



Science Objectives

- Students will collect and analyze water quality data.
- Students will apply their understanding of variables that affect water quality to determine the location of various water samples.

Vocabulary

- dissolved oxygen
- turbidity
- nitrates
- pH
- water quality
- aeration
- buffer strips
- runoff

About the Lesson




- In this lesson students will:
 - Collect data for various water samples.
 - Understand how scientists use data to analyze water samples.

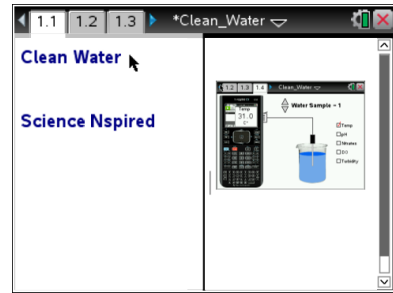


TI-Nspire™ Navigator™

- Send out the *Clean_Water.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

- Student Activity*
- Clean_Water_Student.doc
 - Clean_Water_Student.pdf
- TI-Nspire document*
- Clean_Water.tns



Discussion Points and Possible Answers

Have students read the background information stated on their activity sheet and page 1.2 in the .tns file.



Move to page 1.3.

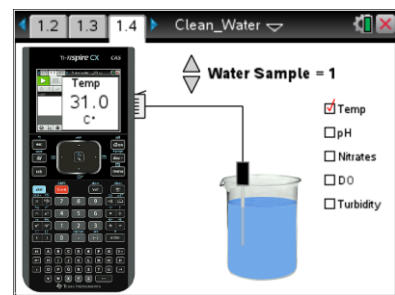
Have students answer question 1 in the .tns file, activity sheet, or both.



Q1. There are many factors that affect water quality. When determining water quality

Answer: B. the factors can affect each other so they are analyzed as a group.



Move to page 1.4

1. Students begin by analyzing Water Sample 1. Students begin data collection by selecting the GREEN record button on the virtual calculator screen. Students select and drag the probe into the beaker. Then, they select  on the virtual calculator to collect a data point.
2. Students then check a new water quality variable to test and select  on the virtual calculator to record another data point.
3. Students should continue collecting data for each of the five variables for Water Sample 1. Then, they should select the RED stop button on the virtual calculator
4. Students will repeat this process for Water Samples 2 and 3. They should use the up and down arrows (▼ and ▲) to select a new water sample. All of the data will be collected in the spreadsheet on page 1.5.




Tech Tip: To access the Directions again, select  > 1: **Clean Water 1: Directions.** To close the directions window, students must close box by selecting .



Tech Tip: To access the Directions again, select  or **Document Tools** () > **Clean Water > Directions.**



Tech Tip: Remind the students that the key in the center of the touchpad () is the button used to capture data for this simulation.



Move to page 1.5.

5. On page 1.5 is a spreadsheet containing the data points collected. Have the students record their data on their activity sheets.

Answer:

Water Sample	Temperature	pH	Nitrates	Dissolved Oxygen	Turbidity
1	31 C	8	1 mg/L	2 mg/L	10 NTU
2	24 C	8	10 mg/L	9 mg/L	50 NTU
3	24 C	8	4 mg/L	10 mg/L	26 NTU

Move to pages 1.6-1.10.

6. The data for each variable and water sample are shown in graphs. Have students examine these graphs and consider the background information on each variable.

Move to page 1.11

7. Students will use the background information on each variable to interpret your data and match each water sample with one of the three locations described in questions 2-7.

Q2. Location A: This sample was taken from a large, fast-moving river. The river's tributaries normally drain both urban and agricultural areas with buffer strips that slow runoff and decrease the amount of sediment entering the river. Which water sample is this?

Answer: C. Water Sample 3

Q3. What evidence did you use to determine the water sample for Location A?

Sample Answer: Student answers will vary; Moving water increases the dissolved oxygen and this sample had the highest DO level. The buffer strips help keep the sediment levels low and this one was in the middle of the normal range. It did have higher nitrate levels that might be attributed to fertilizers used on fields that are drained by its tributaries. The cooler water temperature could be because it's not shallow like a creek.

Q4. Location B: This sample was taken from a farm pond after a heavy rain. There is little vegetation on the banks surrounding this pond. The pond is located in the middle of a bean field that was recently fertilized. Which water sample is this?

Answer: A. Water Sample 2



Q5. What evidence did you use to determine the water sample for Location B?

Sample Answer: Student answers will vary; Ponds can have algae that produce oxygen, but the water isn't moving, so I would expect this sample to have a moderate DO level. According to the graph, this sample had the second highest DO level. The turbidity was very high probably because there were no buffer strips to help keep the sediment levels low after it had rained. The sample had the highest nitrate levels that might be attributed to fertilizers used on fields. The cooler water temperature could be because it's not shallow like a creek.

Q6. Location C: This sample was taken from a shallow creek near an urban mall area. Runoff from the parking lot drains directly into this creek. Because the creek is shallow, it is very slow-moving and the bottom is easy to see. There are few trees along the banks of this creek. Which water sample is this?

Answer: C. Water Sample 1

Q7. What evidence did you use to determine the water sample for Location C?

Sample Answer: Student answers will vary; Shallow water with no shade can cause water temperature to increase. Warmer water holds less oxygen and this sample had the highest temperature and lowest DO readings. The turbidity was low probably because there wasn't any soil that the water was running over. It also had the lowest nitrate levels that might be attributed to the fact that fertilizers aren't used on parking lots.



TI-Nspire Navigator Opportunities

Make a student a Live Presenter to show how to collect data for different water quality variables. Throughout the activity, monitor student progress. At the end of the activity, collect the .tns file and save to Portfolio.

Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.
- Summative assessment could consist of questions/problems on the chapter test or a performance assessment involving students using data collection sensors to collect data from local bodies of water and analyzing the water quality.