Now have fun. That's an order!
Starship Troopers (1997)

August 2nd

A gas is placed in a huge adiabatic vessel, divided into two parts a porous partition, on both sides of which constant pressures p_1 and p_2 are maintained, and in consequence of this the gas slowly flows from one part of the vessel to another. The gas temperature on the left part of the vessel is T_1.

1. *(1 point)* Find the change of the temperature for the small gas portion during its overflow, if it is ideal.

The equation for a Van der Waals gas is

$$\left(p + \frac{a\nu^2}{V^2}\right)(V - b\nu) = \nu RT.$$

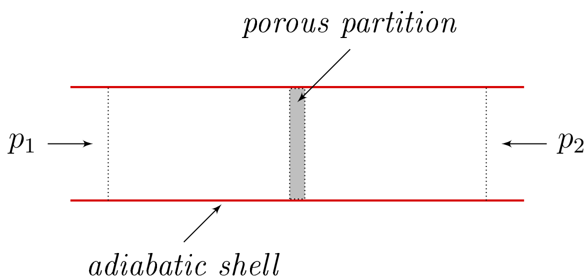
The internal energy of one mole of such a gas obeys the law

$$U = C_V T - \frac{a}{V}.$$

2. *(7 point)* Taking into account the pressure drop $p_1 - p_2 \ll p_1$, find the temperature change for the case of the overflowing small portion of van der Waals gas. Consider that the gas is sufficiently rare. In other words, the terms containing a and b are very small and we can use the linear approximation.

3. *(2 points)* Find the temperature change of the overflowing small portion of the gas if on the left part of the vessel it is dense enough and is described by the equation of Van der Waals, and on the right part is described by the ideal gas model. This is the case if the pressure drop $p_1 - p_2$ is large enough.

In all processes, assume that the heat capacity C_V is known.



First hint — 24.05.2021 14:00 (GMT+3)
Second hint — 26.05.2021 14:00 (GMT+3)

End of the fourth tour — 28.05.2021 22:00 (GMT+3)