

WHAT IS THE QUALITY OF YOUR WATER?

PART 2 – 60 minutes

OVERVIEW

Students read a one-page information sheet about water quality. Based on what they learn, groups design an investigation using one question relating to what they observed on their schoolyard.

Standards: 5c, 5e, 7a, 7b

Materials

- Information Sheet A – What is the Quality of Your Water? – 1 per student
- Completed Schoolyard Review worksheets
- Our Investigation worksheet – 1 per group
- Pencils

Vocabulary Words

- Community
- Ecosystem
- Environment
- Fertilizer
- Groundwater
- Hazardous waste
- Investigation
- Land pollution
- Organism
- Pesticide
- Pollution
- Prediction
- Toxic

Other Resources

See Teacher Resources, page 116 for additional activities that relate to water quality.

Helpful Hints

- As students read this and other Information Sheets, they should underline all the words that they think are associated with water and living organisms.
- Students can create a list of their words, adding definitions as they progress through the unit, using their own first-hand experience to define the terms, and then supporting their definitions with textbook definitions.
- Refer to “Leading Students to Develop Their Own Questions and Perform Investigations” on page 79 for guidelines to assist students in developing testable questions and conducting investigations that relate to water quality.
- Set up times for students to make their observations and collect data. The data collection times will depend on the investigations they choose.

PART 2: WHAT IS THE QUALITY OF YOUR WATER?

PROCEDURE

1. Have each student read Information Sheet A – What is the Quality of Your Water?
2. Have student groups discuss what they read and the ways in which it relates to what they observed on their schoolyard. Each group can report their main points to the class as part of a group discussion.
3. In their groups, have students review their notes from the Schoolyard Review and create a list of questions they have about water quality related to their campus.
4. Guide students to develop “testable” questions. See page 79 for guidelines.
5. Using the Our Investigation worksheet, have groups:
 - a. Create one question to pursue for their investigation. It should:
 - i. Focus on water quality
 - ii. Be measurable over time: 1 – 4 weeks
 - b. Figure out what it will measure
 - i. What kind of observations can you make to answer the question?
 - c. Tools and supplies
 - i. What tools and supplies are needed to conduct the investigation?
 - d. Procedure
 - i. What steps are needed to conduct the investigation?
 - e. Hypothesize what will happen during the investigation
 - i. How are the observations going to support the hypothesis?
 - ii. How is the investigation set-up going to support the hypothesis?



GUIDED QUESTIONS

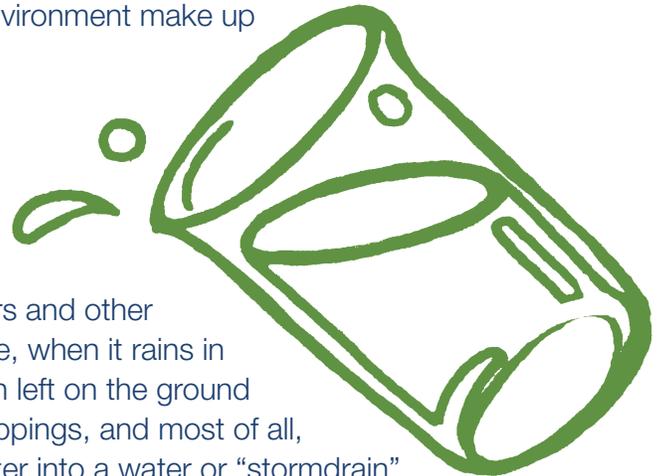


- What makes up a community?
- What makes up an ecosystem?
- How does pollution affect the ecosystem of streams and rivers?
- What kind of land pollution did you observe on our schoolyard?
- In what ways is water wasted at our school?
- Where does water flow into the street at our school?
- Where does water seep into the ground at our school?
- What question do you have about water quality at our school?
- What can you measure as part of an investigation to answer your question?
- What steps are needed to conduct your investigation? Can you summarize the steps in a few sentences?
- What is the explanation for the answer to your question?

WHAT IS THE QUALITY OF YOUR WATER?

Did you know that almost every living thing on Earth needs and depends on its environment for survival? People, plants, animals, and other living organisms live and interact with each other as part of a community. Every member of that community interacts with its physical environment. Together, a community and its physical environment make up an ecosystem.

The number and types of organisms an ecosystem can support depends on the health and condition of its resources. The environment of California has 200,000 miles of rivers and streams, 1,100 miles of coastline, more than 10,000 lakes, and more than 1 million acres of bays and estuaries. Unfortunately, most of these rivers and other water environments have become polluted. For example, when it rains in cities, rainwater picks up many materials that have been left on the ground including car oil, car grease, garden pesticides, pet droppings, and most of all, trash! All this “land pollution” gets carried by the rainwater into a water or “stormdrain” system that leads to streams and rivers. Even when it is not raining, wasted water from hoses, sprinklers, and faucets send polluted water into drains that lead to streams and rivers.



How does this affect the living organisms that live there?

Rainwater seeping into the soil or washing off hard surfaces can carry harmful chemicals such as garden fertilizers, pesticides, and hazardous wastes such as paint that are left on the ground. These toxic substances pollute groundwater or wash into streams, rivers, and lakes harming the living organisms that live there.

How does this affect our need for healthy drinking water?

The everyday activities of people affect the health and condition of our water ecosystems. Whether we are wasting excess water, creating more trash instead of recycling, or simply leaving toxic substances on the ground, our actions determine the quality of our water.

Think about the following questions:

- Do you remember the last time you saw trash and other land pollution on the ground? Where did it come from? Where will it go? If it isn't in a trashcan, what is going to happen to it?
- What about the wasted water? How does extra water that flows over hard surfaces impact the environment and the ability of organisms to live in local rivers and streams?
- How is the quality of water in your area? Think about this when you see trash left on the ground or water rushing into the street. Is it harmful to our water and environment?

TEACHER INFORMATION

Leading Students to Develop Their Own Questions and Perform Investigations

Within the unit, students are asked to come up with a testable question (a question that can be answered scientifically) and set up an investigation. The following are steps and examples for guiding student-led experimentation.

1. Gain knowledge

Through the use of the Schoolyard Review, students gain knowledge about their schoolyard. The Schoolyard Review is designed to help students observe where water flows at their school, recognize and identify the influence of land pollution, wasted water, and the presence of harmful substances.

Students continue to gain information by reading Information Sheet A about water quality issues in California, and relating their observations to what they read, thus driving students to investigate the issues further.

2. Develop a testable question

Students use what they observed and what they have learned to formulate testable questions relating to water quality. After completing the Schoolyard Review, ask students how what they observed may impact local water quality. Use these answers to help develop testable questions.

The testable question can be written in the form of “How does ____ affect ____?” The blanks represent the independent variable (first blank) and dependent variable (second blank).

Variables are the factors in an investigation that could affect results. They are the things that could vary from one sample to the next. Work with students to choose an “independent” variable – the one variable that changes. The “dependent” variable changes as a result of, or in response to, the change in the independent variable.

Some sample testable questions:

- How does the number of students using the trashcan at lunch affect the amount of trash in the street outside the school?
- How does the number of waste water sources at the school affect the amount of water that flows into the street from our school?
- How does the number of students dropping their trash on the ground affect the amount of trash that goes into the street next to the school?
- How does the location of where “hosing” is happening affect the amount of water and topsoil going into the street?
- How does the amount of lawn watering affect the amount of water and topsoil going into the street?
- How does the amount of trash found on the ground affect the amount found in the street outside the school?

3. Make a hypothesis

Discuss with the students what they can investigate to find the answer to their questions. Use what they learned from Information Sheet A to help formulate ideas for investigations.

After listing ideas, have students write an if-then statement of what they think may happen in the investigation based on what they have observed and learned so far.

Sample hypotheses:

- If a greater number of students use the trashcan at lunch, then there will be a decrease in the amount of trash that ends up in the street outside the school.
- If three out of the five sources of water at the school (faucets, hoses, sprinklers, downspouts, and drinking fountains) are found to waste water, then they will contribute to the amount of water that flows into the street from our school.

TEACHER INFORMATION

- If more students drop their trash on the ground, then there will be more trash that goes into the street next to the school.
- If the grounds manager hoses next to grass or permeable areas, less water will go into the street than if he/she hoses next to large concrete areas.
- If the grounds manager keeps the sprinklers or hoses on for a long period of time, then more water will go into the street.
- If there is more trash found on the ground on a given day, then there will be more trash found in the street outside the school on that day.

4. Design an investigation

How will your students test whether their predictions are right? Facilitate a group discussion that leads students to figure out what they can measure that will lead to an answer to their question. It should involve gathering data over time.

Example questions and measuring tools:

- I predict that on days when less students drop their trash on the ground, there will be less trash that goes into the street next to the school.

Audit the number of students that use the trashcan at lunch and later audit the amount of trash found in the street closest to the lunch area.

- I predict that three out of the five sources of water at the school (faucets, hoses, sprinklers, downspouts, and drinking fountains) will contribute to the amount of water that flows into the street from our school.

Audit the different sources of water for leakage and water flow.

- I predict that on days when more students drop their trash on the ground, there will be more trash that goes into the street next to the school.

Audit the number of students using the trashcan and later the amount of trash in the street closest to the lunch area.

- I predict that when the grounds manager hoses next to grass or permeable areas, less water will go into the street than when he/she hoses next to large concrete areas.

Audit the location and direction of water flow when the grounds manager is using the hose.

- I predict that the longer the grounds manager runs the sprinklers or hoses, the more water will go into the street.

Audit the time and amount of water going into the street when the grounds manager is using the hose and sprinklers.

- I predict that on the days that more trash is found on the ground, the more trash will be found in the street outside the school.

Audit the amount of trash on the ground at school and later in the street outside the school.

5. Design procedures

Have students develop and follow a specific method/protocol that helps assure reliability and validity of their results. Help them consider, if necessary, how to:

- Do a procedure the same way every time
- Consider the independent variable in planning data collection
- Use tools and supplies that are available
- Be accurate

6. Design a recording system

Help students design the most appropriate way to record the data they are gathering. They should use this method consistently to ensure they are accurate. This will help in analyzing the data more effectively. Recording systems include:

- Date and time of observation
- Space for written observations
- Space for illustrations and drawings
- Columns for separating information
- Using tally marks for counting
- A place for questions or thoughts to be followed up in the future

7. Data analysis and conclusion

Students describe their results in the clearest way possible. In Part 5, students use the Our Conclusion worksheet to restate their question, prediction, and write a summary of the data they collected. The summary should be a statement that is supported by evidence and identifies the pattern or trend of the data collected during the investigation.

Students are also asked to graphically display their data to show whether the data supports their prediction or not. Show students a variety of graphs, tables, and charts to determine which would be the best one to use. Explain that the graph, table, or chart is a picture of the information they gathered. Graphs, tables, and charts make it easier to make comparisons and draw conclusions. Ask students to name some places where they have seen graphs – in newspapers, magazines, TV news, etc. Show samples of the

basic types of graphs, tables, and charts:

- Pictograph
- Bar graph
- Charts and tables
- Circle graph
- Line graph

If students are measuring the sources of the land pollution found, they could use a bar graph. The bottom of the graph would show the sources and the side would have amounts. The bars would indicate the amounts of trash found for each source. The highest bar would indicate the source of the most land pollution found.

Finally, the Our Conclusion worksheet asks students to explain what they learned about water quality at their school and how their data does or doesn't support their prediction. This is an ideal time to discuss why they made the prediction that they did, or how they may conduct their investigations differently, if given the chance to "do it again."

8. Communicate results

In Part 7, students are asked to reflect on what they have learned and write a news article about water quality issues. Students use this method to communicate their results connecting their investigations to the schoolyard or community. It includes their thoughts about what they have learned about water quality, and any concerns they may or may not have.

These articles will be used as a way to formulate ideas for their service learning project.

OUR INVESTIGATION

Name(s): _____ Date: _____

Testable Question

Our question about water quality on campus is:

How does _____
affect _____?

Investigation

We are going to measure: _____

Tools and Supplies

The tools and supplies we need for our investigation: _____

Procedure

The steps we need to take to conduct the investigation: _____

Hypothesis

The explanation for what you predict will happen: _____

If _____

then, _____