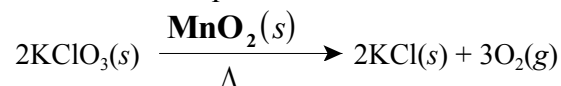


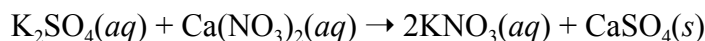
Everything about Equations

A chemical equation contains a lot of information. Many equations show evidence of a chemical change such as a change in temperature (exothermic – give off heat; endothermic – absorb heat), release of a gas, or formation of a precipitate. Other identifying characteristics of a chemical equation such as a change in color or a change in odor cannot be demonstrated in the equation. Some changes and/or conditions are shown using symbols such as [1] solid precipitate – (s) or ↓; [2] liquid – (l); [3] gas – (g) or ↑; [4] dissolved in water or aqueous – (aq); [5] heat – Δ; [6] electricity – elec.; and [7] light – ↑. Symbols and formulas that are neither reactants nor products are written above or below the yield sign (→). Examine the equation below:



The equation tells us the following: [1] The reactant is KClO_3 ; [2] KClO_3 is a solid; [3] KClO_3 decomposes, particularly when heated (Δ) in the presence of the catalyst MnO_2 ; [4] One of the products is KCl , a solid; [5] The other product is O_2 , a gas. [6] Conservation of mass is shown because the reactants contain 2 atoms of K, 2 atoms of Cl, and 6 atoms of O, and the products contain 2 atoms of K, 2 atoms of Cl, and 6 atoms of O also.

Sometimes a reaction results in the formation of a precipitate from dissolved reactants. Examine the equation below:



The equation tells us the following: [1] The reactants are K_2SO_4 and $\text{Ca}(\text{NO}_3)_2$; [2] Both reactants are dissolved; [3] A double-displacement reaction occurs resulting in the formation of a precipitate; [4] The precipitate is identified using *Table F–Solubility Guidelines*; [5] Conservation of mass is shown because the reactants contain 2 atoms of K, 1 sulfate ion, 1 atom of Ca, and 2 nitrate ions, and the products contain 2 atoms of K, 1 sulfate ion, 1 atom of Ca, and 2 nitrate ions; [6] The sum of the coefficients is 5 as in the example below.

<u>Example</u>	
Unbalanced Equation:	$\text{CuSO}_4 + \text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{Ag}_2\text{SO}_4$
Balanced Equation:	$\text{CuSO}_4 + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{Ag}_2\text{SO}_4$
Sum of the Coefficients:	1 + 2 + 1 + 1 = <u>5</u>

Examine the unbalanced equations in the table on the next page. Determine the following: [1] The sum of the coefficients of the balanced equation; [2] The type of reaction (*direct combination, decomposition, single displacement, double displacement*); [3] Identify the phase(s) of the product(s); and [4] The signs that a chemical change has occurred.



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CHEMICAL FORMULAS AND EQUATIONS

Unbalanced Equation	Sum of the Coefficients	Reaction Type	Phase	Evidence of Chemical Change
1. $\text{FeCl}_3(aq) + \text{NaOH}(aq) \rightarrow \text{NaCl}(?) + \text{Fe}(\text{OH})_3(?)$				
2. $\text{Al}(s) + \text{HCl}(aq) \rightarrow \text{AlCl}_3(?) + \text{H}_2(?)$				
3. $\text{Mg}(s) + \text{O}_2(g) \rightarrow \text{MgO}(?)$				
4. $\text{H}_2\text{O}_2(aq) \xrightarrow{\text{MnO}_2} \text{H}_2\text{O}(?) + \text{O}_2(?)$				
5. $\text{H}_2\text{CO}_3(aq) \rightarrow \text{H}_2\text{O}(?) + \text{CO}_2(?)$				
6. $\text{Pb}(s) + \text{CuSO}_4(aq) \rightarrow \text{PbSO}_4(?) + \text{Cu}(?)$				
7. $\text{H}_2\text{O}(l) + \text{N}_2\text{O}_5(g) \rightarrow \text{HNO}_3(?)$				
8. $\text{Na}(s) + \text{H}_2\text{O}(l) \rightarrow \text{NaOH}(?) + \text{H}_2(?)$				
9. $\text{K}_2\text{CrO}_4(aq) + \text{Al}(\text{NO}_3)_3(aq) \rightarrow \text{KNO}_3(?) + \text{Al}_2(\text{CrO}_4)_3(?)$				
10. $\text{NaOH}(aq) + \text{H}_2\text{SO}_4(aq) \rightarrow \text{Na}_2\text{SO}_4(?) + \text{H}_2\text{O}(?)$				
11. $\text{C}_2\text{H}_6(g) + \text{O}_2(g) \rightarrow \text{CO}_2(?) + \text{H}_2\text{O}(?)$				
12. $\text{Cu}(s) + \text{AgNO}_3(aq) \rightarrow \text{Cu}(\text{NO}_3)_2(?) + \text{Ag}(?)$				
13. $\text{N}_2(g) + \text{O}_2(g) \rightarrow \text{N}_2\text{O}_5(?)$				
14. $\text{O}_3(g) \xrightarrow{\uparrow} \text{O}_2(g)$				
15. $\text{Ca}(\text{ClO}_3)_2(aq) + \text{Li}_2\text{SO}_4(aq) \rightarrow \text{CaSO}_4(?) + \text{LiClO}_3(?)$				