

2. (Atmospheric density)

- (a) If you hold up your hand, how many molecules per second are colliding with your palm? We are interested in the order of magnitude, not the last factor of two. Approximate the atmosphere as pure oxygen (of molecular mass 32 a.m.u.).

Suppose that the atmosphere was in equilibrium at constant temperature. Then, in addition to the kinetic energy of the molecules in the air, one would have to take account of the potential energy due to gravity. Under these assumptions:

- (b) What is the probability distribution for the height h of a molecule above the surface of the earth?
- (c) How much less oxygen would you find at a height of 1 km than you do at the earth's surface?

Some relevant constants: $R \approx 8.3 \frac{\text{J}}{\text{mol K}}$, $N_A \approx 6.02 \times 10^{23} \text{mol}^{-1}$.