



Hot & Cold Reactions

Estimated Time: 30-45 minutes

SUMMARY

How do you know when a chemical reaction is taking place? One way is to look for a *temperature* change. There are two great examples of chemical changes you can explore in your kitchen and laundry room!

WHAT YOU'LL LEARN

- The meaning of “endothermic” and “exothermic” in chemistry.
- Common chemical reactions around the house.
- Signs of a chemical change.

Materials Used

- 7.5 g ($\frac{1}{2}$ Tbsp) baking soda
- $\frac{1}{2}$ Tb (10 mL) vinegar
- 7.5 g ($\frac{1}{2}$ Tbsp) washing soda (sodium carbonate)
- $\frac{1}{2}$ Tb (10 mL) water
- 2 resealable plastic bags (sandwich size works best)

WHAT TO DO

1. Have students measure their vinegar into a plastic bag, but *don't add the baking soda yet*. Give students a chance to make predictions about what will happen when the two chemicals combine. They can record their predictions any way they want, then share them in conversation.
2. Combine the baking soda and vinegar and seal the bag, then watch what happens. Were the students' predictions right? Have them write down (or draw) any observations about the reaction including what they see happening, what they hear from the bag, and how the bag feels.
 - a. They should feel the bag getting cooler as a result of the reaction. If they don't notice this, encourage them to hold the bag in their hand and try to sense a temperature change. This will be important later for comparison.
3. Next, have students measure out water into a new bag and make predictions for the next reaction of washing soda and water. Share out the predictions in conversation.
4. Combine the washing soda with the water and seal the bag, then observe what happens. Were the predictions right this time? Include any observations in the same methods as before.
 - a. This time the bag will feel warm to the touch. Encourage the students to feel the bag and sense for temperature changes. This is an important observation.
5. One of these reactions is *exothermic* (released extra heat) while the other is *endothermic* (absorbed heat). Can the students identify which is which? What other

chemical experiments have they tried in this series, or in other contexts, that are exothermic or endothermic? Some searches on the internet (with a parent) can reveal many that they see every day.

TIPS

- There are four signs to look for to confirm that a chemical reaction is occurring: a change in color, a change in temperature, the formation of a precipitate (a solid that separates from a liquid), or the formation of a gas. Sometimes reactions will have more than one of these things occurring, but only very rarely will you see *none* of them.
- The reaction of **baking soda and vinegar** is an endothermic reaction, requiring energy to continue. This means it pulls energy out of the surrounding environment, including your hand, which is why the bag feels cool to the touch. It's also producing a gas, which is another sign of a chemical reaction. Older students may predict the gas (especially if they have ever made a vinegar volcano) but they might be surprised by the cool temperature.
- The reaction of **washing soda and water** is an exothermic reaction, making more energy than the reaction needs. The extra energy is pushed out into the surrounding environment, including your hand, which is why the bag feels warm. This time there isn't a gas produced, but the temperature change is still a sign of a chemical reaction.
- Be sure that students wash their hands well after doing this experiment to avoid irritation from washing soda and vinegar.