

3) Tlak na vnitřní stěně

5. domácí úkol - oprava

a) výslo $\frac{p_R}{p_0} = e^{-\frac{m\omega^2 R^2}{2kT}}$

b) poměr MB rozdělení, $T = \text{konst.}$

$$\frac{p_R}{p_0} = \frac{\frac{m\omega^2}{2\pi H} e^{-\frac{m\omega^2 R^2}{2kT}}}{\frac{m\omega^2}{2\pi H} \cdot e^0} = e^{-\frac{m\omega^2 R^2}{2kT}}$$

$$Z = \frac{1}{h^{6N}} \int \int e^{-\frac{1}{kT} \left(\frac{p^2}{2m} + \frac{m\omega^2 r^2}{2} \right)} d^3r d^3p$$

R^3 válec

$$Z = \frac{1}{h^{6N}} \int_{R^3} e^{-\frac{p^2}{2mkT}} d^3p \int_{\text{válec}} e^{-\frac{m\omega^2 r^2}{2kT}} d^3r = \frac{1}{h^{6N}} (2\pi mkT)^{3/2} \int \int \int_{000}^{R, 2\pi} r e^{-\frac{m\omega^2 r^2}{2kT}} d^3r d\phi d\theta$$

$$= \frac{1}{h^{6N}} (2\pi mkT)^{3/2} \cdot H \cdot 2\pi \cdot \frac{2kT}{m\omega^2} \left[e^{-t} \right]_0^{\frac{m\omega^2 R^2}{2kT}}$$

$$= \underbrace{\frac{1}{h^{6N}} (2\pi mkT)^{3/2} H 2\pi \frac{2kT}{m\omega^2}}_{\text{konst.}} \left(e^{-\frac{m\omega^2 R^2}{2kT}} - 1 \right)$$

$$F = -kT \ln Z \quad p = - \left(\frac{\partial F}{\partial V} \right)_T = kT \frac{1}{Z} \left(\frac{\partial Z}{\partial V} \right)_T$$

$$V = \pi R^2 H$$

$$p = kT \frac{1}{\left(e^{-\frac{m\omega^2 R^2}{2kT}} - 1 \right)} \frac{\partial}{\partial V} \left(e^{-\frac{m\omega^2 R^2}{2kT}} \right)$$

$$dV = 2\pi R H dr$$

$$p = kT \frac{1}{\left(e^{-\frac{m\omega^2 R^2}{2kT}} - 1 \right)} \frac{1}{2\pi R H} \frac{\partial}{\partial R} \left(e^{-\frac{m\omega^2 R^2}{2kT}} \right)$$

$$p = \frac{kT}{e^{-\frac{m\omega^2 R^2}{2kT}} - 1} \frac{1}{2\pi R H} \cdot \left(-\frac{m\omega^2 R}{kT} \right) \cdot e^{-\frac{m\omega^2 R^2}{2kT}} = -\frac{m\omega^2}{2\pi H} \frac{e^{-\frac{m\omega^2 R^2}{2kT}}}{e^{-\frac{m\omega^2 R^2}{2kT}} - 1}$$

$$p = -\frac{m\omega^2}{2\pi H} \cdot \frac{1}{1 + e^{\frac{m\omega^2 R^2}{2kT}}} = \left[m\omega^2 R^2 \gg 2kT \Rightarrow \left(1 - e^{-\frac{m\omega^2 R^2}{2kT}} \right) \approx e^{-\frac{m\omega^2 R^2}{2kT}} \right] =$$

$$p \approx \frac{m\omega^2}{2\pi H} e^{-\frac{m\omega^2 R^2}{2kT}}$$