

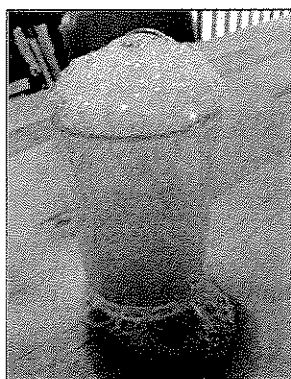
Name: \_\_\_\_\_

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## Student Exploration: Chemical Changes

**Vocabulary:** acid, base, catalyst, chemical change, coefficient, conservation of matter, decomposition, dissolve, double replacement, endothermic, exothermic, indicator, ion, physical change, product, reactant, single replacement, subscript, synthesis

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)



1. A student mixes baking soda and vinegar in a glass. The results are shown at left. Do you think any new substances are being created in this mixture? If so, how do you know?

\_\_\_\_\_

\_\_\_\_\_

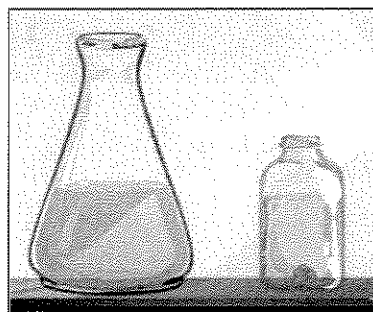
2. Suppose this was done on top of a balance. Do you think the mass would change as the reaction proceeded? \_\_\_\_\_

3. What do you think would happen to the mass if the reaction took place inside a sealed plastic bag? \_\_\_\_\_

### Gizmo Warm-up

A **chemical change**, (or chemical reaction) occurs when one or more substances, called **reactants**, are transformed into different substances, or **products**. In the *Chemical Changes* Gizmo, you will look for evidence of chemical changes by looking at changes you can see, touch, or smell.

To begin, check that **Reactant 1** is **Sodium** and **Reactant 2** is **Water**. Sodium is a metal so soft you can cut it with a knife.

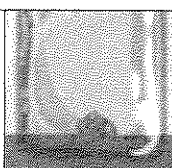


1. Click **Play** (▶). What do you observe? \_\_\_\_\_

\_\_\_\_\_

2. Do you think a chemical reaction has taken place? Explain. \_\_\_\_\_

\_\_\_\_\_

<b>Activity A:</b>  <b>Observing chemical changes</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Click <b>Reset</b> (↺). Check that the reactants are still <b>Sodium</b> and <b>Water</b>.</li> <li>Turn on the <b>Label reactants</b> checkbox.</li> </ul>	
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**Introduction:** It is important to distinguish chemical changes, in which new substances are formed, from **physical changes**, which do not create new substances. In this activity, you will look at many kinds of evidence that chemists use to see if a chemical change has taken place.

**Question: What kinds of evidence indicate a chemical change has taken place?**

- Observe:** Some chemical reactions release heat, and others absorb heat. In an **exothermic** reaction, heat is released and the temperature of the system rises. In an **endothermic** reaction, heat is absorbed and the temperature of the system decreases.

In the Gizmo, drag the **Thermometer** into the flask of water.

- What is the starting temperature? \_\_\_\_\_
  - Click **Play**, and wait for the reaction to end. What is the final temperature? \_\_\_\_\_
  - Was this reaction exothermic or endothermic? \_\_\_\_\_
- Observe:** Two families of chemicals are **acids** and **bases**. Acids and bases can be detected by an **indicator**, which is a substance that changes color in the presence of an acid or a base. Phenol red is an indicator that is yellow in an acid, orange in a neutral solution, and pink in a base.

- Click **Reset**. Drag the **Phenol red** next to the flask of water. What does the indicator show? \_\_\_\_\_
- Click **Play**, and wait for the reaction to end. What does the indicator show now?  
\_\_\_\_\_

- Observe:** Click **Reset**. Select the **Gas collection** setup. Chemists use this apparatus to collect any gases produced in the reaction. From the reaction flask, gases travel through a long tube and into a cylinder of water. As gases bubble into the cylinder, the water is displaced (removed) until the cylinder is filled with gas.

Click **Play** and observe the cylinder. Was any gas produced in the reaction? \_\_\_\_\_

How do you know? \_\_\_\_\_

**(Activity A continued on next page)**



**Activity A (continued from previous page)**

4. **Analyze:** One way to test what kind of gas is in the cylinder is to use a glowing splint. A glowing splint is a wooden stick that has been lit on fire and then blown out, resulting in a glowing, red-hot tip. The table shows how a glowing splint reacts to some common gases:

<b>Gas:</b>	Carbon dioxide (CO <sub>2</sub> ) or ammonia (NH <sub>3</sub> )	Oxygen (O <sub>2</sub> )	Hydrogen (H <sub>2</sub> )
<b>Splint reaction:</b>	Goes out	Burns brightly	Small explosion and "pop" sound

- A. Drag the glowing splint next to the cylinder, and observe. What do you see?

\_\_\_\_\_

- B. Based on the table above, what gas do you think was produced in this reaction?

\_\_\_\_\_

5. **Interpret:** Turn on **Show chemical equation**. A chemical equation is a shorthand way to describe a chemical reaction. Symbols represent the elements: H for hydrogen, O for oxygen, and Na for sodium. The reactants are to the left of the arrow, and the products are to the right. For example, the equation  $H_2 + O_2 \rightarrow H_2O$  shows that the reactants hydrogen and oxygen combine to form the product H<sub>2</sub>O, or water.

- A. Look at the reaction shown in the Gizmo. What are the reactants in this reaction?

\_\_\_\_\_

- B. What are the products in this reaction? \_\_\_\_\_

These symbols represent sodium hydroxide and hydrogen gas. Sodium hydroxide is a strong base. (Chemicals that contain the hydroxide **ion** (OH<sup>-</sup>) are bases.)

- C. How do the products of the reaction relate to the phenol red test and the splint test?

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\_\_\_\_\_  
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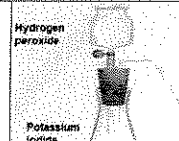


**Activity B:**

**Conservation of matter**

Get the Gizmo ready:

- Click **Reset**. Select **Hydrogen peroxide** for **Reactant 1** and **Potassium iodide** for **Reactant 2**.



**Goal: How does the mass change (or not change) during a chemical reaction?**

1. Review: In this reaction, hydrogen peroxide is added to a potassium iodide solution. Click **Play** and observe the reaction.

A. What do you observe? \_\_\_\_\_

B. What evidence do you see that a chemical reaction is taking place? \_\_\_\_\_  
\_\_\_\_\_

C. Replay the reaction and use the available tools (**Thermometer**, **Phenol red**, and **Glowing splint**.) What do these tools indicate? (Note: You will need to switch to the **Gas collection** setup to use the splint.)

Thermometer: \_\_\_\_\_

Phenol red: \_\_\_\_\_

Glowing splint: \_\_\_\_\_

2. Record: Click **Reset**, and change back to the **Normal setup**. Notice the mass shown on the electronic balance.

A. What is the starting mass for this reaction? \_\_\_\_\_

B. Click **Play**. What is the mass when the reaction has finished? \_\_\_\_\_

C. How does the mass change in this reaction? \_\_\_\_\_

3. Record: Click **Reset**, and select the **Gas collection** setup. Notice that this setup is heavier than the normal setup, but the amounts of reactants is the same.

A. What is the starting mass for this reaction? \_\_\_\_\_

B. How do you think the mass will change during the reaction? \_\_\_\_\_  
\_\_\_\_\_

C. Click **Play**. What is the mass when the reaction has finished? \_\_\_\_\_

**(Activity B continued on next page)**

