LESSON MAKER PRO

Atom Count Check

Balance equations without changing a substance's formula.

HIGH SCHOOL · CHE.3.a

CHE.3.a "Use qualitative and quantitative reasoning to describe and balance chemical equations to satisfy the law of conservation of matter."

NAME _____ DATE _____

COUNT BEFORE YOU BALANCE

Matter is conserved in a chemical reaction, so each element must have the same number of atoms on both sides of the equation. Change coefficients in front of formulas to balance the atoms, but never change subscripts inside a formula.

WORKED EXAMPLE

Balance $NH_3 + O_2 \rightarrow NO + H_2O$.

1. Put 4 before NH_3 and NO to give each side 4 nitrogen atoms.
2. The 4 NH_3 molecules have 12 hydrogen atoms, so put 6 before H_2O.
3. The products now have 10 oxygen atoms total, so put 5 before O_2.

Answer: $4\,NH_3 + 5\,O_2 \rightarrow 4\,NO + 6\,H_2O$

PRACTICE 6 problems

1 Balance $H_2 + O_2 \rightarrow H_2O$. Write the full equation using the smallest whole-number coefficients.

ANSWER _____

2 Balance $Na + Br_2 \rightarrow NaBr$. Write the full equation using the smallest whole-number coefficients.

ANSWER _____

3 Balance $Mg + N_2 \rightarrow Mg_3N_2$. Write the full equation using the smallest whole-number coefficients.

ANSWER _____

4 Balance $Fe + O_2 \rightarrow Fe_2O_3$. Write the full equation using the smallest whole-number coefficients.

ANSWER _____

5 Balance $C_2H_4 + O_2 \rightarrow CO_2 + H_2O$. Write the full equation using the smallest whole-number coefficients.

ANSWER _____

6 Balance $Na_2CO_3 + HCl \rightarrow NaCl + H_2O + CO_2$. Write the full equation using the smallest whole-number coefficients.

ANSWER _____

APPLY IT Show your work

1 A food truck grill burns propane, C_3H_8, in oxygen to produce carbon dioxide and water. Balance $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$. Then find how many O_2 molecules react with 2 propane molecules.

WORK SPACE

ANSWER _____

2 A car's catalytic converter changes carbon monoxide, CO, into carbon dioxide, CO_2, using oxygen, O_2. Balance $CO + O_2 \rightarrow CO_2$. If 8 CO molecules react, how many O_2 molecules are needed?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student writes $C_2H_6 + O_2 \rightarrow 2\ CO_2 + 3\ H_2O$. Does this equation conserve matter? Compare the atom counts on both sides, then write the balanced equation using the smallest whole-number coefficients.

WORK SPACE AND ANSWER

Atom Count Check

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Balance $H_2 + O_2 \rightarrow H_2O$. Write the full equation using the smallest whole-number coefficients.	**$2\ H_2 + O_2 \rightarrow 2\ H_2O$**
2	Balance $Na + Br_2 \rightarrow NaBr$. Write the full equation using the smallest whole-number coefficients.	**$2\ Na + Br_2 \rightarrow 2\ NaBr$**
3	Balance $Mg + N_2 \rightarrow Mg_3N_2$. Write the full equation using the smallest whole-number coefficients.	**$3\ Mg + N_2 \rightarrow Mg_3N_2$**
4	Balance $Fe + O_2 \rightarrow Fe_2O_3$. Write the full equation using the smallest whole-number coefficients.	**$4\ Fe + 3\ O_2 \rightarrow 2\ Fe_2O_3$**
5	Balance $C_2H_4 + O_2 \rightarrow CO_2 + H_2O$. Write the full equation using the smallest whole-number coefficients.	**$C_2H_4 + 3\ O_2 \rightarrow 2\ CO_2 + 2\ H_2O$**
6	Balance $Na_2CO_3 + HCl \rightarrow NaCl + H_2O + CO_2$. Write the full equation using the smallest whole-number coefficients.	**$Na_2CO_3 + 2\ HCl \rightarrow 2\ NaCl + H_2O + CO_2$**

PART 2 · APPLY IT

1. **$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$; 10 O_2 molecules** Balancing carbon and hydrogen gives 3 CO_2 and 4 H_2O, which require 10 oxygen atoms, or 5 O_2 molecules. Double that amount for 2 propane molecules.
2. **$2\ CO + O_2 \rightarrow 2\ CO_2$; 4 O_2 molecules** The balanced equation requires 1 O_2 molecule for every 2 CO molecules. Eight CO molecules need 4 O_2 molecules.

CHALLENGE

No. The left side has 2 carbon, 6 hydrogen, and 2 oxygen atoms; the right side has 2 carbon, 6 hydrogen, and 7 oxygen atoms. The balanced equation is $2\ C_2H_6 + 7\ O_2 \rightarrow 4\ CO_2 + 6\ H_2O$.

Accept omitted coefficients of 1. For the challenge, accept any clear comparison showing that the oxygen atom counts differ in the student's equation.