Family STEM Activity

Acids & Bases

Ages 7 and older Test the pH of liquids in your kitchen using blueberries.

Prep Time: 10 minutes ▪ **Activity Time:** approx. 30 minutes

Materials:

- ¼ cup blueberries (fresh or frozen)
- 1 cup hot water
- Fine mesh sieve or coffee filter
- Bowl and fork (or mortar and pestle)
- Mason jar or a wide drinking glass that can hold at least 1 cup of water
- 3 ¼ cups of test liquid. Suggested liquids: distilled white vinegar, lemon juice, tap water, seltzer, baking soda solution, or dish detergent solution (Solution recipes are provided in the experiment instructions).
  Review "Safety First" guidelines before testing other materials from your home.
- 4 clear containers (drinking glasses, plastic cups, etc.)
- Eye dropper or straw
- Paper and pencil

Optional materials for pH indicator strips extension activity:

- Sheet of paper towel
- Scissors
- Large flat pan or plate with a lip
- Cooling rack
- Sheet of white paper

SAFETY FIRST!

- Never mix chemicals without researching their reactions. Some chemical reactions can produce harmful gases.
- Do not use ammonia or bleach for any chemistry experiments at home.
- Do not touch your eyes or mouth when doing the experiment.
- Do not eat or drink anything when doing the experiment.

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Instructions

Make indicator

1a Measure ¼ cup of blueberries into a bowl.

2a Mash the blueberries into a jam-like consistency with a fork.

3a Add 1 cup of hot water. Then, let the mixture cool to room temperature.

4a Remove blueberry skins by filtering the mixture through a sieve over a mason jar. The resulting indicator liquid should be purple. Set aside the indicator while you prepare the rest of the experiment.

Set up the experiment

1b Use 3 of the 4 clear containers for test liquids. Only add one test liquid per container.

2b Add one of the following test liquids (or available liquids from your home) to each of the 3 clear containers:

- ¼ cup of distilled white vinegar
- Baking soda solution: ½ tsp of baking soda and ¼ cup water
- Dish detergent solution: ½ tsp of powdered dish detergent and ¼ cup water

Label each clear container.

3b Put ¼ cup of the blueberry indicator liquid into the empty clear container. Nothing else should be added to the indicator. This will be the control. Use this control to compare the color reactions of your 3 test liquids.

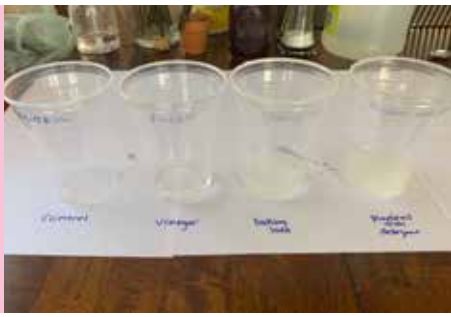
4b Add 2 tbsp of indicator to each of the 3 test liquids using an eye dropper.

5b Observe what happens to the color of the indicator in each test container. Compare it to the control. What do you notice? What colors are the different test liquids turning? Record your observations and results.


1a


3a


4a


1b

3b

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Optional Extension

Use the leftover indicator to create homemade pH paper. This is a great way to keep discovering after your initial experiment.

1c Pour the remaining indicator into a large flat pan. A thin layer is plenty.

2c Cut the paper towel sheet into squares, and place them in the pan. Spread out the squares so they do not overlap.

3c Allow the indicator to saturate the squares before carefully removing them and placing them on the cooling rack. The cooling rack enables air to reach both sides of the squares at the same time so they dry faster. Store the rack and squares in a room with good air flow to dry overnight.

4c Once dry, cut the squares into strips. You can use these indicator strips to test the pH of different liquids in your home. Quickly dip the indicator strip into a test liquid. Place it on the white sheet of paper to observe the color reaction.

Follow-up Questions

1 What other liquids could you test safely?

2 What color will you get if your test liquid is acidic? What color will you get if your test liquid is basic?

3 Is water basic, acidic, or neutral? What happens when you add your indicator to a container with just water?

4 Does the strength of an acid or base change your test results?

5 Are there other household items that can act as a pH indicator?

1c

2c

3c

4c

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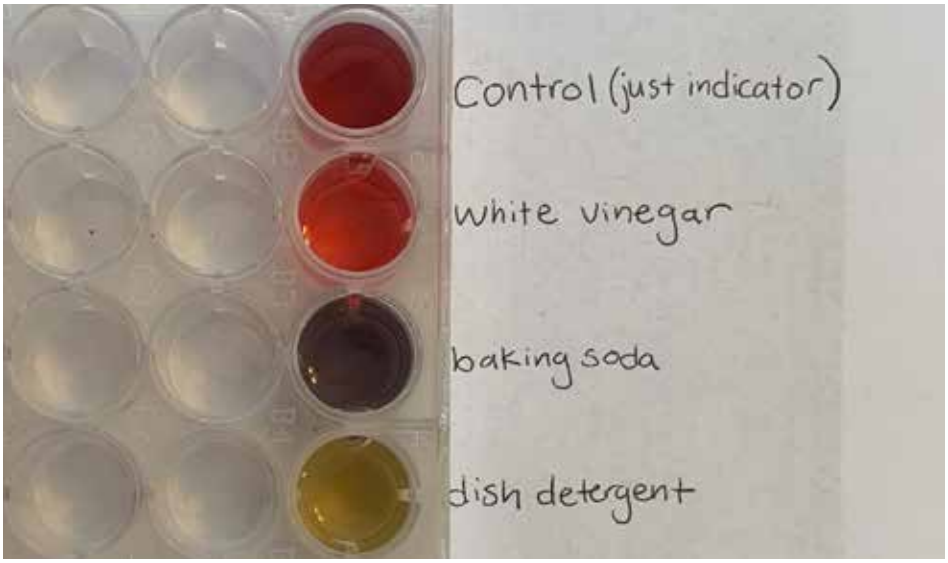
Acids & Bases

BACKGROUND FOR GROWN-UPS

Acids have many hydrogen ions (H+). These chemicals usually taste sour. Lemon juice and vinegar are acidic. Bases have extra hydroxide ions (OH-). These chemicals taste bitter and usually feel slippery or oily. Soap and toothpaste are basic.

This experiment uses blueberries to help demonstrate the different pH levels in ordinary household substances. Blueberries contain naturally occurring pigments called anthocyanins. In the presence of an acid or a base, the anthocyanins will change color. These pigments are responsible for the blue, red, and purple colors in many fruits and vegetables. The strength of the acid or base will create different colors. The anthocyanins in blueberries create blue/green colors for bases and red/pink colors for acids.

View the reaction colors in the image below. Stronger bases, like dish detergent, are greenish-yellow, and weaker ones, such as baking soda, are blue. Acids result in various shades of red and pink as seen in the vinegar sample. Using a different indicator other than blueberries—e.g. powdered turmeric, purple cabbage, or another berry—will alter the reaction colors.



Key Vocabulary:

Anthocyanin: A naturally occurring pigment responsible for the blue, red, and purple colors in many fruits and vegetables. It acts as as an indicator for acids and bases.

Control: A sample that remains the same throughout your experiment. It is often used as a comparison to see what happens when you change a specific variable.

Experiment: A planned test to study a question or theory.

Indicator: A substance that gives a visible sign that a specific chemical is present.

pH: A scale from 0 to 14 used to measure the acid or base levels of a material. Substances that measure 0 to 6 are acids and 8 to 14 are bases. A pH of 7 is neutral.

Solution: A mixture of two or more substances so thoroughly combined its ingredients cannot be told apart from one another. For example, in saltwater, the salt isn't visible because it is completely mixed with the water.