

Section 2: Types of chemical reactions

1. Synthesis reaction: $A + B \rightarrow AB$
 - a. Occurs when 2 elements/molecules react to form one compound
 - i. $H_2 + 2Cl \rightarrow 2HCl$
2. Decomposition reaction: $AB \rightarrow A + B$
 - a. Occurs when one compound reacts to form 2 elements
 - i. $2Ag_2O \rightarrow 4Ag + O_2$
3. Single replacement reaction: $AB + C \rightarrow CB + A$
 - a. When one element replaces the position of a different element comprising a molecule. A lone metal will replace a metal in a molecule, a lone nonmetal will replace a nonmetal in a molecule.
 - i. $CuCl_2 + Fe \rightarrow FeCl_2 + Cu$
4. Double replacement reaction: $AB + CD \rightarrow CB + AD$
 - a. The metals of two compounds will swap places and form new molecules.
 - i. $Ba(NO_3)_2 + Na_2SO_4 \rightarrow 2NaNO_3 + BaSO_4$
 - b. A neutralization reaction can also occur here, when the reactants are an acid and a base. An acid and a base will always react to form water, and one other ionic compound (otherwise known as a salt).
 - i. Acid + base \rightarrow salt + water
 - ii. $HCl + NaOH \rightarrow NaCl + H(OH)$
5. Combustions: $Hydrocarbon + O_2 \rightarrow CO_2 + H_2O$
 - a. Any hydrocarbon (molecule made of carbon and hydrogen) will burn in the presence of oxygen to produce carbon dioxide and water
 - i. $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

Please be aware, not all compounds conform to these 5 reaction types. Some violate the expected pattern of behaviour, such as in the case of sulfur dioxide and water reacting to form sulfurous acid. $SO_2 + H_2O \rightarrow H_2SO_3$

Practice Problems.

Label the reaction type below:

1. $H_2CO_3(aq) \rightarrow H_2O(l) + CO_2(g)$ **Decomposition**
2. $NaCl(aq) + AgNO_3(aq) \rightarrow NaNO_3(aq) + AgCl(s)$ **Double Replacement**
3. $H_2O(l) + SO_3(g) \rightarrow H_2SO_4(aq)$ **Synthesis**
4. $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$ **Double Replacement - neutralization**
5. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ **Decomposition**
6. $Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$ **Single Replacement**

Balancing Chemical Equations - Answer Key

Balance the equations below:

- 1) $1 \text{ N}_2 + 3 \text{ H}_2 \rightarrow 2 \text{ NH}_3$
- 2) $2 \text{ KClO}_3 \rightarrow 2 \text{ KCl} + 3 \text{ O}_2$
- 3) $2 \text{ NaCl} + 1 \text{ F}_2 \rightarrow 2 \text{ NaF} + 1 \text{ Cl}_2$
- 4) $2 \text{ H}_2 + 1 \text{ O}_2 \rightarrow 2 \text{ H}_2\text{O}$
- 5) $1 \text{ Pb(OH)}_2 + 2 \text{ HCl} \rightarrow 2 \text{ H}_2\text{O} + 1 \text{ PbCl}_2$
- 6) $2 \text{ AlBr}_3 + 3 \text{ K}_2\text{SO}_4 \rightarrow 6 \text{ KBr} + 1 \text{ Al}_2(\text{SO}_4)_3$
- 7) $1 \text{ CH}_4 + 2 \text{ O}_2 \rightarrow 1 \text{ CO}_2 + 2 \text{ H}_2\text{O}$
- 8) $1 \text{ C}_3\text{H}_8 + 5 \text{ O}_2 \rightarrow 3 \text{ CO}_2 + 4 \text{ H}_2\text{O}$
- 9) $2 \text{ C}_8\text{H}_{18} + 25 \text{ O}_2 \rightarrow 16 \text{ CO}_2 + 18 \text{ H}_2\text{O}$
- 10) $1 \text{ FeCl}_3 + 3 \text{ NaOH} \rightarrow 1 \text{ Fe(OH)}_3 + 3 \text{ NaCl}$
- 11) $4 \text{ P} + 5 \text{ O}_2 \rightarrow 2 \text{ P}_2\text{O}_5$
- 12) $2 \text{ Na} + 2 \text{ H}_2\text{O} \rightarrow 2 \text{ NaOH} + 1 \text{ H}_2$
- 13) $2 \text{ Ag}_2\text{O} \rightarrow 4 \text{ Ag} + 1 \text{ O}_2$
- 14) $1 \text{ S}_8 + 12 \text{ O}_2 \rightarrow 8 \text{ SO}_3$
- 15) $6 \text{ CO}_2 + 6 \text{ H}_2\text{O} \rightarrow 1 \text{ C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2$
- 16) $2 \text{ K} + 1 \text{ MgBr}_2 \rightarrow 2 \text{ KBr} + 1 \text{ Mg}$
- 17) $2 \text{ HCl} + 1 \text{ CaCO}_3 \rightarrow 1 \text{ CaCl}_2 + 1 \text{ H}_2\text{O} + 1 \text{ CO}_2$
- 18) $1 \text{ HNO}_3 + 1 \text{ NaHCO}_3 \rightarrow 1 \text{ NaNO}_3 + 1 \text{ H}_2\text{O} + 1 \text{ CO}_2$
- 19) $2 \text{ H}_2\text{O} + 1 \text{ O}_2 \rightarrow 2 \text{ H}_2\text{O}_2$
- 20) $2 \text{ NaBr} + 1 \text{ CaF}_2 \rightarrow 2 \text{ NaF} + 1 \text{ CaBr}_2$
- 21) $1 \text{ H}_2\text{SO}_4 + 2 \text{ NaNO}_2 \rightarrow 2 \text{ HNO}_2 + 1 \text{ Na}_2\text{SO}_4$

Word Equations - Answer Key

- 1) Zinc and lead (II) nitrate react to form zinc nitrate and lead.



- 2) Aluminum bromide and chlorine gas react to form aluminum chloride and bromine gas.



- 3) Sodium phosphate and calcium chloride react to form calcium phosphate and sodium chloride.



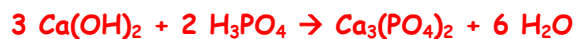
- 4) Potassium metal and chlorine gas combine to form potassium chloride.



- 5) Aluminum and hydrochloric acid react to form aluminum chloride and hydrogen gas.



- 6) Calcium hydroxide and phosphoric acid react to form calcium phosphate and water.



- 7) Copper and sulfuric acid react to form copper (II) sulfate and water and sulfur dioxide.



- 8) Hydrogen gas and nitrogen monoxide react to form water and nitrogen gas.

