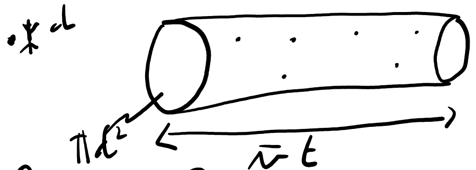


a molecule has a mean velocity $\bar{v}$

During "t", the particle travels across $V = \pi d^2 \bar{v} t$.

Mean free path $\lambda = \dfrac{\bar{v} t}{\pi d^2 \bar{v} t \times n_V}$ → particle concentrat°.

Consider now the displacement of the others molecules.

relative velocity : $\bar{v}_r^2 = |\bar{v}_1 - \bar{v}_2|^2 = \bar{v}_1^2 + \bar{v}_2^2 - 2\bar{v}_1\bar{v}_2$

Uncorrelated velocities $\Rightarrow \bar{v}_1 \bar{v}_2 = 0$

$\Rightarrow \bar{v}_r = \sqrt{2}\ \bar{v}$ (statistically $\bar{v}_1 = \bar{v}_2 = \bar{v}$)

① Ideal gas $\Rightarrow PV = nRT$

and volume density of particles : $n_V = \dfrac{n \times N_A}{V}$

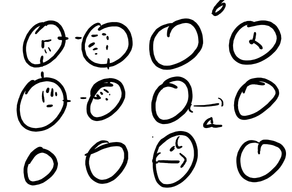
$\Rightarrow n_V = \dfrac{N_A P}{RT}$

$\Rightarrow$ Mean free path : $\lambda = \dfrac{\cancel{\bar{v}}\ \cancel{t}}{\bar{v}_r\, t\, \pi d^2\, n_V}$

$\Rightarrow \lambda = \dfrac{RT}{\sqrt{2}\ \pi d^2\, N_A P}$

↳ Avogadro number

Porosity of some arrangements

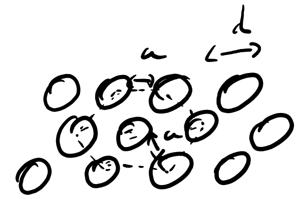


elementary volume

$\varepsilon = \dfrac{S_\alpha}{S_\sigma + S_\alpha} = \dfrac{\pi d^2/4}{(d+a)^2} = \dfrac{\pi}{4\left(1+\frac{a}{d}\right)^2}$

ε_{max} when $a = 0 \Rightarrow \varepsilon_{max} = \dfrac{\pi}{4} = 0.79$.

②

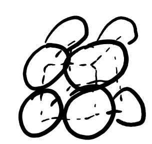


$\varepsilon = \dfrac{S_\alpha}{S_\sigma + S_\alpha}$

$\Rightarrow S_\alpha + S_\sigma = \dfrac{3\sqrt{3}\,(d+a)^2}{2}$ and $S_\alpha = 3 \times \dfrac{\pi d^2}{4}$

$\Rightarrow \varepsilon = \dfrac{\pi}{2\sqrt{3}\left(1+\frac{a}{d}\right)^2}$ $\Rightarrow \varepsilon_{m}(a=0) = \dfrac{\pi}{2\sqrt{3}} \simeq 0.91$

③ Elementary volume



$V_\alpha + V_\sigma = d^3$

$V_\alpha = V_\alpha + V_\sigma - V_\sigma = d^3 - \cancel{8} \times \left(\frac{4}{3}\pi\left(\frac{d}{2}\right)^3\right) \times \frac{1}{\cancel{8}}$

$= d^3\left[1 - \dfrac{\pi}{6}\right]$

$\Rightarrow \varepsilon = \dfrac{V_\alpha}{V_\alpha + V_\sigma} = 1 - \dfrac{\pi}{6} \simeq 0.48$

Specific surface

$S_s = \dfrac{S_\sigma}{V_\alpha + V_\sigma}$

$V_\alpha + V_\sigma = d^3$

$S_\sigma = \cancel{8} \times \dfrac{1}{\cancel{8}} \times 4\pi\left(\dfrac{d}{2}\right)^2 = \pi d^2$

$\Rightarrow S_s = \dfrac{\pi}{d}$