9/09/25

Key! $3\tilde{A} + \tilde{B}_2 \rightarrow 2C$

Ch. 3 Chemical Reactions & Balancing Equations

Chemical equations are used to represent chemical reactions on paper.

The left side of the equation is for the reactants.

The right side of the equation is for the products.

Coefficients represent the number of molecules or moles of that compound.

Subscripts indicate how many atoms of that element are in a single molecule.

Identify what type of chemical reactions are the following:

$2Mg + O_2 \rightarrow 2MgO$ Combination (synthesis)

$2H_2O_2 \rightarrow 2H_2O + O_2$ Decomposition (analysis)

Complete products $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ Combustion

$CO_2 + H_2O$

incomplete

$CO + H_2O$ $CO_2 + H_2O \rightarrow H_2CO_3$ Combination

$2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$ Incomplete combustion

General Formula

$A + B \rightarrow C$

Combination (synthesis)

$C \rightarrow A + B$

Decomposition (Analysis)

Hydrocarbon + $O_2 \rightarrow CO_2 + H_2O$ + energy heat or light

Combustion

Single Replacement

$A + BC \rightarrow AC + B$

Double Replacement

$AB + CD \rightarrow BC + AD$

Reactants

$Al_{(s)} + HCl_{(aq)} \rightarrow$

Ionic

$Al^{+3}Cl^{-1}_{(aq)} + H_2(g)$

Identify the reactants and products in this reaction and balance the equation: When solid aluminum reacts with aqueous hydrochloric acid, it produces aqueous aluminum chloride and hydrogen gas.

$2\ Al_{(s)} + 6\ HCl_{(aq)} \rightarrow 2\ AlCl_{3(aq)} + 3\ H_{2(g)}$

Al: +2 | Al: +2
H: +2 6 | H: 2 6
Cl: +2 6 | Cl: 3 6

$4\ Fe + 3\ O_2 \rightarrow 2\ Fe_2O_3$

Fe: x2 4 | Fe: 2 4
O: 2 6 | O: 3 6

$C_2H_4 + 3\ O_2 \rightarrow 2\ CO_2 + 2\ H_2O$

C: 2 | C: 1 2
H: 4 | H: 2 4
O: 2 6 | O: 3 5 6

$3\ KOH + 1\ H_3PO_4 \rightarrow 1\ K_3PO_4 + 3\ H_2O$

A B | C D | A B | B C

K: +3 | K: 3
O: 5 7 | O: 5 7
H: H 6 | H: 2 6
P: 1 | P: 1

$2\ N_2(g) + 5\ O_2(g) + 2\ H_2O \rightarrow 4\ HNO_3(aq)$

N: 2 4 | N: x2 4
O: 4 12 | O: 3 12
H: 2 4 | H: x2 4

Calculate the molecular weight of the following compounds:

Ammonia (NH_3)

N: 1 x 14.007 = 14.007
H: 3 x 1.008 = + 3.024

17.034 amu

Glucose ($C_6H_{12}O_6$)

C: 6 x 12.011 = 72.---
H: 12 x 1.008 = 12.---
O: 6 x 16.000 = 96.---

180.000 amu

Ethanol (C_2H_5OH)

C: $2 \times 12.01 = 24.02$

H: $6 \times 1.008 = 6.048$ +

O: $1 \times 16.00 = 16.00$ g

46.068 amu

Sulfuric Acid (H_2SO_4)

H: $2 \times 1.008 = 2.016$

S: $1 \times 32.06 = 32.06$ +

O: $4 \times 16.00 = 64.00$

98.076 amu

What's the formula for percent composition?

$$\% \text{ element} = \frac{\left(\begin{matrix}\#\text{ of atoms} \\ \text{of element}\end{matrix}\right)\left(\begin{matrix}\text{atomic weight} \\ \text{of element}\end{matrix}\right)}{\text{Formula weight of substance}} \times 100$$

Calculate the percent composition of Calcium, Carbon, and Oxygen:

Calcium Carbonate ($CaCO_3$) → Ionic bond

$\frac{\text{part}}{\text{whole}} \times 100 = \%$ comp.

Ca: $1 \times 40.078 = 40.078$

C: $1 \times 12.011 = 12.011$

O: $3 \times 16.000 = 48.00$

~~105.09~~

→ 100.089

Ca: $\frac{40.078}{100.089} \times 100 = 40.04\ \%$

C: $\frac{12.011}{100.089} \times 100 = 12.00\ \%$

O: $\frac{48.000}{100.089} \times 100 = 47.96\ \%$

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