

# Rusty Balloon

**Overview:** Mars is coated with iron oxide, which not only covers the surface but is also present in the rocks made by the volcanoes on Mars.

**What to Learn:** Today you get to perform a chemistry experiment that investigates the different kinds of rust and shows that given the right conditions, anything containing iron will eventually break down and corrode. When iron rusts, it's actually going through a chemical reaction: *Steel (iron) + Water (oxygen) + Air (oxygen) = Rust*

## Materials

- Four empty water bottles
- Four balloons
- Water
- Steel wool
- Vinegar
- Water
- Salt

## Experiment

1. This lab is best done over two consecutive days. Plan to set up the experiment on the first day, and finish up with the observations on the next.
2. Line up four empty bottles on the table.
3. Label your bottles so you know which is which: *Water, Water + Salt, Vinegar, Vinegar + Salt*
4. Fill two bottles with water.
5. Fill two with vinegar.
6. Add a tablespoon of salt to one of the water bottles.
7. Add one tablespoon of salt to one of the vinegar bottles.
8. Stuff a piece of steel wool into each bottle so it comes in contact with the liquid.
9. Stretch a balloon across the mouth of each bottle.
10. Let your experiment sit (overnight is best, but you can shorten this a bit if you're in a hurry).
11. The trick to getting this one to work is in what you expect to happen. The balloon should get shoved inside the bottle (not expand and inflate!). Check back over the course of a few hours to a few days to watch your progress.
12. Fill in the data table.

## Rusty Balloon Data Table

What's in the Bottle?	What happened? <i>Describe what happened to the wool, bottle, and balloon.</i>

### Reading

Rust is a common name for iron oxide. When metals rust, scientists say that they oxidize, or corrode. Iron reacts with oxygen when water is present. The water can be liquid or the humidity in the air. Other types of rust happen when oxygen is not around, like the combination of iron and chloride. When rebar is used in underwater concrete pillars, the chloride from the salt in the ocean combines with the iron in the rebar and makes a green rust.

Mars has a solid core that is mostly iron and sulfur, and a soft pastel-like mantle of silicates (there are no tectonic plates). The crust has basalt and iron oxide. The iron is in the rocks and volcanoes of Mars, and Mars appears to be covered in rust.

When iron rusts, it's actually going through a chemical reaction:

*Steel (iron) + Water (oxygen) + Air (oxygen) = Rust*

There are many different kinds of rust. Stainless steel has a protective coating called chromium (III) oxide so it doesn't rust easily.

Aluminum, on the other hand, takes a long time to corrode because it's already corroded — that is, as soon as aluminum is exposed to oxygen, it immediately forms a coating of aluminum oxide, which protects the remaining aluminum from further corrosion.

An easy way to remove rust from steel surfaces is to rub the steel with aluminum foil dipped in water. The aluminum transfers oxygen atoms from the iron to the aluminum, forming aluminum oxide, which is a metal polishing compound. And since the foil is softer than steel, it won't scratch.

### **Exercises**

1. Why did one balloon get larger than the rest?
2. Which had the highest pressure difference? Why?

### **Answers to Exercises: Rusty Balloon**

1. Why did one balloon get larger than the rest? (The balloon will show you how much gas is generated – the larger the balloon, the more gas was produced. The rust (iron oxide) is the name of the reaction taking place between the steel wool and the liquids.)

2. Which had the highest pressure difference? Why? (Check results from data table. In the video, the bottle with just water not only sucked in the balloon, it also sucked in the sides of the water bottle itself, showing you that it used the oxygen in the air to generate the rust. You'll see this more dramatically when you add salt to the water before adding the steel wool.)