

Balancing Chemical Equations

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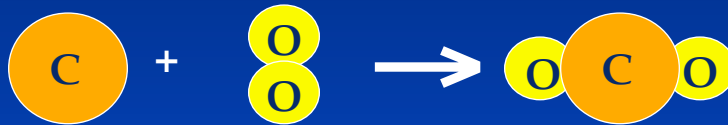


Balanced Equation

- Atoms can't be created or destroyed
- All the atoms we start with we must end up with
- A balanced equation has the same number of each element on both sides of the equation.

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- $C + O_2 \rightarrow CO_2$
- This equation is already balanced
- What if it isn't already?

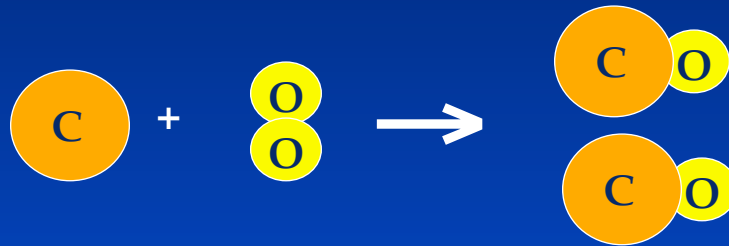
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- $C + O_2 \rightarrow CO$
- We need one more oxygen in the products.
- We can't change the subscripts to balance an equation because this would change the substance

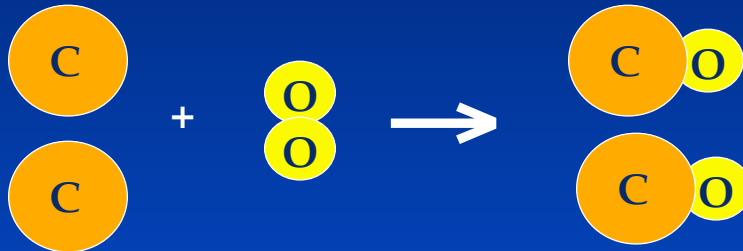
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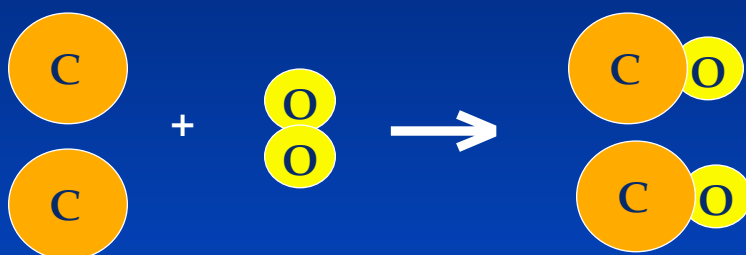
- Instead we have to add change the number of molecules
- Must be used to make another CO
- But where did the other C come from?

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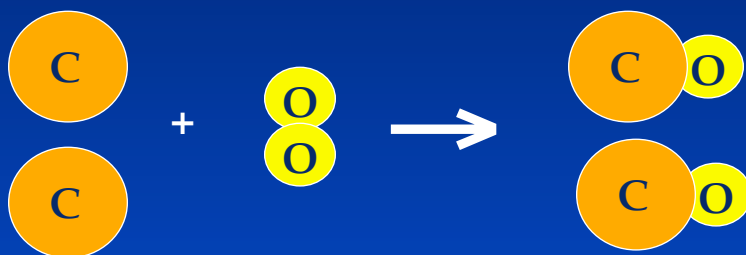
- Must have started with two C

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- We demonstrate the addition of molecules by writing a number in front of the formula
- $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$

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- Numbers in front of a molecule are called coefficients and tell us how many of the molecule.
- $2\text{C} + \text{O}_2 \rightarrow 2\text{CO}$ means that there are
- 2 molecules of C; 1 molecule of O_2 , and 2 molecules of CO

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Rules for balancing

- 1 Write the correct formulas for all the reactants and products
- 2 Count the number of atoms of each type appearing on both sides
- 3 Balance the elements one at a time by adding coefficients (the numbers in front)
- 4 Check to make sure it is balanced.

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Never

- Change a subscript to balance an equation.
- If you change the formula you are describing a different substance and reaction.
- H_2O is a different compound than H_2O_2
- Never put a coefficient in the middle of a formula
- 2NaCl is okay, Na_2Cl is not.

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Example



Make a table to keep track of where you are at

11



Example



| R | | P |
|---|---|---|
| 2 | H | 2 |
| 2 | O | 1 |

Need twice as much O in the product

12



Example



| R | | P |
|---|---|---|
| 2 | H | 2 |
| 2 | O | 1 |

Changes the O

13



Example



| R | | P |
|---|---|----------------|
| 2 | H | 2 |
| 2 | O | 1 2 |

Also changes the H

14



Example



| R | | P | |
|---|---|--------------|---|
| 2 | H | 2 | 4 |
| 2 | O | 1 | 2 |

Need twice as much H in the reactant

15



Example



| R | | P | |
|---|---|--------------|---|
| 2 | H | 2 | 4 |
| 2 | O | 1 | 2 |

Recount

16



Example



| R | | | P | |
|---|--------------|---|--------------|---|
| 4 | 2 | H | 2 | 4 |
| 2 | | O | 1 | 2 |

The equation is balanced, has the same number of each kind of atom on both sides

17



Example



| R | | | P | |
|---|--------------|---|--------------|---|
| 4 | 2 | H | 2 | 4 |
| 2 | | O | 1 | 2 |

This is the answer

Not this

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Examples

- $\text{AgNO}_3 + \text{Cu} \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{Ag}$
- $\text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$
- $\text{P} + \text{O}_2 \rightarrow \text{P}_4\text{O}_{10}$
- $\text{Na} + \text{H}_2\text{O} \rightarrow \text{H}_2 + \text{NaOH}$
- $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

