



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

Date: \_\_\_\_\_

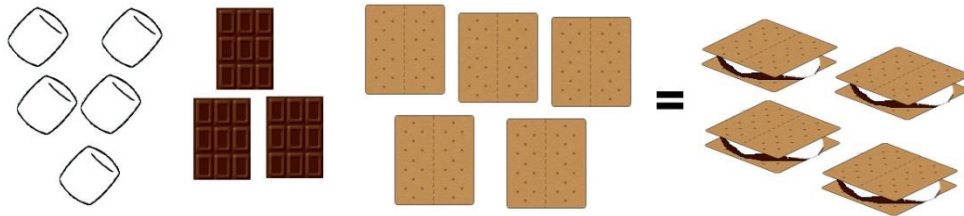
## Student Exploration: Balancing Chemical Equations

**Vocabulary:** coefficient, combustion, compound, decomposition, double replacement, element, molecule, product, reactant, single replacement, subscript, synthesis

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

The scouts are making s'mores out of toasted marshmallows, chocolate, and graham crackers.

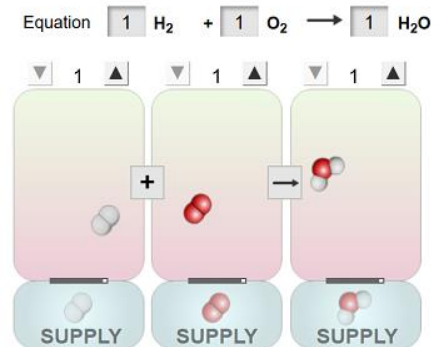
1. What is wrong with the image below? \_\_\_\_\_



2. Assuming a s'more requires two graham crackers, one marshmallow, and one piece of chocolate, how many s'mores could you make with the ingredients shown? \_\_\_\_\_

### Gizmo Warm-up

In a chemical reaction, **reactants** interact to form **products**. This process is summarized by a chemical equation. In the *Balancing Chemical Equations* Gizmo, look at the floating molecules below the initial reaction:  $H_2 + O_2 \rightarrow H_2O$ .



1. How many atoms are in a hydrogen **molecule** ( $H_2$ )? \_\_\_\_\_


2. How many atoms are in an oxygen molecule ( $O_2$ )? \_\_\_\_\_

3. How many hydrogen and oxygen atoms are in a water molecule ( $H_2O$ )? \_\_\_\_\_

4. In general, what does a **subscript** (such as the "2" in  $H_2$ ) tell you about the molecule?  
\_\_\_\_\_

5. A chemical equation is *balanced* if the number of each type of atom on the left side is equal to the number of each type on the right side. Is this reaction balanced? \_\_\_\_\_



<b>Activity A:</b> <b>Balancing equations</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Check that the <b>Synthesis</b> reaction is selected and that all <b>coefficients</b> are set to one. (The coefficients are the numbers in the boxes.)</li> </ul>	
--	--	---

**Introduction:** The equation  $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$  is unbalanced because there are two oxygen atoms on the reactants side of the equation, and only one on the products side of the equation. To balance the equation, you cannot change the structure of any of the molecules, but you can change the number of molecules that are used.

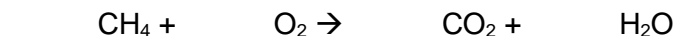
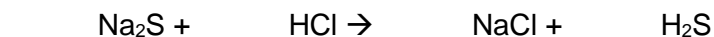
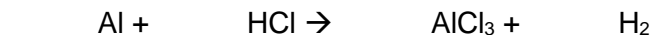
**Question: How are chemical equations balanced?**

- Balance:** Turn on **Show histograms**. The equation is balanced when there are equal numbers of each type of atom represented on each side of the equation.

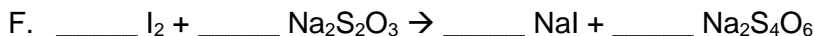
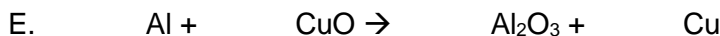
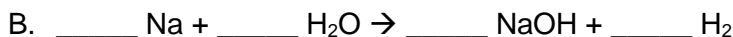
In the Gizmo, use the up and down arrows to adjust the numbers of hydrogen, oxygen, and water molecules until the equation is balanced. When you are done, turn on **Show summary** to check your answer.

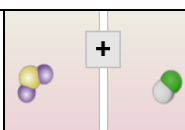
Write the balanced equation here: \_\_\_\_\_  $\text{H}_2$  + \_\_\_\_\_  $\text{O}_2 \rightarrow$  \_\_\_\_\_  $\text{H}_2\text{O}$

- Solve:** Turn off **Show summary**. Use the **Choose reaction** drop down menu to see other equations, and balance them. Check your answers and then write the balanced equations.



- Practice:** Balance the following chemical equations. (These equations are not in the Gizmo.)



<b>Activity B:</b> <b>Classifying reactions</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>• Turn off <b>Show summary</b> and <b>Show histograms</b>.</li> </ul>	
--	--	---

**Introduction:** Chemical equations show how **compounds** and **elements** react with one another. An element is a substance consisting of one kind of atom, such as aluminum (Al) or oxygen gas (O<sub>2</sub>). A compound is a substance made of more than one kind of atom, such as water (H<sub>2</sub>O) or table salt (NaCl).

**Question: How are chemical reactions classified?**

1. Match: Most chemical reactions can be classified as one of four types. Using the chemical equations in the Gizmo as a guide, match the following definitions to the type of reaction.

- |   |                              |
|---|------------------------------|
| _____ One reactant is broken down into two or more products.                            | A. <b>Synthesis</b>          |
| _____ A fuel is combined with oxygen to produce carbon dioxide and water.               | B. <b>Decomposition</b>      |
| _____ Two or more reactants combine to form one product.                                | C. <b>Single replacement</b> |
| _____ Two compounds react to form two different compounds.                              | D. <b>Double replacement</b> |
| _____ A compound reacts with an element to form a new compound and a different element. | E. <b>Combustion</b>         |

2. Practice: Balance each of the chemical equations below. (Some equations may already be in balance.) In the space to the right, classify the reaction as a *synthesis*, *decomposition*, *single replacement*, or *double replacement* reaction.

- |  |       |
|--|-------|
| A. ___ AgNO <sub>3</sub> + ___ KCl → ___ AgCl + ___ KNO <sub>3</sub>   | _____ |
| B. ___ H <sub>2</sub> O + ___ SO <sub>3</sub> → ___ H <sub>2</sub> SO <sub>4</sub>                           | _____ |
| C. ___ KI + ___ Cl <sub>2</sub> → ___ KCl + ___ I <sub>2</sub>   | _____ |
| D. ___ NaHCO <sub>3</sub> → ___ Na <sub>2</sub> CO <sub>3</sub> + ___ H <sub>2</sub> O + ___ CO <sub>2</sub> | _____ |
| E. ___ Zn + ___ HCl → ___ ZnCl <sub>2</sub> + ___ H <sub>2</sub>   | _____ |
| F. ___ BaCl <sub>2</sub> + ___ Na <sub>2</sub> SO <sub>4</sub> → ___ BaSO <sub>4</sub> + ___ NaCl            | _____ |
| G. ___ C <sub>3</sub> H <sub>8</sub> + ___ O <sub>2</sub> → ___ CO <sub>2</sub> + ___ H <sub>2</sub> O       | _____ |
| H. ___ Al + ___ CuCl <sub>2</sub> → ___ AlCl <sub>3</sub> + ___ Cu   | _____ |

