Spring 2002 #6

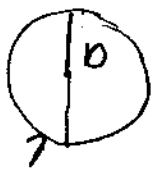
$\ell = \tau \bar{v} = \frac{\bar{v}}{\bar{V}} \frac{1}{n\sigma_0}$ ← average speed of incident particle

$\bar{V}$ ← relative average speed

$n\sigma_0$ — scattering cross section

ℓ · mean free path

$\frac{1}{\tau} = \omega$ ← frequency of collisions



$\sigma_0 = \pi\left(\frac{d}{2} + \frac{D}{2}\right)^2$ Ref 12.2.c.1

$\bar{V} = \bar{v}$ since target is fixed

$\bar{v} = \sqrt{\frac{8KT}{\pi m}}$ Ref 7.10.13

$\frac{\bar{v}}{\omega} = \frac{1}{n\sigma_0}$ $\omega = \bar{v} n \sigma_0$ $= \pi\left(\frac{d}{2} + \frac{D}{2}\right)^2 n \sqrt{\frac{8KT}{\pi m}}$

$= \left(\frac{d}{2} + \frac{D}{2}\right)^2 n \sqrt{\frac{\pi 8KT}{m}}$

$= \frac{1}{4}(d+D)^2 n \sqrt{\frac{\pi 8KT}{m}}$

$= (d+D)^2 n \sqrt{\frac{\pi KT}{2m}}$