



# LESSON PLAN

## CHEMICAL VS. PHYSICAL CHANGES GRADES 3-5

### SUMMARY

To observe and compare a variety of chemical and physical reactions to recognize the difference between chemical and physical changes.



5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Science & Engineering Practices	Connections to Classroom Activity
Planning and Carrying Out Investigations	<ul style="list-style-type: none"><li>• Students work individually, in pairs, and as a class to investigate a variety of chemical and physical reactions and collect data to determine which type of change they observed.</li><li>• Students use new knowledge to think about how they would investigate a reaction to determine if it causes a chemical or physical change.</li></ul>
Disciplinary Core Ideas	Connections to Classroom Activity
PS1.B: Chemical Reactions When two or more different substances are mixed, a new substance with different properties may be formed.	<ul style="list-style-type: none"><li>• Students observe and participate in several chemical reactions where two or more substances are mixed and a new substance is formed.</li></ul>

## Crosscutting Concepts

## Connections to Classroom Activity

### Cause and Effect

- Students think about cause and effect relationships as they relate to physical and chemical reactions and specifically flame tests.

## DURATION

Two 45-minute classroom periods (Engage, Explore, Explain—one 45-minute classroom period; Elaborate, Evaluate—second 45-minute classroom period).

## PRE-ASSESSMENT QUESTIONS

Please see discussion questions located under the video. These can be discussed as a group or answered individually in student science notebooks.



## ENGAGE

Watch the Generation Genius video without the students prior to the lesson. The phenomena you will share is a smaller version of the chemical reaction that Izzy performs at the start of the video. To create this reaction, you will first need to add one package of yeast with warm water and mix until it becomes frothy.

This will be the catalyst (the substance that sparks the reaction). Do this shortly before you plan to use it. When you are ready to show the students, set up a shallow pan or drop cloth to contain the mess. Using the funnel, pour some hydrogen peroxide (a few inches) into the bottle. Then squirt in some dish soap and swirl together gently to mix. Now add about 3 tablespoons of the yeast/water mixture. Now watch as the reaction takes place and foam shoots from the bottle!

Ask students, what is going on here? Explain to students that clearly a change or reaction has taken place. In this lesson, they will explore changes to matter—both chemical and physical. Ask students, was this an example of a chemical or physical reaction? They should write down their answer in their science notebooks and explain their thinking. Tell students we will learn more about this reaction later in the lesson.



## EXPLORE

Facilitate a short discussion with students about the difference between chemical and physical changes. Chemical changes result in the formation of a new substance while physical changes do not. Students will now get a chance to explore several changes and try to determine whether they are chemical or physical. Set up four stations around the room.

## MATERIALS

- Small plastic bottle (12-16 ounce size)
- Funnel
- Hydrogen peroxide (3%)—the strength found in a pharmacy
- Dish soap
- One package of dry yeast
- Warm water
- Shallow pan or drop cloth
- Science notebooks
- Pencils
- Ice cube
- Plate
- Two apples
- Knife
- Plate or cutting board
- Materials for DIY Activity
- Baking soda
- Vinegar
- Latex-free gloves
- Measuring cup
- 8oz plastic cups

### STATION 1

At this station place an ice cube on a plate prior to the start of the lesson so that it is partially melted by the time students visit the station. The melting ice is a phase change from solid to liquid water with the addition of heat. This is a physical change—no new substance is created.

### STATION 2

At this station place two apples. One whole and one cut into pieces. This is an example of a physical change—the apple is still an apple, just in smaller pieces. Some students may key in on the apple beginning to brown. This is an example of a chemical change—oxidation as the fruit reacts with oxygen in the air. This is similar to rust forming on metal.

### STATION 3

This station utilizes Zoe’s DIY Activity from the video. Make enough short secret messages for each student prior to the start of class (you could use symbols instead of words and quarter sheets of paper). Provide just the paper with the invisible message and a blackberry to each student. They will need to think about what happens and decide if there is evidence of a new substance (there is—the purple pigment in the blackberry and the baking soda formed a blue substance). This is an example of a chemical change.

### STATION 4

For this station provide empty small cups, a carton of baking soda, and a bottle of vinegar. Students will mix vinegar into the baking soda and observe the fizzing reaction. This happens because the two chemicals form new substances, including carbon dioxide gas which makes the mixture fizz. This is a chemical reaction.

### STATION 5

At this station all you need is a lamp with a transparent light bulb that students will be able to turn on and off with a switch. A light bulb produces light because the wire coil heats up, but no new substance is produced. This is a physical change.

<p><b>STATION 1</b></p> <p>In your science notebook, sketch and label what you observe at this station. Does this represent a chemical or physical change? Explain your reasoning.</p>	<p><b>STATION 2</b></p> <p>In your science notebook, sketch and label what you observe at this station. Does this represent a chemical or physical change? Explain your reasoning.</p>
<p><b>STATION 3</b></p> <p>At this station, you will be given a sheet of paper that appears to be blank. Put on gloves to prevent your hands from getting stained with blackberry juice. Carefully rub the blackberry across the paper to reveal a secret message. Is this an example of a chemical or physical change? Explain your observations and reasoning in your science notebook.</p>	<p><b>STATION 4</b></p> <p>At this station, measure 15 mL of vinegar into a cup containing one teaspoon of baking soda. Make observations about what happens in your science notebook. Is this a physical or chemical change? Explain your reasoning.</p>
<p><b>STATION 5</b></p> <p>With the light bulb off, examine what is inside. Now turn the light bulb on and see what happens. Is the light produced through a chemical or physical change? Explain your observations and reasoning in your science notebook.</p>	





## EXPLAIN

After students have visited all the stations, gather the group and facilitate a discussion about their observations. Which stations were chemical changes? Which were physical? How did they know (what evidence did they observe)?



### WATCH AS A GROUP THE GENERATION GENIUS CHEMICAL VS. PHYSICAL CHANGES VIDEO.

Then, facilitate a conversation using the Discussion Questions. Then return to your discussion about what the students observed in the stations. Does anyone want to change any of their answers? Why? Ask students to make notes in their Science Notebooks indicating what changes they made and why.



## ELABORATE

Use the DIY Activity so that students can now create their own secret message just like Zoe's from the video. Then, challenge the students to come up with other science tricks or pranks they might pull using chemical or physical reactions (for example, secret messages can also be made using soda or lemon juice and heat).



## EVALUATE

Students have observed the hydrogen peroxide/dish soap/yeast phenomena twice. Once during the Engage portion of the lesson, and again during the video. Yet, they have not determined if this phenomenon is the result of a physical or chemical reaction. Students should watch a video of the demonstration again and answer the following questions in their science notebook:

- What do you need to know to tell if this is a physical or chemical reaction? (To be able to tell if this reaction is physical or chemical, we need to know if the substance produced is a new substance.)
- What evidence have you observed in a physical change? Chemical change? (Students can make a chart in their notebook.)

How might you be able to investigate to find evidence that helps you determine whether this is a physical or chemical reaction? (We know that the substance in the tube was hydrogen peroxide and dish soap, but we don't know what the catalyst is. If we knew what the catalyst was, and we knew what the substance produced was, we would be able to tell if a new product was produced.)

Have the students turn in their science notebooks for your review. Then, at the end of class give them this exit ticket:

The foaming reaction happened when yeast and water (the catalyst) was poured into hydrogen peroxide, mixed with dish soap. The foaming was a result of oxygen bubbles and water being released from the hydrogen peroxide. Is this a physical or chemical change? (This is a chemical change—new substances were produced.)