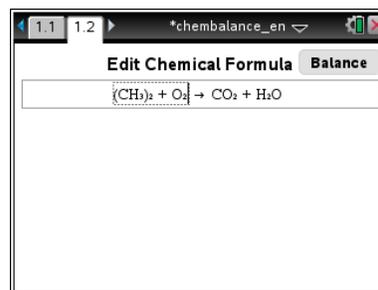




Open the TI-Nspire document *chembalance_en.tns*.



Do you recognize the chemical equation above? It is the equation for photosynthesis—one of the most important processes on Earth! The equation allows us to see the chemical formulas of the compounds involved in the process. During photosynthesis, organisms that contain chlorophyll utilize carbon dioxide (CO_2) and water (H_2O) in the presence of light to make glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) and oxygen (O_2).



The letters in each of the compounds represent elements found on the periodic table. An element may be represented by one capital letter such as (H) for Hydrogen or one capital letter and one lowercase letter such as (Zn) for Zinc. The numbers appearing as *subscript* in a chemical equation indicate the number of atoms of the particular element. In some chemical equations there are large numbers preceding the chemical symbol. These large numbers are called *coefficients* and they represent the total amount of each chemical present in the equation. Equations are said to be balanced when there are the same number of atoms from each element on both sides of the arrow.

There are two general types of reactions, physical and chemical. Physical reactions are reactions where no chemical bonds are broken or formed, and the molecular identities of the substances have not changed. Chemical reactions result in chemical or substance changes. These changes occur at the molecular level with atoms or groups of atoms that rearrange, resulting in different chemical compounds.

In the photosynthesis reaction, $\text{CO}_2 + \text{H}_2\text{O}$ are on the left side of the arrow and are the *reactants*. Reactants undergo changes (demonstrated by the arrow) to become newly formed *products*, $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$ (on the right side of the arrow). In all chemical reactions, the amount of the reactants has to equal the amount of products, due to The *Law of Conservation of Mass*.

You will be using the Chemical Balance tool to learn about balancing chemical equations.

On page 1.1, you will see a list of directions explaining how to use the significant figure tool. Look over these and check with your classmates and teacher to discuss any items you do not understand.

NOTE: Be careful 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.

NOTE: *It is a good idea to have a periodic table available for chemical symbol identification purposes.*



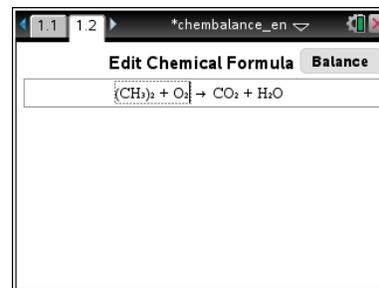
Move to page 1.2.

Example 1:

Look at the chemical equation on the screen. Does it look balanced?

HINT: If you count up the number of each element listed on the left side, does this number correspond to the same number for each element on the right side? If not, the equation ISN'T balanced and the number of molecules of each compound has to be adjusted until the equation is balanced.

Press **ctrl** **▶** and **ctrl** **◀** to navigate through the lesson.



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**.

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 → sign.

Balance mode:

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

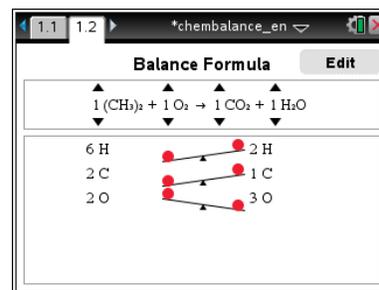
Built-in rules:

- A number in front of a molecule is a multiplier for the molecule and is displayed in regular-sized font.
- A number immediately following a letter or closing parenthesis is automatically changed to subscript. This shows 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 copy (**ctrl** **C**) and paste (**ctrl** **V**) the chemical elements from text documents into either the reactants box or the products box in the Chemical Balance document.



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?

2. Click the up or down arrows (▲ or ▼) that are above or below the element or compound to alter the number of molecules. Balance the equation by changing O₂ to 4, CO₂ to 2, and H₂O to 4.

3. Click **Edit** . Add H₂ 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?

NOTE: The equation balancer only supports a maximum of three reactants and three products.

Chemical Reactions

Using your knowledge of balancing chemical equations, answer the following questions. Remember to use vocabulary terms including Law of Conservation of Mass, reactants and products.

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

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?



Chemical Balance

Student Activity

Name _____

Class _____

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

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

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

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

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