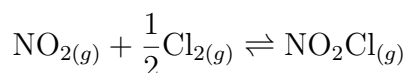


Chemistry 192
Recitation Section Problems
January 29, 2018
Solutions

All the questions pertain to the gas-phase reaction at 298K



1. At equilibrium it is found that $[\text{Cl}_2]=2.74$ M, $[\text{NO}_2\text{Cl}]=1.31$ M and $[\text{NO}_2]=0.531$ M. Calculate the concentration equilibrium constant K_c for the reaction.

Answer:

$$K_c = \frac{[\text{NO}_2\text{Cl}]}{[\text{NO}_2][\text{Cl}_2]^{1/2}} = \frac{1.31}{(0.531)(2.74)^{1/2}} = 1.49$$

2. Under different equilibrium conditions it is found that $[\text{NO}_2]=2.00$ M and $[\text{NO}_2\text{Cl}]=3.35$ M. Calculate the concentration of chlorine gas in the mixture.

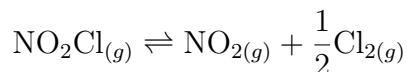
Answer:

$$1.49 = \frac{3.35}{(2.00)[\text{Cl}_2]^{1/2}}$$

$$[\text{Cl}_2]^{1/2} = 1.12$$

$$[\text{Cl}_2] = 1.26 \text{ M}$$

3. Determine K_c for the dissociation of $\text{NO}_2\text{Cl}_{(g)}$; i.e. the reaction



Answer:

$$K_c = \frac{1}{1.49} = 0.671$$

4. Calculate the pressure equilibrium constant, K_P for the dissociation of $\text{NO}_2\text{Cl}_{(g)}$ at 298K.

Answer:

$$K_P = K_c(RT)^{\Delta n_{gas}} = (0.671)[(0.08314)(298)]^{1/2} = 3.34$$

5. In a container of fixed volume, the degree of dissociation of $\text{NO}_2\text{Cl}_{(g)}$ at 298K is found to be $\alpha = 0.784$. Calculate the total pressure in the container.

Answer:

Let n_0 be the initial number of moles of NO_2Cl . Then

	$n_{\text{NO}_2\text{Cl}}$	n_{NO_2}	n_{Cl_2}
initial	n_0	0	0
change	$-0.784n_0$	$0.784n_0$	$0.392n_0$
equilibrium	$0.216n_0$	$0.784n_0$	$0.392n_0$

$$n_{\text{tot}} = 1.392n_0$$

$$P_{\text{NO}_2\text{Cl}} = \chi_{\text{NO}_2\text{Cl}}P = \frac{0.216}{1.392}P$$

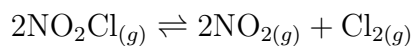
$$P_{\text{NO}_2} = \chi_{\text{NO}_2}P = \frac{0.784}{1.392}P$$

$$P_{\text{Cl}_2} = \chi_{\text{Cl}_2}P = \frac{0.392}{1.392}P$$

$$K_P = 3.34 = \frac{\left(\frac{0.784}{1.392}P\right)\left(\frac{0.392}{1.392}P\right)^{1/2}}{\left(\frac{0.216}{1.392}P\right)} = 1.93P^{1/2}$$

$$P = 3.00 \text{ bar}$$

6. Calculate K_P for the reaction



Answer:

$$K_P = 3.34^2 = 11.2$$