Balancing Act

Atoms are not __________ or __________ during a chemical reaction. Scientists know that there must be the __________ number of atoms on each __________ of the __________. To balance the chemical equation, you must add __________ in front of the chemical formulas in the equation. You cannot _____ or ________ subscripts!

1) Determine number of atoms for each element.

   □ Mg + □ O₂  →  □ MgO
   Mg =     Mg =
   O =     O =

2) Pick an element that is not equal on both sides of the equation.

3) Add a coefficient in front of the formula with that element and adjust your counts.

4) Continue adding coefficients to get the same number of atoms of each element on each side.

Try these:

□ Ca + □ O₂  →  □ CaO
   Ca =     Ca =
   O =     O =

□ N₂ + □ H₂  →  □ NH₃
   N =     N =
   H =     H =

□ Cu₂O + □ C  →  □ Cu + □ CO₂
   Cu =     Cu =
   O =     O =
   C =     C =

□ H₂O₂  →  □ H₂O + □ O₂
   H =     H =
   O =     O =

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Balancing Act Practice

Balance each equation. Be sure to show your lists! Remember you cannot add subscripts or place coefficients in the middle of a chemical formula.

1. \( \text{Na} + \text{MgF}_2 \rightarrow \text{NaF} + \text{Mg} \)

2. \( \text{Mg} + \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2 \)

3. \( \text{Cl}_2 + \text{KI} \rightarrow \text{KCl} + \text{I}_2 \)

4. \( \text{NaCl} \rightarrow \text{Na} + \text{Cl}_2 \)

5. \( \text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O} \)

6. \( \text{Na} + \text{HCl} \rightarrow \text{H}_2 + \text{NaCl} \)

7. \( \text{K} + \text{Cl}_2 \rightarrow \text{KCl} \)

Challenge: This one is tough!

\[ \text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} \]
Atoms are not **CREATED** or **DESTROYED** during a chemical reaction. Scientists know that there must be the **SAME** number of atoms on each **SIDE** of the **EQUATION**. To balance the chemical equation, you must add **COEFFICIENTS** in front of the chemical formulas in the equation. You cannot **ADD** or **CHANGE** subscripts!

Step 1: Determine number of atoms for each element.

\[
\text{Mg} + \text{O}_2 \rightarrow \text{MgO}
\]

Mg = Mg

O = O

Step 2: Pick an element that is not equal on both sides of the equation.

Step 3: Add a coefficient in front of the formula with that element and adjust your counts.

Step 4: Continue adding coefficients to get the same number of atoms of each element on each side.

**Try these:**

\[
\text{Ca} + \text{O}_2 \rightarrow \text{CaO}
\]

Ca = Ca

O = O

\[
\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3
\]

N = N

H = H

\[
\text{Cu}_2\text{O} + \text{C} \rightarrow \text{Cu} + \text{CO}_2
\]

Cu = Cu

O = O

C = C

\[
\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2
\]

H = H

O = O

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Step-by-Step Example Problem:

Step 1: Determine number of atoms for each element.

\[ \text{Mg} + \text{O}_2 \rightarrow \text{MgO} \]

\[ \text{Mg} = 1 \quad \text{Mg} = 1 \]
\[ \text{O} = 2 \quad \text{O} = 1 \]

Step 2: Pick an element that is not equal on both sides of the equation.

\[ \text{Mg} + \text{O}_2 \rightarrow \text{MgO} \]

\[ \text{Mg} = 1 \quad \text{Mg} = 1 \]
\[ \text{O} = 2 \quad \text{O} = 1 \]

Since the O atoms are not equal, we’ll target those first!

Step 3: Add a coefficient in front of the formula with that element and adjust your counts.

\[ 2 \text{Mg} + \text{O}_2 \rightarrow 2 \text{MgO} \]

\[ \text{Mg} = 2 \quad \text{Mg} = 2 \]
\[ \text{O} = 2 \quad \text{O} = 2 \]

Adding a 2 in front of MgO will change the number of atoms on the product side of the equation.

Step 4: Continue adding coefficients to get the same number of atoms of each element on each side.

\[ 2 \text{Mg} + \text{O}_2 \rightarrow 2 \text{MgO} \]

\[ \text{Mg} = 2 \quad \text{Mg} = 2 \]
\[ \text{O} = 2 \quad \text{O} = 2 \]

Now we need to increase the number of Mg atoms we have on the reactant side. Adding a 2 in front of Mg will give us 2 atoms of Mg and balance the equation.

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