Chemistry 12

Equilibrium IV

Name:
Date:
Block:

1. ICE Tables

ICE Tables

Example:
(1) A 2.0 L bulb contains 6.00 mol of $NO_{2\,(g)}$, 3.0 mol of $NO_{(g)}$ and 0.20 mol of O_2 at equilibrium. What is the K_{eq} for this reaction?

$$2\ NO_{(g)} + O_{2\,(g)} \leftrightharpoons 2\ NO_{2\,(g)}$$

- Determine the K_{eq} expression:

- Calculate the concentration of each species:

- Substitute into the K_{eq} expression:

(2) 4.00 mol of SO_3 is introduced into a 2.00 L bulb. After 5 minutes, equilibrium is established and is found that 0.500 mol of $O_{2\,(g)}$ exists. What is the K_{eq} value?

$$2\ SO_{2\,(g)} + O_{2\,(g)} \leftrightharpoons 2\ SO_{3\,(g)}$$

- The system was at equilibrium – then a stress was introduced. What is this stress?

- The addition of product means that the equilibrium will shift _____ forming more _____ and decreasing concentration of the _____.

- **All changes in concentration must obey stoichiometric proportions.**

	$SO_{2\,(g)}$	+	$O_{2\,(g)}$	$\leftrightharpoons$	$SO_{3\,(g)}$
Original Equilibrium					
Initial *(Where the stress is introduced)*					
Change *(How the system responds to the stress)*					
Equilibrium *(New equil'm concentrations)*					

- K_{eq} is calculated using the new equilibrium concentrations:

(3) A 1.00L reaction vessel contains 0.750 mol of CO and 0.275 mol of H_2O only. After 1 hour, equilibrium is reached according to:

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

Analysis shows 0.250 mol of CO_2 is present at equilibrium. What is the K_{eq}?

	$CO_{(g)}$	+	$H_2O_{(g)}$	$\leftrightharpoons$	$CO_{2\,(g)}$	+	$H_{2\,(g)}$
Original Equilibrium							
Initial							
Change							
Equilibrium							

(4) A student placed 7.00 mol NH_3 in a 0.500L flask. At equilibrium, 6.2 M N_2 was found in the flask. What is the equilibrium constant for this reaction?

$$\_\_\_\_ NH_{3\,(g)} \leftrightharpoons \_\_\_\_ N_{2\,(g)} + \_\_\_\_ H_{2\,(g)}$$

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

(1) The following gases are injected into a 1.00L flask: 1.20 mol of $H_{2\,(g)}$ and 1.20 mol of $F_{2\,(g)}$. What will the concentration of HF be when equilibrium is achieved?

$$\_\_\_\_ H_{2\,(g)} + \_\_\_\_ F_{2\,(g)} \leftrightharpoons \_\_\_\_ HF_{(g)} \qquad K_{eq} = 2.50$$

	$H_{2\,(g)}$	+	$F_{2\,(g)}$	⇋	$HF_{(g)}$
Initial					
Change					
Equilibrium					

(2) 4.00 mol H_2 and 4.00 mol C_2N_2 are injected into a 2.00 L flask where they establish equilibrium. What is the $[C_2N_2]$ when equilibrium is achieved? $K_{eq} = 5.00$

$$\_\_\_\_ H_{2\,(g)} + \_\_\_\_ C_2N_{2\,(g)} \leftrightharpoons \_\_\_\_ HCN_{(g)}$$

(3) A 3.00 L flask contains 6.00 M H_2, 6.00 M Cl_2 and 3.00 M HCl at equilibrium. An additional 15 mol of HCl is injected into the flask. What is the $[Cl_2]$ when equilibrium is re-established?

What is K_{eq}?

	$H_{2\ (g)}$	+	$Cl_{2\ (g)}$	⇋	$HCl_{\ (g)}$
Original Equilibrium					
Initial					
Change					
Equilibrium					

(4) The table below shows the molarity of three gases at equilibrium. The concentration of HF is then decreased as shown. What is the [HF] when equilibrium is re-established?

K_{eq}=

	$H_{2\ (g)}$	+	$F_{2\ (g)}$	⇋	$HF_{\ (g)}$
Original Equilibrium	6.00		6.00		12.0
Initial	6.00		6.00		5.00
Change					
Equilibrium					

Hebden Workbook: Pg. 70 #47-49, 53, 55, 60