

2. Gas (6 points) — Jaan Kalda.

A box of volume V contains ν moles of a monoatomic gas of molar mass μ at a negligibly low temperature. The box stops instantaneously after having moved with a constant speed v (much greater than the thermal speed).

- i) (2 points) Find the temperature inside the box after thermalization.
- ii) (2 points) Find pressure to the front wall (the wall that was at the front while the box was moving) immediately after stopping.
- iii) (2 points) Now, a spherical ball of gas (helium, $\mu = 4$ g/mol of radius $r = 1$ cm, at temperature $T = 300$ K is surrounded by vacuum. The mean free path of the molecules is much larger than r . At a certain moment, the walls of the ball break and after $\tau = 5$ ms, a part of the gas is trapped by erecting instantaneously walls forming a cubical vessel of volume $V = 1$ m³. Find the temperature of the gas inside the cube T' after thermalization; neglect the thermal capacitance of the walls of the cubical vessel. $R = 8.31$ J/kg K.