

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, $\mu = 4 \text{ g/mol}$ of radius $r = 1 \text{ cm}$, at temperature $T = 300 \text{ K}$ 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 $\tau = 5 \text{ ms}$, a part of the gas is trapped by erecting instantaneously walls forming a cubical vessel of volume $V = 1 \text{ m}^3$. Find the temperature of the gas inside the cube T' after thermalization; neglect the thermal capacitance of the walls of the cubical vessel. $R = 8.31 \text{ J/kg K}$.