



Balancing Chemical Equations

Making Chemistry Visible

Balancing Chemical Equations

Macroscopic
(Physical Phenomenon)

- Concrete and observable.
- What can be seen, touched and smelt.



The
Chemistry
Triangle

Sub-microscopic
(Particles)

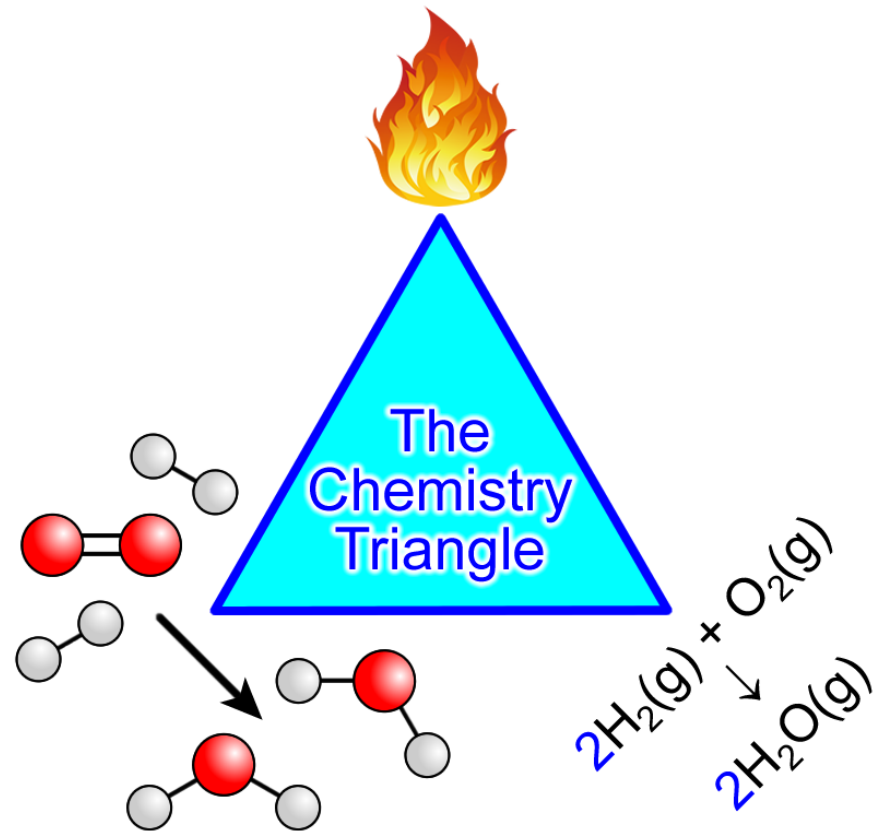
- Conceptual explanation.
- Model drawings and concept diagrams.

Representational
(Symbolic)

- Show connections between concepts.
- Symbols, formulae, equations and graphs.

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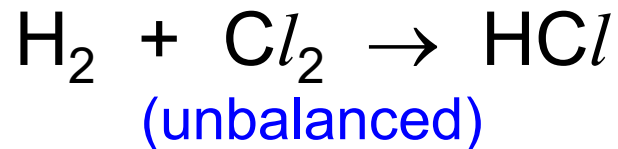
- Matter / mass are *conserved* during a chemical reaction.
- The atoms present at the start of the reaction must be present in the same number at the end of the reaction. Atoms cannot vanish or appear out of nowhere.
- Because of this, chemical equations must be *balanced* to show that matter is conserved during the reaction.

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Example One:

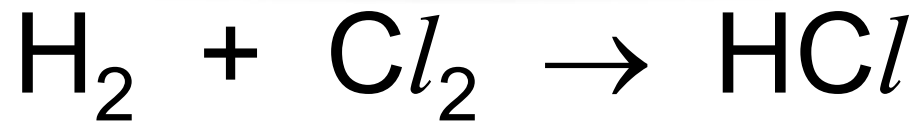
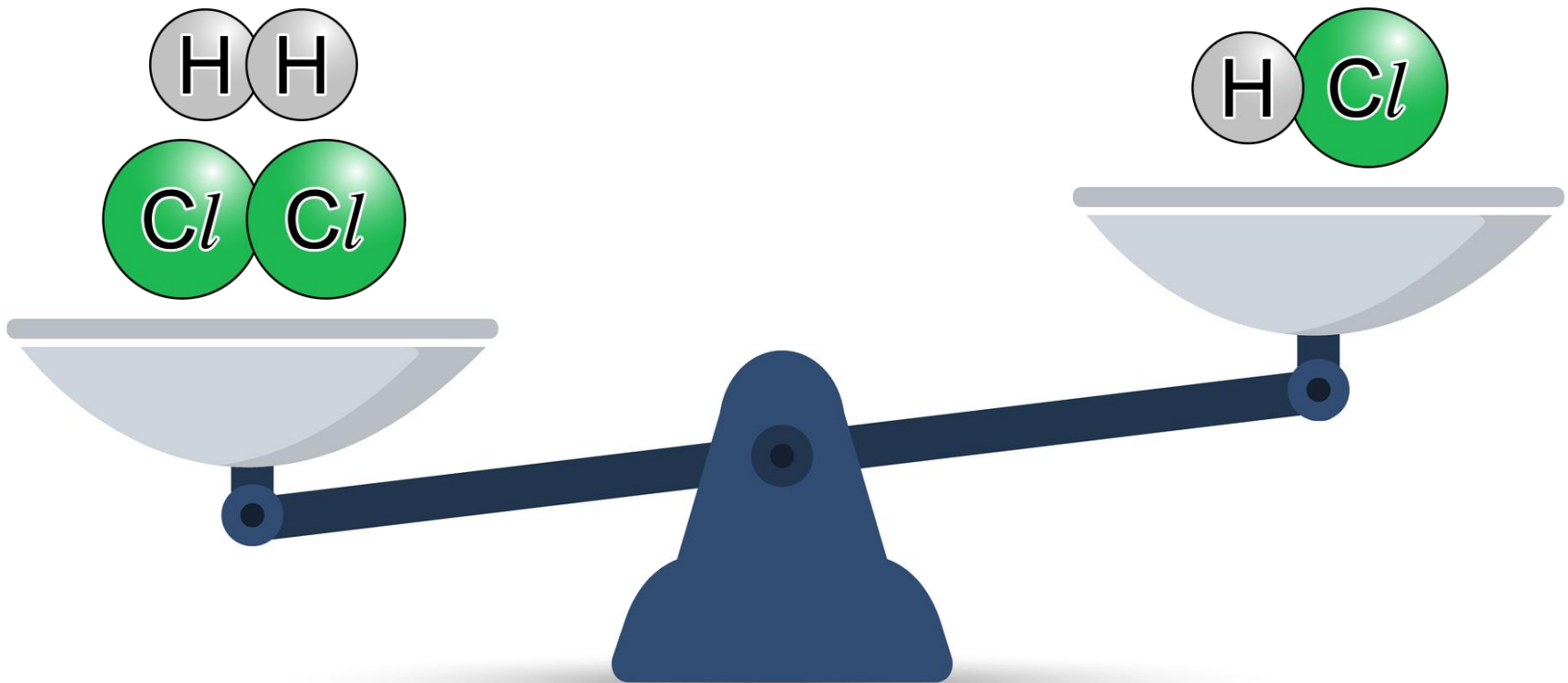
- Hydrogen (H_2) reacts with chlorine (Cl_2) to form hydrogen chloride (HCl).



- Guided by visual representations of the molecules, let us see how the balanced chemical equation for this reaction is written.

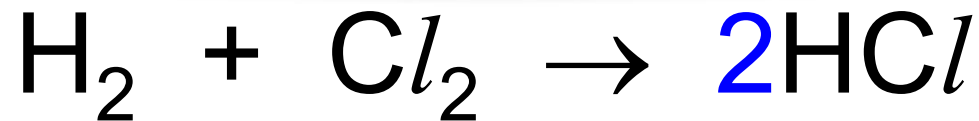
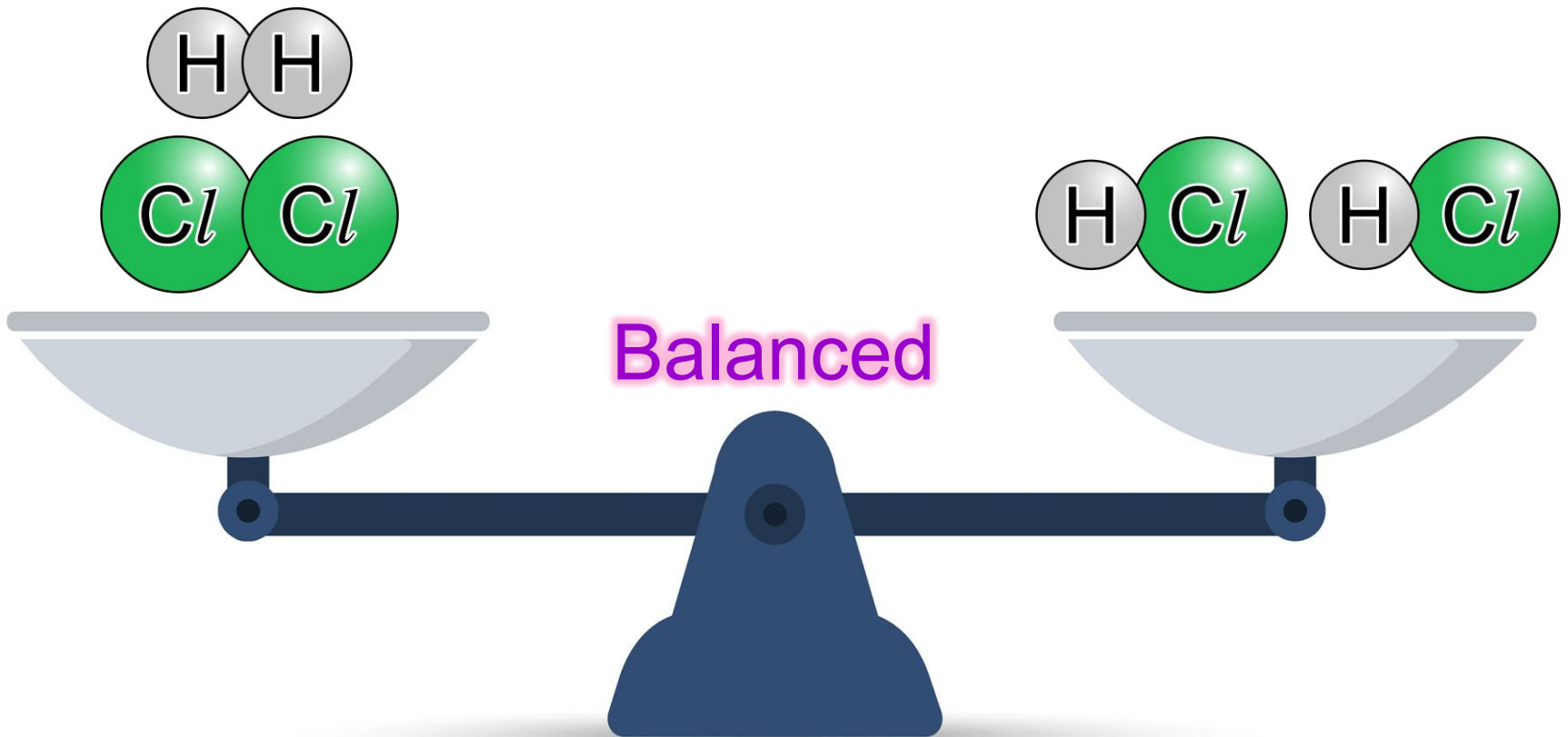
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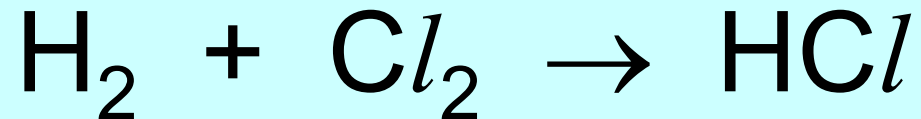
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2 × H & 2 × Cl

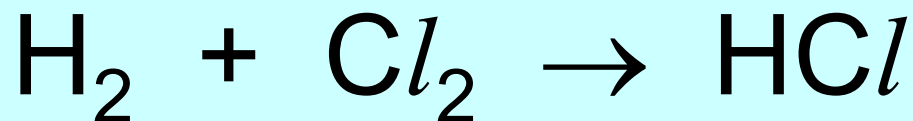
1 × H & 1 × Cl

needs 1 more H

and 1 more Cl

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2 × H & 2 × Cl

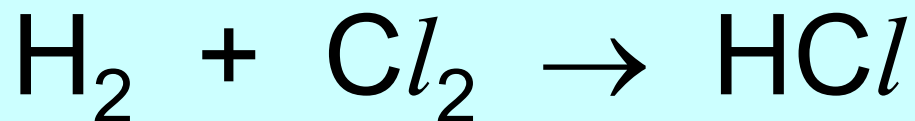
1 × H & 1 × Cl

needs 1 more H
and 1 more Cl

- Can add one hydrogen and one chlorine to this side by adding a single molecule of HCl.

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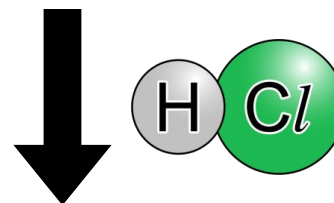


2 × H & 2 × Cl

1 × H & 1 × Cl

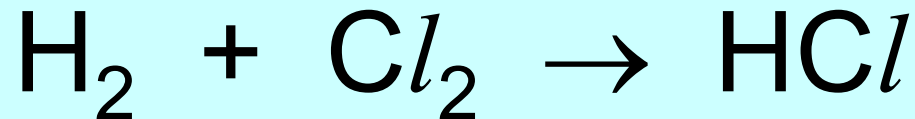
needs 1 more H
and 1 more Cl

add



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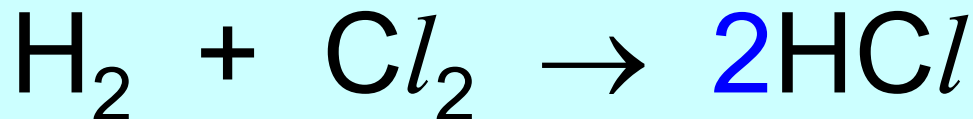
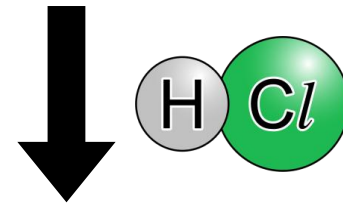


2 × H & 2 × Cl

1 × H & 1 × Cl

needs 1 more H
and 1 more Cl

add



2 × H & 2 × Cl

2 × H & 2 × Cl

Balanced

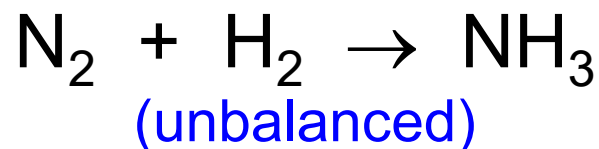


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Example Two:

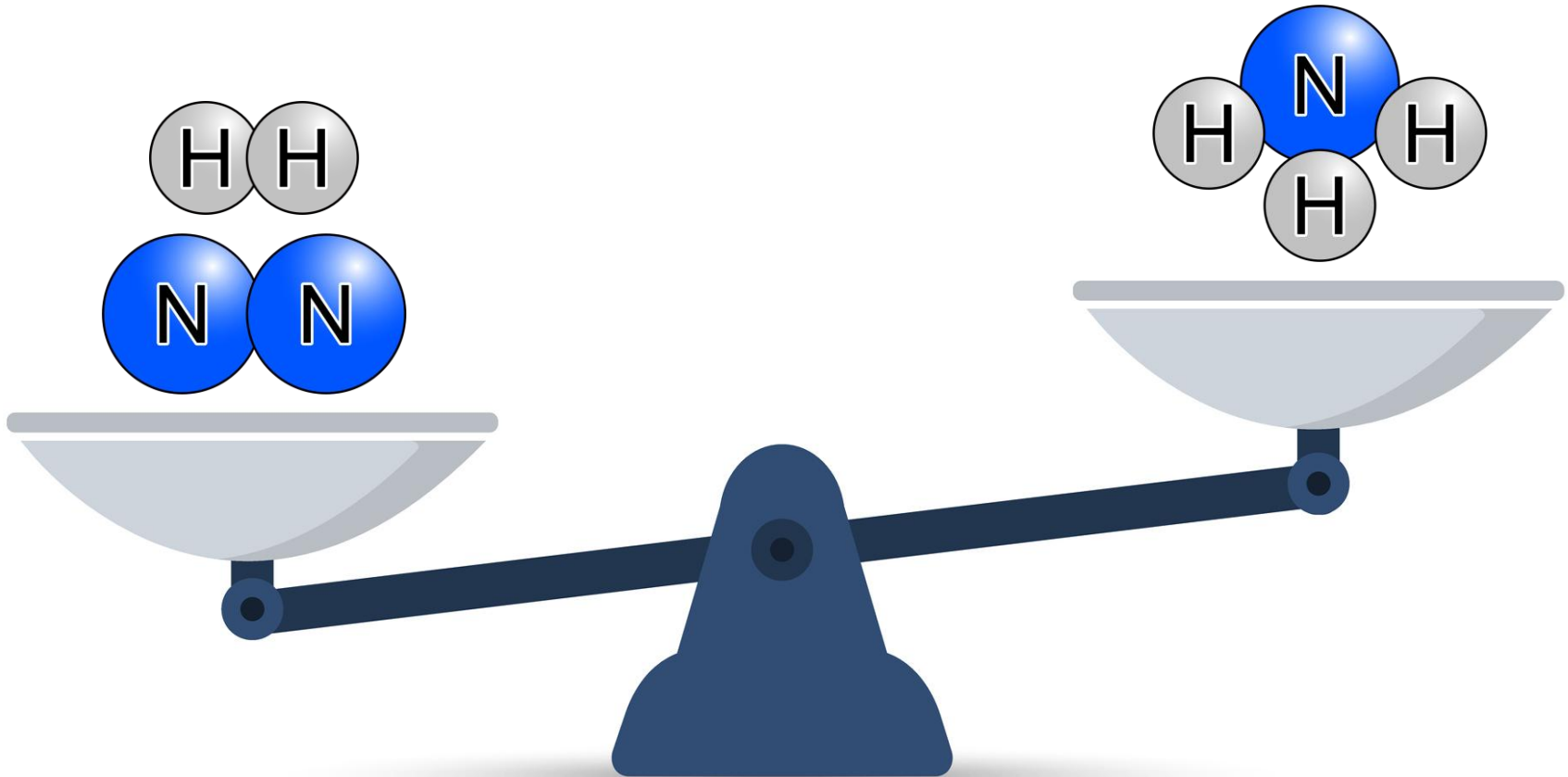
- Nitrogen (N_2) reacts with hydrogen (H_2) to form ammonia (NH_3).



- Guided by visual representations of the molecules, let us see how the balanced chemical equation for this reaction is written.

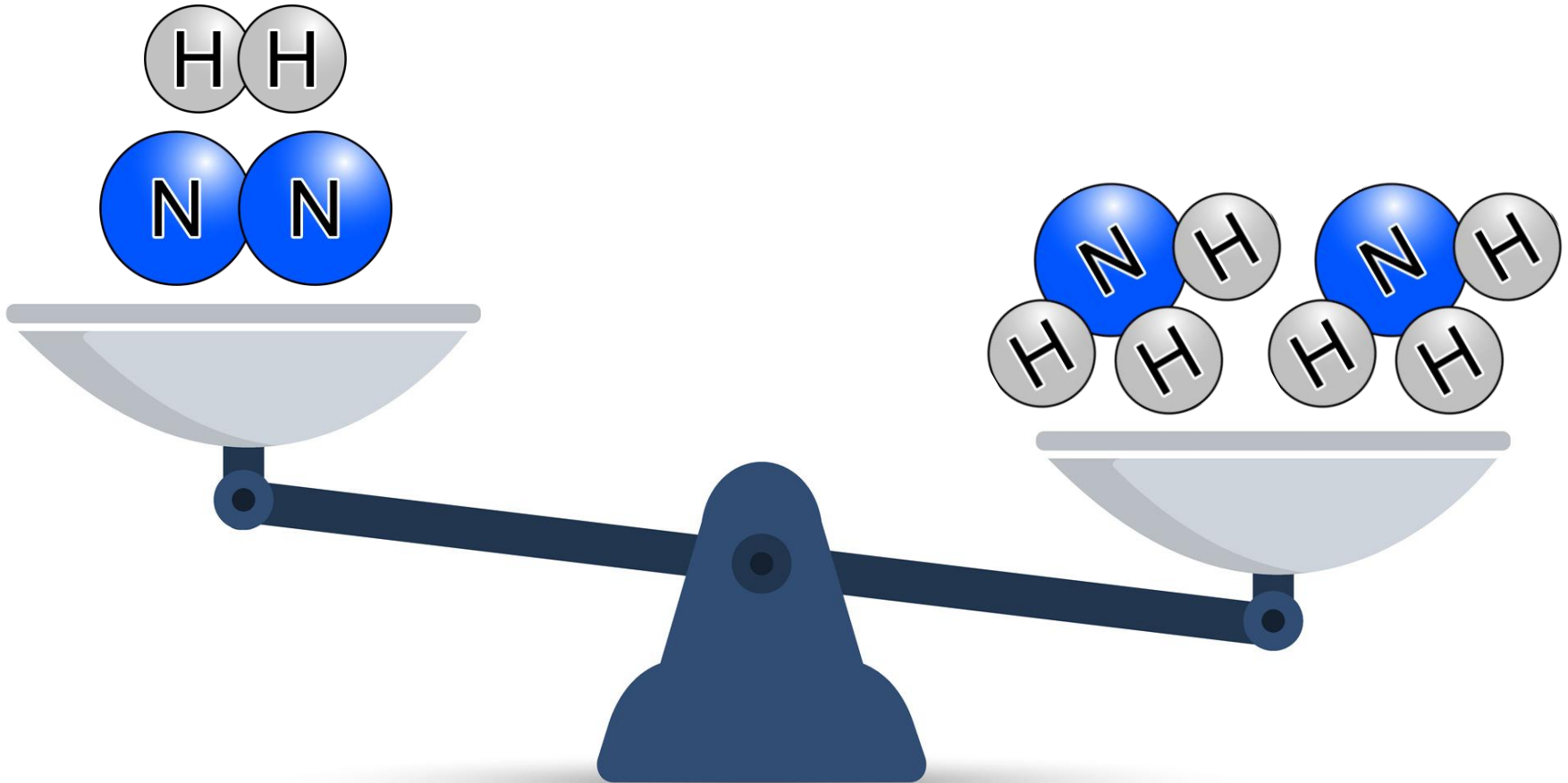
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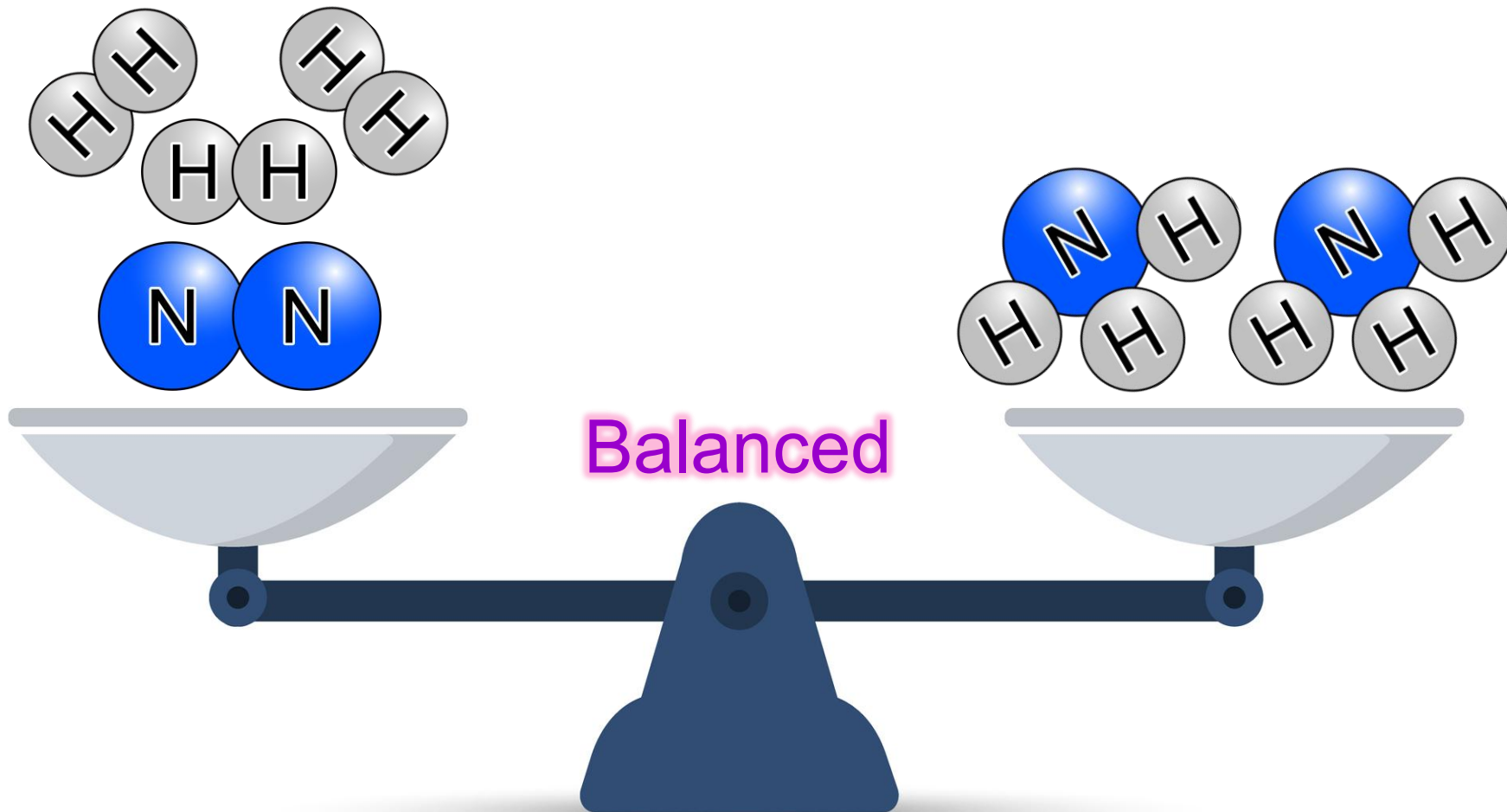
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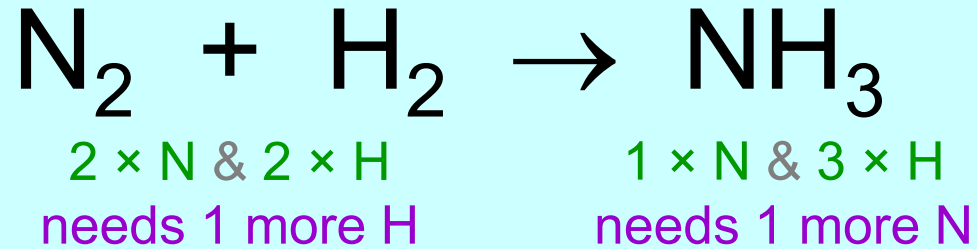
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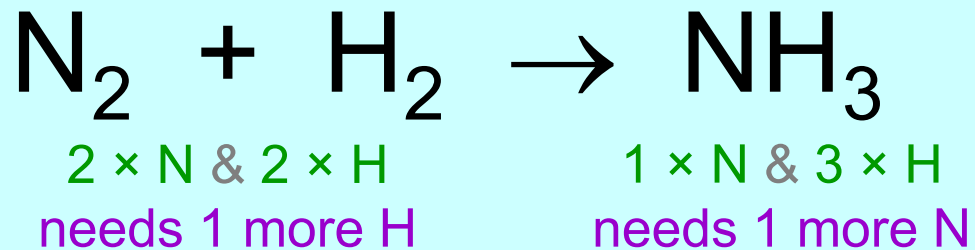
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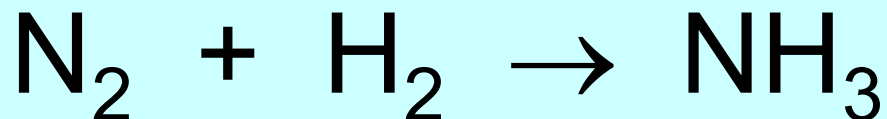


- Difficult to add just one hydrogen to this side because they are bonded together in pairs.

- Can add one nitrogen to this side by adding a single molecule of NH_3 .

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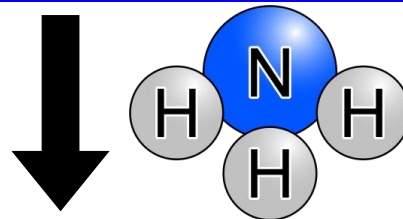
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2 × N & 2 × H
needs 1 more H

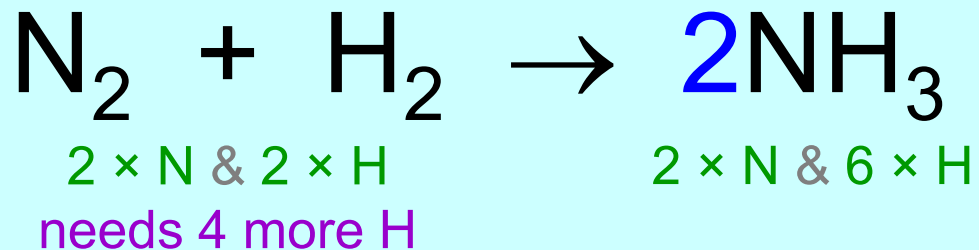
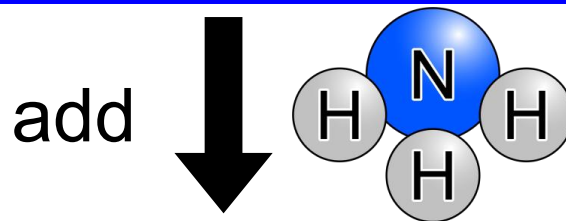
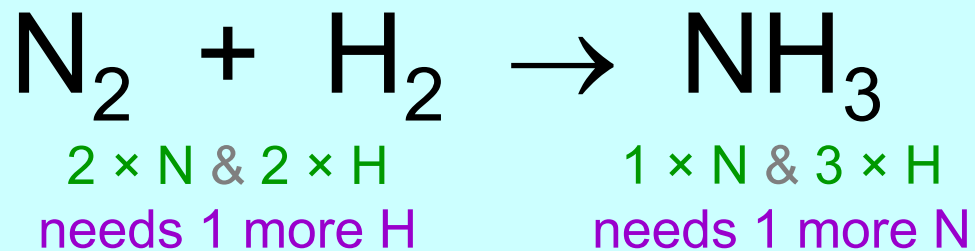
1 × N & 3 × H
needs 1 more N

add



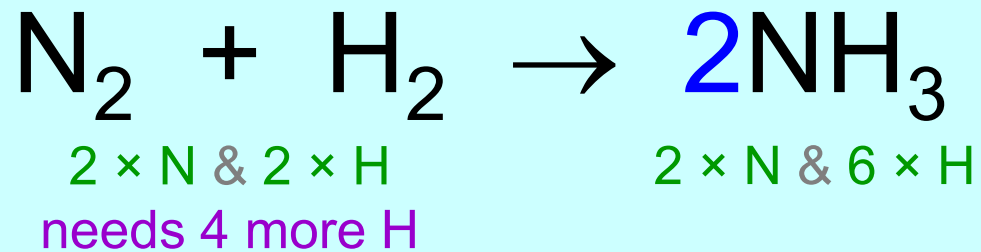
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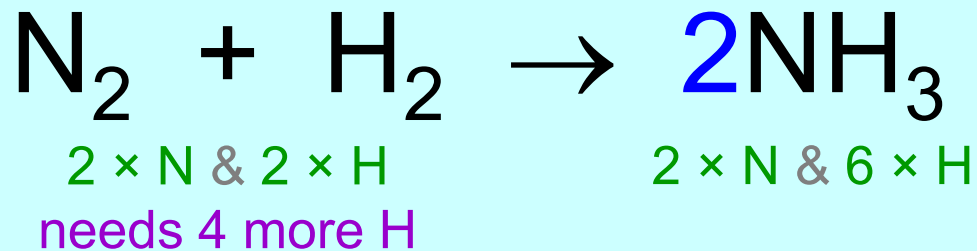
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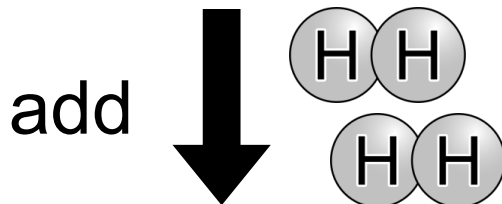
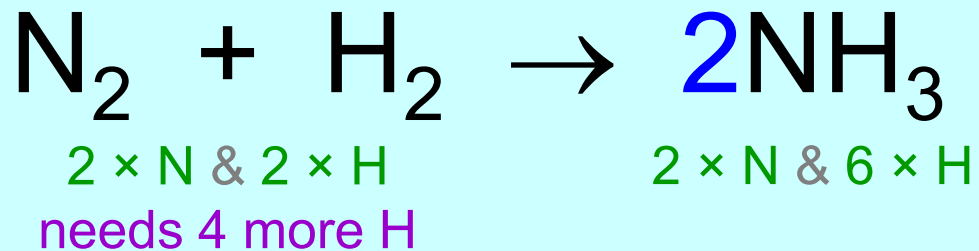
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- Can add four hydrogens to this side by adding two molecules of H_2 .

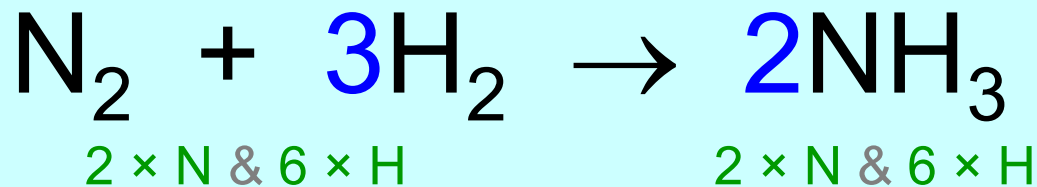
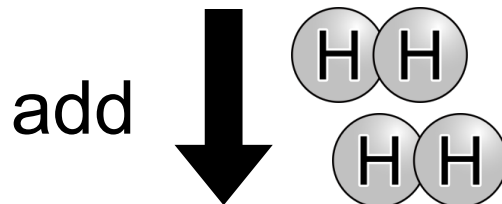
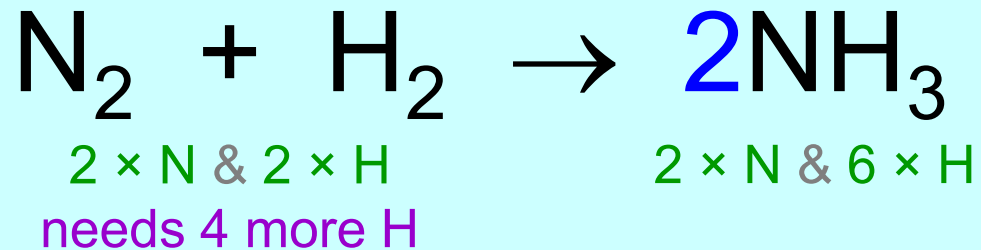
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Balanced

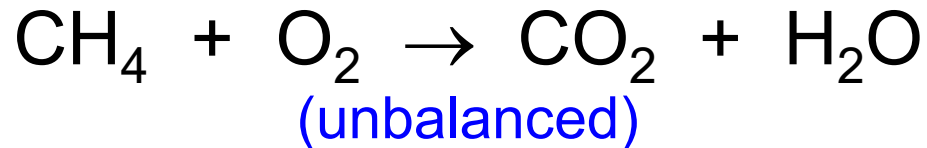


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Example Three:

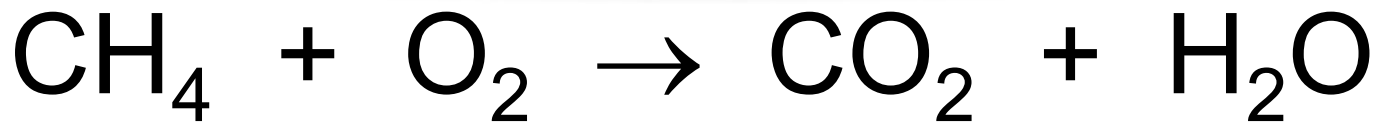
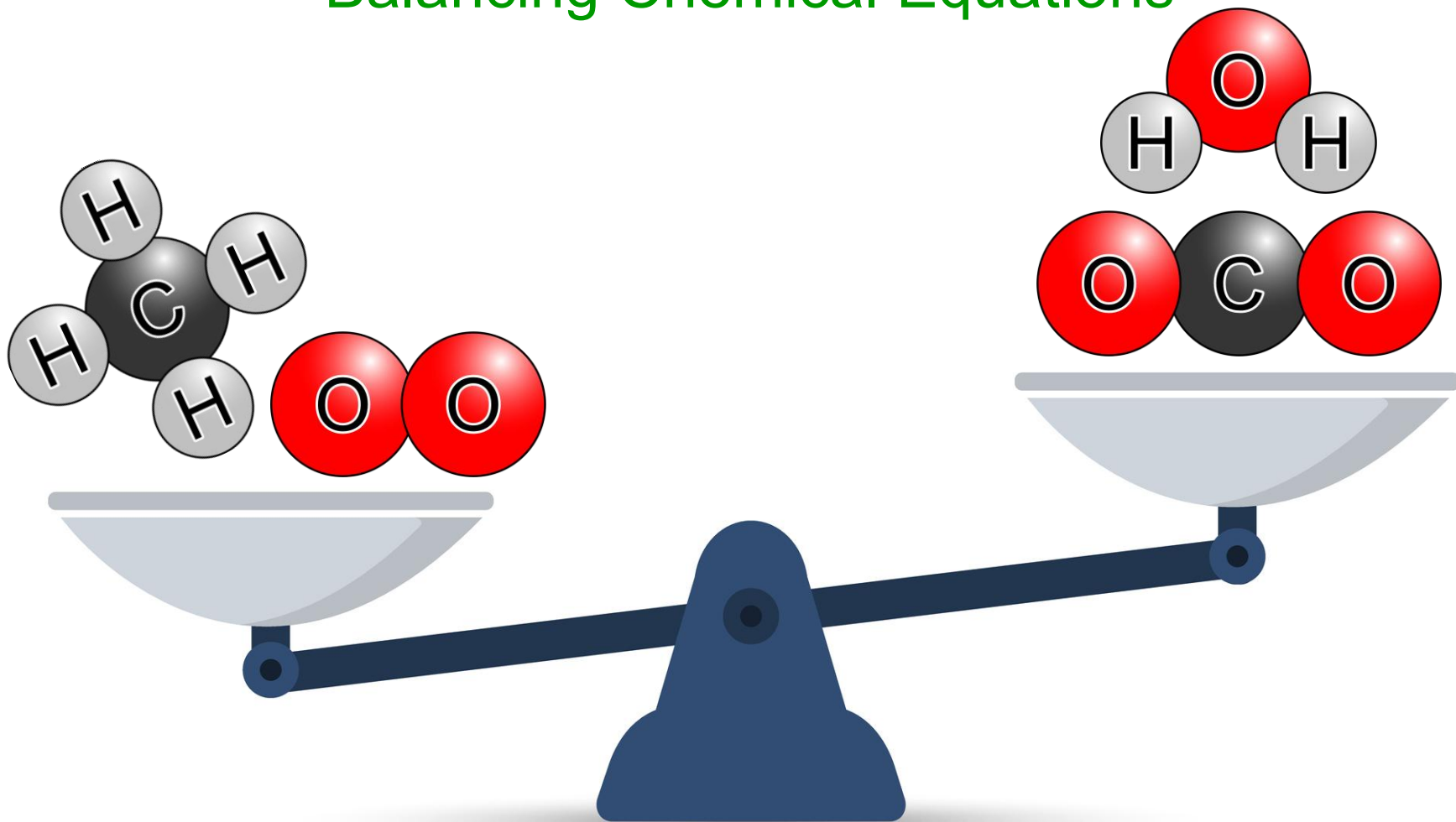
- Methane (CH₄) reacts with oxygen (O₂) to form carbon dioxide (CO₂) and water (H₂O).



- Guided by visual representations of the molecules, let us see how the balanced chemical equation for this reaction is written.

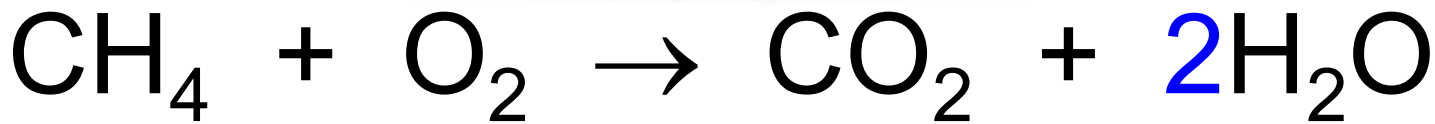
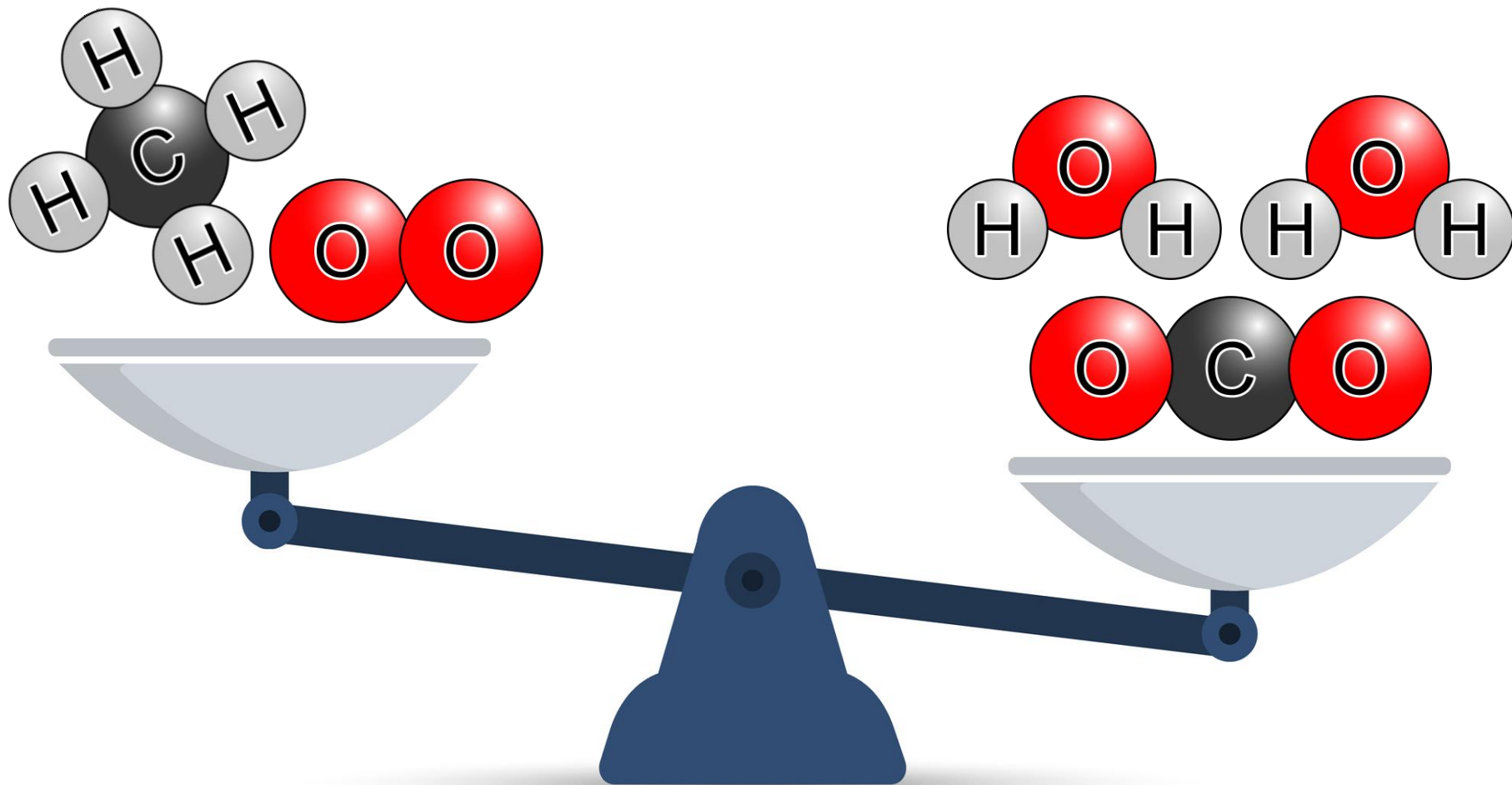
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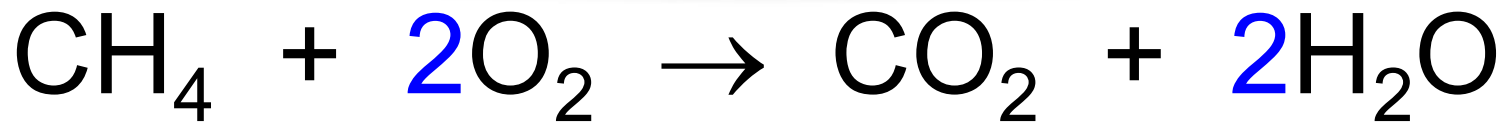
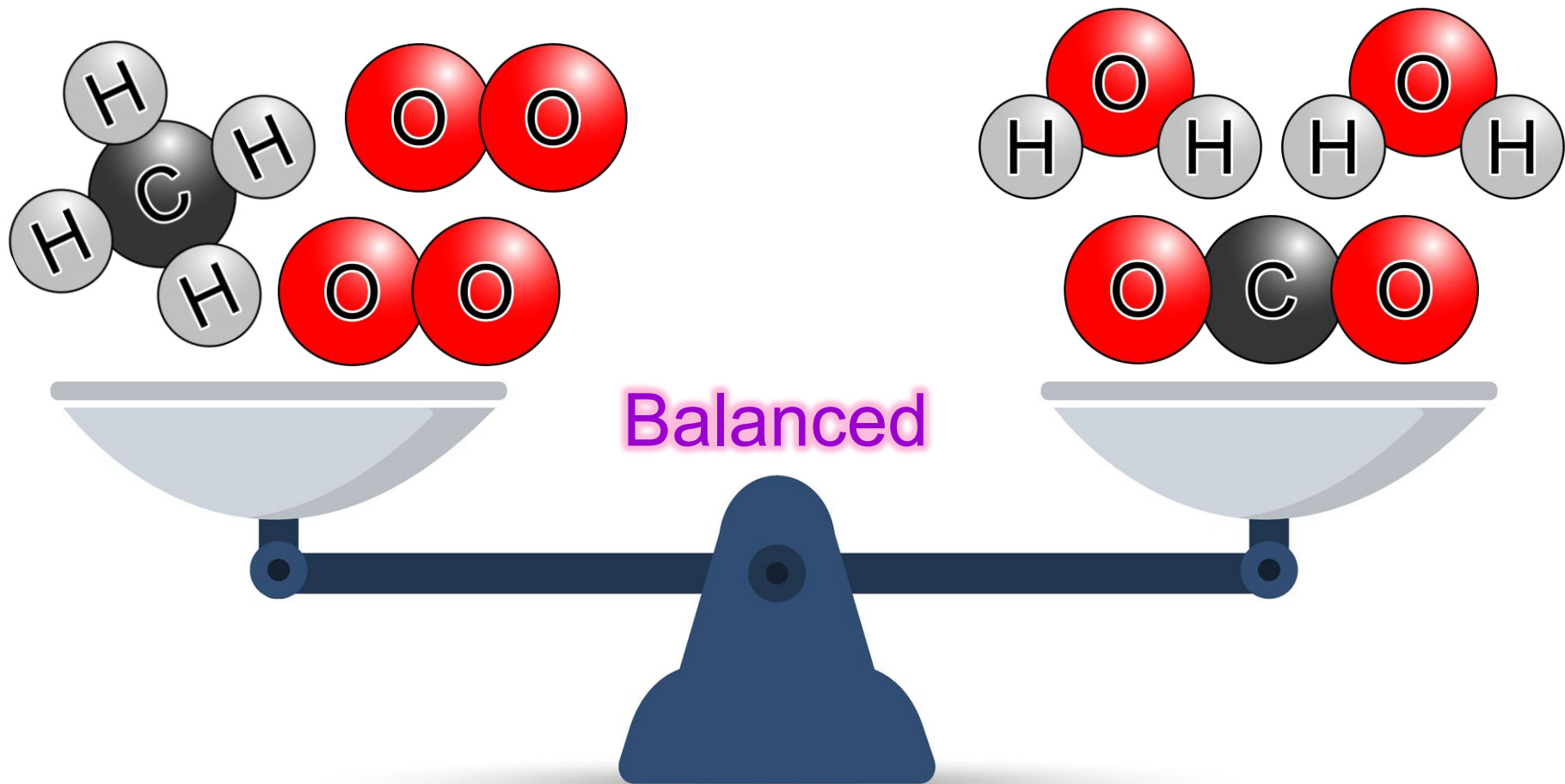
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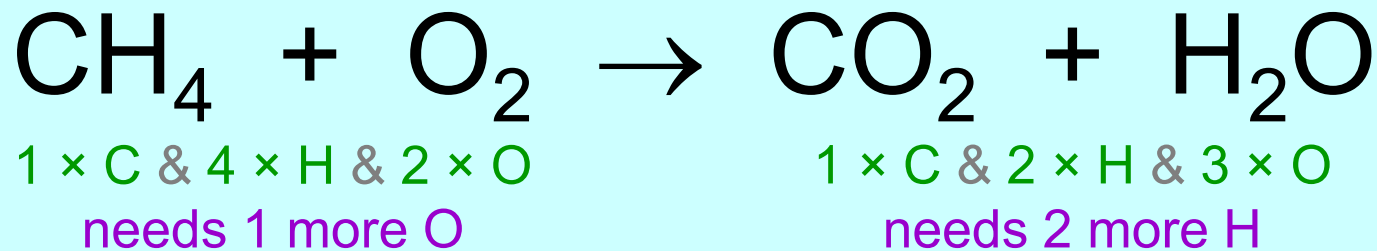
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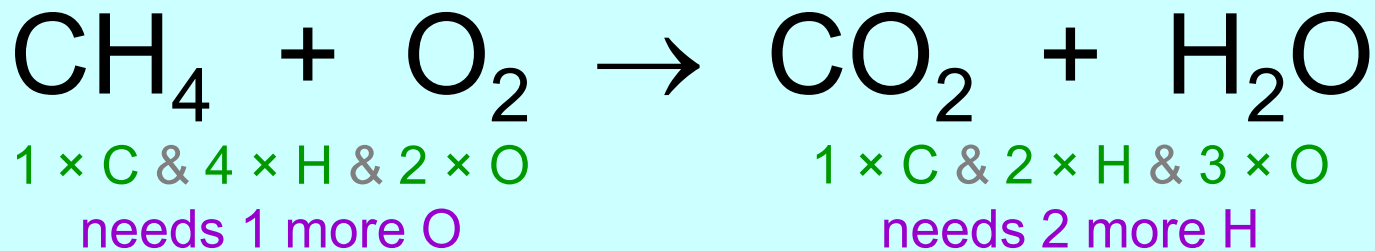
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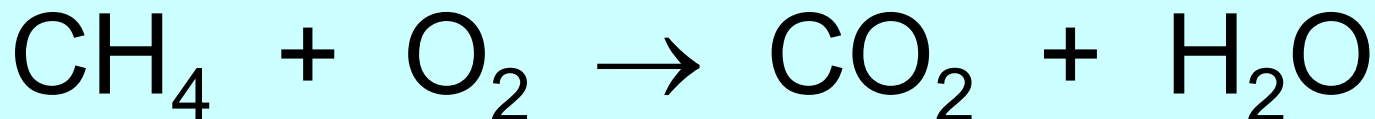


- Difficult to add just one oxygen to this side because they are bonded together in pairs.

- Can add two hydrogens to this side by adding a single molecule of H₂O.

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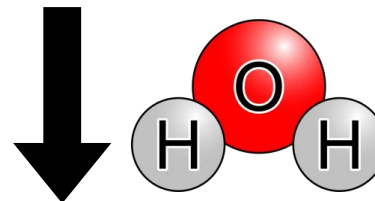
1 × C & 4 × H & 2 × O

needs 1 more O

1 × C & 2 × H & 3 × O

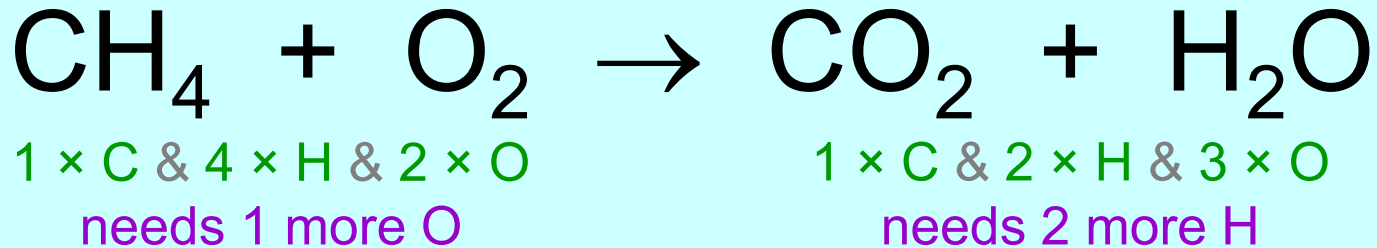
needs 2 more H

add

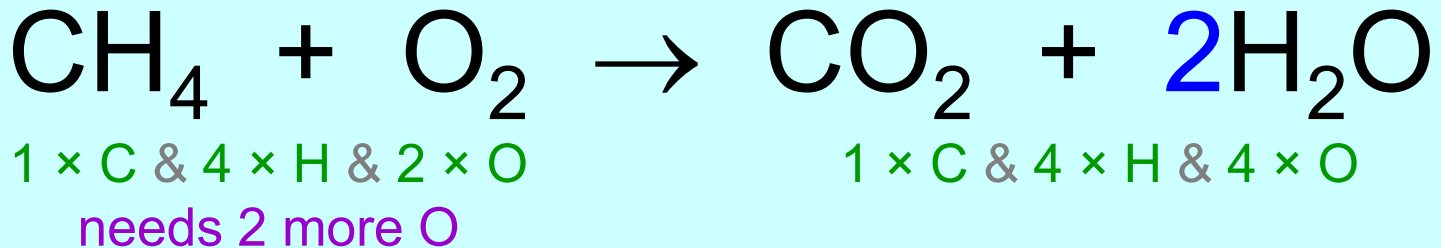
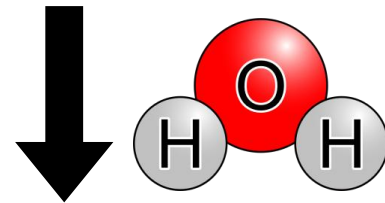


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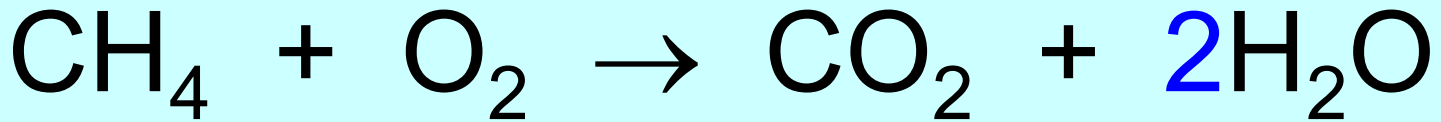


add



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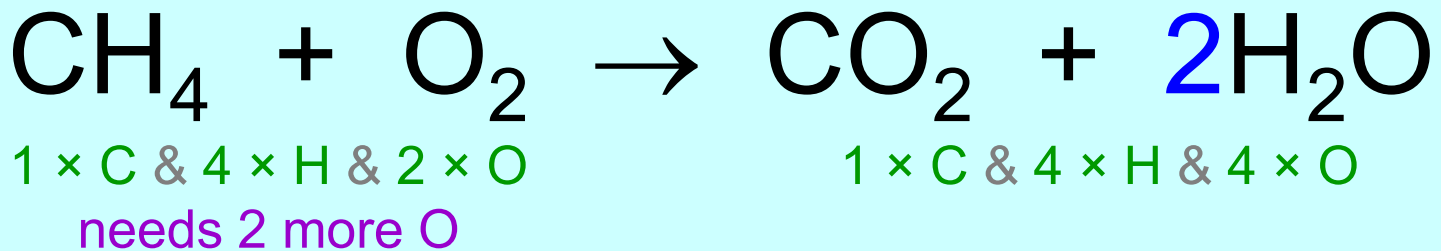
1 × C & 4 × H & 2 × O

needs 2 more O

1 × C & 4 × H & 4 × O

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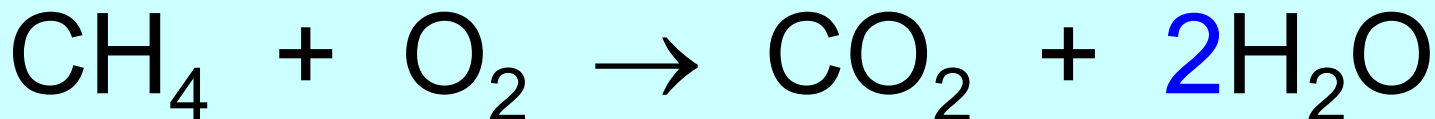
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- Can add two oxygens to this side by adding a single molecule of O₂.

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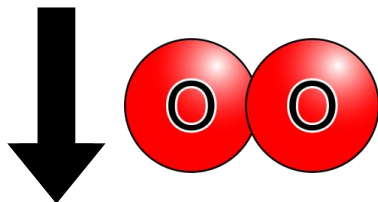


1 × C & 4 × H & 2 × O

needs 2 more O

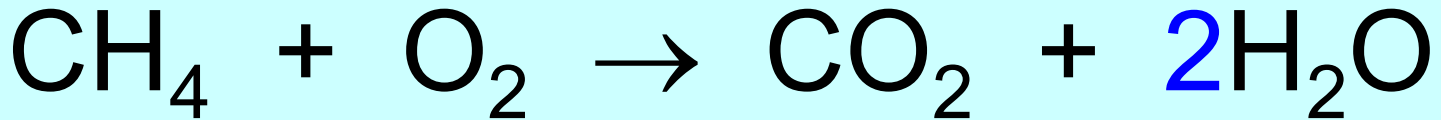
1 × C & 4 × H & 4 × O

add



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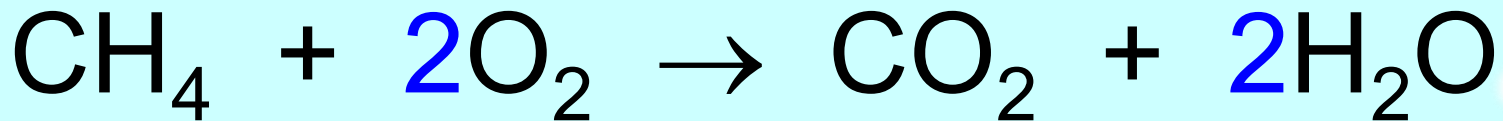
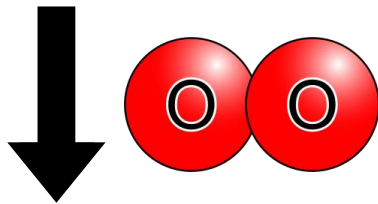


1 × C & 4 × H & 2 × O

needs 2 more O

1 × C & 4 × H & 4 × O

add



1 × C & 4 × H & 4 × O

1 × C & 4 × H & 4 × O

Balanced

Making Chemistry Visible

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Presentation on
Making Thinking Visible:
Balancing Chemical Equations
by Dr. Chris Slatter

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5th April 2024