Ater Dok Phys-271

Finding time between collisions in a cold molecular Hydrogen cloud, with a molecule density of $n = 8.33E8\ mol/m^3$, a temperature of $T = 15k$.

* Approx $d_{H_2} = 1.6E-10m$

Solution: $mfp = \frac{1}{\pi d^2 n} \rightarrow \frac{1}{\pi (1.6E-10m)^2 (8.33E8 mol/m^3)}$

$mfp = 1.49E10\ m \rightarrow .0998\ AU$

$v_{H_2} = \sqrt{\frac{3kT}{(2m_H)}} \rightarrow T = 15K,\ m_{H_2} = 2m_H = 2 \cdot (1.67E-27kg)$

$v_{H_2} = \sqrt{\frac{3(1.38E-23 J/k)\,15k}{3.34E-27 kg}} = 431.2\ m/s$

$t = \frac{mfp}{v} = \frac{1.49E10m}{431.2\ m/s} = 3.46E7\ s,\ 399.99d,\ 1.096yr$