EXPLORE SCIENCE

LET'S DO CHEMISTRY

What's in the Water? Facilitator Guide

ACTIVITY LEARNING GOALS

Learners will develop positive attitudes toward chemistry:

- Learners will increase their understanding of the **relevance** of chemistry by exploring the applications of chemistry and connections to everyday life.
- Learners will increase their sense of **self-efficacy** related to chemistry through hands-on interaction with scientific tools and by experimenting with variables.

Learners will explore chemistry concepts, tools, and practices:

- Chemists use tools understand our world—and how we change it.
- Chemistry can help us explore, understand, and solve problems.

FACILITATION STRATEGIES

Encourage **interest** by asking participants to observe closely, ask their own questions, share their own ideas, and talk with each other about the samples and what they notice.

Encourage **relevance** by discussing when and why clean water is important to us and to the world around us. What animals and plants might need different kinds of water? Some water is naturally saltier (like the ocean). Have participants ever had to think about cleaning or filtering their water? If you filter the water you drink, do you also filter the water you use to brush your teeth, wash your dishes, or bathe?

Encourage **self-efficacy** through hands-on interaction with the tools and recording of real data on their data sheets. You can also ask participants questions about what other water they would be interested in testing. What human activity could affect the quality of water we drink? What other problems would they like to tackle using chemistry?

MATERIALS

- Citric acid (for sample A preparation)
- Salt (for sample B preparation)
- Warm water (to prepare samples)
- ½ teaspoon (to prepare samples)
- 3 250-milliliter beakers (labeled A, B, C)
- 3 1-milliliter pipettes (labeled A, B, C)
- pH paper (2 strips per participant)
- Refractometer
- Digital thermometer
- Data collection sheets
- pH scale graphic
- Pencils
- Tray to hold the samples
- Microfiber cloth (or paper towels)
- Waste container (to dump sample C)
- Marker and labels

ADVANCE PREPARATION

Prepare two water samples, each in a 250-milliliter beaker:

- Sample **A**—fill beaker half way with regular tap water and add 2–3 teaspoons of citric acid. Mix to disolve. Add a pippette. Label beaker and pipette **A**.
- Sample **B**—fill beaker half way with regular tap water and add 2–3 teaspoons of salt. Mix to disolve. Add a pippette. Label beaker and pipette **B**.

Place the two samples on the tray at the front of your table. Leave out the empty beaker and pipette. Label beaker and pipette **C**. All beakers and pipettes should be labeled with corresponding sample names to avoid cross-contamination.

Lay out the pencils and data collection sheets (for participants to record pH, salinity, and temperature).

SAFETY

Always follow and model prudent practices when doing chemistry activities.
Think about:

- What **hazards** exist and what associated risks may arise from these hazards?
- How to **minimize** risks through protocols we have designed into the activities and training materials.
- How **safe practices and protocols** should best be communicated with facilitators, participants, and others.

The diluted citric acid and salt water samples pose minimal risk to participants and facilitators, but normal lab precautions should be taken. Discourage participants from playing with or squirting the pipettes.

Your institution may have special rules or protocols for chemistry related activities, so check with your facilities staff, safety committee, and/or others. Learn more about safe practices in

the *Let's Do Chemistry: Safety Guide* included in the physical kit and with the online digital kit resources.

CLEANUP

Rinse all the tools and containers with water after doing the activity and pat or air-dry. You can dump the waste container and all the premade samples down a regular sink or drain.

FACILITATION NOTES

Using the thermometer:

- If both samples used the same tap water or have been at room temperature for a while, they will probably show the same number reading. It's ok to have the temperature readings be the same. This may be surprising to participants.
- Optional: Prepare one sample in advance and place it in the fridge overnight before doing the activity so that it reads a cooler temperature.

Using the refractometer:

- A refractometer measures the change of direction or the bending of the light as it passes from air to water. Light moves slower in water than in air. The more salt in the water, the slower the light moves.
- Have visitors look through the refractometer and describe what they see. Where is the divide between the blue and white colors?
- The size of the white area indicates the saltiness of the water.
- Visitors can read off the percentage if they can see the numbers or just estimate the line where the white and blue meet on the data collection graphic.
- Twist to loosen or tighten the eyepiece of the refractometer to focus it.

Explaining pH:

- This is a tool that will tell us how acidic or basic the water is. Lower numbers suggest the water is more acidic (more like vinegar or orange juice). Higher numbers suggest the sample is more basic (more like baking soda or toothpaste).
- Share the pH scale to help them visualize and relate pH to everyday products.

To reset the activity between visitor groups, throw away used pH strips. Dump sample **C** in a waste container or encourage other visitors groups to use the same mixture.

Optional extension: Try adding another sample of water from a nearby local water source (like a river or lake) or from a fish tank if your museum has one.

An activity training video is available at vimeo.com/channels/nisenet

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