Demonstration: Catalyst in Motion

FOR THE TEACHER

Summary
This demonstration allows students to visualize how a catalyst can impact a chemical reaction. Students will also identify the products of a decomposition reaction, as well as determine if the reaction was endothermic or exothermic based on their observations.

Grade Level
High or Middle School

Objectives
By the end of this demonstration, students should be able to
- Indicate the effect of a catalyst on a reaction.
- Identify a decomposition chemical reaction and its products.
- Distinguish between endothermic and exothermic reactions.

Chemistry Topics
This demonstration supports students’ understanding of
- Chemical Reactions
- Classification of Reactions
- Chemical Change
- Kinetics
- Catalyst
- Observations

Time
Teacher Preparation: 15 minutes
Lesson: 30 minutes

Materials:
- 100ml of 3% or 6% hydrogen peroxide solution
- 1 tablespoon (¼ ounce packet) of dry yeast
- 50 ml of warm water
- 10 ml liquid dishwashing liquid
- Food coloring
- 1000ml graduated cylinder
- 100 ml beaker
- 50ml graduated cylinder
- 10ml graduated cylinder
- Stirring rod
- Plastic Bin

Safety
- Students should wear proper safety gear during chemistry demonstrations. Safety goggles and lab apron are required.
Teacher Notes

- In this reaction hydrogen peroxide will decompose into water and oxygen gas. The catalyst (yeast) will accelerate a chemical reaction without itself being affected.
- Note: Either concentration, 3% or 6% of hydrogen peroxide will work for this demonstration. The higher concentration will create a more vigorous reaction.
- Teacher Procedure:
  1. Carefully pour approximately 100ml hydrogen peroxide into the 1000ml graduated cylinder.
  2. Add 5 drops of your favorite food coloring to the hydrogen peroxide.
  3. Measure and add about 10ml of liquid dish soap into the graduated cylinder containing the hydrogen peroxide.
  4. Swirl mixture.
  5. Create water + yeast mixture: combine 50ml of warm water with one package of dry yeast (1/4 ounce) in the 100ml beaker. Use stirring rod to mix thoroughly.
  6. Pour the yeast water mixture into the graduated cylinder. Be sure to place the cylinder within a plastic bin, as the result will overflow and be messy!

- The soap is helpful for visualization purposes, as each tiny foam bubble is filled with oxygen gas created in the decomposition reaction.
- Using a thermometer or simply touching the outside of the graduated cylinder will indicate that heat was released, and this reaction can be classified as an exothermic chemical reaction.
- A video of this demonstration is available for your reference.
- Teachers should check the pre-lab questions, and have a discussion before beginning the demonstration.

FOR THE STUDENT
Lesson
Catalyst in Motion

Background
In this demonstration you will observe the effect of that a catalyst has on a decomposition chemical reaction. A catalyst will be used to make the reaction occur faster than it would otherwise. As you know, heat can either be released or absorbed during a chemical reaction. Based on your observations you will also determine if this reaction is exothermic or endothermic.

Pre-lab Questions
These questions will be discussed as a class prior to observing the demonstration.

1. Using your chemistry knowledge, predict the 2 products of this decomposition chemical reaction:

   \( \text{H}_2\text{O}_2 \rightarrow \)

2. In this demonstration, yeast will be used as the catalyst. What is a catalyst?

3. What is the difference between an exothermic and endothermic reaction? What data could you collect in order to classify the reaction as exothermic or endothermic?

Safety
- Students should wear proper safety gear during chemistry demonstrations. Safety goggles and lab apron are required.
Observations

<table>
<thead>
<tr>
<th>Actions</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>What happened when the yeast was added to the hydrogen peroxide mixture?</td>
<td></td>
</tr>
<tr>
<td>What types (states of matter) are the 2 products in this reaction? Use observations to support your claim.</td>
<td></td>
</tr>
<tr>
<td>Was there a temperature change during this reaction?</td>
<td></td>
</tr>
</tbody>
</table>

Analysis

1. How did the yeast affect the decomposition of hydrogen peroxide?

2. Is this reaction exothermic or endothermic? How do you know?

Conclusion

Why are catalysts used in the real-world? Using the internet, conduct independent research to find an interesting example of how a catalyst can be beneficial in the real-world. Cite the source that you use.