LESSON MAKER PRO

Atom Balance Lab

Use atom counts to balance chemical reactions.

HIGH SCHOOL · CHE.3

CHE.3 "Develop and use multiple types of models to represent chemical reactions. a. Use qualitative and quantitative reasoning to describe and balance chemical equations to satisfy the law of conservation of matter. b..."

NAME _____ **DATE** _____

KEEP THE ATOMS

In a chemical reaction, each element must have the same number of atoms before and after the reaction. Change coefficients in front of formulas to balance an equation, but never change subscripts inside a formula. Use the smallest possible whole-number coefficients.

WORKED EXAMPLE

Balance $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$.

1. Balance carbon: 3 carbon atoms need $3CO_2$.
2. Balance hydrogen: 8 hydrogen atoms need $4H_2O$.
3. Count oxygen on the right: $3CO_2$ and $4H_2O$ contain 10 oxygen atoms.
4. Balance oxygen: 10 oxygen atoms need $5O_2$.

Answer: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

PRACTICE 6 problems

1 Balance $H_2 + Cl_2 \rightarrow HCl$. Write the full equation.

ANSWER _____

2 Balance $Al + Br_2 \rightarrow AlBr_3$. Write the full equation.

ANSWER _____

3 Balance $KClO_3 \rightarrow KCl + O_2$. Write the full equation.

ANSWER _____

4 Balance $Cu + O_2 \rightarrow CuO$. Write the full equation.

ANSWER _____

5 Balance $Na + H_2O \rightarrow NaOH + H_2$. Write the full equation.

ANSWER _____

6 Balance $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$. Write the full equation and give the number of oxygen atoms on each side.

ANSWER _____

APPLY IT Show your work

1 Magnesium in a sparkler reacts with oxygen to form magnesium oxide. Balance $Mg + O_2 \rightarrow MgO$. If 7 molecules of O_2 react, how many formula units of MgO form?

WORK SPACE

ANSWER _____

2 Aluminum on a bike frame reacts with oxygen to form a thin coating of Al_2O_3. Balance $Al + O_2 \rightarrow Al_2O_3$. If 9 molecules of O_2 react, how many formula units of Al_2O_3 form?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student writes $2Fe + 3O_2 \rightarrow Fe_2O_3$. Explain why the equation is not balanced, write a corrected equation, and give the number of oxygen atoms on each side of your corrected equation.

WORK SPACE AND ANSWER

ANSWER KEY

Atom Balance Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Balance $H_2 + Cl_2 \rightarrow HCl$. Write the full equation.	**$H_2 + Cl_2 \rightarrow 2HCl$**
2	Balance $Al + Br_2 \rightarrow AlBr_3$. Write the full equation.	**$2Al + 3Br_2 \rightarrow 2AlBr_3$**
3	Balance $KClO_3 \rightarrow KCl + O_2$. Write the full equation.	**$2KClO_3 \rightarrow 2KCl + 3O_2$**
4	Balance $Cu + O_2 \rightarrow CuO$. Write the full equation.	**$2Cu + O_2 \rightarrow 2CuO$**
5	Balance $Na + H_2O \rightarrow NaOH + H_2$. Write the full equation.	**$2Na + 2H_2O \rightarrow 2NaOH + H_2$**
6	Balance $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$. Write the full equation and give the number of oxygen atoms on each side.	**$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$; 14 oxygen atoms on each side.**

PART 2 · APPLY IT

1. **$2Mg + O_2 \rightarrow 2MgO$; 14 formula units of MgO.** Each O_2 molecule reacts to form 2 formula units of MgO. Multiply 7 by 2.
2. **$4Al + 3O_2 \rightarrow 2Al_2O_3$; 6 formula units of Al_2O_3.** The balanced equation produces 2 formula units of Al_2O_3 for every 3 molecules of O_2. Nine O_2 molecules make three times as much product.

CHALLENGE

The proposed equation has 6 oxygen atoms on the left but only 3 on the right. The corrected equation is $4Fe + 3O_2 \rightarrow 2Fe_2O_3$, with 6 oxygen atoms on each side.

Accept omitted coefficients of 1. In the challenge, an explanation that identifies the unequal oxygen counts is sufficient.