil Properties

Time Required

- Two 45-minute periods

Level of Complexity

- Medium

Materials*

- TI-73 Explorer™
- TI CBL 2™ or Vernier LabPro
- TI-73 DataMate
- Light Sensor
- Small Flashlight
- Potting Soil
- Sandy Soil
- Balance
- Water
- Funnel
- 2 Clear Plastic Bottles (½ liter) with Caps

TI-73 Explorer™

TI Light Sensor

* This activity has been written for the TI-73 Explorer™ but you can easily substitute the TI-83 or TI-83 Plus. Also see Appendix A for steps on how to transfer DataMate to your graphing device and how to use DataMate for data collection.

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Concept Background

- Sand particles are the only particles which may be large enough to be seen with the naked eye. Sandy soil is coarsely textured and has a gritty feel when rubbed between the fingers. Silty soil is finely textured and has a soft feel when rubbed between the fingers. Clay soil is very finely textured and has a smooth and sticky feel when wet.
- Although composed mostly of sand, sandy soil may still contain silt and clay particles. Potting soil is composed mostly of silt and clay.
- Suspension of particles in water depends on several factors including particle size, particle shape, particle density, and current speed. Small and light soil particles, such as clay and silt, can remain suspended in slow currents. Larger and heavier particles require higher currents to remain suspended. As currents slow, larger and heavier particles are deposited first. In river deltas, as the river current slows, larger and heavier particles are quickly deposited. Small and lighter particles remain suspended and can be carried for miles out to sea.

Preparation and Classroom Management Tips

- Encourage students to connect what they have learned in this activity to their study of the Mississippi River and Louisiana's wetlands. The mixing of the soil and water in the bottle simulates the mixing of soil runoff and river bottom sediments with the waters of the Mississippi River. Shaking the bottle represents the motion of the river's currents as they rush downhill in response to the force of gravity. When the bottle is set down on the table, it imitates the slowing of the river as it reaches the Gulf of Mexico.
- As a demonstration, the time settings can be changed to collect data for longer time periods such as overnight or for several days. Given enough time, all suspended particles should settle in the water.
- Students need to shake the sandy soil bottle, quickly place it between the Light Sensor, and start the data collection. Large particles, such as sand, will settle very quickly at the start of the experiment.
- The initial light intensity will be different for the two types of soil. At the beginning of the experiment, the clarity in the potting soil will be low; therefore the light intensity will be low.
- The graphs of the sandy soil and potting soil may be on different scales. Caution students to examine the Y-axis carefully.
- The TI Light Sensor measures light intensity in irradiance units of milliwatts per square centimeter (mW/cm^2). For comparison, irradiance at noon on a sunny day is about 100 mW/cm^2. Under cloudy conditions at the same time, irradiance is about 30 mW/cm^2.
- This activity was written for use with the TI Light Sensor but the Vernier Light Sensor may also be used. The Vernier sensor measures light intensity in units of lux. Refer to *Vernier Light Sensor User Guide* for setup information.
- This activity works well with students working in groups or as a demonstration.
- Encourage students to answer the questions in Data Analysis in their journals.

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National Education Standards

Science Standard A: Science As Inquiry

Students should understand scientific inquiry and develop abilities necessary to perform it.

Science Standard B: Physical Science

Students should develop an understanding of properties and changes in matter, motions and forces, and transfer of energy.

Math Standard: Data Analysis & Probability

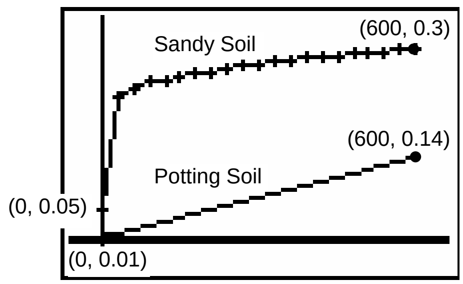
Students should develop an understanding about how to collect, organize, display, and interpret data.

- Create your own student questions for use on your students' TI graphing devices using the Texas Instruments StudyCard applications. For more information, go to

http://education.ti.com/us/product/apps/studycards/scresources.html.

Part B — Settling of Potting Soil and Sandy Soil

Data Analysis



Sample graph

Note: The values shown on the graph will vary according to your soil sample.

1 Q. Draw a sketch of the graph created by your graphing device. Label the curves *Potting Soil* and *Sandy Soi*l.

A. Answers will vary. The students should sketch a graph similar to the sample graph above.

2 Q. By observing your graph, describe how the light intensity changed for the potting soil.

A. The light intensity for the potting soil increased steadily during the 10-minute period.

3 Q. By observing your graph, describe how the light intensity changed for the sandy soil.

A. The light intensity for the sandy soil increased sharply at the beginning of the experiment. It then increased steadily until the end of the experiment.

4 Q. By observing your graph, compare the light intensity for sandy soil and the light intensity for potting soil?

A. The light intensity for the potting soil increased steadily during the experiment. For the sandy soil there was a dramatic increase in light intensity at the beginning of the experiment. At the end of the experiment the light intensity for sandy soil was higher than the light intensity for the potting soil.

5 Q. By observing your graph and by referring to your observations in your journal, what was happening to potting soil and sandy soil particles as light intensity increased?

A. As light intensity increased, potting soil and sandy soil sediment settled at the bottom of the bottles.

Vocabulary

Delta A deposit of sediments, usually triangular in shape, that forms at the mouth of a river when the river's speed decreases and sediment settles out of the water.

Deposition The process by which sediments settle out of water.

Distributaries A river channel that flows away from the river.

Drainage Basin The area drained by a river and all of its tributaries.

Erosion The removal of soil and rock material by wind or water.

Gravity The force of attraction between two masses; the force that pulls an object toward the Earth.

Hydrology The patterns of water flow in a system.

Light Intensity The amount of light energy from a given location.

Mouth The place where a river flows into another body of water.

Particle A very small piece of soil or sediment.

Sediment A solid material that has fallen out of a liquid.

Source The area where a river begins.

Stem The main channel of a river.

Suspension A combination of solid particles and liquid, in which certain particles of the solid do not fall to the bottom for a long period of time because they are too light to overcome the movement of the liquid.

Translucent Able to let light pass through, but not enough light to see distinct objects.

Transparent Able to let enough light pass through to see distinct objects.

Tributaries Rivers or streams that flow into larger rivers or lakes.

6 Q. How did the clarity of water change as light intensity changed for potting soil? Explain.

A. *As light intensity for potting soil increased, the clarity of water increased. Soil particles suspended in the water prevented light from passing through. As potting soil particles settled, the water clarity increased, and more light passed through the water.*

7 Q. How did the clarity of water change as light intensity changed for sandy soil? Explain.

A. *As light intensity for sandy soil increased, the clarity of water increased. Particles suspended in the water prevented light from passing through. As potting soil particles settled, the water clarity increased, and more light passed through the water. At the beginning of the experiment sandy soil particles settled at the bottom of the bottle fast, therefore the light intensity increased sharply.*

8 Q. Copy Table 2 into your journal.

9 Q. Record the light intensity for potting soil at the beginning of the experiment in Column A of Table 2 (x = 0 seconds).

A. *Answers will vary. See sample data in Table 2.*

Table 2

	A	B	B - A
Time (seconds)	**0**	**600**	**Total Change in Light Intensity**
Light Intensity Potting Soil (mW/cm^2)	*0.01*	*0.14*	*0.13*
Light Intensity Sandy Soil (mW/cm^2)	*0.05*	*0.3*	*0.25*

Sample Data

10 Q. Record the light intensity for potting soil at the end of the experiment in Column B (x = 600 seconds).

A. *Answers will vary. See sample data in Table 2.*

11 Q. Record the light intensity for sandy soil at the beginning of the experiment in Column A of Table 2 (x = 0 seconds).

A. *Answers will vary. See sample data in Table 2.*

12 Q. Record the light intensity for sandy soil at the end of the experiment in Column B (x = 600 seconds).

A. *Answers will vary. See sample data in Table 2.*

13 Q. Find the total change in light intensity for potting soil by subtracting Column A from Column B (B - A). Record the change in light intensity in Table 2.

A. *Answers will vary. See sample data in Table 2.*

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14 Q. Find the total change in light intensity for sandy soil by subtracting Column A from Column B (B - A). Record the change in light intensity in Table 2.

A. *Answers will vary. See sample data in Table 2.*

15 Q. Which soil's sediment settled to the bottom of the bottle the fastest? Explain how the total change in light intensity from Table 2 can help you answer this question.

A. *Sandy soil had the greatest total change in light intensity over a period of 10 minutes. This indicates that more sandy soil sediment settled than potting soil sediment in 10 minutes. Therefore, sandy soil sediment settled to the bottom the fastest.*

16 Q. What do you think would happen to the light intensity and the amount of sediment particles settling at the bottom of each bottle if you performed the experiment for a long period of time?

A. *Most suspended sediment particles will settle if given enough time. If the experiment were performed for a long period of time, the water in both bottles would be clear and have about the same light intensity.*

17 Q. If sediment from the two types of soil you used in this experiment were carried by the Mississippi River, which type would you expect to find more of at the river's mouth? Explain.

A. *You would expect to find more sandy soil near the river's mouth. Larger and heavier particles, such as sand, require a fast current to remain suspended. At the mouth of the Mississippi River the currents slow down. The larger sand particles are not able to remain suspended and they settle at the bottom. The smaller clay particles can remain suspended much longer in slower currents and are carried further out into the ocean.*

18 Q. Based on information provided in the Research Article and your learning experience from this experiment, explain the process by which sediments of different size and weight settle out of the Mississippi River to form Louisiana's wetlands.

A. *Sediment is carried thousands of kilometers to the river's mouth by the fast moving river. At the mouth, the river reaches sea level and the currents slow. When this happens, large and heavy sediments settle out of the Mississippi River and are deposited near the mouth of the river. The deposition of these sediments is responsible for the formation of new land.*

19 Q. If sediment deposition in Louisiana's coastal wetlands were to stop, what would happen to the wetlands over time? Explain.

A. *If sediment deposition in Louisiana's coastal wetlands were to stop, the wetlands would start to disappear over time. When more land is eroded than land formed, there will be wetland loss. Disappearing wetlands is currently an issue in coastal Louisiana. Sediment deposition is no longer occurring at the rate it once did and as a result, Louisiana's coastal wetlands are disappearing.*