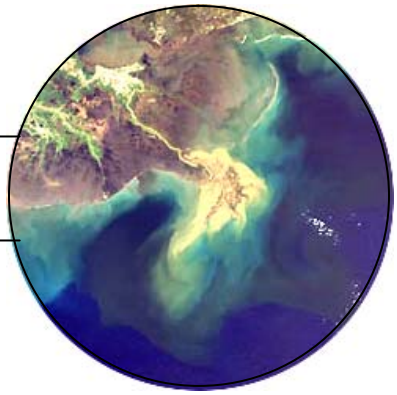
LET'S SETTLE THIS

Focus Question
How fast do different types of soil settle in water?

ACTIVITY



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, you will perform an experiment to simulate sediment deposition in still water. You 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, you will investigate how sediment particles settle. You 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™. You will make connections between the sediment settling in the experiment and the process by which sediment settles out of the Mississippi River.

What does the amount of light passing through the water tell you about how sediment settles? Which soil's sediment settles faster? If sediment from these two types of soil were carried by the Mississippi River, which type would have more sediment settle near the river's mouth?

Part A — Setting Up the Experiment to Measure Light

Procedure

1 **Mix the water and soil.**

a. Label one of the plastic bottles *Potting Soil* and the other *Sandy Soil*.
b. Add 25 grams of potting soil to the bottle labeled *Potting Soil*.
c. Add 25 grams of sandy soil to the bottle labeled *Sandy Soil*.
d. Fill each plastic bottle with 475 mL of water.
e. Cap the bottles.

2 **Connect the Light Sensor to the CBL 2™or Vernier LabPro and TI-73 Explorer™.**

a. Plug the Light Sensor into Channel 1 of the CBL 2™ or Vernier LabPro.
b. Use the link cable to connect the TI-73 Explorer™ to the interface.
c. Firmly press in the cable ends.

3 **Set up the TI-73 Explorer™ for Data Collection.**

a. Turn on the TI-73 Explorer™ and start the DATAMATE application. (For instructions on DATAMATE see Appendix A.)
b. Press [CLEAR] to reset the program.
c. Select SETUP from the MAIN SCREEN by pressing [1].
d. Select MODE. Use the arrow keys ([▲], [▼]) to move the cursor next to MODE and press [ENTER].
e. Press [2] to select TIME GRAPH from the SELECT MODE MENU.
f. Press [2] to select CHANGE TIME SETTINGS from the GRAPH SETTINGS MENU.
g. Enter 30 as the time between samples in seconds and press [ENTER].
h. Enter 20 as the number of samples and press [ENTER]. Data will be collected for 600 seconds (10 minutes).
i. Press [1] to return to the SETUP SCREEN.
j. Press [1] to return to the MAIN SCREEN.

4 **Set up the Equipment.**

a. Use a ring stand and clamp to position the Light Sensor 5 cm below the surface of the water in the bottle. The sensor should be parallel to the surface and positioned as close to the bottle as possible. See Figure 1.
b. Using another ring stand and clamp, position the flashlight to point directly at the Light Sensor through the bottle. The flashlight and Light Sensor need to be at the same height. See Figure 1.

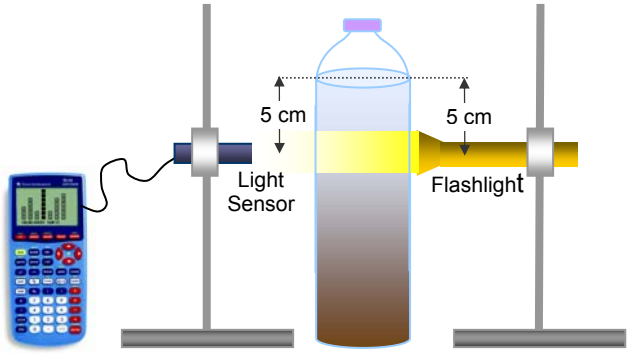


Figure 1

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

Part B — Settling of Potting Soil and Sandy Soil

Soil is typically composed of clay, silt, and sand particles. The amount of clay, silt, and sand particles varies for different types of soil. Sand is larger than silt and both are larger than clay. Settling of sediment depends on several factors including particle size, particle shape, particle density, and current speed. Larger and heavier sediments tend to settle near the mouth of a river while smaller particles tend to be carried into the ocean and settle in deeper water.

Procedure

1 **Collect your potting soil data.**

a. Shake the bottle labeled Potting Soil and place it between the flashlight and Light Sensor.
b. Press [2] on the TI-73 Explorer™ to begin data collection.
c. Record your observations during the experiment in your journal.
d. At the end of the 600-second time period, a graph is displayed representing the change in light penetrating the water.

2 **Store your data so you can use it later.**

a. Press [ENTER] to return to the MAIN SCREEN.
b. Select TOOLS from the MAIN SCREEN.
c. Select STORE LATEST RUN from the TOOLS MENU.

3 **Collect your sandy soil data.**

a. Return to the MAIN SCREEN.
b. Shake the bottle labeled *Sandy Soil* and place it between the flashlight and Light Sensor.
c. Press [2] on the TI-73 Explorer™ to begin data collection.
d. Record your observations during the experiment in your journal.
e. At the end of the 600-second time period, a graph is displayed representing the change in light penetrating the water.

4 **Analyze your data.**

a. Press [ENTER] to return to the MAIN SCREEN.
b. To graph both runs on a single graph, select GRAPH from the MAIN SCREEN to see the last graph, and then press [ENTER].
c. Select MORE, then select L2 AND L3 VS L1 from the MORE GRAPHS MENU.

5 Complete the Data Analysis section. Answer the questions in your journal.

↺ *To collect your data again, follow the steps below:*

- *Press [ENTER] to go to MORE GRAPHS*
- *Press [8] to return to the GRAPH SCREEN*
- *Press [2] to return to the MAIN SCREEN and repeat Step 1.*

Data Analysis

Note: You may use the rescale menu to adjust the graphs.

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

Use the left and right arrow keys (◄, ►) to move the cursor along a curve. The time (x) and light (y) values of each data point are displayed below the graph. Use the up and down arrow keys (▲, ▼) to move the cursor from one curve to the next.

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

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

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

5 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?

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

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

8 Copy Table 2 into your journal.

Table 2

	A	B	B - A
Time (seconds)	**0**	**600**	**Total Change in Light Intensity**
Light Intensity Potting Soil (mW/cm^2)			
Light Intensity Sandy Soil (mW/cm^2)			

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

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

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

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

13 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.

14 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.

15 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.

16 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?

17 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.

18 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.

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