**Name: Period: Seat#:**

**Worksheet #3**

**Directions:** Show all work in a way that would earn you credit on the AP Test! This is always the rule! Some answers are provided at the end in italics and underlined. If you need more space, use binder paper and staple to your worksheet.

**For the following three reactions:**

1. Write the Keq expression in terms of concentration, Kc.
2. Given the equilibrium concentrations, state whether each equilibrium is product-favored, reactant-favored, or fairly even ([products] ≈ [reactants]).
3. Calculate the value of Kc.
4. N2(g) + 3 H2(g) ⮀ 2 NH3(g) *8.33 x 10-6*

|  |  |
| --- | --- |
| At equilibrium: | [N2] = 1.50 M[H­2] = 2.00 M[NH3]= 0.01 M |

1. HF(aq) ⮀ H+(aq) + F-(aq)  *1.82 x 10-6*

|  |  |
| --- | --- |
| At equilibrium: | [HF] = 0.55 M[H+] = 0.001 M[F-]= 0.001 M |

1. Fe3+(aq) + SCN-(aq) ⮀ FeSCN2+(aq) *1.82*

|  |  |
| --- | --- |
| At equilibrium: | [Fe3+] = 0.55 M[SCN-] = 0.001 M[FeSCN2+]= 0.001 M |

**Summarize:**

Fill in the blanks with product-favored, reactant-favored, and approximately equal

|  |  |
| --- | --- |
| **Kc** | **state of equilibrium** |
| Kc >> 1 |  |
| Kc << 1 |  |
| Kc ≈ 1 |  |

1. Knowing that pure water has a density of 1g/1mL calculate the mass of 1.00 Liter of water.

 Calculate the number of moles in 1.00 L of H2O.

 What is the concentration (M) of water in water?

 At this temperature, can you get more moles of water into this Liter of water?

 The [H2O] \_\_\_\_\_\_\_\_ (is / is not) constant.

 **Remember!**

 Since the concentrations of solids and liquids are constant, they aren’y incorporated into the equilibrium constant, Keq. That means, just leave them out of the Kc or Kp expression. Only include (g) and (aq)!

1. Write equilibrium expressions for each of the rxns:
2. CaCO3(s)  CaO(s) + CO2(g)

1. Ni(s) + 4CO(g)  Ni(CO)4(g)

1. 5CO(g) + I2O5(s)  I2(g) + 5CO2(g)

1. Ca(HCO3)2(aq)  CaCO3(s) + H2O(l) + CO2(g)

1. AgCl(s)  Ag+(aq) + Cl-(aq)
2. Write the equilibrium expression in terms of partial pressures (Kp) for each of the following reactions.

 Rate the reactions (a, b, c, d) in order of their increasing tendency to proceed toward completion:

\_\_\_\_\_\_\_ \_\_\_\_\_\_\_ \_\_\_\_\_\_\_ \_\_\_\_\_\_\_

More Reactant More Product

 Favored Favored

1. 4NH3(g) + 3O2(g)  2N2(g) + 6H2O(g)
Kp = 1 x 10228 atm
2. N2(g) + O2(g)  2NO(g)
Kp = 5 x 10-31
3. 2HF(g)  H2(g) + F2(g)
Kp = 1 x 10-13
4. 2NOCl(g)  2NO(g) + Cl2(g)
Kp = 4.7 x 10-4 atm

**A Question That You Should Be Able To Answer:**

Why don’t the Kp’s in (b) and (c) have units?

|  |
| --- |
|  |

1. **(a)**  Write the Kc expression for

 2 SO2(g) + O2(g) ⮀ 2 SO3(g)

 Calculate the value of Kc: *4.36*

|  |  |
| --- | --- |
| At equilibrium: | [SO2] = 1.50 M[O2] = 1.25 M[SO3]= 3.50 M |

1. If we **reverse** the equation, it is:

 2 SO3(g) ⮀ 2 SO2(g) + O2(g)

 Write the Kc expression for this equation and calculate the new value of Kc: *0.229*

 How does the expression and the value of Kc in 7(b) compare with those in 7(a)?

1. If we now **multiply all of the coefficients by ½:**

SO3(g) ⮀ SO2(g) + ½ O2(g)

 Write the Kc expression for this equation and calculate the new value of Kc: *0.479*

 How do they compare with 7(b)?

1. What would happen to the Kc expression and its value if we **doubled** the coefficients?

**Summarize:**

|  |  |
| --- | --- |
| **Equation** | **Kc in terms of original K** |
| doubled |  |
| reversed |  |
| halved |  |

1. Consider an equilibrium that occurs in two steps:

H2S(aq) ⮀ H+(aq) + HS-(aq)

HS-(aq) ⮀ H+(aq) + S2-(aq)

1. Write the overall reaction.
2. How do the Kc’s for the two steps (Kc1 & Kc2) relate to the Kc of the overall reaction (Kc)?