

Pukin' Pumpkin

A Carolina Essentials™ Demonstration



Overview

Watch a carved pumpkin “puke” a massive eruption of foam in this classic elephant toothpaste chemistry demonstration with a spooky twist, using 30% hydrogen peroxide, potassium iodide, and dish soap. This Halloween classroom demonstration takes one of the most popular chemistry experiments and gives it a seasonal upgrade. It’s a great way to grab students’ attention in October while teaching science concepts from observable chemical changes to more advanced chemistry topics.

This quick demonstration shows the decomposition of hydrogen peroxide, catalyzed by iodide ions, and gives students visual evidence of a chemical reaction. Students then compare the reaction rate of the catalyzed and uncatalyzed reactions and use time data and observations to write a statement explaining what catalysis is.

Physical Science, Chemistry
Grades: 6–12

Phenomenon

Show students samples of the hydrogen peroxide (H_2O_2) and the potassium iodide (KI). Let them observe the chemicals and predict what will happen. Let them share their predictions and write down a master list.



Essential Question

How does the addition of a catalyst affect reaction rate?

Demonstration Objectives

1. Observe a catalyzed decomposition reaction.
2. Compare the reaction rates of catalyzed and uncatalyzed reactions.

Continued on the next page.

TIME REQUIREMENTS



PREP	ACTIVITY
30 min	20 min

Teacher Prep: 30 min

Demonstration: 20 min

SAFETY REQUIREMENTS



MATERIALS (PER GROUP)

Carved pumpkin

Dishwashing liquid

Green food coloring

[Hydrogen peroxide](#), 30%, 30 mL

[Potassium iodide](#), 1.5 g

Large garbage bag or large tray

[Weighing boat](#) or filter paper

2 plastic bottles or [large graduated cylinder](#),
250 to 500 mL

[Graduated cylinder](#), 100 mL

[Digital balance](#)

[Spatula](#)

[Timer](#) (online, smartphone, or
stopwatch)

[Safety goggles](#)

[Gloves](#)

HELPFUL LINKS

[Chemistry Activity Video:](#)
[Elephant Toothpaste](#)

[Motivate Students with](#)
[Chemistry Demos](#)

REFERENCE KITS

[Carolina Chemonstrations®:](#)
[Elephant Toothpaste](#)

Next Generation Science Standards* (NGSS)

PE HS-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Use reaction-time data and a potential energy diagram to construct a model of catalyzed and uncatalyzed reactions.	Matter and Its Interactions Develop a model showing that the release or absorption of energy from a chemical reaction system depends on changes in total bond energy.	Energy and Matter Changes of energy and matter in a system can be described in terms of flows into, out of, and within that system.

Safety Procedures and Precautions

Hydrogen peroxide at 30% is a very strong oxidizer. It is corrosive to clothing and will cause burns if spilled on the skin. Use appropriate personal protective equipment (PPE), such as gloves, chemical splash goggles, and lab coats or aprons, to avoid contact. Know and follow all federal, state, and local regulations as well as school district guidelines for the disposal of laboratory wastes.

Teacher Preparation and Disposal

Upon completion of this demonstration, rinse and dry the bottles before putting them away. Keep PPE on in case a bottle contains leftover hydrogen peroxide. Unless otherwise prohibited, carefully roll up the foam and catalyst on the trash bag and discard it in the trash.

Teacher Procedure

- Put on gloves and safety goggles.
- Crush any lumps of potassium iodide (KI) into fine crystals with a spatula, and then weigh 1.5 g onto a weighing boat or filter paper.
- Lay a large garbage bag flat on a desk, table, or lab bench to protect the demonstration area. A large tray may also be used.
- Prepare both bottles or cylinders at the same time. Label one "Uncatalyzed" and the other "Catalyzed."
- Place the plastic bottles or large graduated cylinders in the middle of the carved pumpkin.
- Measure 15 mL of 30% hydrogen peroxide and pour it into the bottle or cylinder. Repeat for the second bottle or cylinder.
- Add 25 drops of dishwashing liquid to the hydrogen peroxide in both bottles or cylinders.
- Swirl the bottles or cylinders to mix the liquid soap and peroxide.
- Prepare students to begin timing the reactions as soon as the KI is added to the bottle or cylinder labeled "Catalyzed."
- Quickly add the KI crystals to the bottle or cylinder labeled "Catalyzed" and begin timing.
- Observe the oxygen gas as it forms bubbles in the soap, creating a plume of foam that is quickly expelled from the pumpkin.
- Stop timing the catalyzed reaction when the foam stops flowing out of the pumpkin. Continue timing the uncatalyzed reaction.
- Direct students to answer the demonstration analysis questions. Check for evidence of a reaction in the uncatalyzed container every 5 minutes until students finish. Stop timing if or when a noticeable volume of bubbles is produced in the uncatalyzed container.

Teacher Preparation and Tips

Make sure the bottles are identical and that students understand both bottles are getting the same amount of the same chemicals. The only difference is the addition of the catalyst.

Dawn dishwashing liquid produces a high volume of bubbles.

Announce for students to get ready to time the reactions. You may want to assign individual students, 2 students per group, or split the room in half so both reactions are timed.

Begin timing as soon as the KI is added.

Announce to students when to stop timing the catalyzed reaction.

Check the uncatalyzed reaction periodically for any evidence of bubbles.

Continued on the next page.

Data and Observations

Reaction	Time (s)	Observations
Uncatalyzed Reaction	<i>Will vary with temperature</i>	<i>May see small bubbles</i>
Catalyzed Reaction	<i>Instantaneous—runs for about 2 minutes</i>	<i>Large amounts of foam spew out of the pumpkin</i>

Analysis and Discussion

1. What evidence indicates that a reaction took place?

Bubbles were produced.

2. Explain why dishwashing detergent was added to the hydrogen peroxide.

The detergent traps the oxygen bubbles, making a foam that allows the bubbles to be more visible and last longer.

3. Why was the solid potassium iodide added to one of the bottles.

It serves as a catalyst.

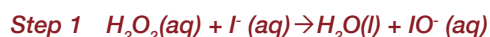
4. Compare the times for the 2 reactions. Using the time data, write a statement explaining what catalysis is.

When a reaction time is relatively slow and needs to be faster, a catalyst can be added. A catalyzed reaction has a shorter reaction time because the addition of a catalyst lowers activation energy. See the explanation of the reaction mechanism below.

Hydrogen peroxide (H_2O_2) is stable for at least a year if stored in an airtight opaque container at room temperature. Common in first aid kits, a 3% H_2O_2 solution can be applied to minor cuts and abrasions. When the solution contacts tissue and blood, it rapidly decomposes into water (H_2O) and oxygen gas (O_2).



The oxygen gas creates a foam that lifts and washes contaminants out of the wound. This rapid decomposition can only happen in the presence of a catalyst. In the human body that catalyst is catalase, a biological catalyst in blood and tissue. Catalase can lower the activation energy from 75 kJ/mol to about 8 kJ/mol. In this demonstration, solid potassium iodide (KI) dissolves in aqueous H_2O_2 , forming an aqueous iodide ion (I^-) and catalyzing the reaction of aqueous H_2O_2 . The steps of the reaction mechanism are:



Slow Reaction



Fast Reaction



Overall Net Reaction

TEACHER NOTES

Pukin' Pumpkin

A Carolina Essentials™ Demonstration

Student Worksheet



Overview



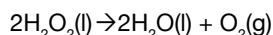
SAFETY REQUIREMENTS



Watch a carved pumpkin “puke” a massive eruption of foam in this classic elephant toothpaste chemistry demonstration with a spooky twist, using 30% hydrogen peroxide, potassium iodide, and dish soap.

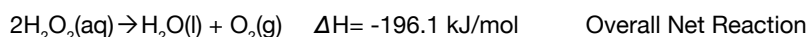
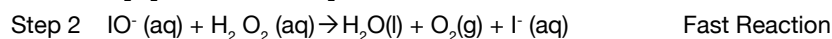
Every chemical reaction proceeds at a certain reaction rate. Reaction rates can be altered by changing temperature, pressure (if gases are involved), concentration of reactants, or particle size (if solids are involved). When a reaction time is relatively slow and needs to be faster, a catalyst can be added. A catalyzed reaction has a shorter reaction time because adding a catalyst lowers activation energy.

Hydrogen peroxide (H_2O_2) is stable for at least a year if stored in an airtight opaque container at room temperature. Common in first aid kits, a 3% H_2O_2 solution can be applied to minor cuts and abrasions. When the solution contacts tissue and blood, it rapidly decomposes into water (H_2O) and oxygen gas (O_2).



The oxygen gas creates a foam that lifts and washes contaminants out of the wound. This rapid decomposition can only happen in the presence of a catalyst. In the human body that catalyst is catalase, a biological catalyst in blood and tissue. Catalase can lower the activation energy from 75 kJ/mol to about 8 kJ/mol.

In this demonstration, solid potassium iodide (KI) dissolves in aqueous H_2O_2 , forming an aqueous iodide ion (I^-) and catalyzing the reaction of aqueous H_2O_2 . The steps of the reaction mechanism are:



Continued on the next page.

Phenomenon

Observe the starting chemicals your teacher is using. Predict what will happen.

Essential Question

How does the addition of a catalyst affect reaction rate?

Demonstration Objectives

1. Observe a catalyzed decomposition reaction.
2. Compare the reaction rates of catalyzed and uncatalyzed reactions.

Key Materials

Identify the materials used in the demonstration.

Procedure

Summarize the demonstration steps.

Continued on the next page.

Data and Observations

Reaction	Time (s)	Observations
Uncatalyzed Reaction		
Catalyzed Reaction		

Analysis and Discussion

1. What evidence indicates that a reaction took place?
2. Explain why dishwashing detergent was added to the hydrogen peroxide.
3. Why was the solid potassium iodide added to one of the bottles?
4. Compare the times for the 2 reactions. Using the time data and observations, write a statement explaining what catalysis is.