Chemical Reaction



Chemical Reaction

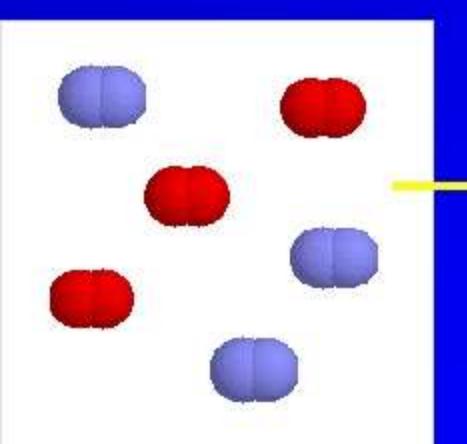
- Chemical equations are a process showing the changes in a chemical reaction.
- Example: AgNO₃ + NaCl → AgCl + NaNO₃ reactants
- Reactants are on the left of the →
- means that the putting those two chemicals together yields
- Product of the chemical reaction is after the ->

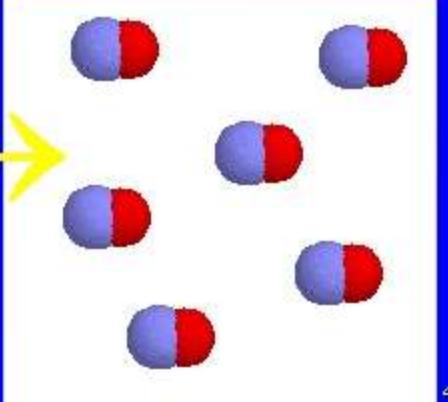


Combination Reactions

Reactants

Product





Symbols

- Symbols are used to show the state of the matter in the chemical reaction
 - (c) stands for crystal,
 - -(g) stands for gas,
 - (I) stands for liquid, &
 - (aq) means that is dissolved in water.
 - Example: AgNO3 (aq) + NaCl (aq) → AgCl (c)+ NaNO3 (aq)

Precipitate

- The crystal falls out of the solution in this reaction
- This process is called precipitate
- Sometimes gases are released from a reaction
 - Mg (c) + 2HCl (aq) \rightarrow MgCl (aq) + H₂ (g)

Balancing chemical equations

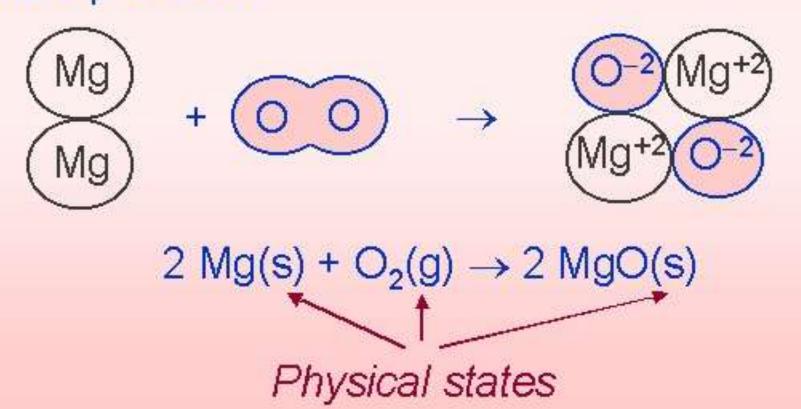
- Write the word equationHydrogen + Oxygen Yields Water
- Then write the symbols and balanced the formulas for the substances in the equation

Balancing Chemical Equations

- Put the reactants on the left and the products on the right
- Check the numbers of atoms of each element on each side of the equation to make sure they balance
- Example Mg + O_2 → MgO
- If atoms do not balance then use coefficients to balance the equation 2Mg + O₂ → 2MgO

Balancing Chemical Equations

A <u>balanced</u> chemical equation has the same type and number of atoms in the reactants as in the products.





Balancing chemical equations

Balance the following equations:

- $Ca_3N_2 + H_2O \rightarrow Ca(OH)_2 + NH_3$
- $\bullet \ \ H_2O_2 \rightarrow \ \ H_2O + \ \ O_2$
- $KClO_3 \rightarrow KCl + O_2$
- $N_2O_5 + H_2O \rightarrow HNO_3$
- O $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$
- Na + $H_2O \rightarrow NaOH + H_2$

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Balanced Equations

- \bullet Ca₃N₂ + 6H₂O \rightarrow 3Ca(OH)₂ + 2NH₃
- O 2H₂O₂ \rightarrow 2H₂O + O₂
- $2KClO_3$ → $2KCl + 3O_2$
- \bullet N₂O₅ + H₂O \rightarrow 2HNO₃
- \circ 2C₂H₆ + 7O₂ \rightarrow 4CO₂ + 6H₂O

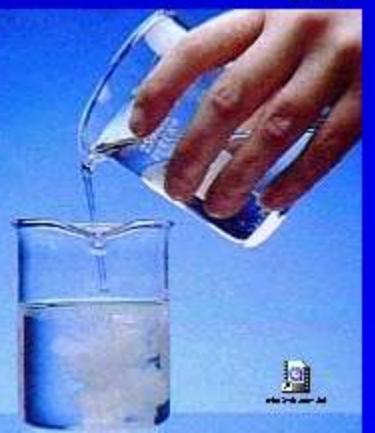


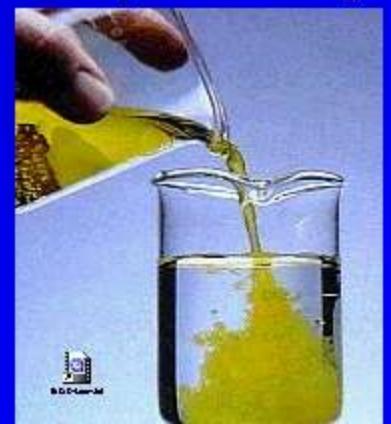
Precipitate Formation

 $Ag^+ + Cl^- \rightarrow AgCl$

 $Cr^{3+} + 3OH^{-} \rightarrow Cr(OH)_{3}$

Ba²⁺ + CrO₄²⁻ → BaCrO₄







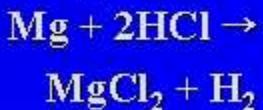


Gas Bubbles

 $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2(g)$









Types of reactions

- Synthesis reaction is putting things together
- Synthesis is sometimes called a composition or combination reaction C + O₂ → CO₂



Combination

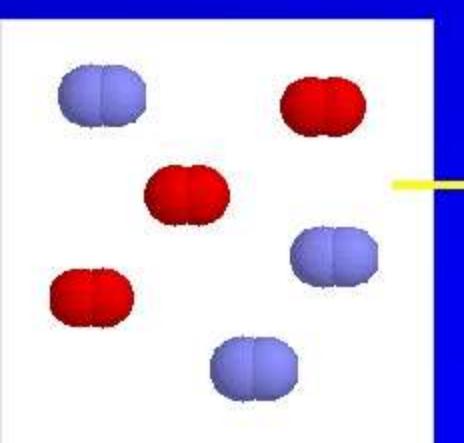
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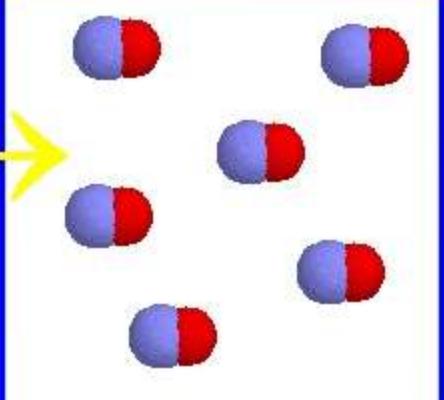


Combination Reactions

Reactants

Product





Types of Reactions

 Decomposition is a reaction that causes things to break down 2H₂O₂ → 2H₂O + O₂



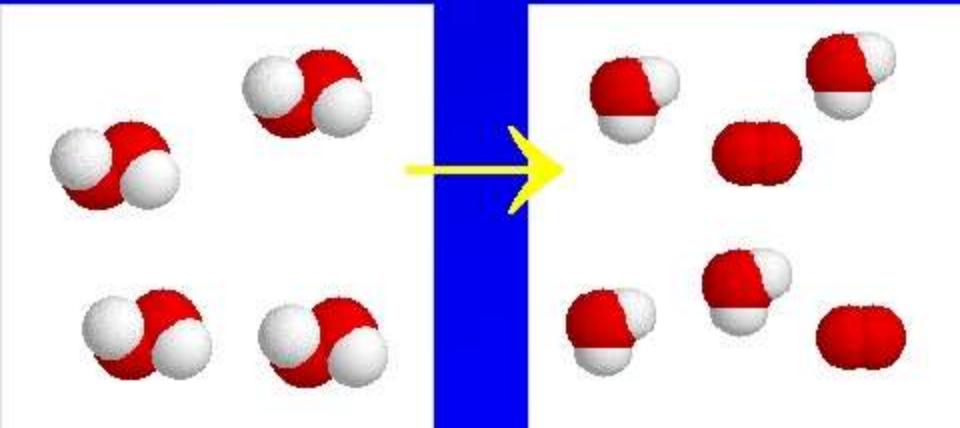
Decomposition





Decomposition Reactions

Reactant Products

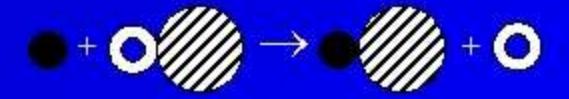


Types of reactions

- Displacement reactions are when one element will replace another element
 - Single displacement
 BeF₂ + Mg → MgF₂ + Be
 - Double Displacement
 AgNO₂ + NaCl → AgCl + NaNO₃
- Electrolysis is the process of running an electrical current through a brine solution to cause them to break down



Single Displacement





Double Displacement





Classify the following reactions, based on the changes happening at an atomic/molecular level.

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1. AIF_3(aq) + 3H_2O(1) \rightarrow AI(OH)_3(s) + 3HF(aq)
2. BaCl<sub>2</sub>(aq) + Na<sub>2</sub>SO<sub>4</sub>(aq) \rightarrow BaSO<sub>4</sub>(s) + 2NaCl(aq)
3. Ca(OH)_2(s) \rightarrow CaO(s) + H_2O(g)
4. Ca(s) + 2H_2O(1) \rightarrow Ca(OH)_2(aq) + H_2(g)
5. CaO(s) + CO_3(g) \rightarrow CaCO_3(s)
6. Cl_2(aq) + 2NaI(aq) \rightarrow 2NaCl(aq) + I_2(aq)
7. Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)
8. Fe(s) + 2HCl(aq) \rightarrow FeCl_2(aq) + H_2(g)
9. H_2SO_3(aq) \rightarrow H_2O(1) + SO_2(g)
10. 2\text{HgO}(s) \rightarrow 2\text{Hg(I)} + O_2(g)
11. KOH(aq) + HNO<sub>3</sub>(aq) \rightarrow KNO<sub>3</sub>(aq) + H<sub>2</sub>O(I)
12. 4\text{Li}(s) + O_2(g) \rightarrow 2\text{Li}_2O(s)
13. Na<sub>2</sub>S(aq) + 2H Cl(aq) \rightarrow 2NaCl(aq) + H<sub>2</sub>S(g)
14. NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)
15. NiC O<sub>g</sub>(s) \rightarrow NiO(s) + C O<sub>g</sub>(g)
16.P_s(s) + 10F_s(g) \rightarrow 4PF_s(g)
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The law of conservation of mass

- Applies to regular chemical reactions.
 - The basics of the law state that matter is not created or destroyed
 - This is why it is necessary to have the right number and kinds of atoms on each side of the equation. The mass must be the same.

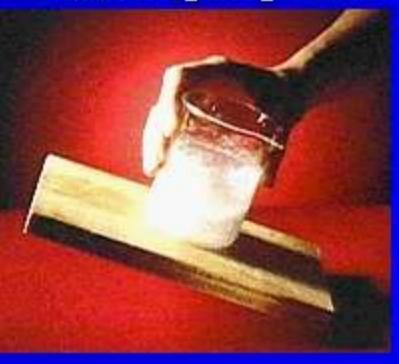
Energy of Reactions

- Exothermic Reactions give off energy
- Endothermic reactions require energy to take place
- The Rate of the reaction can be affected Inhibitors - slow down the reaction
 - Preservatives
- Catalyst speed up a reaction
 - Enzymes



Temperature Change

$Ba(OH)_2 \cdot 8H_2O + NH_4CI$



Thermite: Al + Fe₂O₃





Predicting Reactions

- When two salts react it will be a double displacement
- When a salt reacts with another single element it is usually a single displacement
- When an acid and a base react the produce salt and water
- When a metal oxide is put in water it forms a hydroxide
- When a highly reactive metal is put in water it forms a hydroxide and hydrogen gas
- When a nonmetal oxide is put in water it forms an acid
- When a hydrocarbon burns it produces carbon dioxide and water