

31. (a) According to Eq. 20-25, the mean free path for molecules in a gas is given by

$$\lambda = \frac{1}{\sqrt{2}\pi d^2 N/V} ,$$

where d is the diameter of a molecule and N is the number of molecules in volume V . Substitute $d = 2.0 \times 10^{-10} \text{ m}$ and $N/V = 1 \times 10^6 \text{ molecules/m}^3$ to obtain

$$\lambda = \frac{1}{\sqrt{2}\pi(2.0 \times 10^{-10} \text{ m})^2(1 \times 10^6 \text{ m}^{-3})} = 6 \times 10^{12} \text{ m} .$$

- (b) At this altitude most of the gas particles are in orbit around Earth and do not suffer randomizing collisions. The mean free path has little physical significance.