

Lesson Topic: Chemical Reactions: Evidence of a Reaction

Objective:

Students will be able to:

1. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Time Required: 110 minutes

Materials Needed:

- Evidence of Chemical Reactions Lab Handout (1 per student)
- Baking soda
- Vinegar
- Yeast packets (10)
- Hydrogen Peroxide
- Solution of soap mixed in water
- Mineral water
- Alka-seltzer tablets
- Water
- Vitamin C tablets dissolved in water
- Iodine with dropper
- Spoons (5-7)
- Clear plastic cups (pack of 25 or so)
- 6 small beakers
- Salt
- Small beaker of water
- Piece of bread or a cracker
- Playdough
- Can of soda
- Mentos
- Piece of chocolate
- Station instructions (print 1 for each station)

Teacher Preparation:

- Prepare soap solution by mixing hand soap or dish soap in water
- Prepare Vitamin C solution by dissolving 2-3 Vitamin C tablets in water
- Set up stations around the room based on the Chemical Reactions lab include materials and station instructions (attached)
 - Station 1 - Box of baking soda, bottle of vinegar, thermometer, clear plastic cups (enough for 1/group), spoons (enough for 1/group), 1 small beaker
 - Station 2 - Yeast packets, bottle of hydrogen peroxide, liquid soap, thermometer, thermometer, clear plastic cups (enough for 1/group), 1 small beaker, spoons (enough for 1/group)
 - Station 3 - Soap solution, bottle of mineral water, thermometer, clear plastic cups (enough for 1/group), 2 small beakers
 - Station 4 - Alka seltzer tablets, large beaker of water, thermometer, clear

- plastic cups (enough for 1/group), 1 small beaker
- Station 5 - Vitamin C solution, liquid iodine, dropper, clear plastic cups (enough for 1/group), 1 small beaker
- Gather materials for the teacher demonstration in the Engage portion of the lesson
 - Salt
 - Small beaker of water
 - Piece of bread or a cracker
 - Playdough
 - Can of soda
 - Mentos
 - Piece of chocolate
 - Aluminum foil
 - Candle
- Make copies of the Evidence of Chemical Reactions Lab handout (1 per student).
- Assign a Legends of Learning Instructional [Quick Play](#) playlist for the end of the lesson.
 - Instructional - Middle School - Chemical Reactions: Evidence of a Reaction
- Assign a Legends of Learning Content Review [Quick Play](#) playlist for the end of the lesson.
 - Content Review - Middle School - Chemical Reactions: Evidence of a Reaction

Engage (15 minutes):

Safety note: *The teacher, not students, should perform these demonstrations.*

1. Tell students, “I am going to demonstrate 5 different changes to various materials. After each “change”, we will discuss whether you think the change is a physical change or chemical change”. After each demonstration, take a tally of student votes for physical or chemical change.
 - a. Stir salt into the beaker of water and have it dissolve
 - b. Place three drops of iodine on a piece of bread or cracker
 - c. Change the shape of playdough
 - d. Add a mento mint to a can of soda
 - e. Melt chocolate over a flame (set the chocolate in an aluminum foil boat, use the playdough as a stand for the candle, and move the aluminum foil back and forth over the flame to melt the chocolate)
2. Tell students that they will refer back to this list later in the lesson and see if the class votes change.

Explore (20 minutes):

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Instructional playlist.
2. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

Explain (15 minutes):

1. Review what students learned from the Legends of Learning playlist by going through [these slides](#) or writing the notes from the slides on the board.
2. Refer back to the 5 demonstrations at the beginning of the lesson. Once again, poll

the class on whether each change is a physical or chemical change. Have a student volunteer explain their reasoning for each change.

Elaborate (40 minutes):

1. Split your class into 5 groups and have each group go to a different station set up in the classroom. For large classes, you can make two of each station to allow for smaller group sizes.
2. Hand out the Evidence of Chemical Reactions Lab Handout to students.
3. Provide student groups 5-7 minutes at each station to follow the station instructions and complete the handout.
4. Have students rotate between all 5 stations.
5. Provide some extra time for students to complete the analysis questions after groups have visited all stations.

Evaluate (20 minutes):

1. Collect the Evidence of Chemical Reactions Lab Handout and evaluate for a grade if desired.
2. Assign a Legends of Learning Content Review [Quick Play](#) playlist for the end of the lesson.
 - a. Content Review - Middle School - Chemical Reactions: Evidence of a Reaction

Additional Lesson Strategies:

- To use Legends for additional instruction, create a [custom playlist](#) with an [instructional game](#) and pre and post [assessment](#).
- To use Legends for a quick formative assessment, create a 5-question [assessment](#) in a [playlist](#).
- To use Legends for a student-directed experience, create a [targeted freeplay](#) playlist.
- Encourage students to play on their own at home in [Legends of Learning: Awakening](#) for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.



Evidence for Chemical Reactions Lab

Name: _____

Date: _____

Follow the directions given at each lab station. Record your data from each station in the appropriate part of the lab sheet.

Station 1: Baking Soda and Vinegar

Description of Baking Soda: _____

Description of Vinegar: _____

Temperature of Vinegar Before Reaction: _____

Observations of Reaction: _____

Temperature of mixture after reaction: _____

Evidence that a chemical reaction has occurred:

- _____
- _____

Station 2: Yeast and Hydrogen Peroxide

Description of Yeast: _____

Description of Hydrogen Peroxide: _____

Temperature of Hydrogen Peroxide Before Reaction: _____

Observations of Reaction: _____

Temperature of mixture after reaction: _____

Evidence that a chemical reaction has occurred:

- _____
- _____

Station 3: Soap Solution and Hard Water

Description of Soap Solution: _____

Description of Hard Water: _____

Temperature of Hard Water Before Reaction: _____

Observations of Reaction: _____

Temperature of mixture after reaction: _____

Evidence that a chemical reaction has occurred:

- _____

Station 4: Alka-Seltzer and Water

Description of Alka-Seltzer tablet: _____

Temperature of Water Before Reaction: _____

Observations of Reaction: _____

Temperature of mixture after reaction: _____

Evidence that a chemical reaction has occurred:

- _____
- _____

Station 5: Vitamin C and Iodine

Description of Vitamin C tablet: _____

Description of Iodine: _____

Temperature of Water with dissolved Vitamin C Before Reaction: _____

Observations of Reaction: _____

Temperature of mixture after reaction: _____

Evidence that a chemical reaction has occurred:

- _____

Analysis Questions:

- 1) How do you know when a chemical reaction has occurred?

- 2) You boil some water on the stove to cook dinner. Is boiling water a physical or chemical change? How do you know?

- 3) Classify the following as a physical or chemical change:

milk going sour: _____	closing a door: _____
burning oil: _____	breaking an egg: _____
melting ice: _____	grinding coffee beans: _____
rusting iron: _____	tarnishing of a spoon: _____



Evidence for Chemical Reactions Lab KEY

Station 1: Baking Soda and Vinegar

Description of Baking Soda: **White powder**

Description of Vinegar: **Clear liquid, strong odor**

Temperature of Vinegar Before Reaction: **Varies, about room temperature**

Observations of Reaction: **Fizzing/bubbles, noisy, rises up**

Temperature of mixture after reaction: **Students should note it cools down**

Evidence that a chemical reaction has occurred:

- **Formation of gas**
- **Temperature change**

Station 2: Yeast and Hydrogen Peroxide

Description of Yeast: **Small granules, brown**

Description of Hydrogen Peroxide: **Clear liquid, slight odor**

Temperature of Hydrogen Peroxide Before Reaction: **Varies, about room temperature**

Observations of Reaction: **Foam is created and rises up**

Temperature of mixture after reaction: **Students should note it warms up**

Evidence that a chemical reaction has occurred:

- **Formation of gas**
- **Temperature change**

Station 3: Soap Solution and Hard Water

Description of Soap Solution: **Slightly murky liquid**

Description of Hard Water: **Clear liquid**

Temperature of Hard Water Before Reaction: **Varies, about room temperature**

Observations of Reaction: **A substance is formed when you mix the two solutions**

Temperature of mixture after reaction: **Varies, about room temperature**

Evidence that a chemical reaction has occurred:

- **Precipitate is formed**

Station 4: Alka-Seltzer and Water

Description of Alka-Seltzer tablet: **Small, round, white tablet, chalky**

Temperature of Water Before Reaction: **Varies, about room temperature**

Observations of Reaction: **Bubbles form in water**

Temperature of mixture after reaction: **Students should note temperature decrease**

Evidence that a chemical reaction has occurred:

- **Formation of gas**
- **Temperature Change**

Station 5: Vitamin C and Iodine

Description of Vitamin C solution: **Clear solution with some undissolved pieces of Vitamin C visible**

Description of Iodine: **Liquid, brown/red color**

Temperature of Water with dissolved Vitamin C Before Reaction: **Varies, about room temperature**

Observations of Reaction: **Iodine turns from brown/red color to clear when put into solution**

Temperature of mixture after reaction: **Varies, about room temperature**

Evidence that a chemical reaction has occurred:

- **Color change**

Analysis Questions:

- 2) How do you know when a chemical reaction has occurred? **You know a chemical reaction has occurred if a gas is formed, if the temperature changes, if an odor is produced, or if a precipitate is formed**
- 3) You boil some water on the stove to cook dinner. Is boiling water a physical or chemical change? How do you know? **Physical change because the water does not change into something else. It is still water, just in a different state of matter**
- 4) Classify the following as a physical or chemical change:
milk going sour: **chemical** closing a door: **physical**
burning oil: **chemical** breaking an egg: **physical**
melting ice: **physical** grinding coffee beans: **physical**
rusting iron: **chemical** tarnishing of a spoon: **chemical**



Station Instructions

Station 1 - Baking Soda and Vinegar

1. Observe the vinegar and baking soda. Write down your observations of these two substances on your lab sheet.
2. Measure 30ml of vinegar in the small beaker and pour into a clean plastic cup.
3. Use the thermometer to take the temperature of the vinegar. Record on your lab sheet.
4. Using a spoon, scoop one spoonful of baking soda into your cup of vinegar.
5. Observe the reaction and write your observations on your lab sheet.
6. Use the thermometer to take the temperature of the mixture after the reaction stops. Record on your lab sheet.
7. On your lab sheet, write your evidence that a chemical reaction has occurred.

Station 2 - Yeast and Hydrogen Peroxide

1. Observe the yeast and hydrogen peroxide. Write down your observations of these two substances on your lab sheet.
2. Measure 30ml of hydrogen peroxide in the small beaker and pour into a clean plastic cup.
3. Squeeze a small amount of soap into the hydrogen peroxide and gently stir with a spoon.
4. Use the thermometer to take the temperature of the hydrogen peroxide and soap mixture. Record on your lab sheet.
5. Using a spoon, scoop one spoonful of yeast into your cup of hydrogen peroxide solution and stir.
6. Observe the reaction and write your observations on your lab sheet.
7. Use the thermometer to take the temperature of the mixture after the reaction stops. Record on your lab sheet.
8. On your lab sheet, write your evidence that a chemical reaction has occurred.

Station 3 - Soap Solution and Hard Water

1. Observe the soap solution and hard water. Write down your observations of these two substances on your lab sheet.
2. Measure 30ml of hard water in a small beaker and pour into a clean plastic cup.
3. Use the thermometer to take the temperature of the hard water. Record on your lab sheet.
4. Measure 30ml of the soap solution in a different small beaker and pour into your cup of hard water.
5. Observe the reaction and write your observations on your lab sheet.
6. Use the thermometer to take the temperature of the mixture after the reaction stops. Record on your lab sheet.
7. On your lab sheet, write your evidence that a chemical reaction has occurred.

Station 4 - Alka-Seltzer and Water

1. Observe the Alka-Seltzer tablet. Write down your observations of the tablet on your lab sheet.
2. Measure 30ml of water in a small beaker and pour into a clean plastic cup.
3. Use the thermometer to take the temperature of the water. Record on your lab sheet.
4. Place one Alka-seltzer tablet into your cup of water.
5. Observe the reaction and write your observations on your lab sheet.
6. Use the thermometer to take the temperature of the mixture after the reaction stops. Record on your lab sheet.
7. On your lab sheet, write your evidence that a chemical reaction has occurred.

Station 5 - Vitamin C and Iodine

1. Observe the Vitamin C solution and iodine. Write down your observations of the two substances on your lab sheet.
2. Measure 30ml of the Vitamin C solution in a small beaker and pour into a clean plastic cup.
3. Use the thermometer to take the temperature of the Vitamin C solution. Record on your lab sheet.
4. Using the dropper, slowly place 5 drops of iodine into your cup of Vitamin C solution, observing what happens after each drop.
5. Observe the reaction and write your observations on your lab sheet.
6. Use the thermometer to take the temperature of the mixture after the reaction stops. Record on your lab sheet.
7. On your lab sheet, write your evidence that a chemical reaction has occurred.