

Chemical Reactions & Equations



I. Chemical Reactions

- A. Chemical reactions occur when atoms are: **separated, joined or rearranged**
- B. As reactants are converted to products, the bonds holding the atoms together are: **broken and new bonds are formed**
- C. In a reaction, one or more substances **(reactants)** change into one or more new substances **(products)**.



Atoms of one element never change into atoms of another element in a chemical reaction.

Why?

Atoms are neither created or destroyed in a chemical reaction, they are simply rearranged.



Reactants → Products

Left side is called? Rt. side is called?

D. What symbol separates the reactants from the products?

Arrow, which means:

Yield, Reacts to produce, To produce

Reactant + Reactant → Product + Product

↓
“Reacts with” to separate 2 reactants

↓
“and” is used to separate 2 products



II. Writing Chemical Equations

A. Chemical equation:
identifies & describes the reactants & products

Chemical equations can be described 3 ways:

Written Words

Word Equation

Skeletal Equation



Rules for writing chemical eq.

1. Include the physical states of reactants & products.

Solid (s), Liquid (l), Gas (g), Aqueous (aq)
Aqueous means dissolved in water

2. Some elements in chemical equations **ONLY** appear as diatomic molecules.

H₂ O₂ F₂ Br₂ I₂ N₂ Cl₂

3. Some reactions require the help of a catalyst.

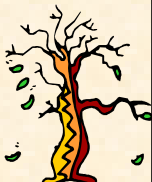
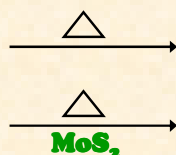
Catalyst speeds up the reaction but is not part of the product or used up in the rxn.

4. The chemical formula for the catalyst must always be written above or below the arrow in a chemical equation.



5. If heat is a catalyst in a reaction, it is symbolized as a triangle and is always written above the arrow.

What happens if you have both heat & a chemical as catalysts?



A. Written Words

Ex 1: $\text{Fe(s)} + \text{O}_2\text{(g)} \rightarrow \text{Fe}_2\text{O}_3\text{(s)}$, interpret the following equation in written words

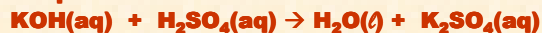
Solid iron reacts with oxygen gas to produce solid iron (III) oxide.



Why is oxygen in the example written as O_2 ?

Written Words

Example 2:



Aqueous potassium hydroxide reacts with aqueous sulfuric acid to produce water and aqueous potassium sulfate.



The word **“reacts with”** is used to separate two reactants and the word **“and”** is used to separate two or more products.

B. Word Equation

Ex 1: Solid sodium reacts with water to produce aqueous sodium hydroxide and hydrogen gas.

Solid sodium + water → Aqueous sodium hydroxide + hydrogen gas

A (+) symbol is used to separate two reactants or two products.



C. Skeletal Equation

What is a skeletal equation?

Ex 1: Manganese (IV) oxide catalyzes the decomposition of aqueous hydrogen peroxide into water vapor and oxygen gas.



Why is oxygen gas written as O_2 ?

Skeletal Equation

Ex 2: Solid sodium reacts with water to produce aqueous sodium hydroxide and hydrogen gas.



Why is hydrogen gas written as H_2 ?

Skeletal Equation

Ex 3: Solid sodium hydrogen carbonate reacts with a solution of hydrochloric acid to produce aqueous sodium chloride, water and carbon dioxide gas.

