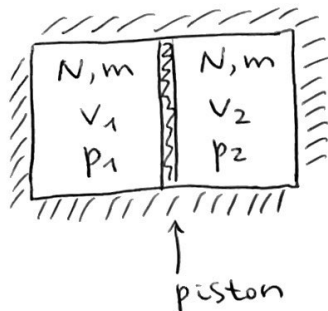


HW #4 (2025)

- ① 20 pt a thermally insulated cylinder is separated into two compartments by a frictionless piston:



Both compartments have the same total number of particles N with mass m . Ideal Fermi gases form in each compartment. Particles in compartment 1 have spin S_1 ; — " — — " — — " — " — 2 have spin S_2 .

Compute the volume ratio $\frac{V_2}{V_1}$ at thermal equilibrium with:

(a) $T = 0$

(b) $T = \infty$

② 20 pt Consider 2D ideal Bose gas.

(a) Find the grand-canonical partition function $\Sigma(\mu, V, T)$ in terms of

$$g_2(z) = \sum_{k=1}^{\infty} \frac{z^k}{k^2}.$$

(b) Find pressure p in this system.

(c) Find chemical potential μ in terms of T and $n = \frac{N}{A}$, the # part. per unit area.
↑ area = L^2