

WATER QUALITY LESSON – Chemical & Physical Properties of Water



TOPIC: Chemical and Physical Properties of Water

AUTHOR: Beaver Water District

CLASS TIME NEEDED:

- This lab can be performed in one class period of 45 to 60 minutes.
- Student presentations would be another class period of 45 to 60 minutes.

SUBJECT/GRADE LEVEL: K-12 - Physical Science/Biology/Earth Science/ETS/Environmental Science

ARKANSAS SCIENCE STANDARDS:

Grades K-2

- Physical Science – K-PS2-1, K-PS2-2, 1-PS4-3, 1-PS4-4, 2-PS1-1, 2-PS1-4
- Biology – K-LS1-1
- Earth Science – K-ESS3-1, K-ESS3-3, 2-ESS1-1, 2-ESS2-1, 2-ESS2-2, 2-ESS2-3
- Engineering, Technology, & Application of Science – K-ETS1-1, K-ETS1-2, K-ETS1-3, 1-ETS1-1, 1-ETS1-2, 1-ETS1-3, 2-ETS1-1, 2-ETS1-2, 2-ETS1-3

Grades 3-4

- Physical Science – 3-PS2-1, 3-PS2-2, 4-PS3-1, 4-PS3-3, 4-PS3-4, 4-PS4-1, 4-PS4-3*This particularly relates to trans-oceanic navigational methods of island cultures.
- Biology – 3-LS4-3, 3-LS4-4
- Earth Science – 3-ESS2-2, 3-ESS3-1, 4-ESS1-1, 4-ESS2-1, 4-ESS2-2, 4-ESS3-2
- Engineering, Technology, & Application of Science – 3-ETS1-1, 3-ETS1-2, 3-ETS1-3, 4-ETS1-1, 4-ETS1-2, 4-ETS1-3

Grades 5-8

- Physical Science – 5-PS1-1,2,3,4; 6-PS3-3,4,5; 7-PS1-1,2,3,4,5,6 ; 8-PS3-1, 8-PS3-2, 8-PS4-1, 8-PS4-2,
- Biology – 5-LS1-1, 5-LS2-1, 6-LS1-5, 7-LS2-2,4,5
- Earth Science – 5-ESS1-2, 5-ESS2-1, 5-ESS2-2, 5-ESS3-1, 6-ESS2-4,5,6; 6-ESS3-3,4,5; 7-ESS2-1, 7-ESS2-2, 7-ESS3-1, 7-ESS3-2
- Engineering, Technology, & Application of Science – 5-ETS1-1, 5-ETS1-2, 5-ETS1-3, 6-ETS1-1, 6-ETS1-2, 6-ETS1-3, 6-ETS1-4, 7-ETS1-1, 7-ETS1-2, 7-ETS1-3,7-ETS1-4, 8-ETS1-1, 8-ETS1-2, 8-ETS1-3, 8-ETS1-4

Grades 9-12

- Physical Science - PSI-LS2-7, PSI-LS4-5, PSI-ESS2-1, PSI-ESS3-1, PSI6-ETS1-1, PSI6-ETS1-2, PSI6-ETS1-3, PSI6-ETS1-4
- Biology – BI-LS2-1, BI-LS2-2, BI-LS2-6, BI-LS2-7, BI-LS4-6, BI3-ETS1-3, BI-ESS2-2, BI-ESS2-4, BI-ESS2-5, BI-ESS3-5, BI6-ETS1-2, BI6-ETS1-3, BI-ESS3-1, BI-ESS3-2, BI-ESS3-3, BI-ESS3-4, BI-ESS3-6, BI7-ETS1-1, BI7-ETS1-4
- Earth Science - ES-ESS2-2, ES-ESS2-5, ES2-ETS1-1, ES2-ETS1-3
- Environmental Science - EVS-ESS2-2, EVS-ESS2-3, EVS-ESS2-5, EVS-ESS2-6, EVS-ESS3-5, EVS1-ETS1-1, EVS-LS2-1, EVS-LS2-2, EVS-LS2-6, EVS-LS2-8, EVS3-ETS1-3, EVS-LS2-2

LEARNING PERFORMANCE TARGET(S): (learning expectations for this lesson combines a science practice, crosscutting concept and core idea embedded in the lesson)

Students will gain functioning knowledge and expertise equipping them to:

- Design experiments
- Use chemical test to assess water quality; identify contaminant(s) such as nitrate, phosphate, chlorine, dissolved oxygen, ammonia, pH; determine nutrient levels in surface water
- Investigate potential pollution sources.

SCIENCE AND ENGINEERING PRACTICES:

Lab and field work, acquire data, graphing, planning and carrying out investigations, analyzing and interpreting data, asking questions and defining problems.

CROSCUTTING CONCEPTS:

Structure and Function, Stability and Change

CCSS CONNECTIONS: (include mathematical concepts and reading, writing, speaking and listening opportunities in the lesson)

All exist throughout the lesson. ELA/Literacy & Mathematics.

MATERIALS:

Acorn Naturalists Science Supplies - www.acorn-naturalists.com/

- LaMotte Urban Water Quality Test Kit for up to 10 Water Samples \$52.95 - <https://www.acorn-naturalists.com/urban-water-quality-test-kit.html>
- Earth Force®, LaMotte GREEN (Global Rivers Environmental Education Network) Introductory Water Quality Monitoring Single 8-Parameter Test Kit for up to 10 Water Samples \$38.95 - www.acorn-naturalists.com/green-global-rivers-environmental-education-network-introductory-water-quality-monitoring-kit.html
- Earth Force®, LaMotte GREEN (Global Rivers Environmental Education Network) Introductory Water Quality Monitoring Multiple Tests Kit for 7-Parameters in 100 Water Samples and Coliform in 44 Water Samples \$258.95 - www.acorn-naturalists.com/green-global-rivers-environmental-education-network-comprehensive-water-quality-monitoring-kit.html

TEACHER PREPARATION:

Very little preparation is needed. We suggest identifying your water location to be tested before the lab. How easy is it to get to the water? How long does it take to get there? You can also collect some water from your location and have it in the classroom to be tested.

BACKGROUND INFORMATION/CONTENT:

Teacher: There are several water quality monitoring test kits available. You can purchase inexpensive kits like the TesTab kits or very expensive, more technical kits from Hach. The inexpensive TesTab kits are easy and student-proof. It is a great way to introduce the topic. The kits give background and detailed information on each nutrient.

If you want to have students do a true inquiry lab, students conduct tests to identify parameters, then research and report potential sources. If you want a guided lesson, then inform students about sources of these parameters:

Students: Access and read the following to prepare for Chemical Testing of Water Lab:

- “Water Quality Assessment: Overview” - www.cotf.edu/ete/modules/waterq3/WQassess1.html
- “Water Quality Assessment: Chemical” - www.cotf.edu/ete/modules/waterq3/WQassess3.html

Water Quality Test Parameters

Parameter	Source
Nitrate	Animal waste
Phosphate	Soaps, fertilizers, wastewater
Ammonia	Decomposing organic waste
Chlorine	Treated water, city water
Dissolved Oxygen	Amount of free oxygen present in water
pH	Acidic/basic

Good sources for comprehensive understanding of watersheds and water quality:

Classroom of the Future – www.cotf.edu

Beaver Water District - www.bwdh2o.org

- Drinking Water Quality Annual Reports - www.bwdh2o.org/about/regulatory-compliance/
- Lake Data/Beaver Lake Water Quality Annual Reports - www.bwdh2o.org/beaver-lake/lake-data/

United States Environmental Protection Agency (USEPA) - www.epa.gov

- Water Topics - www.epa.gov/environmental-topics/water-topics

Arkansas Game & Fish Commission - www.agfc.com

- Get Involved/On The Water/Arkansas Stream Team - www.agfc.com/en/get-involved/onthewater/streamteam/

Center for Innovation in Science and Engineering at Stevens Institute of Technology - www.k12science.org

- Global Water Sampling Project: An Investigation of Water Quality - www.k12science.org/curriculum/waterproj/

7E'S HISTORY OF WATER QUALITY MONITORING – CHEMICAL TESTING OF WATER

Elicit

- Watch the following video:
 - “Troubled Water” Investigation of Drinking Water in America - troubledwater.news21.com/documentary/
- Look for stories of local water quality issues online and in broadcast and print media (examples below).
 - Arkansaswater.org - <https://www.arkansaswater.org/water-quality>
 - Ozark Water Watch at Beaver Lake “Why Does That Water Look So Dirty?” - owwbeaverlake.org/blog/2016/01/why-does-that-water-look-so-dirty/
 - Buffalo National River
 - Beneath The Surface: Controversy On The Buffalo National River - www.417mag.com/issues/november-2017/beneath-the-surface-controversy-on-the-buffalo-national-river/
 - The Joplin Globe/Andy Ostmeier: Will 20th century ways of protecting Ozark rivers be up to the challenge of the 21st century? - www.joplinglobe.com/news/lifestyles/andy-ostmeier-will-th-century-ways-of-protecting-ozark-rivers/article_2e06b8cc-006a-595f-9f2f-e3426e59e656.html
- Propose to students an investigation is needed about a problem in the water. Use the test kits to try to identify the type of pollution and then determine what the source might be.

Engage

Have the students investigate local water quality problems. Look at previous investigations and solutions. Develop teams in class and have them discuss their pre-investigation.

Explore

Have the teams of students assigned to one chemical test each. Each team reads the instructions in the kit. Have the students move to their class lab station and begin test on collected water or move students to the testing location outside. Students will then perform their chemical test with several repetitions and return to the classroom for analysis.

Explain

Have the student groups display their findings and explain possible sources of pollution upstream. Have students use power point, graphs, or other media to explain.

Elaborate

Students can explain possible urban and agricultural sources of pollution.

Evaluate

Evaluation can be performed for field study and lab techniques, display of information, and unit test.

Extensions

Further investigation could be performed throughout the area or in their neighborhood. Evaluate city or local water source problems. These test kits are very easy and inexpensive, so the students can take them home.