

Activity Duration: 10-40 minutes**Grade Level:** K-5

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Acids and Bases

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Overview

Infrastructure like buildings, roads, pipes, and power sources all need to be strong and sturdy to give us shelter, paths for transportation, water, and electricity to power our homes! Engineers and scientists study the effects of ACIDS and BASES so they can choose the right materials that will stand up to weather and the environment, so our infrastructure lasts for a long time.

Materials like steel and concrete can be damaged by acids. The soil on which structures are built has a pH level. If it is too acidic, it can damage the structure. The materials used in a construction site also have a pH level. When it rains, acids that are washed off of the construction site can affect the surrounding environment.

Activity Time

Time can be adjusted per age group. About a 10-minute presentation for preschool/kindergarten age up to a 30-40 minute experiment for 1st-6th.

Intended Audience

Preschool through 6th grade, with adjustments made per grade level.

Materials Checklist

- Beakers or mason jars
- Red cabbage powder (indicator)

Preschool/kindergarten age

- Citric acid dissolved in water or vinegar and baking soda dissolved in water

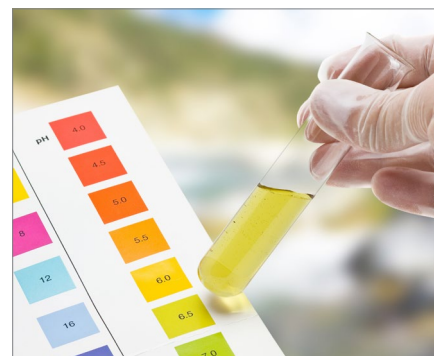
1st-6th Grade

At least 2 acidic liquids:

- Lemon juice
- Orange juice
- Citric acid powder dissolved in water
- Vinegar

At least 2 basic liquids:

- Baking Soda dissolved in water
- Milk
- Household cleaner with ammonia



Preparation

Most materials are from home – find them or purchase as needed.

- Purchase red cabbage powder (available from Amazon)
- Mix distilled or bottled water and red cabbage powder to create the indicator. Be careful – a little goes a long way. Start with 1/8 teaspoon of red cabbage powder to 8 oz. of water.
- If using mason jars, pour a small amount of each liquid into a mason jar (1/4 to 1/2 cup) and seal with the lid.
- If using beakers, pour the liquids once in the classroom.
- Do a test run of the demonstration at home so you know what to expect in the classroom.

Activity Instructions

Preschool/Kindergarten

1. Explain the difference between an acid and a base.
 - The chemical difference between acids and bases is that acids produce hydrogen ions and bases accept hydrogen ions. (www.sciencelearn.org.nz).
 - The pH of an acid is less than 7. The pH of a base is greater than 7.
2. Tell the students a few examples of acids and bases
3. Explain to the students that an indicator helps to determine if something is an acid or a base.
 - **ACID** - When red cabbage powder indicator is added to an acid, the liquid will turn **red, red-orange, or pink**.
 - **BASE** - When the indicator is added to a base, the liquid will turn **blue or green-blue**.
4. Pour about **a tablespoon of the indicator** into each jar (mixing if needed) and allow the students to see what color each liquid turns
5. A fun end to the experiment is to mix the citric acid or vinegar liquid and the baking soda liquid. First, tell the students that when you mix an acid and a base, a chemical reaction occurs. For example, if you mix vinegar and baking soda, they will produce carbon dioxide, which you can see in the form of bubbles. **Over a sink or large container**, pour the citric acid or vinegar and the baking soda into a larger jar at the same time. It will bubble out of the jar, so do not do this on a table – it needs to be in a container or sink. The students enjoy this part, so you may want to repeat it so they can see it again.

1st-6th Grade

1. Explain the difference between an acid and a base.
 - The chemical difference between acids and bases is that acids produce hydrogen ions and bases accept hydrogen ions. (www.sciencelearn.org.nz).
 - The pH of an acid is less than 7. The pH of a base is greater than 7.
 - Tell the students a few examples of acids and bases
2. For older children, an additional item that can be added to this lesson is explaining the **scientific method of conducting an experiment**. Then conduct the experiment utilizing the scientific method - question, hypothesize, experiment, observe/record, and analyze/conclude.
3. Write the name of each liquid on a piece of paper and place it front of the beaker/jar.
4. Have the students hypothesize about which liquids will be acids and which will be bases, also explaining that a liquid can be neutral. Write down their predictions.
5. Explain to the students that an indicator helps to determine if something is an acid or a base.
 - **ACID** - When red cabbage powder indicator is added to an acid, the liquid will turn **red, red-orange, or pink**.
 - **BASE** - When the indicator is added to a base, the liquid will turn **blue or green-blue**.
 - The exact color depends on the color of the liquid (for example, lemon juice will be more orange vs. citric acid which will be red or pink).
6. Pour about a tablespoon of the indicator into each jar (mixing if needed) and allow the students to see what color each liquid turns vs. their prediction. Write down the results.
7. Do this for each liquid, talking about each. Discuss if their hypotheses were correct.
8. A fun end to the experiment is to mix the citric acid or vinegar liquid and the baking soda liquid. First, tell the students that when you mix an acid and a base, a chemical reaction occurs. For example, if you mix vinegar and baking soda, they will produce carbon dioxide, which you can see in the form of bubbles. Over a sink or large container, pour the citric acid or vinegar and the baking soda into a larger jar at the same time. It will bubble out of the jar, so do not do this on a table – it needs to be in a container or sink. The students enjoy this part, so you may want to repeat it so they can see it again.



Critical Thinking Questions

1. What is the difference between an acid and a base?
2. How can we use the scientific method?
3. What gas is produced when you mix vinegar and baking soda water?

References

<https://www.sciencelearn.org.nz/resources/3019-acids-and-bases-introduction>

The pH Scale

