Problem of the Day 22 CHEM 1252

Suggested Book Problems for Chapter 15: 2, 13, 17, 27, 33, 41, 43, 47, 51

1. Sulfuric acid is the most widely produced chemical in the United States. An important step in this manufacturing process is shown below.

$$2\ SO_2(g) + O_2(g) \rightleftharpoons 2\ SO_3(g)$$

(a) Write the expression for the equilibrium constant.

$K_c =$ 4

(b) At a temperature of 900 K, 0.0216 mol of SO_2 and 0.0148 mol of O_2 were placed in a 1.00 L container and allowed to react. At equilbrium, 0.0175 mol SO_3 were present. Fill in the table below with appropriate concentrations.

	$2\ SO_2(g)$	+	$O_2(g)$	$\rightleftharpoons$	$2\ SO_3(g)$
initial	1		1		1
change	1		1		1
equilibrium	1		1		1

(c) Using your answers from part (b), calculate K_c.

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2. A gaseous mixture containing 0.50 M each CO and H_2O, and 2.0 M each CO_2 and H_2 is allowed to undergo the following reaction at 1000 °C.

$$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g) \qquad K_c = 0.58$$

What direction does the reaction need to proceed to reach equilibrium? You must justify your answer.

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3. The following reaction was studied at 500 K.

$$H_2(g) + I_2(g) \longrightarrow 2HI(g)$$

(a) A reaction vessel initially contained 9.84×10^{-4} M H_2 and 1.38×10^{-3} M I_2. The reaction was allowed to come to equilibrium. Using this information, fill in the table below with concentrations and/or variables.

	$H_2(g)$	+	$I_2(g)$	→	$2HI(g)$
initial	2		2		2
change	2		2		2
equilibrium	2		2		2

(b) At equilibrium, the concentration of I_2 was measured to be $[I_2] = 4.73 \times 10^{-4}$ M. Calculate the equilibrium concentrations of H_2 and HI. You must show your work.

$[H_2] =$ $[HI] =$ 10

(c) What is the value of the equilibrium constant for the reaction at 500 K? You must show your work.

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