Problem 1.18

Calculate the rms speed of nitrogen molecule at room temperature.

Problem 1.25

List all the degreees of freedom for a molecule of water. Careful!

Calculate rms speed of nitrogen molecule at room temp.

$$V_{rms} = \sqrt{\overline{v^2}} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3 N_B k T}{N_A m}} = \sqrt{\frac{3RT}{M}}$$

$$\frac{1}{2} m \overline{v_2} = \frac{3}{2} kT$$

N_A , M molar mass

$$V_{rms} = \sqrt{\frac{3 \cdot (8.31 \, J/K)(300\,K)}{2 \cdot 14 \cdot 10^{-3} kg}} = 517 \frac{m}{s} \quad !$$

List all the degrees of freedom for a molecule of water. Careful!

3 transl.

2 × 2 vibrational (bonds) k_1 k_2 } frozen out at room temp.

1 × 2 vibr. of angle

3 rotational (because no symm.)

→ f = 12