Oxidation of Iron - An example of a Combination Reaction

Vanderbilt Student Volunteers for Science

Training Presentation

2018-2019 VINSE/VSVS Rural

Introduction

- Ask students if they know what **oxidation** is? What are some things that **oxidize**?

- **Oxidation:** Oxidation usually occurs when an element or compound combines with **oxygen**.
  - Apples turn brown after they have been cut and left exposed to the air.
  - Iron is oxidizing when it rusts and turns a reddish color
- Tell students we are going to investigate the oxidation of iron, commonly called rusting.
- This example of rusting is called a **combination reaction**

- A **Combination Reaction** is a reaction where two or more reactants are chemically bonded together to produce a single product.
- Rust is the common name for a very common compound, iron oxide.
- Rusting is a very slow process which takes place over several weeks or months.

Experiment 1: Rusting of Iron Filings

1. Put cotton ball into a 1oz cup and sprinkle with iron filings.
2. Sprinkle a small scoop of salt
3. Add a squirt of Hydrogen Peroxide
4. Set aside and observe after starting part 2.

An obvious orange color forms within 2-5 minutes.

Experiment 2: Iron Filings Oxidation an Exothermic Reaction

1. Put iron filings into plastic bag
2. Put plastic bag into cup (line it like a garbage can)
3. Add a spoonful of salt and the rest of the peroxide.
4. Feel the bag and note the temperature (Should be at room temperature).
5. Measure the temperature with the thermometer.
6. Students will measure the temperature again in 1 minute

Observations will include:

Solution is becoming orange colored.

Solution is bubbling (producing a gas).

Temperature will probably not show any increase yet

Line like a garbage can

Looking back at Experiment 1

- Based on the color of the product, ask students to hypothesize which iron oxide has formed (look at the iron oxide vials in the first part of the lesson).
- Equation: $4Fe + 3O_2 \rightarrow 2Fe_2O_3$
- Why is this classified as a combination reaction?
- What is an oxidation reaction?

Before: no rust

After: orange color

Return to Experiment 2.

1. Measure the temperature of the liquid in the plastic bag now.
2. *Students should observe an increase of 10-20 degrees C.*
3. The temperature of the iron filings plus peroxide plus salt mixture increases, so the reaction is EXOTHERMIC.

Is it a Chemical Reaction?

- Ask students what evidence there is for a chemical reaction taking place?
  - *A change in color (rust is reddish) is evidence of a chemical change.*
  - *A new substance is formed.*
  - *Gas (bubbles) is being given off (from the decomposition of hydrogen peroxide.)*
  - *There is a temperature change. Rusting is exothermic. It usually happens so slowly that it is not noticed.*

Clean Up

- Rinse and dry the thermometers.
- Seal plastic bags and throw away in trash can.
- Try NOT to get 10 oz cups contaminated with iron oxide liquid – it stains.