Answer on Question #60239, Chemistry / General Chemistry

1. Under conditions of constant temperature, 200 cm3 of H2 gas pressure of 800mmhg was forced into a cylinder of volume 600cm3, which already contained O2 gas (partial pressure of 400mmhg) and Ne gas (partial pressure of 300mmhg.)
What's the final pressure in the cylinder and determine the mole fraction of each gas in the final mixture.

Conditions:

T=const=298K; $V(H_2)$=200ml; $P(H_2)$=800mmhg; V_{cyl}=0.0006m^3; P_iO_2=400mmhg; P_iNe=300mmhg;

R=8.3144598(48) J mol^{-1} K^{-1}

P_{last}-?

X_iH_2-?; X_iO_2-?; X_iNe-?;

Solution:

In a mixture of gases, each gas has a partial pressure which is the hypothetical pressure of that gas if it alone occupied the volume of the mixture at the same temperature. The total pressure of an ideal gas mixture is the sum of the partial pressures of each individual gas in the mixture.P_i= $R*T*m_i/(M_i*V)$ (1)

1. P_iO_2=400mmhg. 760mmhp=101.325kPa hereof P_iO_2=400*101325/760=53329(Pa)
   From [1] $nO_2=P_iO_2*V/(R*T)$= 53329*0.0006/(8.31*298)=0.0129(mol)
2. P_iNe=300mmhg. 760mmhp=101.325kPa hereof P_iNe=300*101325/760=39997(Pa)
   From [1] nNe=P_iNe*V/(R*T)= 39997*0.0006/(8.31*298)=0.0032(mol)
3. P_iH_2=800mmhg. 760mmhp=101.325kPa hereof P_iH_2=800*101325/760=106658(Pa)
   From [1] $nH_2=P_iO_2*V/(R*T)$= 106658*0.0002/(8.31*298)=0.0086(mol)
4. n(Sum)=0.0086+0.0032+0.0129=0.0247(mol)
5. X_iH_2=0.0086/0.0247=0.348
6. X_iO_2=0.0129/0.0247=0.522
7. X_iNe=0.0032/0.0247=0.129
8. P_{last} =n(Sum)*R*T/V=0.0247(mol)*8.31(J mol^{-1} K^{-1})*295(K)/0.0006(m^3)=101944(Pa)

Answer: P_{last}=101944(Pa);
X_iH_2=0.348
X_iO_2=0.522
X_iNe=0.129

https://www.AssignmentExpert.com