

Chemical Reactions

Quantitative Chem

Indicators of a Chemical Reaction

Indicators of a Chemical Reaction

1. Formation of a solid
(called a *precipitate*)

Indicators of a Chemical Reaction

1. Formation of a solid (called a *precipitate*)
2. Production of gas

Indicators of a Chemical Reaction

1. Formation of a solid (called a *precipitate*)
2. Production of gas
3. Production (or absorption) of heat and light

Parts of a Chemical Equation



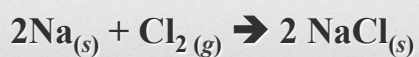
Parts of a Chemical Equation

Reactants → Products



Parts of a Chemical Equation

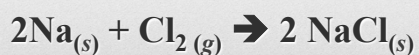
Reactants → Products



↑ Coefficients ↑

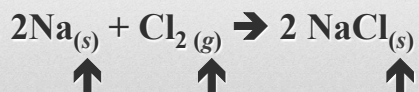
Parts of a Chemical Equation

Reactants → Products



↑ Subscripts

Parts of a Chemical Equation



↑ ↑ ↑
States of Matter

Parts of a Chemical Equation

States of Matter:

(s) = solid (l) = liquid

(g) = gas (aq) = solution

Arrows: → means “to yield”
or “produce”

Why do we need to balance a chemical equation?

Because matter is not created or destroyed in a chemical reaction! (The law of conservation of matter)

The amount of each element remains the same.

Determine the number of atoms in each of the following compounds.

NaCl: _____ Na _____ Cl

K₃N: _____ K _____ N

Al₂O₃: _____ Al _____ O

Coefficients!

3NaCl: _____ Na _____ Cl

4Al₂O₃: _____ Al _____ O

Rules for Balancing (Coeff)

1. Start with the most complex element or compound.
2. Balance oxygen last
3. Balance hydrogen second to last
4. If stuck on oxygen, double everything except O₂, then balance.
5. Double-check your work.

- $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$
- $NaOH \rightarrow Na_2O + H_2O$
- $H_2 + O_2 \rightarrow H_2O$
- $Zn + 2 HCl \rightarrow H_2 + ZnCl_2$
- $K_2CrO_4 + Pb(NO_3)_2 \rightarrow$
 $2 KNO_3 + PbCrO_4$
- $H_2CrO_4 + Pb(OH)_2 \rightarrow$
 $2 H_2O + PbCrO_4$

Examples of Chemical Reactions

Type	Definition	Characteristics	Examples
Synthesis	Two or more reactants combine to form a single product.	$A + B \rightarrow AB$ Energy ("Δ") needs to be supplied. Only 1 compound is formed	$Mg + O_2 \xrightarrow{\Delta} MgO$ $Fe + S_8 \xrightarrow{\Delta} FeS$
Decomposition	A compound is broken down into two or more simpler substances.	$AB \rightarrow A + B$ 1. Metallic Hydroxide → Metallic Oxide + H ₂ O 2. Metallic Carbonate → Metallic Oxide + CO ₂ 3. Metallic Chlorate → Metallic Chloride + O ₂ 4. Oxyacid → Nonmetallic Oxide + H ₂ O 5. Binary Compound → 2 Elements	$NaOH \rightarrow Na_2O + H_2O$ $Na_2CO_3 \rightarrow Na_2O + CO_2$ $NaClO_3 \rightarrow NaCl + 3O_2$ $H_2CO_3 \rightarrow H_2O + CO_2$ $2H_2O \rightarrow H_2 + O_2$

Classifying Reactions

Type	Definition	Characteristics	Examples
Single Displacement	One element displaces another element from a compound.	$AX + Z \rightarrow AZ + X$ $A + BX \rightarrow B + AX$ A cation replaces a cation or an anion replaces an anion. An element and compound are formed	$Cu + AgNO_3 \rightarrow Ag + Cu(NO_3)_2$ $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$ $Zn + 2HCl \rightarrow H_2 + ZnCl_2$
Double Displacement	Two aqueous compounds switch their cations (or anions).	$AC + BD \rightarrow BC + AD$ Two soluble compounds react Forms two compounds where the cations (or anions) switch places.	$KI + PbCrO_4 \rightarrow K_2CrO_4 + PbI_2$ $AgNO_3 + CuCl_2 \rightarrow AgCl + Cu(NO_3)_2$ $Fe_2(SO_4)_3 + HCl \rightarrow H_2SO_4 + FeCl_3$

Classifying Reactions

Type	Definition	Characteristics	Examples
Neutralization	An acid reacts with a base to form salt and water.	HA+BOH→BA+H ₂ O An acid reacts with a hydroxide compound Produces an ionic compound ("salt") and water.	HCl+NaOH → NaCl+H ₂ O H ₂ SO ₄ +NaOH → Na ₂ SO ₄ +H ₂ O H ₂ CO ₃ +Ca(OH) ₂ → CaCO ₃ +H ₂ O
Combustion	An exothermic reaction that takes place between a substance and oxygen.	C _x H _y +O ₂ →CO ₂ +H ₂ O (X and Y are integers) A carbon-based substance that reacts with oxygen. Produces carbon dioxide and water.	CH ₄ + 2O ₂ → CO ₂ + 2H ₂ O 2C ₄ H ₁₀ +13O ₂ → 8CO ₂ +10H ₂ O 2C ₂ H ₃₀ +73O ₂ →48CO ₂ +50H ₂ O

Classifying Reactions

