



PASS THAT ION

Identifying acids and bases in the basketball gym, the locker room, and your own kitchen

Whether you are washing your gym socks or crushing your thirst with a citrusy drink, you use acids and bases every day. What exactly is an acid or a base? How do we recognize them? Let's experiment to find out.

HERE'S WHAT YOU'LL NEED:

- Water
- Clear cups or jars
- Spoon
- Goggles
- Red cabbage
(which actually looks purple!)
- Access to a stove or hot plate
- A pot
- Oven mitt
- Strainer
- Baking soda
- Vinegar
- Various things that you want to test like sports drinks, hand sanitizer, soap, vitamin C – these need to be used with permission of a teacher or parent
- Journal
- Pencil
- Markers or crayons
- Help from an adult

WARMUPS

Our world is made up of chemicals. Everything we see can be broken down into smaller pieces that have their own characteristics. When you know these characteristics, it is easier to identify a chemical. One property is if a liquid is an **acid**, **base** or **neutral**. Whether something is acidic, basic, or neither depends on the smaller pieces of the chemicals — in this case charged particles called ions.

It can be hard to know which ions are being passed around, so we'll use chemistry to take a look. You can make a special indicator that changes colors to identify which ions are passing back and forth. Not unlike passing a basketball around a court!

Pro tip: Protect your eyes! Take this moment to put on some safety goggles.

Science does not require expensive tools. With just a red cabbage, some water, a pot, and a little heat, we'll make an acid-base indicator and investigate some everyday chemicals.

To get started, take about half of the red cabbage and chop it up. Place it into a pot and cover with water. Using a hot plate or stove, bring the water and cabbage to a boil, turn off the heat, and let it cool for about 30 minutes. This liquid is your indicator, but let's get rid of the cabbage bits by pouring it through a strainer over a jar or bowl. All the left over bits can be discarded or composted.

Pro tip: This cabbage water indicator can be used immediately or placed in repurposed bottles and used later. It won't stay effective forever, so refrigerate and plan to use it all within a week or so. Also, it is quite smelly, so beware!

Pour some of your indicator solution into three clear cups. You don't need a lot in each cup, just enough to easily see what color the solution is. Place the three cups side by side.

The cup in the middle will serve to remind us of the original color of the cabbage water. Label this cup with an "N." This will remain our neutral solution, or our "control" for the tests. We will not add anything to it.

Label the cup to the left with an "A," pour in a small amount of vinegar. What do you notice?

Label the cup to the right of the middle cup with a “B,” stir in a small amount of baking soda until you notice a change. What happens this time?



Vinegar is a type of acid, specifically acetic acid. Note the indicator color it turned. Baking soda is a type of base, its chemical name is sodium bicarbonate. Compare this color to the one with added vinegar.

Now that you see the kind of indicator color acids or bases produce, along with a somewhat neutral sample — our middle control sample — we can test other things! As you gather items to test, try to include some things that your favorite basketball player or athlete might use to get game-ready, like sports drinks, shampoo, vitamin C, or hand sanitizer.

GAME TIME

Think about the differences between vinegar and baking soda. We know that one is an acid and the other is base. Create a chart and predict if the other things you want to test are acids or bases. Consider the overall properties of the items. How are some of them similar? What makes them different?

Get fresh cups and label them with the names of the ingredient you will test on each one. Add the same amount of indicator solution to the cups.

Test each of your chemicals and record your data on the chart.

Which of your predictions were correct?

ANALYZE THE REPLAY

What happened?

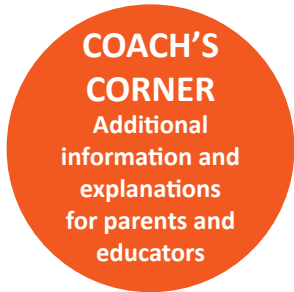
Arrange the cups in a line with similar colors next to each other. Keep the control, the one that has nothing added, in the middle. By looking at the colors we can identify if the substance is neutral, acid, or base. How can you determine if one is more acidic or basic than the others?

With all of the cups organized, use crayons or markers to create a color chart of your discoveries. Label each color with the name of the item tested.

Review your chart; were there any surprises?

Based on your small sampling, what characteristics do the acids or bases seem to share? We mentioned ions earlier — when identifying acids and bases, it is ions that are being detected. Hydrogen ions are the key. Like basketball players tossing a ball, hydrogen ions can be passed too. A point guard passing the ball is like a solution giving a hydrogen ion. A basketball player that catches the ball and holds on to it is similar to a base holding onto a hydrogen ion.





Check with your adult to see if you can pour the solutions down the drain. Use lots of running water and pour solutions in slowly, starting with your acids and then bases. Do not move any solutions or pour anything down the sink without your safety goggles and an adult present.

In this activity a color chart was made that allowed us to figure out if everyday things are acids and bases. In science, a pH scale can relate colors to a numeric value. Bases are represented by numbers greater than 7 up to 14. A pH of 14 would be a very strong base, like the stuff used to unclog drains. Numbers less than 7 and down to 0 represent acids. An acid represented by a very small number would be very strong, like battery acid.

The “pH” in pH scale refers to “potential of Hydrogen.” Solutions that pass or dissociate hydrogen ions in water are referred to as acids, and solutions that catch or bind hydrogen ions are known as bases.

Why did we use cabbage to make our indicator? Red cabbage contains the pigment molecule anthocyanin. It is also found in cornflowers and the skin of several fruits. In neutral conditions anthocyanin is purple, acidic conditions turn it red, and very strong bases turn it yellow-green.

DO YOU WANT TO LEARN MORE?
Research: solution, control, ion, base, alkaline, Svante Arrhenius

OKLAHOMA ACADEMIC STANDARDS - SCIENCE

| STANDARD | | 4 th GRADE | 5 TH GRADE | 6 TH GRADE |
|-------------------|--|-----------------------|-----------------------|-----------------------|
| LS1-1 | From Molecule to Organisms: Structures and Processes | ● | | |
| PS1-1 MS-PS1-1 | Matter and its interactions | | ● | ● |
| PS1-3 | Matter and its interactions | | ● | |
| PS1-4 | Matter and its interactions | | ● | |