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Exercise 1

1) Classify the following systems as open, closed, or isolated and specify the nature of the exchanges (matter and/or energy) that exist between each system and the external environment:
You (you facing this paper), A tree, a car that is driving, a TV set turned on, the liquid in a thermometer, hot coffee in a thermos bottle, The universe.
2) Among the following variables, which ones are intensive and which ones are extensive?
Pressure, volume, mass, temperature, mole fraction of a constituent « i », molar concentration, molar volume, energy, power, speed, volumic mass.

Exercise 2

1) A cylinder contains 765 mL of propane gas at a pressure of 1,25. 10^5 Pa. What would be the volume occupied by this gas if the pressure was reduced to 10^5 Pa and the temperature remains constant?
2) A mass of dioxygen is stored in a rigid container at a pressure of $1,63.10^5$ Pa and at a temperature of -50°C. At what temperature must the container be brought to make the pressure twice as great?
3) A quantity of gaseous helium occupies a volume of 22,4 L at 0°C. What will be the volume of this gas if the temperature is 25°C and the pressure remains constant?

Exercise 3

1) A spherical balloon is inflated with helium (He) until its diameter reaches 25 m. If the pressure is 730 torrs and the temperature is equal to 82 °F, what is the mass of helium (in kg) that the balloon contains?
2) Calculate the pressure of one mole of water vapor at 300 K corresponding to V = 20 L then V = 1 L considering water vapor as an ideal gas.
Data : M(He) = 4 $g.mol^{-1}$, R = 0,082 $L.atm.mol^{-1}.K^{-1}$

Exercise 4

1) We introduce into an initially empty container, with a constant volume of V = 6 L, n_0 moles of gaseous nitrous oxide N_2O at a temperature T = 600° C, the initial pressure being p_0 = 0,49 atm. Determine the number of moles n_0. We assume the gas is an ideal gas.
2) After a certain period of time and at the same temperature, this gas decomposes into dinitrogen (N_2) and dioxygen (O_2), the pressure in the container is then p_f = 0.65 atm. Write the equation for the decomposition reaction of dinitrogen oxide.
3) Construct the progress table of the reaction in terms of the number of moles and give the number of moles of the mixture n_f, at equilibrium in terms of n_0 and the progress x.
4) Determine the values of the progress of reaction x and the number of moles of each molecule at equilibrium.
5) Calculate the mole fractions and deduce the partial pressures.
6) Calculate the molar mass of the gas mixture.
Data : M(N) = 14 $g.mol^{-1}$, M(O) = 16 $g.mol^{-1}$.

Exercise 5

We consider two rigid-walled containers, one containing hydrogen and the other containing methane. At the beginning, we have:
H_2 p_1= 5 atm ; T_1= 250 K ; V_1= 10 liters
CH_4 P_2= 40 atm ; T_2= 300 K ; V_2= 40 liters
1) Calculate the masses of hydrogen and methane contained in each container.
2) We heat the two containers to a temperature of 350 K, calculate the pressure of H_2 and that of CH_4.
3) Using a tap, we then connect the two containers; what happens? Calculate the partial pressures of each gas. Deduce the total pressure.
4) We close the tap; calculate the masses of H_2 and CH_4 in each container.
Data : M(H) = 1 $g.mol^{-1}$, M(C) = 12 $g.mol^{-1}$.