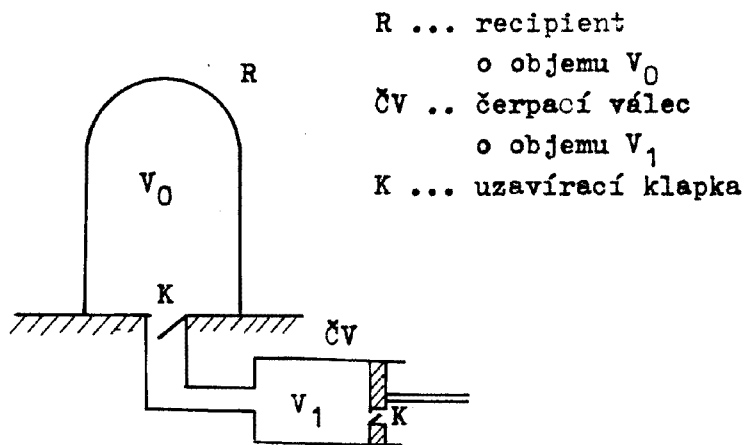
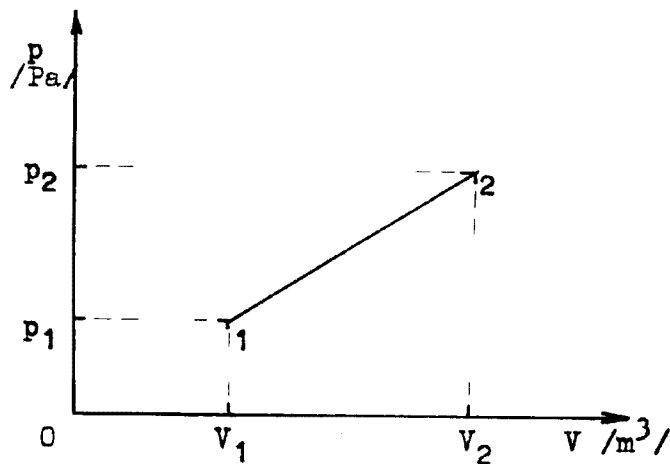


P2.1-1 The pumping cylinder of a piston pump has a volume $V_1 = 2 \text{ dm}^3$, the recipient of the pump has volume $V_0 = 3 \text{ dm}^3$. Calculate, what will be the pressure p_4 and the density of air ρ_4 under the receiver after the fourth stroke if pumping is so slow that the temperature the air pumped can be considered constant. After how many strokes of the piston, the air pressure in the recipient drops to one tenth of the original pressure p_0 ? A diagram of the apparatus is shown in Figure O2.1-1.



Obr.O2.1-1
 Schema pístové vývěvy

P2.1-2 The process in n moles of the ideal gas takes place from state 1 to state 2 according to the diagram in Fig. O2.1-2. How does the volume V and pressure p on temperature Θ during the transition from state 1 to state 2? How does the specific heat capacity (or molecular heat) depend during this process on c_V (or C_V)?



Obr. O2.1-2

P2.1-3 Weight 200 g of nitrogen (consider it ideal gas) heated at constant pressure from a temperature of $\vartheta_1 = 20^\circ\text{C}$ to temperature $\vartheta_2 = 100^\circ\text{C}$. What amount of heat must be supplied to the nitrogen? What is the internal heat gain of the gas? What work does the gas do? (Consider the value for the specific heat capacity of nitrogen in isochoric action $c_V = 0.74 \text{ J}\cdot\text{g}^{-1}\cdot\text{K}^{-1}$.)

P2.1-10 Gas compression from a pressure of 10^5 Pa to $6.5 \cdot 10^5 \text{ Pa}$ takes place by polytropic action with polytropic degree $n = 1, 2$.

Calculate the final temperature of the system Θ_2 , the final volume of the system V_2 and the work W if the initial volume of the gas is 15 m^3 and the initial temperature is 17°C .

$$[\theta_2 = 149^\circ\text{C}, V_2 = 3,2 \text{ m}^3, W = -2,9 \cdot 10^6 \text{ J}]$$

P2.1-12 Determine the mass of oxygen (ideal gas) m enclosed in a bomb with a volume of 10 l , if at a temperature of -13°C the pressure gauge reads $87,5 \cdot 10^5 \text{ Pa}$.

$$[m = 1296 \text{ g}]$$

P2.1-14 What is the change in the internal energy of nitrogen (consider that nitrogen behaves like an ideal gas), which at normal pressure has a volume of 10 litres, if it expands to a volume of 12 litres.

a) isobarically,

(b) adiabatically ?

[a) $\Delta U = 506,5 \text{ J}$

b) $\Delta U = -178 \text{ J}$]

P2.1-18 Derive the ideal gas adiabatic equation and write it in the variables $p, V; \Theta, V; \Theta, p$.

P2.1-19 Calculate the work of the ideal gas at adiabatic change from volume V_1 to volume V_2 . Perform the calculation in two ways:

a) $W = - \int_{U_1}^{U_2} dU$

b) $W = \int_{V_1}^{V_2} p dV.$

$[W = 1/(1 - \kappa) (p_2 V_2 - p_1 V_1)]$