

Predicting Redox Reactions

- * Metals lose electrons and form ions in redox reactions.
- * The most reactive metals have the greatest tendency to lose electrons.
- * Therefore the order of reactivity of metals is also the order of strength as reducing agents

The Spontaneity Rule

- * A spontaneous reaction occurs only if the oxidizing agent (OA) is above the reducing agent (RA) in a table of relative strengths of oxidizing and reducing agents

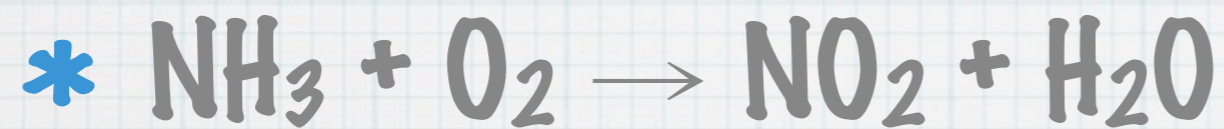
Balancing Redox Reactions Using Oxidation Numbers

Example

- * Write a balanced net ionic equation to show the combustion of ammonia in oxygen to produce nitrogen dioxide and water.

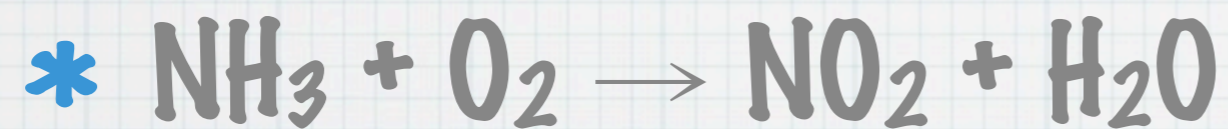
Solution

* Step 1: Write an unbalanced equation



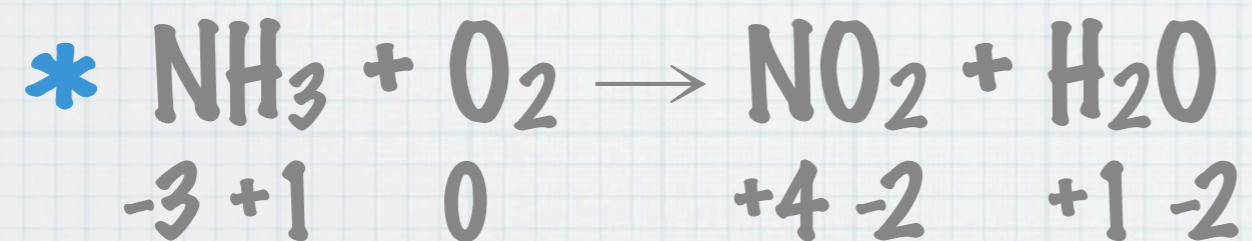
Solution

* Step 2: Assign Oxidation numbers to each element



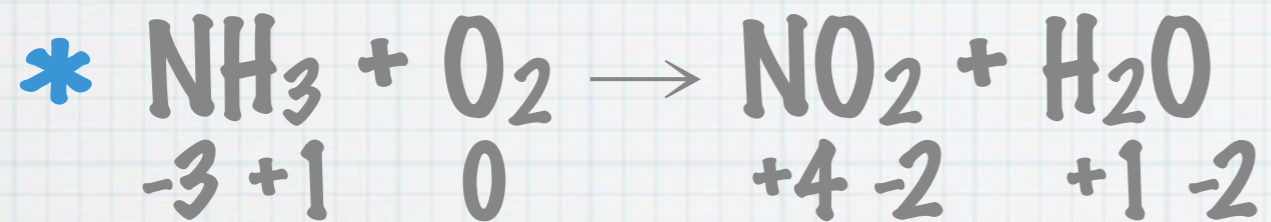
Solution

* Step 2: Assign Oxidation numbers to each element



Solution

* Step 3: Identify the changes in oxidation numbers as OXIDATION or REDUCTION



* OXIDATION: Nitrogen $\text{NH}_3 \longrightarrow \text{NO}_2 + 7e^-$

* REDUCTION: Oxygen $\text{O}_2 + 4e^- \longrightarrow \text{NO}_2$

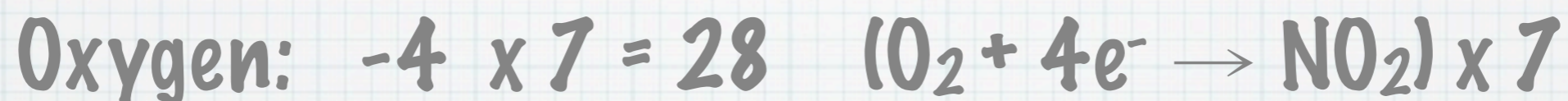
Solution

- * Step 4: Find the numerical value for the changes in oxidation number.
- * 1 nitrogen atom: changes from -3 to $+4$
→ increase of 7
- * 2 oxygen atoms: change from 0 to -2 →
decrease of 2×2 atoms = total decrease of 4

Solution

- * Step 5: Balance electron loss and gain by multiplying
- * nitrogen: increase of 7 oxygen: decrease of 4
- * lowest common multiple = 28

Solution



Electrons will cancel out



Solution

- * Step 6: Balance the other elements by inspection.



Example

* Balance the following reaction using the oxidation number method.



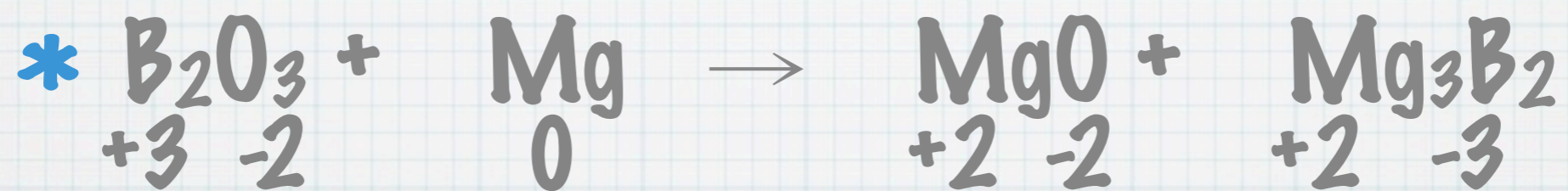
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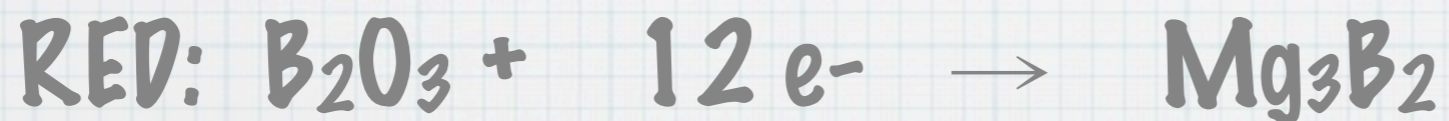
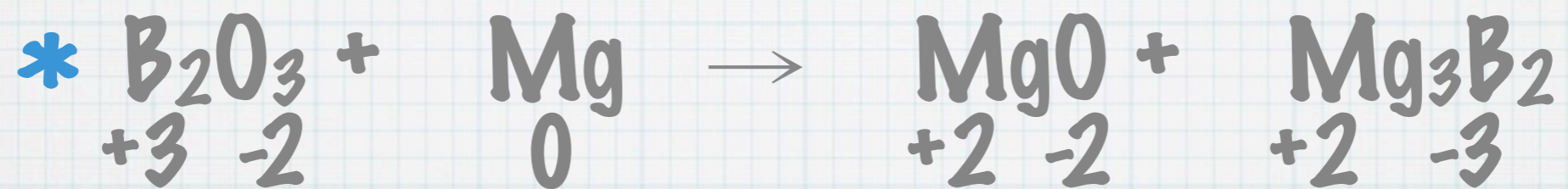
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