Thermodynamics list 5

1. A compressor is compressing the oxygen to a tank with volume of $V = 8{,}2m^3$. Calculate the amount of compressed gas if before starting the process the parameters within the tank were: the absolute pressure $p_1 = 0{,}1MPa$ and $T_1 = 293K$, and after the compression is completed the parameters are $p_2 = 0{,}8\ MPa, T_2 = 303K$.

2. Calculate density of a gas which represents following volume fractions in the standard conditions: $r_{H_2} = 0{,}5,\ r_{co} = 0{,}19,\ r_{CH_4} = 0{,}22,\ r_{N_2} = 0{,}09$.

3. Calculate the density of the natural gas in standard condition if the volume fraction of the gas is $r_{CH_4} = 0{,}95,\ r_{N_2} = 0{,}05$.

4. Perform balance of a closed system by a diathermic partition, in which 2 kg of helium performed the work of 200kJ while decompressing as a consequence of heat delivery of 400kJ. What is the change of internal energy.

5. As a consequence of heat delivery the air with mass of m=1kg is warmed up under constant pressure for 100K. Find the change of internal energy, absolute work and the amount of heat delivered to the air.

6. A perfect gas has undergone a isothermal process from the stage of $p_1 = 12bar, V_1 = 20dm^3$ to the pressure of $p_2 = 1\ bar$. Calculate volume of the gas at the point where the pressure was $p_a = 8\ bar,\ p_b = 4\ bar$ and $p_2 = 1\ bar$. Moreover, calculate the absolute and technical work.

7. A cylinder closed by the piston is inflated with nitrogen with parameters of $p = 0{,}25\ MPa$ and $V_1 = 3m^3,\ T_1 = 288K$. After a heat delivery the volume of the gas increased to $V_2 = 8m^3$. Calculate the amount of heat consumed by the nitrogen.

8. A monoatomic gas with parameters of $V_1 = 0{,}4\ dm^3,\ p_1 = 1MPa,\ T_1 = 600K$ had undergone an adiabatic process. The final pressure of the gas is $p_2 = 1{,}5bar$. Calculate the technical and absolute work of the process as well as the final parameters of the gas.

9. The oxygen with mass of m=16kg has undergone an isothermal process from $p_1 = 6bar, T_1 = 423K$. During the process there was a technical work performed ($L_{t1-2} = 600kJ$). Calculate the final volume and final pressure of the oxygen.

10. The Carnot heat engine is running between two heat sources, i.e. $t_1 = 1500℃\ and\ t_2 = 30℃$. What will be the change of the engines efficiency when $t_1' = t_1 + 100℃$ and $t_2' = t_2 - 30℃$?