CHM152 Quiz 3 25 Pts Fall 2018 Name: Key

Show all work to receive credit.

1. (2 Pts) For the following reaction at equilibrium, which gives a change that will shift the position of equilibrium to favor formation of more products?

$2NOBr(g) \rightleftharpoons 2NO(g) + Br_2(g), \quad \Delta H°_{rxn} = 30 \text{ kJ/mol}$

A) Remove Br_2.
B) Increase the total pressure by decreasing the volume.
C) Remove NOBr selectively.
D) Add more NO.
E) Lower the temperature.

2. (4 Pts) What is the equilibrium constant, K_c, for an equilibrium mixture for the reaction $2BrCl_3(g) \rightleftharpoons Br_2(g) + 3Cl_2(g)$ that was found to contain 1.0 mol $BrCl_3$, 2.0 mol Br_2 and 6.0 mol Cl_2 in a 6.0 L vessel.

$$K_c = \frac{[Br_2][Cl_2]^3}{[BrCl_3]^2} = \frac{\left[\frac{2.0}{6.0}\right]\left[\frac{6.0}{6.0}\right]^3}{\left[\frac{1.0}{6.0}\right]^2} = 12$$

3. (5 Pts) The solubility of silver bromide can be increased by dissolving it in a solution containing the thiosulfate anion.

$AgBr(s) \rightleftharpoons Ag^+(aq) + Br^-(aq) \quad K_1 = 7.7 \times 10^{-13}$
$Ag^+(aq) + 2S_2O_3^{2-}(aq) \rightleftharpoons Ag(S_2O_3)_2^{3-}(aq) \quad K_2 = 4.7 \times 10^{13}$

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

$AgBr(s) + 2S_2O_3^{2-}(aq) \rightleftharpoons Ag(S_2O_3)_2^{3-}(aq) + Br^-(aq)$

Since the reactions add up to 5

$$K = K_1 \times K_2 = 36$$

4. (4 Pts) Carbon tetrachloride reacts at high temperatures with oxygen to produce two toxic gases, phosgene and chlorine.

$CCl_4(g) + (1/2)O_2(g) \rightleftharpoons COCl_2(g) + Cl_2(g), K_c = 4.4 \times 10^9$ at 1,000 K

Calculate K_c for the reaction $2CCl_4(g) + O_2(g) \rightleftharpoons 2COCl_2(g) + 2Cl_2(g)$.

Since the second reaction is the first reaction doubled.

$$K = (K_{c_1})^2 = (4.4 \times 10^9)^2 = 1.9 \times 10^{19}$$

More Question on Back

5. (3 Pts) At 700 K, the reaction $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ has the equilibrium constant $K_c = 4.3 \times 10^6$, and the following concentrations are present: $[SO_2] = 0.10$ M; $[SO_3] = 10.$ M; $[O_2] = 0.10$ M. Which of the following is true based on the above? YOU MUST SHOW A CALCULATION TO SUPPORT YOUR ANSWER.

A) $Q_c < K_c$, the reaction proceeds from left to right to reach equilibrium
B) $Q_c > K_c$, the reaction proceeds from left to right to reach equilibrium
C) $Q_c < K_c$, the reaction proceeds from right to left to reach equilibrium
D) $Q_c = K_c$, the reaction is currently at equilibrium
E) $Q_c > K_c$, the reaction proceeds from right to left to reach equilibrium

E on tan form

$$Q_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]} = \frac{(10)^2}{(0.10)^2(0.10)} = 1.0 \times 10^5$$

$Q_c < K_c$ more products needed →

6. (2 Pts) Write the correct equilibrium constant expression for the following reaction?

$FeO(s) + H_2(g) \rightleftharpoons Fe(s) + H_2O(g)$

$$K_c = \frac{[H_2O]}{[H_2]}$$

7. (5 Pts) 1.75 moles of H_2O_2 were placed in a 2.50 L reaction chamber at 307°C. After equilibrium was reached, 1.20 moles of H_2O_2 remained. Calculate the equilibrium constant, K_c, for the reaction $2H_2O_2(g) \rightleftharpoons 2H_2O(g) + O_2(g)$.

	$2H_2O_2$	$2H_2O$	O_2
I	0.7 M	0	0
C	$-2x$	$2x$	x
E	$0.7M - 2x = 0.48$	$2x$	x

$x = 0.11$ M

$2x = 0.22$ M

$$K_c = \frac{[0.22]^2[0.11]}{[0.48]^2}$$

$$K_c = 2.3 \times 10^{-2}$$