

ELEPHANT TOOTHPASTE

DECOMPOSITION REACTION, EXOTHERMIC REACTION

A simple yet exciting way to introduce students to the concepts of decomposition or exothermic reactions.

DEMONSTRATION PREP

Time: 10-15 Minutes

Topics of Interest: Decomposition reactions, exothermic reactions, balancing equations, atoms, and molecules

Materials Required: Hydrogen peroxide (30%), sodium iodide, dish soap, food coloring.

- Note: Sodium iodide can be replaced with potassium iodide as the iodide ion acts as the catalyst and the metal is the spectator ion.

Safety Notes:

- Hydrogen peroxide is a corrosive oxidant. Avoid contact with skin and handle with care.
- During and for a brief period after the chemical reaction has taken place, there is a lot of heat generated. Be cautious when handling the foam. Wait until the foam is no longer high heat before allowing students to touch.

KEY TERMS

Decomposition reactions occur when one compound is split into simpler compounds or elements. Some decomposition reactions are unfavorable (when heat must be added) or favorable (heat will be released).

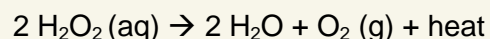
Exothermic Reactions are when heat is released to its surroundings

Catalysts are added to a reaction to increase the reaction rate. They lower the activation energy of the rate-determining step by creating an alternate pathway. Catalysts are never consumed in the reaction.

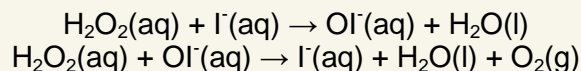


CHEMISTRY BEHIND THE DEMO

In this reaction hydrogen peroxide will be decomposed into water, oxygen gas, and will release heat.



This reaction is a favorable reaction so given enough time hydrogen peroxide will decompose on its own. To increase the reaction rate an iodide ion is added to act as a catalyst.



In the first step of the reaction the iodide ion bonds with an oxygen molecule to form an OI^- . The OI^- bonds with another oxygen from a hydrogen peroxide atom, which causes the I^- to become a free ion and the oxygen atoms double bond and are released as a gas.

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Did you know?

In the ninth episode of *The Big Bang Theory's* third season, the elephant toothpaste experiment is used as a prank for Dr. Sheldon Cooper to exact revenge on Dr. Kripke. It goes horribly wrong, but what a cool scene! Here is a YouTube video showing the whole disaster that can be used to hook students before the demonstration: <http://www.youtube.com/watch?v=IDYiATTyrjw>

Materials:

- 20 mL of 30% hydrogen peroxide
- 5 mL of dish soap
- 20 mL of 2M sodium iodide
- Food coloring
- Graduated Cylinder
- Safety Glasses
- Rubber Gloves

Safety:

Safety Glasses:

Protect your eyes from exposure to the chemicals

Rubber Gloves:

Protect your hands from direct contact with the chemicals

Disposal:

After dilution, all products can be disposed of down the drain.

PROCEDURE

Set Up:

- 1) Premix solutions to form 2M NaI (aq)
- 2) Clean graduated cylinder
- 3) Place container under graduated cylinder to keep mess contained

Experimental Procedure:

- 1) Place 20 mL of hydrogen peroxide (30%) in a graduated cylinder
- 2) Add 5 mL of dish soap to the graduated cylinder
- 3) Add food coloring (only a few drops)
- 4) Add 20 mL of sodium iodide to the graduated cylinder
- 5) Watch and enjoy!

Variations:

It is possible to have a sealed container with moderately large sized holes to force the expulsion of the foam out of specific pores. Be creative!

Student Participation & Follow Up:

1. Students should make predictions for results of the experiment before doing the demonstration.
2. During the demonstration student's must take observations
3. After experiment discuss how the bubbles are formed from the dish soap.
4. Discuss real life applications.
5. Sheldon's Revenge (*Big Bang Theory*) S03 E09 (14:34)