

Lesson Outline for ALEX

General Lesson Information

Title: What is in your Water? (2022)

Overview/Annotation- *A short summary or description of the lesson including activities and science concepts.*

First, the students will watch a video about water quality and follow along by answering the questions on the video reflection sheet. Then, the teacher will lecture using the PowerPoint provided for more background information on the subject matter. The teacher will then pass out the test tubes and assign the students to take a sample of drinking water around their house to be brought in the following day. This will conclude the first day. The second day is a lab and review day. The students will interact with lab materials and use the scientific method in order to determine the pH of different drinking water samples. They will then use data analysis to compare their results with other students to reach a conclusion. They will then play a game to review the information learned, and write a reflective essay on the topics discussed.

Setting or format (outdoors, in groups, lab, etc.): In classroom or laboratory

Intended group size (if groups are used): 3

Intended grade level(s): 9-12

Approximate Time of Lesson (*Ideally break down into 20-50 minute periods*):
Two 50-minute periods (one is a lab day and one is a lecture day and an optional field trip)

Researcher Biography

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Brief Description of Research Interests:

Water quality, drinking water, water treatment facilities, well-testing kits, groundwater

Associated Standards and Objectives

Content Standards- Environmental Sciences Standards: 10, 11, 12, 13, and 15
Human Geography Standards: 10

Primary Learning Objectives- *Sentences beginning with “Students will be able to...” that describe what students will do in the lesson that relates to how students will be assessed.*

- ∄ Students will be able to identify normal water contaminants in Alabama.
- ∄ Students will be able to identify safe pH levels in drinking water
- ∄ Students will be able to identify the major issues found in the area of drinking water, for instance a smaller and smaller drinking water supply, access to drinking water supply or the removal of viruses.
- ∄ Students will be able to identify specific water crisis issues to Alabama or their community in particular.
- ∄ Students will be able to correctly use pH paper and follow lab procedures properly.
- ∄ Students will be able to use the scientific method to follow procedures and obtain results.
- ∄ Students will be able to understand how their way of life affects the natural environment around them.
- ∄ Students will be able to interpret precipitation data and analyze its effects on groundwater.

Additional Learning Objectives- *Any learning outcomes that are not directly related to the content standards but may relate to other local or national standards*

- Students will be able to identify local and national resources for drinking water regulations

Preparation Information

Total Duration- *How many minutes will the lesson last?*

Two 50-minute periods, or 100 minutes (1.75 hours)

Materials and Resources- *List of materials teacher will need to gather or prepare for lesson*

- pH Strips (3-pack of 240 strips - \$6)
 - https://www.amazon.com/pH-1-14-Extensive-Storage-Testing-Monitoring/dp/B0811PYS6T/ref=zg_bs_4989325011_5?encoding=UTF8&psc=1&refRID=61X0EDFN4FWZFT8Z6ZJ7
- Disposable Test Tubes (200 clear tubes - \$9)
 - https://www.amazon.com/ISKYBOB-Centrifuge-Disposable-Container-Leakproof/dp/B0852JZYGZ/ref=sr_1_6?dchild=1&keywords=disposable+Test+Lab+Tubes&qid=1617060488&s=industrial&sr=1-6
- If necessary, similar materials can be easily searched for on Amazon

Technology Resources Needed- *What technology will teacher and students need for the lesson?*

- Projector screen and computer
- Clear area for laboratory-type setting (in case of water spills, etc.)

Background and Preparation- *Description of information (science content, use of materials, etc.) teacher and/or students will need to know prior to this lesson; list steps for any preparation prior to the lesson*

- Print out Video Reflection Sheet, Lab Procedure Sheet, and plan review game with given questions (up to teacher's discretion)
- Day 1: Watch YouTube video reviewing Water Quality
 - Hand out Video Reflection Sheets beforehand
 - Video 2 - Water Treatment Plant Tour
<https://trainingthetrainers.weebly.com/videos.html>
- Day 1: Hand out test tubes and ask students to get water from home to sample in next class period
- Day 1: Additional presentation over Water Quality
- Day 2: Lab Day for students test pH of water
 - Hand out Lab Procedure Sheet and litmus paper
- Day 2: Review by playing game with provided questions, teacher can choose which game is most appropriate for their class
 - Can be done via teams, jeopardy, etc.
- Day 3: Optional field trip to local drinking water treatment plant

Procedures and Activities

Step-by-step description of lesson that would allow another teacher to successfully complete the lesson (suggest possible reflection or comprehension questions along with examples of correct answers or common misconceptions)

Engagement (sparking interest, introducing phenomenon, engage students' everyday experiences)

Day 1:

- Introduction video to Water Quality and Treatment is played for students.
- Introduction PowerPoint presentation from teacher. The slides and knowledge are basic information and relate to local & personal level, and provide important resources.
- Pass out test tubes for students to collect water for the next day

Main activity (suggest possible reflection or comprehension questions along with examples of correct answers or common misconceptions)

Day 2:

- Explain differences in pH and what they mean (acidic, basic, neutral), and which pH's are best for drinking water (in introduction to lab)
- Have all students bring in test tubes containing tap/well water from home, or somewhere out of class to be have pH tested
- Have students compare results in groups of 3, and turn in lab before review session

Wrap up and Reflection (wrap up activity, reflecting on learning, informal assessments of student learning)

- Review game (questions attached)
 - Split class into two groups
 - Team names MUST be water puns
 - The game is specifically left to the teacher to design the format because they know what game their students would learn/enjoy the most
 - All the questions were pulled from the materials given (lab report, lecture, videos), if the teacher needs to create more questions to fit a specific game

Final product/Summative evaluation (e.g. quiz, presentation, essay, etc., may occur during a later class period)

TikTok/YouTube video detailing the sampling. Most creative wins! (Class vote) Video must include:

- Sampling of water for at least one location
- Clip showing results of the litmus paper pH test
- Voice-over/text-over: talk about the results of their water sample test, what those results mean and why knowing the pH of water is important

Day 3: Optional field trip to local drinking water treatment plant

- Ed Love Drinking Water Plant – contact lesson plan creators for help

Lab Procedure

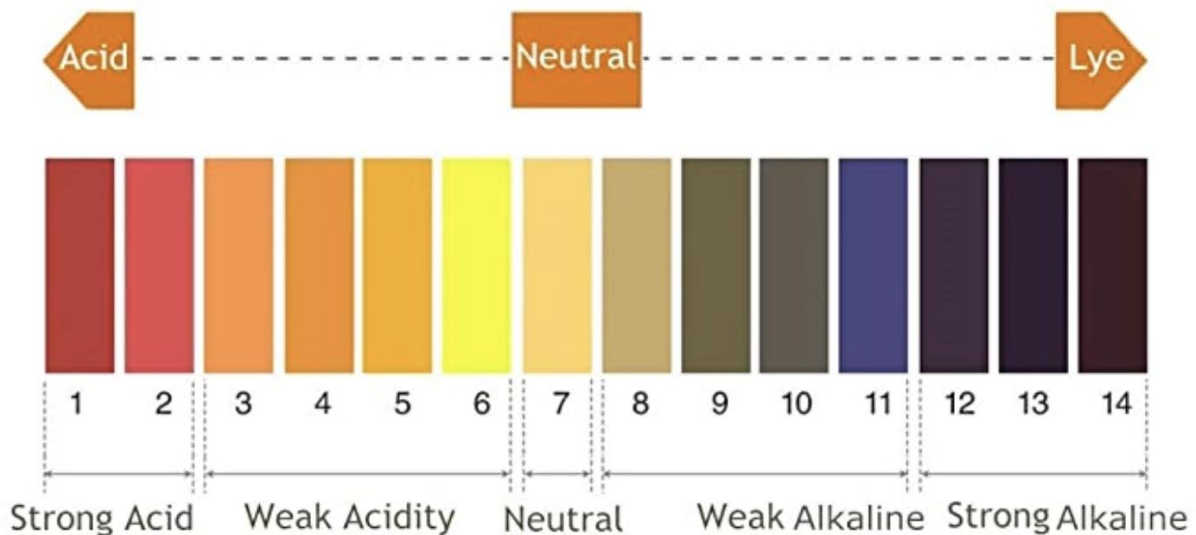
Introduction:

71% of the surface of the Earth is covered by water, but how much is available to use for everyday uses such as drinking water or washing? Well, it's less than you might think. Only 1% or less of Earth's water supply is usable for human consumption. Now, what are some of the characteristics that professionals use to determine if water is safe to drink or not? Some of them are the amount of bacteria, which should be very little to none, and pH, which should be between 6.5-8.5 according to the EPA standards for drinking water. In this lab, you will be testing the pH of the water sample that you took the day before from either your tap, your well water, or a different site approved by your teacher.

Hypothesis:

Will your water sample be acidic, basic, or neutral? Why do you think this?

Standard Color Chart



Procedure:

1. Before touching the Litmus paper, make sure to not touch the end that will be dipped in the water because the oils in your hand can impact the pH.
2. Grab a piece of Litmus paper and dip it into the water sample you took from your home yesterday.
3. Place the Litmus paper on a paper towel and wait for it to change color, it may take around five minutes to fully develop.
4. Record the color and use the color tool above to determine the pH level, put results in the table in the Results section.
5. Record results from two other students and compare.

Results:

Area of Sample (tap or well)	Color of Litmus Paper	pH

Questions:

1. Compare the results between the three samples. Which has a lower pH on average, wells or tap water?

2. Were all the results within the EPA standard of 6.5-8.5 pH? If not, which results did not and why do think they were too acidic or basic?

3. Has water security ever affected your life or your community? If not, how might this affect a person and their community?

Video Reflection Sheet

1. Explain how groundwater is pulled from the ground.
2. What are the two categories of water sources?
 - a.
 - b.
3. What are some things to consider when using groundwater?
4. What are some things to consider when using surface water?
5. List three processes used in the water treatment train.
 - a.
 - b.
 - c.
6. Why is there always more than one of everything at a water treatment plant?
7. Why are sedimentation basins so long?
8. Why is fluoride added to water?

Key:

1. Explain how groundwater is pulled from the ground.
 - Wells are drilled into aquifers and water is then pumped from them.
2. What are the two categories of water sources?
 - Groundwater, surface water
3. What are some things to consider when using groundwater?
 - Salty
 - High levels of Calcium and Magnesium (water hardness)
4. What are some things to consider when using surface water?
 - Typically come from freshwater bodies
 - Recharged by elements of water cycle
5. List three processes used in the water treatment train.
 - Screening, Coagulation, flocculation, sedimentation, filtration, disinfection (choose 3)
6. Why is there always more than one of everything at a water treatment plant?
 - So if there is maintenance or something breaks, water will still be treated and distributed.
7. Why are sedimentation basins so long?
 - Allows enough time for as many particles as possible to settle out.
8. Why is fluoride added to water?
 - Dental health

Review Game

1. What are the two sources of drinking water?
 - a. Groundwater
 - b. Surface water
2. What does the EPA recommend for the pH of drinking water?
 - a. 6.5-8.5
3. What is a watershed?
 - a. An area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.
4. How much of the water on Earth is available for drinking?
 - a. 1% or less
5. How much of Earth's surface is covered by water?
 - a. 71%
6. What is the highest pollutant found in water in the US?
 - a. Farm pollutants such as pesticides, fertilizer, and manure/livestock waste
7. What is the largest threat to drinking water in Alabama?
 - a. Old and leaking septic tanks that contaminate groundwater
8. What pollutants cause water to turn acidic?
 - a. Fossil fuels polluting the air become part of the water cycle when it rains and turns water more acidic.
9. What color does yellow Litmus paper turn when in contact with acidic water?
 - a. Red
10. Name one major issue that we face in drinking water today?
 - a. 29% of the world's population still does not have access to clean drinking water
 - b. salt water cannot be used because the salt cannot be removed in an inexpensive way
 - c. too many pollutants
11. How much of the US population used groundwater as a drinking water supply?
 - a. 51%

12. How much of the US population uses well water as a drinking water supply?
 - a. 15%

13. How many gallons of water does the average American use in a day?
 - a. 82 gallons

14. Name a process used in drinking water treatment.
 - a. Screening, Coagulation, flocculation, sedimentation, filtration, disinfection

15. Why is fluoride added to water?
 - a. Dental health