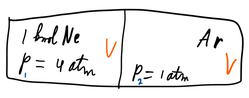
Exercise 9-8

woensdag 20 mei 2020 20:45

$T = 300\ K$




ideal gas: $pV = nRT$

$$n_{Ar} = \frac{p_2 V}{RT} = \frac{p_2\ RT n_1}{p_1 RT} = \frac{1}{4} n_1 = \frac{1}{4}\ mol$$

no chemical interaction and same initial T $\Rightarrow$ same final T

$$T_f = T_i = 300\ K$$

$$\boxed{\begin{array}{c}\text{final pressure = sum of partial pressures} \\ p_f = \sum_i p_i\end{array}}$$

gas doubles volume when wall is removed; pressure is halved

$$p_{Ne} = \frac{1}{2} \cdot 4 = 2\ atm$$

$$p_{Ar} = \frac{1}{2} \cdot 1 = \frac{1}{2}\ atm$$

$$\rightarrow p = 2 + \frac{1}{2} = 2\frac{1}{2}\ atm$$

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$$\left.\begin{array}{l} dg = -sdT + vdp \\ dT = 0 \end{array}\right\} \left.\begin{array}{l} dg = vdp \\ v = \frac{RT}{p} \end{array}\right\} dg = \frac{RT}{p} dp$$

$$\Delta g = RT \ln\left(\frac{p}{p_0}\right)$$ for each gas

thus $\Delta G = \sum_{gas} n_{gas} RT \ln\left(\frac{p}{p_0}\right)$

$$\Delta G = 1 \cdot 8{,}314 \cdot 10^3 \cdot 300 \ln\left(\frac{2}{4}\right) + \frac{1}{4} \cdot 8{,}314 \cdot 10^3 \cdot 300 \ln\left(\frac{\left(\frac{1}{2}\right)}{1}\right)$$

$$= -2{,}16 \cdot 10^6\ J$$

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$$G = U - TS + Vp$$

$$\cancel{dG = TdS - PdV - TdS - SdT + PdV + Vdp}$$

$$\cancel{= -SdT + Vdp}$$

$$\cancel{\overset{\text{isothermal}}{=} Vdp}$$

$$G = H - TS$$

$$dG = dH - TdS - SdT$$

$$dT = 0 \Rightarrow dH = 0$$

$$dG = -TdS$$

$$dS = -\frac{dG}{T}$$

$$\Delta S = -\frac{\Delta G}{T} = 7{,}2 \cdot 10^3\ J\ K^{-1}$$