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**Molecular Level Origin of Pressure**

$$P = \frac{nN_A}{V} \mathbb{E}(\mathcal{V}^2) = \frac{nN_A}{V} k_B T \quad (1)$$

**Ideal Gas Equation of State**

$$PV = nRT \quad (2)$$

**Definition of Absolute Temperature Scale Relative to Celsius Scale**

$$\frac{T}{K} = \frac{T_C}{^\circ C} + 273.15 \quad (3)$$

**Relation Between Total and Partial Pressure**

$$P = \sum_{i=1}^k \frac{n_i RT}{V} = \sum_{i=1}^k P_i = P_1 + P_2 + P_3 + \cdots + P_k \quad (4)$$

**Relation Between Partial Pressure, Total Pressure, and Mole Fraction**

$$\frac{P_i}{P} = \frac{\frac{n_i RT}{V}}{\sum_{i=1}^k \frac{n_i RT}{V}} = \frac{\frac{n_i RT}{V}}{\frac{nRT}{V}} = \frac{n_i}{n} = x_i \quad (5)$$

**Van Der Waals Equation of State**

$$\left( P + \frac{an^2}{V^2} \right) (V - nb) = nRT \quad (6)$$