

Does **CLEAR** Water mean **HEALTHY** Water?

ACTIVITY



Activity Overview

Most aquatic animals and plants need clear water to survive. Cloudy waters can put an aquatic habitat into serious danger. Fish cannot find food and the growth of aquatic plants is affected. Water clarity is important to humans. Humans are often responsible for polluting the water, which results to poor water clarity.

Perform an experiment to measure the water clarity of your local aquatic site. First make field observations to determine if the aquatic site supports animal life and vegetation, and if there are signs of pollution. Next, collect a water sample and measure its turbidity, which shows how cloudy the water is. Use a Turbidity Sensor connected to a TI CBL 2™ or Vernier LabPro, and a TI-73 Explorer™. Repeat the experiment to obtain a second turbidity reading and find the average value.

What does your data tell you about the quality of the water? Does the water clarity of your aquatic site explain your observations?



Focus Question

What is the turbidity at your aquatic site?



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Preparation

- ① **Connect the Turbidity Sensor to the CBL 2™ or Vernier LabPro and TI-73 Explorer™.**
 - a.. Plug the Turbidity 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.
- ② **Set up the TI-73 Explorer™**
 - a. Turn on the TI-73 Explorer™ and start DATAMATE (*for instructions on DATAMATE see Appendix A*).
 - b. Press **[CLEAR]** to reset the program.
 - c. If CH 1 displays TURBIDITY (NTU), proceed to Step 3. If it does not, continue with this step to set up your sensor manually.
 - d. Press **[1]** to go to the setup screen.
 - e. Press **[ENTER]** to select CH1.
 - f. Select TURBIDITY (NTU) from the SELECT SENSOR menu.
 - g. Select OK to return to the main screen.
- ③ **Calibrate the Turbidity Sensor.**

First Calibration point

 - a. Press **[1]** to go to the setup screen.
 - b. Select CALIBRATE, then CALIBRATE NOW.
 - c. Rinse the empty turbidity cuvette with distilled water, then fill it with distilled water so that the water level is equal to the level in the 100 NTU standard bottle. Place the lid on the cuvette. Gently wipe the outside with a soft, lint-free cloth or tissue.
 - d. Check the cuvette for air bubbles. If you see air bubbles, gently tap the bottom of the cuvette on a hard surface to remove them.
 - e. Holding the cuvette by the lid, place it in the Turbidity Sensor. Make sure that the mark on the cuvette is aligned with the mark on the Turbidity Sensor. Close the lid.
 - f. When the voltage reading is stable, press **[ENTER]**.
 - g. Enter "0" as the turbidity of the water.
 - h. Remove the cuvette from the sensor and set aside for use in the experiment (*see Procedure*)

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Materials*

- TI-73 Explorer™
- TI CBL 2™ or Vernier LabPro
- TI-73 DataMate
- Turbidity Sensor
- Sampling bottle with lid
- Empty Turbidity Cuvette (comes with sensor)
- Turbidity standard (StableCal® Formazin Standard 100 NTU) (comes with sensor)
- Distilled water
- Soft, lint-free cloth or tissue



Turbidity Sensor

*This activity has been written for use with the TI-73 Explorer™, however it can be easily adapted for use with the TI-83 and the TI-83 Plus. Appendix A explains how to transfer DataMate on you device and how to use DataMate for data collection.



Adapted from "Experiment 3 — Turbidity," *Water Quality with Calculators*, written by Johnson, Robyn L., Holman, Scott, and Holmquist, Dan D., published by **Vernier Software & Technology**, 2002.

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Preparation

Second Calibration point

- i. Obtain the cuvette containing the Turbidity Standard (100 NTU) and gently invert it four times to mix in any particles that may have settled to the bottom. *Important: Do not shake the standard. Shaking will introduce tiny air bubbles that will affect turbidity.*
- j. Wipe the outside with a soft, lint-free cloth or tissue.
- k. Holding the standard by the lid, place it in the Turbidity Sensor. Make sure that the mark on the cuvette is aligned with the mark on the Turbidity Sensor. Close the lid.
- l. When the voltage reading is stable, press **ENTER**.
- m. Enter "100" as the turbidity of the standard.
- n. Select OK to return to the setup screen.

④ Set up the TI-73 Explorer™ for data collection.

- a. Use **▲** and **▼** to select MODE and press **ENTER**.
- b. Select SINGLE POINT from the SELECT MODE menu.
- c. Select OK to return to the main screen.

Procedure

① Make Field Observations.

- a. Observe and record animal life, vegetation, and signs of pollution at your aquatic site.

② Obtain your aquatic site water sample.

- a. You need to collect about 100 mL water sample in a bottle that has a lid.
- b. Try to collect the sample from below the surface of the water and as far away from the shore as is safe. If suitable construct a sampler with a rod and a container.
- c. Stand upstream from any activity that could stir up sediment and affect your readings. Hold the sample bottle upstream from your body.
- d. If you cannot test for turbidity right away store the sample in an ice chest or a refrigerator.

③ Prepare the water sample for data collection.

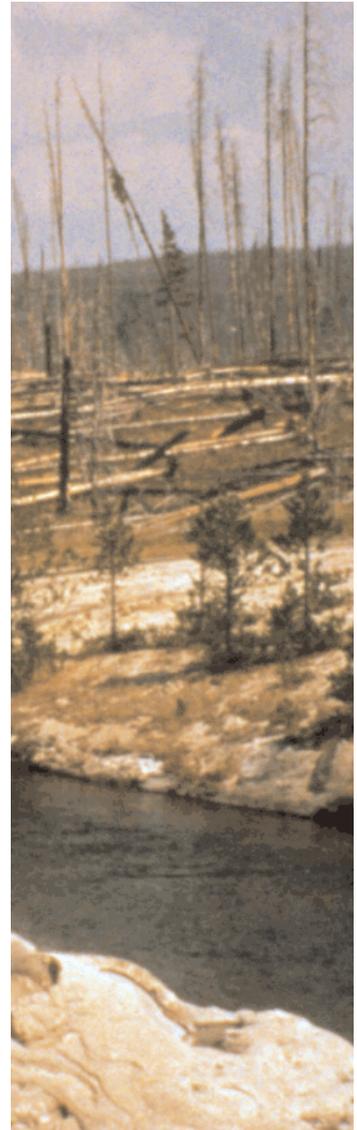
- a. Gently invert the sample water four times to mix in any particles that may have settled to the bottom. *Important: Do not shake the sample. Shaking will introduce tiny air bubbles that will affect turbidity.*
- b. If the cuvette contains distilled water empty it. Rinse the cuvette with sample water, then fill it so that the water level is equal to the level in the 100 NTU standard bottle. Place the lid on the cuvette. Gently wipe the outside with a soft, lint-free cloth or tissue.
- c. Check the cuvette for air bubbles. If you see air bubbles, gently tap the bottom of the cuvette on a hard surface to remove them.
- d. Holding the cuvette by the lid, place it into the Turbidity Sensor. Make sure that the mark on the cuvette is aligned with the mark on the Turbidity Sensor. Close the lid.

④ Collect your turbidity data.

- a. Select START to begin sampling.
- b. After 10 seconds, the turbidity value (in NTU) will appear on the screen. Record this value in the table(round to the nearest 1 NTU).
- c. Press **ENTER** to return to the main screen.

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Procedure

- ⑤ Repeat Steps, 2, 3, and 4 with a second sample of water.
- ⑥ Discuss the questions to the right.

Water Sample Turbidity Values	
Reading	Turbidity (NTU)
1	
2	
Average	



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Observations & Conclusions

A. What observations did you make at your aquatic site? (weather, description and type of site, signs and condition of animal life, signs and condition of vegetation, signs of pollution)

B. Compare your turbidity levels with your observations. Based on your observations and the information provided in the research article, identify the factors that influenced your turbidity levels.

C. Find examples of watersheds (local or outside of your area) that are affected by turbidity levels. Describe efforts that are being done to maintain or change turbidity levels.



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