Gilletti

CHM152 Quiz3B 25 Pts Spring 2017 Name: Key

Turn off all cell phones. Show all work to receive credit.

1. (5 Pts) 2.50 mol NOCl was placed in a 2.50 L reaction vessel at 400°C. After equilibrium was established, it was found that 28% of the NOCl had dissociated according to the equation

$2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$.

Calculate the equilibrium constant, K_c, for the reaction.

$K_c = \frac{[NO]^2[Cl_2]}{[NOCl]^2}$

	$2NOCl(g)$	$\rightleftharpoons 2NO(g)$	$+ Cl_2(g)$
I	1.00 M	0	0
C	$-2x$	$+2x$	$+x$
E	$1.00-2x$	$2x$	x

$2x$ = amount dissociated = $0.28 \times 1.00 = 2x$ $\quad x = 0.14\,M$

$K_c = \frac{[0.28]^2[0.14]}{[0.72]^2} = 0.021$

2. (4 Pts) Calculate K_p for the reaction $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$ at 400°C if K_c at 400°C for this reaction is 2.1×10^{-2}.

$K_p = K_c(RT)^{\Delta n}$

$= (2.1\times10^{-2})(0.0821\times673)^{1} = 1.16 \approx 1.2$

3. (4 Pts) Calculate K_c for the reaction $2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ given that the concentrations of each species at equilibrium are as follows: [HI] = 0.85 mol/L, $[I_2]$ = 0.60 mol/L, $[H_2]$ = 0.27 mol/L.

$K_c = \frac{[H_2][I_2]}{[HI]^2}$

$K_c = \frac{[0.27][0.60]}{[0.85]^2} = 0.22$

4. (4 Pts) The solubility of silver chloride can be increased by dissolving it in a solution containing ammonia.

$AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$ $\quad K_1 = 1.6 \times 10^{-10}$

$Ag^+(aq) + 2NH_3(aq) \rightleftharpoons Ag(NH_3)_2^+(aq)$ $\quad K_2 = 1.5 \times 10^{7}$

What is the value of the equilibrium constant for the overall reaction?

$K_{net} = K_1 \times K_2$ $\quad AgCl(s) + 2NH_3(aq) \rightleftharpoons Ag(NH_3)_2^+(aq) + Cl^-(aq)$ $\quad K_{net} = ?$

$K_{net} = 1.6\times10^{-10} \times 1.5\times10^{7} = 0.0024 = 2.4\times10^{-3}$

5. (4 Pts) The equilibrium constant for the reaction $Ni(s) + 4CO(g) \rightleftharpoons Ni(CO)_4(g)$ is 5.0×10^4 at 25°C. What is the equilibrium constant for the reaction $Ni(CO)_4(g) \rightleftharpoons Ni(s) + 4CO(g)$?

$K_2 = \frac{1}{K_1} = \frac{1}{5.0\times10^4} = 2.0\times10^{-5}$

6. (4 Pts) Which is the correct equilibrium constant expression for the following reaction?

$Fe_2O_3(s) + 3H_2(g) \rightleftharpoons 2Fe(s) + 3H_2O(g)$

$K_c = \frac{[H_2O]^3}{[H_2]^3}$ solids are ignored