Dougherty Valley HS Chemistry
Equilibrium – Le Chatelier's Principle and Keq Practice

Worksheet #5

Name: **Period:** **Seat#:**

Directions: Complete the following chart by choosing from the following options:
Equilibrium Shift: *left, right, no change* Δ [ ] / Temp: *increase, decrease, no change* Δ Keq: *no, yes*

____ $N_{2\,(g)}$ + ____ $H_{2\,(g)}$ ↔ ____$NH_{3\,(g)}$ + 92.05 kJ

Stressor	Equilibrium Shift	Δ [N_2]	Δ [H_2]	Δ [NH_3]	Δ Temp	Δ Keq
1) Add N_2	Right	*Slight* increase	Decrease	Increase	Increase	No
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						

11) Write the equilibrium constant expression for K_{eq}
$POCl_{3\,(g)}$ ↔ $POCl_{\,(g)}$ + $Cl_{2\,(g)}$

12) Write the equilibrium constant expression for K_{eq}
$2H_{2\,(g)}$ + $O_{2\,(g)}$ ↔ $2H_2O_{\,(g)}$

13) Write the equilibrium constant expression for K_{eq}
$2C_2H_{4\,(g)}$ + $O_{2\,(g)}$ ↔ $2CH_3CHO_{\,(g)}$

14) Write the equilibrium constant expression for K_{eq}
$2H_2S_{\,(g)}$ + $3O_{2\,(g)}$ ↔ $2H_2O_{\,(g)}$ + $2SO_{2\,(g)}$

15) Write the equilibrium constant K_c for the equation
$2SO_{2\,(g)} + O_{2\,(g)} \leftrightarrow 2SO_{3\,(g)}$

16) Write the equilibrium constant K_c for the equation
$CaCO_{3\,(s)} \leftrightarrow CaO_{\,(s)} + O_{2\,(g)}$

17) Write the equilibrium constant K_p for the equation
$2SO_{2\,(g)} + O_{2\,(g)} \leftrightarrow 2SO_{3\,(g)}$

18) Write the equilibrium constant K_p for the equation
$H_2O_{\,(g)} + C_{\,(s)} \leftrightarrow H_{2\,(g)} + CO_{\,(g)}$

19) The equilibrium constant expression for a gas reaction in $K_{eq} = \frac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$ Write the balanced chemical equation corresponding to this expression.

20) The equilibrium constant expression for a gas reaction in $K_{eq} = \frac{[CS2][H_2]^4}{[CH_4][H_2S]^2}$ Write the balanced chemical equation corresponding to this expression.

21) The equilibrium constant K_{eq} for the equation $2HI_{\,(g)} \leftrightarrow H_{2\,(g)} + I_{2\,(g)}$ at 425°C is 1.84. What is the value of K_{eq} for the following equation: $H_{2\,(g)} + I_{2\,(g)} \leftrightarrow 2HI_{\,(g)}$

22) Consider the decomposition of nitrous oxide, also known as laughing gas. $2N_2O_{\,(g)} \leftrightarrow 2N_{2\,(g)} + O_{2\,(g)}$
At 25°C the K_c is 7.3×10^{34}

a. Based on the information given, what can you say about the rate of decomposition of the reaction?

b. Based on the information given, does nitrous oxide have a tendency to decompose into nitrogen and oxygen, or does it have a tendency to stay as nitrous oxide? Justify your answer.

c. You can convert back and for between K_c and K_p if you are given one of the values using the following equation: $K_p = K_c(RT)^{\Delta n}$ where R is the ideal gas constant (0.0821 L•atm/K•mol), T is temperature (in Kelvin), and Δn is the change in number of moles of gaseous products compared to gaseous reactants $\Delta n =$ $\Sigma\,(moles\ of\ gaseous\ products) - \Sigma\,(moles\ of\ gaseous\ reactants)$ Using this information, and the information given at the start of the problem, calculate the value of K_p

23) For the equilibrium system described by $2SO_{2\,(g)} + O_{2\,(g)} \leftrightarrow 2SO_{3(g)}$ at a particular temperature the equilibrium concentrations of SO_2, O_2 and SO_3 were 0.75 M, 0.30 M, and 0.15 M, respectively. At the temperature of the equilibrium mixture, calculate the equilibrium constant K_{eq} for the reaction.

24) For the equilibrium system described by: $PCl_{5\,(g)} \leftrightarrow PCl_{3\,(g)} + Cl_{2\,(g)}$ K_{eq} equals 35 at 487°C. If the concentrations of the PCl_5 and PCl_3 are 0.015 M and 0.78 M, respectively, what is the concentration of the Cl_2?

25) $CO_{2\,(g)} + H_{2\,(g)} \leftrightarrow CO_{(g)} + H_2O_{(g)}$
Calculate the value of the equilibrium constant, K_c, for the above system, if 0.1908 moles of CO_2, 0.0908 moles of H_2, 0.0092 moles of CO, and 0.0092 moles of H_2O vapor were present in a 2.00 L reaction vessel at equilibrium. (Remember that M = $^{mol}/_{L}$)

26) The following table gives some values for reactant and product equilibrium concentrations (in mol/L) at 700 K for the Shift Reaction, an important method for the commercial production of hydrogen gas. $CO_{(g)} + H_2O_{(g)} \leftrightarrow CO_{2\,(g)} + H_{2\,(g)}$

Trial	$[CO_2]$	$[H_2]$	$[CO]$	$[H_2O]$
1	0.600	0.600	0.266	0.266
2	0.600	0.800	0.330	0.286
3	2.00	2.00	0.877	0.896
4	1.00	1.50	0.450	0.655
5	1.80	2.00	0.590	1.20

a. Write the expression for calculating K_{eq} for the reaction.

b. Calculate the K_{eq} for each of the five trials.

c. How do the Keqs for each trial compare to each other? Why?