

## Ideal Gas Law

### *Molecular Mass, the Mole, and Avogadro's Number:*

Atomic mass unit:  $1 \text{ u} = 1.6605 \times 10^{-27} \text{ kg}$

⇒ the mass per mole (g/mol) of a substance has the same numerical value as the atomic or molecular mass of the substance (in u)

$n$  → # of moles

$N$  → # of particles

$N_A$  →  $6.022 \times 10^{23} \text{ mol}^{-1}$

$m$  → mass of sample

$m_{\text{particle}}$  → mass of particle

$$n = \frac{N}{N_A}$$

$$m = m_{\text{particle}} N$$

$$\text{Mass per mole} = m_{\text{particle}} N_A$$

$$n = \frac{m}{\text{Mass per mole}}$$

### *Ideal Gas Law:*

$$PV = nRT \quad R = 8.31 \text{ J/mol}\cdot\text{K}$$

$$PV = NkT \quad k = 1.38 \times 10^{-23} \text{ J/K}$$

Boyle's law (applies if  $n$  and  $T$  are constant):  $P_i V_i = P_f V_f$

Charles' law (applies if  $n$  and  $P$  are constant):  $\frac{V_i}{T_i} = \frac{V_f}{T_f}$