



## Try This at Home Science: Exo and Endo

### Activity Overview:

Some chemical reactions absorb heat while others release it!

### Materials:

- 2 empty 1-L plastic bottles
- Teaspoons
- Calcium Chloride ( $\text{CaCl}_2$ ) or Ice Melt
- Baking Soda
- Water
- Vinegar
- Gloves
- Safety goggles

### Safety precaution:

Calcium chloride can be an irritant to body tissues. In the event of contact, rinse affected areas thoroughly with water. Do **not** let children handle calcium chloride.

Rinse bottles after each use with water.

### Try this!

#### **Reaction 1:**

1. Add 1 teaspoon of calcium chloride to one of the plastic bottles.
2. Then add approximately 2 tablespoons of water to that same bottle.
3. Secure the lid and shake well.

How does this reaction feel? *Optional: Use a thermometer to record temperature.*

#### **Reaction 2:**

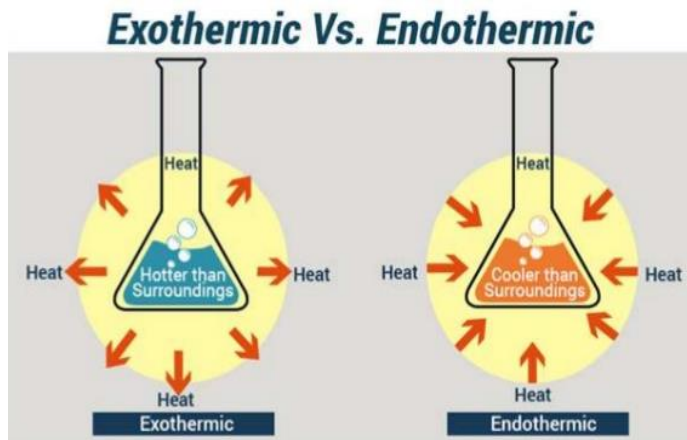
1. Add 2-teaspoons of baking soda to the other plastic bottle.
2. Then add approximately 3 tablespoons of vinegar to that same bottle.
3. Secure the lid and shake well.

How does this reaction feel? Does it feel different than the other bottle?

*Optional: Use a thermometer to record temperature and compare.*

## What's happening?

All chemical reactions either absorb or release energy. In a chemical reaction, chemical bonds are both broken and formed to create new substances. The difference in total bond energy is either released or absorbed as heat as the reaction completes. Using household products, you can observe these two types of reactions.

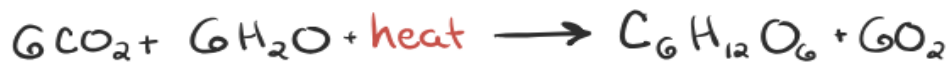


An **exothermic** reaction occurs when the energy used to break the bonds in the reactants is less than the energy released when new bonds are made in the. This extra energy is released as heat and there is a temperature rise around the surroundings of the reaction; you will feel warmth.

- **Combustion** (burning) is an example of an exothermic reaction:



An **endothermic** reaction occurs when the energy used to break the bonds in the reactants is greater than the energy given out when bonds are formed in the products. This means that overall, the reaction absorbs energy from its surroundings and feels cold. **Photosynthesis** is an example of an endothermic reaction because heat energy from sunlight is used to convert carbon dioxide and water into glucose and oxygen.



### How does this relate to everyday life?

The First Law of Thermodynamics states that energy cannot be created nor destroyed, only transferred. The energy of the universe is constant. In these two types of reactions, kinetic energy (observed as heat) is transferred, but never destroyed.

Humans, polar bears, penguins, great white sharks, and other birds and mammals are all endothermic. They are considered endotherms because all are able to adjust their metabolic rate in response to environmental temperature change. When it is cold outside, our bodies increase metabolic production, which involves breaking down fuel (e.g. sugars!) we give our bodies!

Burning substances and using chemical handwarmers are exothermic reactions. These handwarmers, once you begin to crack them, begin to heat the contents inside the pack and release heat.

### Now try...

- Pick other combinations of liquids and solids: Water and Epsom salts, Lemon juice and baking soda, Vinegar and a steel wool pad.
- Look at the things you do in your daily life, are any of them endothermic or exothermic reactions? Is cooking an endothermic or exothermic reaction?

### Additional Information

<https://www.khanacademy.org/test-prep/mcat/chemical-processes/thermochemistry/a/endothemic-vs-exothermic-reactions>

For more “Try This at Home Science” activities, visit [www.mi-sci.org](http://www.mi-sci.org).