

Cool Reactions, Hot 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 and there are two great examples in your kitchen and the laundry!

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

- At least 10 mL (about $\frac{1}{2}$ Tb) of baking soda
- At least 10 mL (about $\frac{1}{2}$ Tb) of vinegar
- At least 10 mL (about $\frac{1}{2}$ Tb) of powdered laundry detergent
- At least 10 mL (about $\frac{1}{2}$ Tb) of water
- At least 2 sandwich-sized, sealable plastic bags

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 are combined. 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 see. This will be important later for comparison.
3. Next, have students measure out water into a *separate bag* and make another round of predictions. Share out the predictions in conversation after the students make them.
4. Combine the powdered laundry detergent with the water and seal the bag, then watch 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. Have them write that down as an observation and you'll come back to it in the next step.
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 going on: a change in color, a change in temperature, the formation of a precipitate (a solid that comes out of 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 already predict the gas but they might be surprised by the cool temperature.
- The reaction of **laundry detergent 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 sure sign of a chemical reaction.
- Be sure that students wash their hands well after doing this experiment to avoid rubbing vinegar or laundry detergent in their eyes.