EQUILIBRIUM CONSTANT WORKSHEET

Part 1 – Write the K_{eq} expressions for the reactions below. NOTE: Equations are not balanced.

1.) $N_2\,(g) + H_2\,(g) \text{ <---> } NH_3\,(g)$

2.) $KClO_3\,(s) \text{ <---> } KCl\,(s) + O_2\,(g)$

3.) $H_2O\,(\ell) \text{ <---> } H^{+1}\,(aq) + OH^{-1}\,(aq)$

4.) $CO\,(g) + O_2\,(g) \text{ <---> } CO_2\,(g)$

5.) $Li_2CO_3\,(s) \text{ <---> } Li^{+1}\,(aq) + CO_3^{-2}\,(aq)$

Use the K_{eq} expressions written above to determine the value of K in each of the following sets of conditions.

1.) $[N_2] = 0.0200$ M, $[H_2] = 0.0200$ M, $[NH_3] = 0.0100$ M

2.) $[O_2] = 0.0500$ M

3.) $[H^{+1}] = 1 \times 10^{-8}$ M, $[OH^{-1}] = 1 \times 10^{-6}$ M

4.) $[CO] = 2.0$ M, $[O_2] = 1.5$ M, $[CO_2] = 3.0$ M

5.) $[Li^{+1}] = 0.2$ M, $[CO_3^{-2}] = 0.1$ M

LE CHATELIER'S PRINCIPLE WORKSHEET

Complete the following chart by writing "left", "right", or "none" for equilibrium shift. Write "increases", "decreases", or "remains the same" for the concentration of reactants and products, and for the value of K.

$N_2\,(g) + 3\,H_2\,(g) \text{ <---> } 2\,NH_3\,(g) + 22.0$ kcal

	Stress	Equilibrium Shift	$[N_2]$	$[H_2]$	$[NH_3]$	K
1	add N_2	right	---	decreases	increases	same
2	add H_2			---		
3	add NH_3				---	
4	remove N_2		---			
5	remove H_2			---		
6	remove NH_3				---	
7	increase temp.					
8	decrease temp.					
9	increase pressure					
10	decrease pressure					

12.6 kcal + H_2 (g) + I_2 (g) <---> 2 HI (g)

	Stress	Equilibrium Shift	[H_2]	[I_2]	[HI]	K
1	add H_2	right	---	decreases	increases	same
2	add I_2			---		
3	add HI				---	
4	remove H_2		---			
5	remove I_2			---		
6	remove HI				---	
7	increase temp.					
8	decrease temp.					
9	increase pressure					
10	decrease pressure					

NaOH (s) <---> Na^{+1} (aq) + OH^{-1} (aq) + 10.6 kcal

	Stress	Equilibrium Shift	Amount of NaOH (s)	[Na^{+1}]	[OH^{-1}]	K
1	add NaOH		---			
2	add NaCl (adds Na^{+1})			---		
3	add KOH (adds OH^{-1})				---	
4	add H^{+1} (removes OH^{-1})				---	
5	increase temp.					
6	decrease temp.					
7	increase pressure					
8	decrease pressure					

UNIT 13 REVIEW WORKSHEET

1. Given the equilibrium equation at 25°C: $A_{2\,(g)} + B_{2\,(g)} \longrightarrow 2\ AB_{(g)}$
   If, *at equilibrium*, the concentrations are as follows: $[A_2] = 3.45$ M, $[B_2] = 5.67$ M, and $[AB] = 0.67$ M
   (A) Write the Keq expression for the reaction.

   (B) Find the value of the equilibrium constant at 25°C.

2. Given the equilibrium equation: $X_{2\,(g)} + 3\ Y_{2\,(g)} \longrightarrow 2\ XY_{3\,(g)}$ at a temperature of 50°C, it is found that when equilibrium is reached that:
   $[X_2] = 0.37$ M, $[Y_2] = 0.53$ M and $[XY_3] = 0.090$ M
   (A) Write the equilibrium constant expression (K_{eq}).

   (B) Calculate the value of K_{eq} at 50°C.

3. Predict which way these equilibrium systems will shift when the total <u>pressure</u> is <u>increased</u>.
   (A) $N_{2\,(g)} + O_{2\,(g)} \longrightarrow 2\ NO_{(g)}$
   (B) $2\ SO_{2\,(g)} + O_{2\,(g)} \longrightarrow 2\ SO_{3\,(g)}$
   (C) $4\ NH_{3\,(g)} + 5\ O_{2\,(g)} \longrightarrow 4\ NO_{(g)} + 6\ H_2O_{(g)}$

4. Hydrogen peroxide decomposes according to the following equation:

   $187\ kJ + H_2O_{2\,(\ell)} \longrightarrow H_{2\,(g)} + O_{2\,(g)}$

   Predict the direction of equilibrium shift by each of these changes:
   (A) Increase the $[H_2]$ (B) Decrease the $[O_2]$
   (C) Decrease the total pressure (D) Increase the temperature

5. Consider the following equilibrium and answer the questions when these changes are made.

   $Heat + CH_{4\,(g)} + 2\ H_2S_{(g)} \longrightarrow CS_{2\,(g)} + 4\ H_{2\,(g)}$

   ~ CH_4 gas is added
   (A) direction of equilibrium shift?
   (B) $[H_2S]$?
   (C) $[CS_2]$?
   (D) $[H_2]$?

   ~ CS_2 gas is removed
   (A) direction of equilibrium shift?
   (B) $[CH_4]$?
   (C) $[H_2S]$?
   (D) $[H_2]$?

   ~ H_2 gas is added
   (A) direction of equilibrium shift?
   (B) $[CH_4]$?
   (C) $[H_2S]$?
   (D) $[CS_2]$?

   ~ The temperature is increased
   (A) direction of equilibrium shift?
   (B) $[CH_4]$?
   (C) $[H_2S]$?
   (D) $[CS_2]$?
   (E) $[H_2]$?