2 lesson. Equation of state of perfect and real gas. Perfect gas processes. 1st law of thermodynamics.

1. Calculate the final pressure when 1 mole of nitrogen at 300 K and 100 atm is heated, at constant volume, until attaining 500 K.
2. Calculate the pressure exerted by 1 mole of CO_2 behaving as (a) perfect gas and (b) van der Waals gas, when it is confined in the following conditions: T = 273.15 K and V = 22.414 L (constants of the van der Waals equation: a=3.592 $atm \cdot L^2 \cdot mol^{-2}$ and b=4.267·$10^{-2} \cdot L \cdot mol^{-1}$)
3. Suggest the pressure and for 1 mole of He at 25 °C to be in same volume with 1 mole of H_2 at 1 atm and 25 °C.
4. Calculate the pressure exerted by 1 mole of ethane (C_2H_6) behaving as: (a) perfect gas; (b) van der Waals gas, when confined in the following conditions: i) 273.15 K and V = 22.414 L; ii) 1000 K and 100 cm^3. Data: a=5.489 $L^2 \cdot atm \cdot mol^{-2}$ and b=6.380·10^{-2} $L \cdot mol^{-1}$.
5. The mass percentage of dry air at sea level is approximately: N_2, 75%; O_2, 23.2% and Ar, 1.3%. What are the partial pressures of each component when the total pressure is 1 atm?
6. A sample of 87 mg of an ideal gas at 0,600 bar duplicates its volume and triplicates its temperature. What will be the final pressure?
7. Two moles of an ideal gas at 500 K are isothermally and reversibly compressed until a final volume that is 1/10 of the initial volume. Calculate: (a) ΔU (b) ΔH (c) work done by the gas (d) heat absorbed by the gas. Specific molar isochoric thermal heat capacity of gas should be taken according to KMT 2.5R.
8. One mole of an ideal gas expands from 10 L and 0 °C to 20 L and 100 °C. Taking C_V = 20 $J \cdot K^{-1} \cdot mol^{-1}$, calculate ΔU, W and Q for each of the following alternative steps for the whole process: (a) Isothermic and reversible expansion at 0 °C from 10 L to 20 L, followed by a constant volume heating until 100 °C and (b) Heating of 10 L at constant volume until 100 °C, followed by an isothermic and reversible expansion until 20 L.