Mood Ring—Text Version

Image of mood ring on finger. The next column has three images of emotional facial expressions, an angry face, happy face, and anxious face.

Have you ever seen a mood ring? The liquid crystal inside changes color based on your body temperature, which is often related to your mood. When you are relaxed and happy, your body temperature tends to be on the cool side and the liquid crystal turns blue.

When you are angry and upset, your body temperature rises slightly, enough to turn the liquid crystal black.

Drag the emotions onto the mood ring and watch what happens!

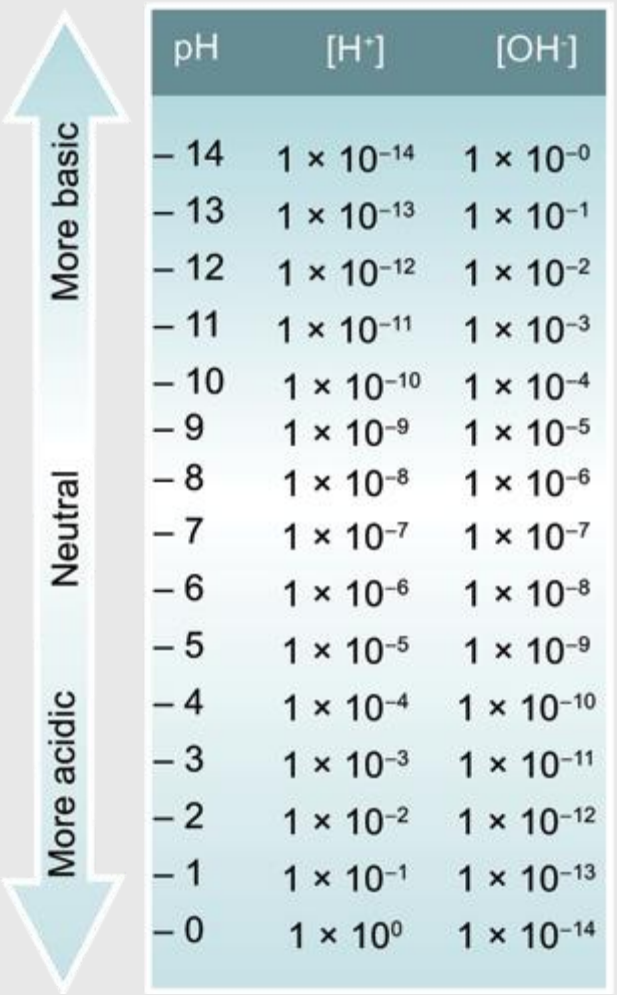
Answers:

- Angry emotion- Mood ring turns black
- Happy emotion- Mood ring turns blue
- Anxious emotion- Mood ring turns orange

What if you could use color to run chemical tests? You can. In fact, color indicators are plentiful in the chemistry lab. One application is the testing of pH.

In this lab, you will have an opportunity to use colored indicators to test the pH of ordinary household chemicals.

Lab Time



Grab your virtual lab coat. We are going to investigate some common acids and bases using pH indicators. First, let's review what an acid-base indicator is, and how to use a pH test strip.

Many of the substances found in homes are acids or bases. These items include soaps, cleaning solutions, medicines, and foods. In this activity we will test some of these items using an acid-base indicator. An **acid-base indicator** is a substance that changes color in response to the concentration of hydronium ions. An acid-base indicator's color is related to hydronium ion concentration. Therefore, it can be used to determine the pH of a substance.

Recall that pH is a measure of hydronium ion concentration. The chart shows the relationship between hydronium ion concentration, hydroxide ion concentration, and pH. The greater the hydronium ion concentration, the lower the pH. The lower the hydronium ion concentration, the higher the pH.

Acidic substances contain high concentrations of hydronium ions and low concentrations of hydroxide ions. In contrast, basic substances contain low concentrations of hydronium ions and high concentrations of hydroxide ions.

In a pH test strip, the indicator compound is trapped between the cellulose fibers of the paper. When the indicator comes into contact with a substance, a portion of the indicator molecules react with hydronium ions and change form. If a lot of hydronium ions are present, a lot of indicator molecules

will change color. If a lot of hydroxide ions are present, the indicator molecules change to a different color. When a mix of forms is present, the colors mix, giving rise to intermediate hues.

As a result, you can use the color change of the indicator to learn what pH is represented in the substance. A reference color chart is supplied that allows you to determine the pH range that corresponds to a specific color change. This reference chart was created using solutions of known pH and testing them to see the corresponding color of the indicator at that pH.

Try It At Home

You can make a pH indicator using red cabbage and test substances from around your house. Follow the optional home lab below. Make sure to carefully read through the whole activity before you begin.

You can also access your lab safety guide in the Toolkit.

* You will need your parent or guardian's permission and assistance with this project.

Red cabbage
Tablespoon and teaspoon
Small clear jars (baby food jars work well)
1 large jar (mayonnaise jar size)
Water

Household item suggestions:

- Powder soap (i.e. Laundry powder)
- Aspirin
- Bathroom cleaner
- Lemon juice
- Vinegar
- Shampoo
- Vitamin C tablet

hred up about ½ cup of red cabbage. Place the cabbage in a pot with about ¼ inch of water and gently heat until it boils. Continue to boil until the solution is deep purple. Set the pot aside and let it cool completely. Pour off the liquid into a clean jar.

Label a small glass jar for each of your substances.

For each jar:

- Fill the jar with about ¼ cup of water.
- Add 1 tablespoon of the substance you are testing to the correctly labeled jar. (Note: Do **not** mix any substances together. Each jar should only contain water and 1 substance)
- Dissolve the substance in the water by stirring slowly. (Try to avoid creating bubbles)
- Observe the initial color of the solution.
- Add 1 teaspoon of the pH indicator to the jar and swirl gently.
- Observe any color change.

- Compare the color with the following:
  - Red (pH 1–3)
  - Dark violet (pH 4–6)
  - Blue (pH 7)
  - Blue/green (pH 8–10)
  - Yellow (pH >12)

Assessment

When you reach this point, you will be able to:

- explain how acid-base indicators can be used to determine the approximate pH of a substance
- give examples of the pH values of some common household items
- explain what a low pH and what a high pH indicates about the hydronium ion concentration present in substances
- identify acidic and basic substances based on their pH measurements

pH Virtual Lab

In this virtual lab, you will investigate five substances and identify them as acids or bases. Look over the Lab Report and get started! You will submit the lab report to your instructor. Be sure to also review the grading rubric.

Lab Time: Acid and Base Indicators

When you are conducting any science investigation with chemicals, always practice safe laboratory procedures. Be sure to wear goggles, wash your hands, and measure substances carefully.

Today you will identify the pH value of some familiar substances. Our stock room is full of chemicals. Some of these chemicals you may even have in your home. To begin the experiment, read the instructions below:

Lab Instructions:

Use the supplied lab equipment to test the pH value of various substances.

You will test the pH level of five different substances in test tubes. To conduct your experiment, you must complete the following steps:

1. Add 10 mL of a substance into your test tube.
2. Add 3 mL of pH indicator to the test tube.
3. Mix and check against the pH scale.

Then repeat steps one through three for the remaining substances.

From your previous experience with these substances, estimate the pH level of each substance:

- Bleach
- Detergent
- Eye drops
- Lemon juice
- Tea

Now you are going to test each substance.

You will start with bleach. You pour ten mL of bleach into a test tube. Then you add three mL of pH indicator into the test tube. Finally, you mix the substances together using a stirring rod. The mixture turns yellow. You can determine the pH of this substance using the pH color chart below:

- Red corresponds to pH levels 1 through 3
- Purple corresponds to pH levels 4 through 6
- Blue corresponds to pH level 7
- Green corresponds to pH levels 8 through 10
- Yellow corresponds to pH levels greater than 11

Record the pH of the bleach.

Now you will test the detergent. You pour ten mL of detergent into a test tube. Then you add three mL of pH indicator into the test tube. Finally, you mix the substances together using a stirring rod. The mixture turns green. You can determine the pH of this substance using the pH color chart below:

- Red corresponds to pH levels 1 through 3
- Purple corresponds to pH levels 4 through 6
- Blue corresponds to pH level 7
- Green corresponds to pH levels 8 through 10
- Yellow corresponds to pH levels greater than 11

Record the pH of the detergent.

Now you will test the eye drops. You pour ten mL of eye drops into a test tube. Then you add three mL of pH indicator into the test tube. Finally, you mix the substances together using a stirring rod. The mixture turns blue. You can determine the pH of this substance using the pH color chart below:

- Red corresponds to pH levels 1 through 3
- Purple corresponds to pH levels 4 through 6
- Blue corresponds to pH level 7
- Green corresponds to pH levels 8 through 10
- Yellow corresponds to pH levels greater than 11

Record the pH of the eye drops.

Now you will test the lemon juice. You pour ten mL of lemon juice into a test tube. Then you add three mL of pH indicator into the test tube. Finally, you mix the substances together using a stirring rod. The mixture turns red. You can determine the pH of this substance using the pH color chart below:

- Red corresponds to pH levels 1 through 3
- Purple corresponds to pH levels 4 through 6
- Blue corresponds to pH level 7

- Green corresponds to pH levels 8 through 10
- Yellow corresponds to pH levels greater than 11

Record the pH of the lemon juice.

Finally, you will test the tea. You pour ten mL of tea into a test tube. Then you add three mL of pH indicator into the test tube. Finally, you mix the substances together using a stirring rod. The mixture turns purple. You can determine the pH of this substance using the pH color chart below:

- Red corresponds to pH levels 1 through 3
- Purple corresponds to pH levels 4 through 6
- Blue corresponds to pH level 7
- Green corresponds to pH levels 8 through 10
- Yellow corresponds to pH levels greater than 11

Record the pH of the tea.