What's in the Water

ACTIVITY OVERVIEW

STEM Focus Area: Water Quality

Learning Goal: To understand different ways you can check the quality of water, and that while water might look clean, there could still be hidden chemicals mixed in it.

Youth Learning Targets:

- "I can test water quality. "
- "I understand that even if water looks clean, it might not be."
- "I understand why clean water is important"

LEARNING ENVIRONMENT

Activity Duration: 20 minutes

Class Size: Small

Type of Space: Indoor

Age of Youth: Grades 3-5

Guiding Question: What is the question to explore OR the problem or challenge to solve?

What are some different ways we can test water quality? Can we always see whether water is clean or healthy?

Through this activity, youth will:

- Develop and understanding of different methods water quality can be tested.

Facilitator Prep

- Set up the materials before the activity, including mixing the water samples.
- Become familiars with how to use the salinity refractometer, as this might be the most challenging part for youth.

Literacy Connection: Great books to get youth support learning about plant life cycles! *(available on Amazon).*

- *One Well: The Story of Water on Earth by Rochelle Strauss (Author), Rosemary Woods (Illustrator)*
- *The Water Princess Hardcover by Susan Verde (Author), Georgie Badiel (Author)*

DoS: Authentic Stem Practices

- ○ Predict and hypothesize
- ○ Develop and use models
- ✓ Measure materials
- ✓ Observe
- ○ Investigate
- ✓ Record observations
- ✓ Analyze and infer
- ✓ Share and communicate data
- ○ Interpret data
- ○ Test and revise
- ✓ Draw conclusions and relationships
- ○ Have voice and agency, make decisions and guide their own learning

PREPARATION

Materials

- Anhydrous citric acid (for Sample 1)
- Salt (for Sample 2)
- Warm water (to prepare samples)
- ½ teaspoon (to prepare samples)
- 3 - 250 milliliter beakers (or glasses)
- pH paper strips (2 per individual)
- 1 or 2 salinity refractometers
- Pencils (1 per group)
- Tray to hold the samples
- Towels/Rags
- Maker and Labels
- Pipettes
- Digital Thermometer
- Data collection sheets: Link
- A graphic of the pH scale

Advance Preparation

Prepare two water samples, each within a glass or beaker:

- Sample 1: fill beaker halfway with warm tap water and add 2-3 teaspoons of citric acid. Mix to dissolve. Add a pipette. Label both pipette and the beaker “Sample 1.”
- Sample 2: fill beaker halfway with regular tap water and add 2-3 teaspoons of salt. Mix to dissolve. Add a pipette. Label both pipette and the beaker “Sample 2.”
    - Optional: prepare this one early and leave it in the fridge overnight
- Sample 3: Label the third beaker and pipette “Samples 3.” Leave this beaker empty.

The facilitator may want to acquire more than one salinity refractor if doing this activity in larger (7+ individuals) groups.

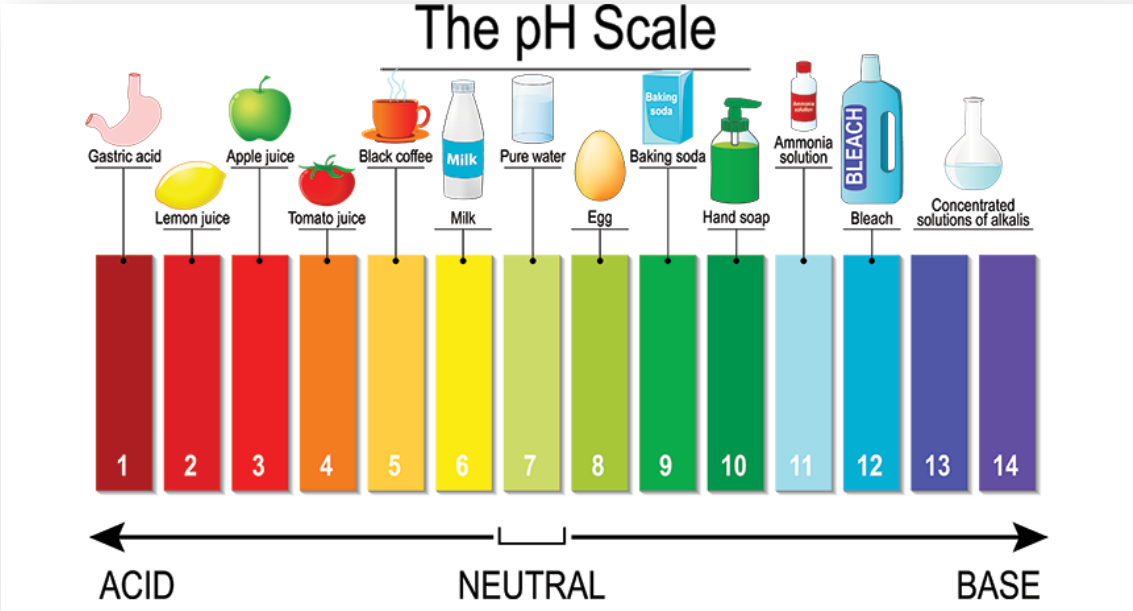
For increased relevance: beforehand (or as a group as a part of the activity) collect samples from a nearby water source.

Room

An informal setup would be best suited for this activity, ensuring there’s for the youth to sit, do their tests, and record their observations.

Content

- The quality of water will affect the health of plants and animals that rely on it.
- The **thermometer** will test the temperature of a sample.
- The **refractometer** measures the change in the direction of the bending of light as it passes from the air to the water. Light moves slower in water than air, and will move even slower when there’s salt in the water. When looking through the optic, the size of the white are indicates the saltiness of the water. You can read the percentage inside the optic.
- The **pH** strips test how acidic or basic water is. Lower numbers indicate the water is more acidic (more like vinegar or orange juice) and higher numbers indicate the water is more basic (more like baking soda or toothpaste).



Source: https://www.sciencenewsforstudents.org/

- Common Misconception: While water that is clear might appear clean, many toxic or unhealthy compounds can be invisible to the human eye. Tests like the one in this lesson allow us to see other qualities of water.

Inquiry

- Do samples 1 & 2 look the same? Do they look different?
- What do the samples look like? Are there any other ways we can make observations about them?
- How can we tell whether they're different?

DoS:

- ✓ Organization: I practiced the activity/technology, prepared materials/extras/place to record youth ideas, and completed an activity (including timings).
- ✓ Materials: Materials are appropriate for teaching the learning goals; youth will be able to use them and will think they are appealing.
- ✓ Space Utilization: The space is set up appropriately for the activity and there will be no safety issues or distractions.
- ✓ Relevance: I have researched why the content matters to youth's everyday lives.
- ✓ Content Learning: I have become familiar with the content.
- ✓ Inquiry: I have become familiar with how authentic, age-appropriate inquiry practices look in this activity

INTRODUCTION TO ACTIVITY (10 MINUTES)

- Start with a conversation about things that we sometimes find in our water. Write them out as they're named. As they're coming up with their list, it will likely be things that will be easy to see with the bare eye like animals, plants, or trash-sized pollutants.
- Discuss how every living thing relies on water, whether it lives in water or drinks water. If the water has bad things it, what could happen to the living things that live in it?
- Draw the youth's attention to the samples of water. Bring them to the group and allow the youth to observe them
    - Do samples 1 & 2 look the same? Do they look different?

- What do the samples look like? Are there any other ways we can make observations about them?
- How can we tell whether they're different?

DoS:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Purposeful Activities: This intro section gets youth on track for the learning goal.
- ✓ Content Learning: If age appropriate, I will accurately present content.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Relationships: I will make each youth feel welcome.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

ACTIVITY ENGAGEMENT (10 MINUTES)

- Explain that they're going to use some tools to test and record things about the water we can't see with just our eyes. Explain how to do the tests:
  - **Ph:** with the pipette, drip some drops from each sample onto a strip. Record the observations
  - **Salinity**: lift the clear id on the end of the refractometer and use the pipette to add two drops of water on one of the samples onto the blue plate, place the lid down, and look through the eyepiece. Look for the line between the white and blue areas. The more white you see, the saltier the water. Record the reading, wipe the lens, and then repeat with the other sample, recording your observation.
  - **Temperature:** place the thermometer in the water, wait a few moments until the reading stops changing, then record what the thermometer reads. Wipe the thermometer between tests.
- Divide them into groups of two. Have the youth trade rolls between recorder and tester, and each group to rotate through doing the tests on each sample.
- When all groups have tested sample 1 & 2, combine samples 1 & 2 into the beaker with "sample 3" written on it. Have them repeat the tests they did for sample 1 & 2 on the new sample.

DoS:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Participation: All youth will have access to the activity.
- ✓ Purposeful Activities: This core section helps youth to move toward the learning goal.
- ✓ Engagement: This activity has youth physically engaged with their hands and their minds.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection: If appropriate, I will ask youth questions during the core activity that will help them make sense of what they are learning.
- ✓ Relationships: I will take steps to share my enthusiasm and create a nurturing, safe learning environment.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

FINAL REFLECTION AND RELEVANCE (5 MINUTES)

- Have each group share their results.
  - Were there any surprising results?
  - Were there any differences between the test results between the groups?

    - What happened when we combined samples? What changes and what stayed the same? Why?
- Discuss ways the youth can help to keep the water clean.
- Discussion why clean water is important for both humans and the environment.
- Come up with a plan that the group can use to keep a nearby water resource clean.
- Consider having a guest speaker come and discuss ways their city/town helps keep local water sources clean.

DoS:

- ✓ Space Utilization: Again, I will use the space informally.
- ✓ Participation: I will prompt youth who do not have access to the activity to participate.
- ✓ Purposeful Activities: The closing section helps youth to reach the learning goal.
- ✓ Content Learning: I will help youth make connections between different ideas. I will create opportunities for youth to ask questions/provide ideas that show a deeper level of understanding.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection. I will provide youth with a sustained opportunity to make sense of their learning.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

REFERENCES

What's in The Water? – NISENET : https://www.nisenet.org/catalog/whats-water