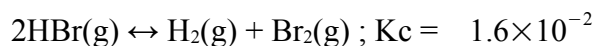


CHM 111 – In-Class Practice Problems

1) Hydrogen bromide (HBr) dissociates on heating to 200 °C:



If we load a 1.00 L reaction vessel with 0.010 moles of HBr, how many moles of HBr will be in the vessel at equilibrium?

0.0080 moles HBr

$$K_c = \frac{[\text{Br}_2][\text{H}_2]}{[\text{HBr}]^2} = 0.016$$

Assign 'x' to be the change in bromine concentration

species	[init]	Δ	[Equil]
Br ₂	0	+x	x
H ₂	0	+x	x
HBr	$\frac{0.010}{1.00} = 0.010$	-2x	0.010-2x

$$\frac{(x)(x)}{(0.010 - 2x)^2} = 0.016 \rightarrow \frac{x^2}{(0.010 - 2x)^2} = 0.016$$

Take square root of both sides (or use quadratic eqn)

$$\frac{x}{0.010 - 2x} = \sqrt{0.016}$$

$$\frac{1}{\sqrt{0.016}} x = 0.010 - 2x \text{ - Rearrange to isolate 'x'}$$

$$\left(\frac{1}{\sqrt{0.016}} + 2\right) x = 0.010$$

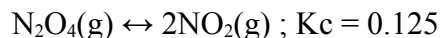
$$x = 1.0095 \times 10^{-3}$$

mol = M times L

$$\text{M HBr} = 0.010 - 2(1.0095 \times 10^{-3}) = 0.00798 \text{ M} \times 1.00 \text{ L} = \boxed{0.0080 \text{ mol HBr}}$$

CHM 111 – In-Class Practice Problems

2) Dinitrogen tetroxide dissociates to give nitrogen dioxide at 25 °C.



If a 1.00 L flask is loaded with 0.0500 mol N_2O_4 , what is the concentration of NO_2 in the flask when equilibrium is reached?

0.0536 M NO_2

$$K_c = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]} = 0.125$$

Species	[Init]	Δ	[Equil]
NO_2	0	+2x	2x
N_2O_4	$\frac{0.0500}{1.00} = 0.0500$	-x	$0.0500 - x$

Assign 'x' to change in dinitrogen pentoxide conc

$$\frac{(2x)^2}{0.0500 - x} = 0.125 \rightarrow \frac{4x^2}{0.0500 - x} = 0.125$$

$$32x^2 = 0.0500 - x$$

$$32x^2 + x - 0.0500 = 0$$

Quadratic Rearrange for quadratic formula

$$x = \frac{-1 \pm \sqrt{(1)^2 - 4(32)(-0.0500)}}{2(32)} = \frac{-1 \pm \sqrt{7.4}}{64}$$

$$x = 0.0268746 ; 2x = \boxed{0.0536 \text{ M NO}_2}$$

$$= -0.0581296$$

Discard this root, since it would result in a negative concentration.