

HW #1 (2026)

1. 10 pt Consider an entropy function
- $$S = k(NVE)^{1/3}, \quad \text{where } k = \text{const}$$

and N, V, E are the system's # particles, volume, and total energy, respectively.

Find E^A and E^B for two subsystems at thermal equil. The subsystems can exchange energy but not particles or volume. The subsystems are adiabatically insulated from the outside world.

2. 20 pt Consider ideal gas.
- (a) Show that $C_p - C_v = N k_B$
- ↑ specific heat, $p = \text{const}$
↑ specific heat, $V = \text{const}$
↑ Boltzmann's const

- (b) Show that

$$\left(\frac{\partial p}{\partial v}\right)_S = -\gamma \frac{p}{v} \quad , \quad \text{where } \gamma = \frac{C_p}{C_v} .$$

(c) assuming that $\gamma = \text{const}$, derive the law of adiabatics:

$$p T^{\frac{\gamma}{1-\gamma}} = \text{const.}$$

3. 10 pt Chandler 1.15

4. 10 pt Chandler 1.16