Answer on Question #52017 – Chemistry – Physical Chemistry

The ideal gas law is:

$$PV = nRT,$$

where p – pressure, V – volume, n – number of moles, T – temperature, R – gas constant.

For N_2 and H_2 partial pressures are:

$$P(N_{2(1L)}) = n(N_2)RT/V_{1L}$$

$$P(H_{2(1L)}) = n(H_2)RT/V_{1L},$$

where $P(N_{2(1L)})$ and $P(H_{2(1L)})$ – partial pressures of N_2 and H_2 in 1L

Now we have to determine $n(N_2)$ and $n(H_2)$. From the ideal gas law:

$$n(N_2) = P(N_{2(0.5L)})V_{0.5L}/RT$$

$$n(H_2) = P(H_{2(0.45L)})V_{0.45L}/RT,$$

where $P(N_{2(0.5L)})$ and $P(H_{2(0.45L)})$ –pressures of N_2 and H_2 in 0.5L and 0.45L respectively.

At last we'll get:

$$P(N_{2(1L)}) = P(N_{2(0.5L)})V_{0.5L}/V_{1L} = 0.3atm \cdot 0.5L / 1L = \mathbf{0.15atm}$$

$$P(H_{2(1L)}) = P(H_{2(0.45L)})V_{0.45L}/V_{1L} = 0.5atm \cdot 0.45L / 1L = \mathbf{0.225atm}$$

We use 1L, because the volume of the pot is 1L. Two gases after mixing in the pot will occupy all volume (1L). That is why their partial pressures will decrease.