Problem 2 (Molecular Physics)

Two cylinders A and B, with equal diameters have inside two pistons with negligible mass connected by a rigid rod. The pistons can move freely. The rod is a short tube with a valve. The valve is initially closed (fig. 2.1).

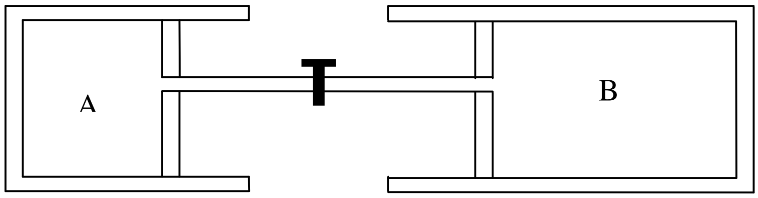

Fig. 2.1

The cylinder A and his piston is adiabatically insulated and the cylinder B is in thermal contact with a thermostat which has the temperature $\theta = 27^oC$.
Initially the piston of the cylinder A is fixed and inside there is a mass m= 32 kg of argon at a pressure higher than the atmospheric pressure. Inside the cylinder B there is a mass of oxygen at the normal atmospheric pressure.
Liberating the piston of the cylinder A, it moves slowly enough (quasi-static) and at equilibrium the volume of the gas is eight times higher, and in the cylinder B de oxygen's density increased two times. Knowing that the thermostat received the heat $Q' = 747,9.10^4$J, determine:

a) Establish on the base of the kinetic theory of the gases, studying the elastic collisions of the molecules with the piston, that the thermal equation of the process taking place in the cylinder A is $TV^{2/3}$ = constant.

b) Calculate the parameters p, V, and T of argon in the initial and final states.

c) Opening the valve which separates the two cylinders, calculate the final pressure of the mixture of the gases.

The kilo-molar mass of argon is μ = 40 kg/kmol.