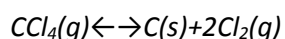


### Question 71624/Chemistry/General Chemistry

At 700 K the equilibrium constant for the reaction:



is  $K_p=0.76$ . A flask is charged with 1.90 atm of  $\text{CCl}_4$ , which then reaches equilibrium at 700 K. What fraction of the  $\text{CCl}_4$  is converted into C and  $\text{Cl}_2$ ?

**Answer:**

If the fraction of  $\text{CCl}_4$  converted into C and  $\text{Cl}_2$  is  $\gamma$ , then  $\gamma = \frac{x}{C_0}$  and  $K_p = \frac{4x^2}{C_0 - x}$ . Let combine these two equations together:

$$K_p = \frac{4C_0^2\gamma^2}{C_0 - C_0\gamma} = \frac{4C_0\gamma^2}{1 - \gamma}$$

Let finally express  $\gamma$  from a given equation:

$$\gamma = \frac{-K_p + \sqrt{K_p^2 + 16 \cdot C_0 \cdot K_p}}{8 \cdot C_0}$$

Now we must convert *atm* units to *mols per volume* of the reaction vessel units:

$$C_0 = \frac{n}{V} = \frac{P}{RT} = 0.033 \text{ mol/L}$$

$$\text{Thus, } \gamma = \frac{-0.76 + \sqrt{0.76^2 + 16 \cdot 0.033 \cdot 0.76}}{8 \cdot 0.033} = 0.87 \text{ or } 87\%$$