Name: _____

# Student Exploration: Chemical Changes

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If needed: P1: **ZYK2YGT4K2** P4: **PPXTNBMQWH**

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|---|---|---|
| **Activity:**<br><br>**Types of reactions** | Get the Gizmo ready:<br>• Click **Reset**. Select **Normal setup**.<br>• Select **Sodium** for **Reactant 1** and **Chlorine** for **Reactant 2**. |  |

**Goal: Explore, observe, and classify a variety of chemical reactions.**

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

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.

1. Observe: In this reaction, a small piece of sodium is added to a flask containing poisonous chlorine gas which has a yellowish color, and sand. Water is added to start the reaction.

   A. Click **Play**. What happens? _____

   _____

   B. Try the experiment with the **Thermometer**. Is the reaction exothermic or endothermic? _____

   How do you know?

   C. Run the experiment one more time, this time watching the mass. What do you notice? _____

   _____

   D. Repeat the experiment, this time in the **Closed system**. How does the mass change during the reaction now? _____

2. Challenge: Turn on **Show chemical equation**. In this reaction, solid sodium reacts with chlorine gas to form solid sodium chloride (NaCl), also known as table salt.

   How does this explain the normal setup increase in mass during the reaction? _____

   _____

3. Observe: Select **Ammonium nitrate** for **Reactant 1** and **Water** for **Reactant 2**. Add the **Thermometer** to the flask and click **Play**.

   A. What do you observe? _____

B. Is this process exothermic or endothermic? _____

C. What is the equation for this process? _____

In this example, ammonium nitrate ($NH_4NO_3$) **dissolves** in water, producing ammonium ($NH_4^+$) and nitrate ($NO_3^-$) ions. Chemists do not all agree about whether this is an example of a physical change or a chemical change.

4. Classify: There are many types of chemical reactions. Four are described below:

   - **Synthesis**: Two or more reactants combine to form a single product. For example, $2H_2 + O_2 \rightarrow 2H_2O$. (Synthesis reactions are also called *combination* reactions.)
   - **Decomposition**: One reactant breaks down to form two or more products. For example, $2KCl \rightarrow 2K + Cl_2$.
   - **Single replacement:** An element reacts with a compound to form another element and compound. For example, $Zn + 2HCl \rightarrow ZnCl_2 + H_2$.
   - **Double replacement**: Two compounds react to form two different compounds. For example, $FeS + 2HCl \rightarrow FeCl_2 + H_2S$.

   Using the Gizmo, find an example of each type of reaction.

   Synthesis: _____ Decomposition: _____

   Single replacement: _____

   Double replacement: _____

5. Explore: Find an example of each of the following in the Gizmo:

   A. An example of *no* chemical reaction occurring: _____

   B. A reaction that produces an acid: _____

   C. A reaction that produces a base: _____

   D. A reaction that uses a catalyst: _____

6. Demonstrate learning: Choose an interesting reaction in the Gizmo. Use the available tools to make observations, and use what you have learned so far to draw conclusions about the reaction. Describe your findings below.

   Reaction: _____

   Findings: _____

_____

*Complete assessment questions at end of GIZMO*