Thermodynamics list 2

1. A tank of volume $V = 0,8m^3$ is inflated with compressed air with manometric pressure of $p_m = 0,4MPa$ and temperature of $27°C$. Calculate the amount of air using following units: kg, kmol, um^3 (conventional cubic meters). The ambient pressure is $p_0 = 1\ bar$.

2. A tank of volume $V = 20dm^3$ is inflated with a gas with absolute pressure of $p_1 = 50bar$ and themperature of $t_1 = 120°C$. After adding some amount of gas into the system the pressure increased to $p_2 = 100bar$ and temperature to $t_2 = 200°C$. Calculate the amount of added gas in kilo moles.

3. Two tanks with volume of $V = 4m^3$ are inflated with nitrogen N_2. The parameters within the firs tank are: the absolute pressure $p_1 = 5bar$, and $t_1 = 150°C$, whereas parameter in second tank are: $p_2 = 3,5bar$ and $t_2 = 10°C$. Which tank contains greater mass of nitrogen?

4. A tank of volume $V = 5m^3$ is inflated with a monoatomic perfect gas with initial parameters of $p_1 = 0,15MPa$ and $T_1 = 288K$. As a consequence of an additional heat delivered into the system, the pressure increased up to $p_2 = 0,28MPa$. Calculate numbers of kilo moles of the gas and the final temperature.

5. The gas within a cylinder was heated from the temperature of $T_1 = 310K$ up to such temperature that volume of the gas has doubled. What was the final temperature?

6. The pressure and temperature of air was measured after pumping it into the tank. The measured pressure and temperature are $T_1 = 480K$, $p_1 = 8,2\ MPa$. What will be the pressure in the cylinder when the air cools to a temperature of $T_2 = 290K$?

7. Weight of the tank with nitrogen decreased by 5 kg due to the release of gas into the environment at a temperature of 300 K. The pressure drop measured on the manometer when the gas temperature equalled with the ambient temperature is $\Delta p = 0,5MPa$. Calculate the volume of the tank.

8. An engine power was measured by means of water brake. The water stream flowing through the brake is $\dot{m} = 5\ ^{kg}/_s$. The temperature of water is $t_1 = 15°C$ at the brake inlet, whereas at the brake outlet $t_2 = 50°C$. Assuming that the heat loss is 10% of overall engine power, calculate the effective power of the engine.

9. During heating of some mass of gas for $\Delta T = 2K$ at p=const its volume increased by 0.005 of the initial value. Calculate the initial gas temperature.

10. A vertical cylinder, closed by a moving with no friction piston is filled with nitrogen with initial parameters of $V_1 = 0,05m^3$, $p_1 = 0,12\ MPa$, $T_1 = 288K$. Due to heat delivery into the cylinder volume of the gas increased up to $V_2 = 0,07m^3$. Calculate the number of kilo moles and the temperature after heat delivery.