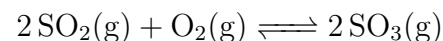


## SOLVED EXAMPLES

1. What is  $K_c$  for the following equilibrium when the equilibrium concentration of each substance is;  $[\text{SO}_2 = 0.6\text{M}$ ,  $\text{O}_2 = 0.82\text{M}$ ,  $\text{SO}_3 = 1.9\text{M}$ ?[NCERT: 7.2]

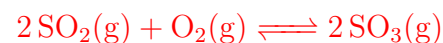


ANSWER:

$K_c$  expression for the given equilibrium

$$\begin{aligned} K_c &= \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2[\text{O}_2]} \\ &= \frac{(1.9)^2}{(0.6)^2 \times 0.82} = 12.23 \end{aligned}$$

2. At 450K,  $K_p = 2.0 \times 10^{10} \text{ bar}^{-1}$  for the given reaction at equilibrium.



What is  $K_c$  at this temperature?[NCERT: 7.10]

ANSWER:

For the given equilibrium,  $\Delta n_g = 2 - (2 + 1) = -1$

Relation between  $K_c$  and  $K_p$  is

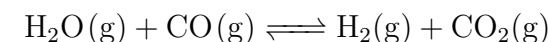
$$\begin{aligned} K_p &= K_c \times (RT)^{\Delta n_g} \\ 2.0 \times 10^{10} &= K_c \times (0.083 \times 450)^{-1} \\ K_c &= 2 \times 10^{10} \times 0.083 \times 450 = 7.47 \times 10^{11} \end{aligned}$$

3. One mole of  $\text{H}_2\text{O}$  and one mole of  $\text{CO}$  are taken in 10L vessel and heated to 725K. At equilibrium 40% of water (by mass) reacts with  $\text{CO}$  according to the equation:[NCERT: 7.14]



Calculate the equilibrium constant for the reaction.

ANSWER:



Initially  $\Rightarrow n_{\text{H}_2\text{O}} = 1$ ;  $n_{\text{CO}} = 1$

As per the reaction 40% of  $\text{H}_2\text{O}$ (0.1 mole) reacts with 40 % of  $\text{CO}$ (0.1 mole) and forms 40% each of  $\text{H}_2$  and  $\text{CO}_2$ . Therefore, at equilibrium  $1 - 0.4 = 0.60$  mole each of  $\text{H}_2\text{O}$  and  $\text{CO}$  and 0.4 mole each of  $\text{H}_2$  and  $\text{CO}_2$  are present

$$\text{Molarity} = \frac{\text{Number of moles}}{\text{Volume in liters}}$$

At Equilibrium  $\Rightarrow [\text{H}_2\text{O}] = \frac{0.6}{10} \text{M}$ ;  $[\text{CO}] = \frac{0.6}{10} \text{M}$ ;  $[\text{H}_2] = \frac{0.4}{10}$  and  $[\text{CO}_2] = \frac{0.4}{10} \text{M}$

$$\begin{aligned} K_c &= \frac{[\text{H}_2][\text{CO}_2]}{[\text{H}_2\text{O}][\text{CO}]} \\ K_c &= \frac{\frac{0.4}{10} \times \frac{0.4}{10}}{\frac{0.6}{10} \times \frac{0.6}{10}} = \frac{4}{9} = 0.44 \end{aligned}$$