Chemistry 12

Equilibrium V

Name:
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1. **ICE Tables (cont'd)**
2. **Trial K_{eq}**

ICE Tables

Determining Initial Concentrations from K_{eq} and the Equilibrium Concentrations

(1) Some CH_3OH was injected into a flask where it established equilibrium with a [CO]=0.15M. What was the initial concentration of CH_3OH?

$$\_\_\_\_ CH_3OH_{(g)} \leftrightharpoons \_\_\_\_ H_{2(g)} + \_\_\_\_ CO_{(g)} \qquad K_{eq} = 0.040$$

	$\_\_\_\_ CH_3OH_{(g)}$	$\leftrightharpoons$	$\_\_\_\_ H_{2(g)}$	+	$\_\_\_\_ CO_{(g)}$
I					
C					
E					

(2) NiS reacted with O_2 in a 2.0L flask. When equilibrium was achieved, 0.36 mol of SO_2 were found in the flask. What was the original $[O_2]$ in the flask? $K_{eq} = 0.30$

	$\_\_\_\_ NiS_{(s)}$	+	$\_\_\_\_ O_{2(g)}$	$\leftrightharpoons$	$\_\_\_\_ SO_{2(g)}$	+	$\_\_\_\_ NiO_{(s)}$
Initial							
Change							
Equilibrium							

(3) Some HI is pumped into a flask. At equilibrium, the [HI] = 0.60 mol/L. What is the initial [HI]?

$$\_\_\_\_\ HI_{(g)} \leftrightharpoons \_\_\_\_\ H_{2(g)} + \_\_\_\_\ I_{2(g)} \qquad K_{eq} = 0.25$$

(4) Some SO_2 and O_2 are injected into a flask. At equilibrium, the $[SO_2]$ = 0.050M and the $[O_2]$ = 0.040 M. What was the initial $[O_2]$?

$$\_\_\_\_\ SO_{2(g)} + \_\_\_\_\ O_{2(g)} \leftrightharpoons \_\_\_\_\ SO_{3(g)} \qquad K_{eq} = 100.$$

Trial K_{eq}

With any given values of the concentration of product or reactant, a trial K_{eq} can be found. From this value, it can be predicted whether the reaction will proceed to the left or right to reach equilibrium.

Trial K_{eq} is also called the reaction quotient, Q.

$$\text{Trial } K_{eq} = \frac{[\text{products}]}{[\text{reactants}]} @ \text{ any time}$$

Remember…
The [reactants] and [products] will shift in order to reach equilibrium.

Comparing trial K_{eq} and actual K_{eq}…

1. If trial K_{eq} is greater than actual K_{eq}…

$$\text{Trial } K_{eq} = \frac{[\text{products}]}{[\text{reactants}]} \qquad K_{eq} = \frac{[\text{products}]}{[\text{reactants}]}$$

- More _____ will need to be formed.
- The reaction will shift _____.

2. If trial K_{eq} is less than actual K_{eq}…

$$\text{Trial } K_{eq} = \frac{[\text{products}]}{[\text{reactants}]} \qquad K_{eq} = \frac{[\text{products}]}{[\text{reactants}]}$$

- More _____ will need to be formed.
- The reaction will shift _____.

Example:
(1) The following gases are introduced into a closed flask: 0.057M SO_2, 0.057M O_2 and 0.12M SO_3. In which direction will the reaction proceed to establish equilibrium?

$$\_\_\_\_ SO_{2\,(g)} + \_\_\_\_ O_{2\,(g)} \leftrightharpoons \_\_\_\_ SO_{3\,(g)} \qquad K_{eq} = 85$$

(2) The following gases are introduced into a closed 1.50 L flask: 1.5 mol of NO_2 and 4.0 mol N_2O_4. In which direction will the reaction proceed to achieve equilibrium?

$$\_\_\_\_ NO_{2\,(g)} \leftrightharpoons \_\_\_\_ N_2O_{4\,(g)} \qquad K_{eq} = 0.940$$

(3) A mixture contains 0.025M CH_4, 0.045M H_2O, 0.10M CO and 0.30M H_2. In which direction will the reaction proceed to reach equilibrium?

$$\_\_\_\_ CH_{4\,(g)} + \_\_\_\_ H_2O_{\,(g)} \leftrightharpoons \_\_\_\_ CO_{\,(g)} + \_\_\_\_ H_{2\,(g)} \qquad K_{eq} = 4.7$$

(4) At a certain temperature the reaction:

$$\_\_\_\_\_ CO_{(g)} + \_\_\_\_\_ H_2O_{(g)} \leftrightharpoons \_\_\_\_\_ CO_{2(g)} + \_\_\_\_\_ H_{2(g)}$$

has a K_{eq} = 0.400. Exactly 1.00 mol of each gas was placed in a 100. L vessel and the mixture was allowed to react. Find the equilibrium concentration of each gas.

Hebden Workbook Pg. 72 #50-52, 54, 58, 61-66