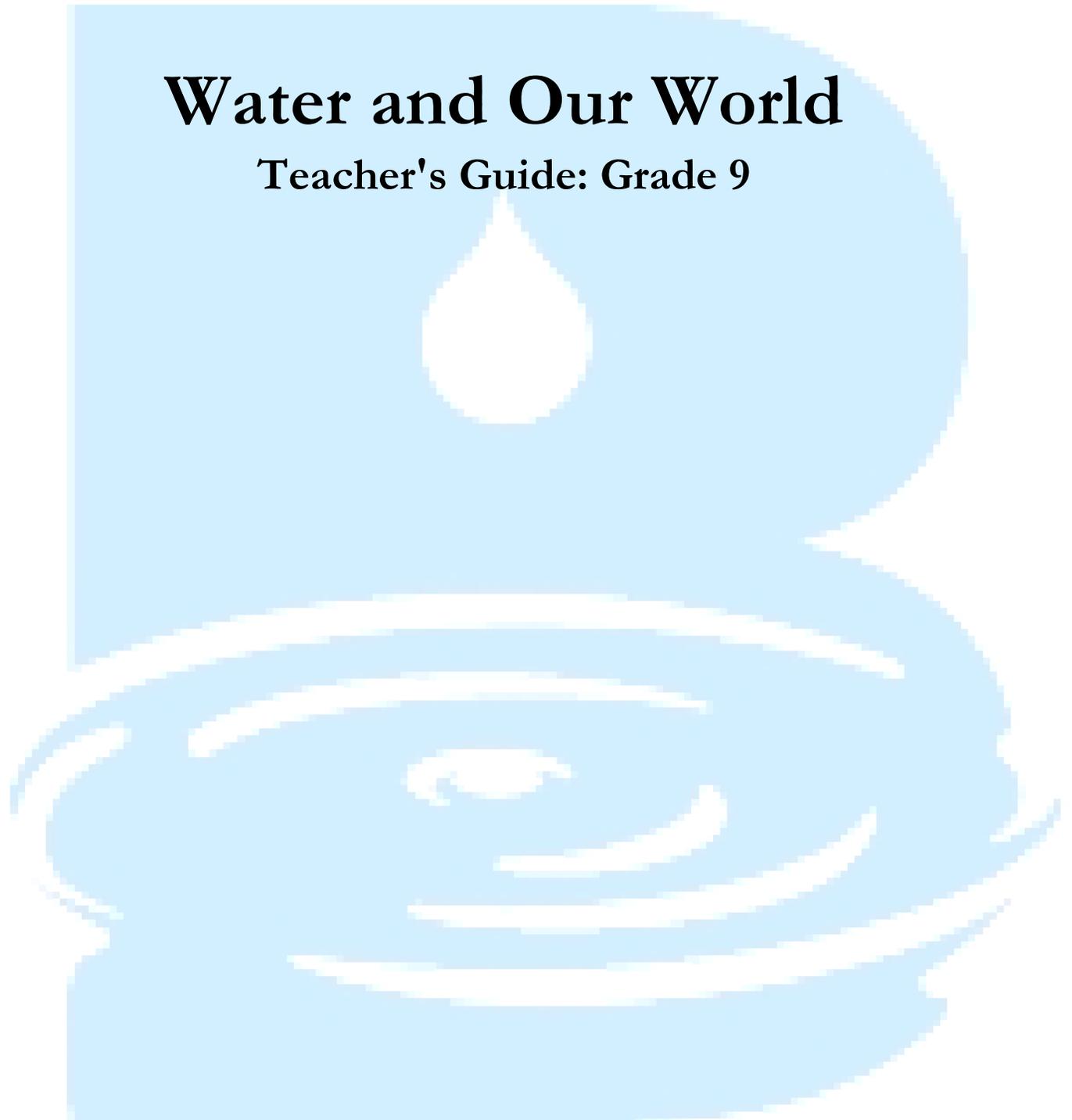


Water and Our World

Teacher's Guide: Grade 9



Beaver **Water** District

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CHAPTER 1

Lesson 1: Biochemical Oxygen Demand (BOD) on a Stream

Purpose

BOD is useful information in determining the health of a stream. Stream organisms are less likely to survive when oxygen is too low.

Objective

- Students will be able to design an experiment.
 - Students will understand the importance of oxygen in the water.
 - Students will be able to interpret data, graph, and display information.
-

Arkansas Framework Correlation

Science

9th Grade

PD.1.ES.11 Describe the physical and chemical properties of water

PD.1.ES.19 Describe the cycling of materials and energy:

- nitrogen
- oxygen
- carbon
- phosphorous
- hydrological
- sulfur

BD.2.ES.9 Explain how limiting factors affect populations and ecosystems

SP.3.ES.3 Explain common problems related to water quality:

- conservation
- usage
- supply
- treatment
- pollutants (point and non-point sources)

NS.4.ES.1 Collect and analyze scientific data using appropriate mathematical calculations, figures and tables

NS.4.ES.2 Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware)

Problem Question

How is BOD used in determining the health of a stream?

BACKGROUND INFORMATION

Teacher: Acquire a good BOD test kit and read the directions. You can perform this lab in the field or in the classroom. If you collect some water samples and have them for an in-class lab, refrigerate your samples.

There are several good sources for this topic:

www.bwdh2o.org

www.epa.gov

www.agfc.com

<http://www.k12science.org/curriculum/waterproj/index.shtml>

Student: No background is needed.

Keywords

- BOD: Biochemical Oxygen Demand

Timeline

- **One class period** explaining the importance of oxygen in the water and how it affects stream health.
- **One class period** is needed for the lab.
- Wait **five days** to read the results then have students finish their lab write up.
- **One class period** is needed for their presentation.

Materials

- BOD test kit
- Water samples or creek on site

Teacher Preparation

Very little preparation is needed if you have a stream on campus. If no stream, then you will need to collect some water samples in advance. Refrigerate your samples if you are not testing BOD immediately. Remember to time your lab in order to accommodate for the five day waiting period on the BOD test results.

The BOD test takes 5 days to complete and is performed using a dissolved oxygen test kit. The BOD level is determined by comparing the DO level of a water sample taken immediately with the DO level of a water sample that has been incubated in a dark location for 5 days. The difference between the two DO levels represents the amount of oxygen required for the decomposition of any organic material in the sample and is a good approximation of the BOD level.

Take 2 samples of water and record the DO level (ppm) of one immediately using the method described in the dissolved oxygen test. Place the second water sample in an incubator in complete darkness at 20 °C for 5 days. If you don't have an incubator, wrap the water sample bottle in aluminum foil or black electrical tape and store in a dark place at room temperature (20 °C or 68 °F). After 5 days, take another dissolved oxygen reading (ppm) using the dissolved oxygen test kit. The BOD level is determined by subtracting the Day 5 reading from the Day 1 reading. Record your final BOD result in ppm.

Use these sites for ordering information. A Google search for dissolved oxygen test kits gives you many options for inexpensive, easy kits to high tech, expensive kits.

<http://www.h2ou.com/L1980.pdf>

<http://www.flinnsci.com/store/Scripts/prodView.asp?idproduct=21605&noList=1>

<http://www.amazon.com/Mini-Oxygen-Test-Freshwater-Saltwater/dp/B0002ARBBO>

<http://www.lamotte.com/pages/edu/tablet.html>

Additional Resources

Resources for materials not included:

UA Center for Math & Science Education

<http://www.uark.edu/~k12info/>

479.575.3875

Northwest Arkansas Education Co-Op

<http://starfish.k12.ar.us/web/>

479.267.7450

Beaver Water District

www.bwdh2o.org

479.717.3807

Know of other resources? Please let us know!

education@bwdh2o.org or 479.756.3651

7E's Biochemical Oxygen Demand on a Stream

Elicit

Show images from the internet showing healthy looking streams and polluted streams. Show images of a fish kill. Research articles about water quality problems where lakes have died or streams have been placed on the state impaired list.

Engage

Demonstrate the activity. Have students do the research on troubled bodies of water. What damage was done to wildlife? What were some solutions involved in the restoration?

Explore

Have the students form teams for investigation. Move the students to the lab location and collect their samples and begin the testing. Have the students record their observations and data collected.

Explain

Have the students interpret their data, graph their results, and list possible sources of the problem. Have the teams present their findings to the class.

Elaborate

Have questions for the teams during their presentation. Identify other streams or sources of depletion of oxygen. What could cause oxygen depletion in agricultural or urban settings?

Evaluate

Assess the student's lab skills, team work, presentation, and also with a unit test.

Extensions

Combine this lab with full array of chemical tests and also biological testing to determine total stream health.