## Key Equations

*Equation* 12.1 (page 477)

Boyle's law (where $P$ is the pressure and $V$ is the volume)

$$P_1V_1 = P_2V_2$$

*Equation* 12.2 (page 478)

Charles's law (where $T$ is the Kelvin temperature)

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

*Equation* 12.3 (page 479)

General gas law (combined gas law) for a fixed amount of gas

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

*Equation* 12.4 (page 481)

Ideal gas law (where $n$ is the amount of gas (moles) and $R$ is the universal gas constant, $0.082057L \cdot \mathrm{atm}/K \cdot \mathrm{mol})$

$$\mathrm{PV} = \mathrm{nRT}$$

*Equation* 12.5 (page 483)

Density of gases (where $d$ is the gas density)

$$d = \frac{m}{V} = \frac{\mathrm{PM}}{\mathrm{RT}}$$

*Equation* (page 488)

Dalton's law of partial pressures. The total pressure of a gas mixture is the sum of the partial pressures of the component gases $(P_n)$.

$$P_{\text{total}} = P_1 + P_2 + P_3 + \cdots$$

*Equation* 12.7 (page 488)

The total pressure of a gas mixture is equal to the total number of moles of gases multiplied by $(\mathrm{RT}/V)$.

$$P_{\text{total}} = n_{\text{total}} \left(\frac{\mathrm{RT}}{V}\right)$$

*Equation* 12.8 (page 489)

The partial pressure of a gas (A) in a mixture is the product of its mole fraction $(X_A)$ and the total pressure of the mixture.

$$P_A = X_A\left(P_{\text{total}}\right)$$

*Equation* 12.9 (page 492)

Maxwell's equation, which relates the rms speed $\left(\sqrt{\overline{u^2}}\right)$ to the molar mass of a gas (*M*) and its temperature (*T*)

$$\sqrt{\overline{u^2}} = \sqrt{\frac{3\text{RT}}{M}}$$

*Equation* 12.10 (page 492)

Graham's law. The rate of effusion of a gas—the quantity of material moving from one place to another in a given amount of time—is inversely proportional to the square root of its molar mass.

$$\frac{\text{Rate of effusion of gas 1}}{\text{Rate of effusion of gas 2}} = \sqrt{\frac{\text{molar mass of gas 2}}{\text{molar mass of gas 1}}}$$