

## Science Objectives

- Students will learn the difference between reactants and products in chemical reactions.
- Students will learn about the two types of reactions: physical and chemical.
- Students will understand how balanced chemical equations relate to the Law of Conservation of Mass.
- Students will learn how to read coefficients and subscripts in chemical symbols.
- Students will practice balancing chemical equations.

## Vocabulary

- Reactions
- Chemical symbol
- Chemical formula
- Coefficient
- Subscript
- Reactants
- Products
- Law of Conservation of Mass

## About the Lesson

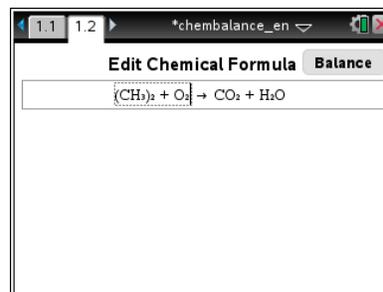
- In this activity, students will balance chemical equations using a balancing tool on their handheld.
- As a result, students will:
  - Understand the relationship between chemical reactants and products.
  - Understand how chemical equations are balanced.

## TI-Nspire™ Navigator™

- Send out the *chembalance\_en.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

## Activity Materials

- *chembalance\_en.tns* document
- TI-Nspire™ Technology



### TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Use an expression box

**Tech Tips:** Tell students to properly capitalize the formulas and molecules on each side of the equation. CL on one side of the equation will not match up against CI on the other side of the equation.

### Lesson Materials:

#### *Student Activity*

- Chemical\_Balance\_Student.doc
- Chemical\_Balance\_Student.pdf

#### *TI-Nspire document*

- chembalance\_en.tns

## Discussion Points and Possible Answers

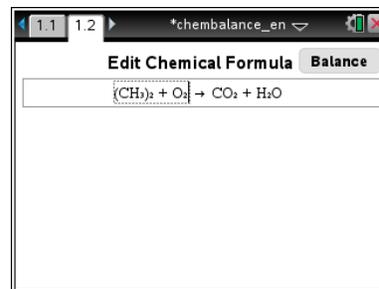
Have students read the background information stated on their activity sheet. Have students practice using the chemical equation balance tool on their handheld using the following two examples.

It is a good idea to have a periodic table available for chemical symbol identification.

### Move to page 1.2.

#### Example 1:

Have students look at the chemical equation on the screen and ask if it looks balanced.



Here are the key steps in balancing equations using your handheld. The **Edit** button lets you enter or edit the chemical equation. The **Balance** button lets you balance the chemical equation. You can toggle between the two modes by clicking those buttons or pressing **enter**.

**Note:** You may want to review these steps as a class.

**Edit** mode:

- Enter the reactants in the area to the left, and enter the products in the area to the right.
- Enter a plus (+) sign to separate the elements.
- Use the **tab** key to move between the left and right hand side of the chemical equation. You cannot adjust the  $\rightarrow$  sign.

**Balance** mode:

- Click the up or down arrows to adjust the coefficients of each element until the formula is balanced.

Built-in rules:

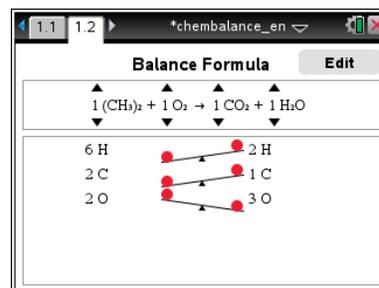
- Leading digits are treated as a multiplier for the molecule and are displayed in regular-sized characters.
- An integer immediately following an alphabetic character or closing parenthesis is automatically converted to subscript. This indicates the number of atoms or group of atoms in a molecule.
- Entering (s), (l), (g), or (aq) after the compound indicates its state: solid, liquid, gas, aqueous.
- You can paste the chemical elements from text documents into either the reactants box or the products box in the Chemical Balance document.



**Tech Tip:** If using the TI-Nspire™ computer software, students can paste the chemical elements from the activity sheet into either the reactants box or the products box in the Chemical Balance tool.

**Example 2:**

There are two reactants on the left side, which change to form products on the right side. The elemental concentrations on the left side do **not** equal the elemental concentrations on the right side, which means the equation is **not** balanced. To balance the equation:

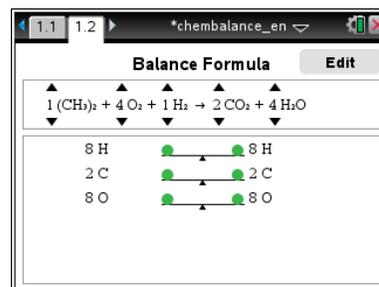


1. Click **Balance**.

Q1. What do the red dots represent? What do you notice about the numbers on each side of the red dots?

**Answer:** an unbalanced equation; the numbers are not equal

2. Students can click the up or down arrows (▲ or ▼) that are above or below the element or compound to alter the number of molecules. They are to balance the equation by changing O<sub>2</sub> to 4, CO<sub>2</sub> to 2, and H<sub>2</sub>O to 4.



3. Then students click **Edit**. Add H<sub>2</sub> to the expression on the left side. Then click **Balance**.

Q2. What do the green dots represent? What do you notice about the numbers on each side of the green dots?

**Answer:** a balanced equation; the numbers are equal

**Tech Tip:** The Chemical Balance tool only allows a maximum of three reactants and three products.

**TI-Nspire™ Navigator™ Opportunities**

Use *Class Capture* to make sure that all students understand how to correctly go through the steps of balancing chemical equations.



**Teacher Tip:** The first set of reactions are physical and may require some review regarding changes in states of matter. The first set of questions all deal with the changes in water.

## Chemical Reactions

Q3. Identify the relationship between “reactants” and “products” in chemical equations.

**Answer:** Reactants are on the left side of a chemical equation. Reactants undergo chemical changes to become new products. Products are on the right side of chemical equations. Due to the Law of Conservation of Mass, the amount of each element in the reactants must equal the amount of each element in the products.

Q4. Consider the chemical equation:  $\text{CuO (s)} + \text{H}_2\text{(g)} \rightarrow \text{Cu(s)} + \text{H}_2\text{O(g)}$

A. Using a periodic table, what are the element names for each of the chemical symbols?

**Answer:** Cu = Copper, O = Oxygen, H = Hydrogen

B. What do the (s) and (g) symbols next to the chemicals represent in this equation?

**Answer:** (s) = solid phase, (g) = gaseous phase

C. How many atoms of each element are represented on each side of the equation?

**Answer:** Cu = Has one molecule, O = Has one molecule, H = Has two molecules

D. Is this equation balanced? Why or why not?

**Answer:** Yes, this equation is balanced. Equations are said to be balanced when there are the same number of atoms from each element on both sides of the arrow.



Q5. Using the Chemical Balance tool, balance the chemical equations in the table below.

| <b>Chemical Equation</b>   | <b>Balanced Chemical Equation</b>  |
|--|--|
| $\text{Zn} + \text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$                                  | $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$                                   |
| $\text{S}_4 + \text{F}_2 \rightarrow \text{SF}_6$  | $\text{S}_4 + 12\text{F}_2 \rightarrow 4\text{SF}_6$   |
| $\text{H}_2\text{SO}_4 + \text{Fe} \rightarrow \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2$          | $3\text{H}_2\text{SO}_4 + 2\text{Fe} \rightarrow \text{Fe}_2(\text{SO}_4)_3 + 3\text{H}_2$         |
| $\text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$ | $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O}$ |
| $\text{KOH} + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + \text{H}_2\text{O}$      | $3\text{KOH} + \text{H}_3\text{PO}_4 \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O}$      |
| $\text{Au}_2\text{S}_3 + \text{H}_2 \rightarrow \text{Au} + \text{H}_2\text{S}$                  | $\text{Au}_2\text{S}_3 + 3\text{H}_2 \rightarrow 2\text{Au} + 3\text{H}_2\text{S}$                 |
| $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$                 | $2\text{C}_2\text{H}_6 + 7\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 4\text{CO}_2$               |
| $\text{SiO}_2 + \text{HF} \rightarrow \text{SiF}_4 + \text{H}_2\text{O}$                         | $\text{SiO}_2 + 4\text{HF} \rightarrow \text{SiF}_4 + 2\text{H}_2\text{O}$                         |
| $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2 + \text{O}_2 + \text{H}_2\text{O}$                | $\text{NH}_4\text{NO}_3 + \text{O}_2 \rightarrow 2\text{N}_2 + 2\text{O}_2 + 4\text{H}_2\text{O}$  |
| $\text{Mg}_3\text{N}_2 + \text{H}_2\text{O} \rightarrow \text{MgO} + \text{NH}_3$                | $\text{Mg}_3\text{N}_2 + 3\text{H}_2\text{O} \rightarrow 3\text{MgO} + 2\text{NH}_3$               |

### TI-Nspire™ Navigator™ Opportunities

Have students work out individual chemical equations such as cellular respiration which is the opposite of photosynthesis, and then review the steps together as a class. Use Class Capture to monitor students' progress through the lesson. Use Quick Poll to send formative assessment questions during the lesson.

### Wrap Up

When students are finished with the activity, retrieve the .tns file using TI-Nspire™ Navigator™. Save grades to Portfolio. Discuss activity questions using Slide Show.

### Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test.