**AP CHEMOISTRY SOULUBILLITY WS 1**

**Le Chatelier’s Principle**

1. NH4HS(s) <-----> NH3(g) + H2S(g)  H = +93 kilojoules

 The equilibrium above is established by placing solid NH4HS in an evacuated container at 25oC. At equilibrium, some solid NH4HS remains in the container. Predict and explain each of the following.

a) The effect on the equilibrium partial pressure of NH3 gas when additional solid NH4HS is introduced into the container.

b) The effect on the equilibrium partial pressure of NH3 gas when additional H2S gas is introduced into the container.

c) The effect on the mass of solid NH4HS present when the volume of the container is decreased

d) The effect on the mass of solid NH4HS present when the temperature is increased.

2. For the system 2 SO2 (g) + O2(g) <===> 2 SO3(g) , \_H is negative for the production of SO3. Assume that one has an equilibrium mixture of these substances. Predict the effect of each of the following changes on the value of the equilibrium constant and on the number of moles of SO3 present in the mixture at equilibrium. Briefly account for each of your predictions. (Assume that in each case all other factors remain constant.)

a) Decreasing the volume of the system

b) Adding oxygen to the equilibrium mixture

c) Raising the temperature of the system.

3. NH4Cl(s) ⬄ NH3(g) + HCl(g) H = +42.1 kcal

 Suppose the substances in the reaction above are at equilibrium at 600oK. State whether the partial pressure of NH3(g) will have increased, decreased, or remained the same when equilibrium is re-established after each of the following disturbances to the original system. Some solid NH4Cl remains in the flask at all times.

 a) a small quantity of NH4Cl is added.

 b) the temperature of the system is increased.

 c) a quantity of gaseous HCl is added.

**Ksp from solubility**

4. The solubility of silver bromate (AgBrO3)in water is 0.0072 g/L. Calculate Ksp.

5. The solubility of Cd(OH)2 in water is 1.14 x 10-5 mol/L at 25 C. What is the Ksp value for Cd(OH)2?

**Solubility from Ksp**

6. Celestite (strontium sulfate) is an important mineral of strontium with a Ksp SrSO4 = 3.2 x 10-7. Calculate the solubility of strontium sulphate in g/L.

7. What is the concentration of Al+3 in a saturated aqueous solution of Al(OH)3 (Ksp Al(OH)3 = 2 x 10-32)?

What is the concentration of OH- in this solution?

8. Calculate the concentration of Ag+, in mols L-1, in a saturated solution of Ag2CO3. Ksp Ag2CO3 = 8.1x10-12

**Common ion effect**

9. What is the solubility, in mols L-1, of strontium sulfate in 0.10 M sodium sulfate? Ksp SrSO4 = 3.2 x 10-7

10. What is the solubility, in mols L-1, of magnesium fluoride in 0.015 M sodium fluoride?

11. Calculate the number of moles of Ag2CrO4 that will dissolve in 1.00 L of 0.010 M K2CrO4 solution. Ksp for Ag2CrO4 = 9.0 x 10-12.

**Predicting precipitation**

12. Lead(II))chromate is used as a yellow paint pigment ("chrome yellow"). If a solution is prepared that is

5.0 x 10-4 M in lead ion, Pb2+, and 5 x 10-5 M in chromate ion, CrO42-, would you expect some of the lead chromate to precipitate? (Ksp PbCrO4 = 2.0x10-16)

13. The following solutions are mixed: 1.0 L of 0.00010 M NaOH and 1.0 L of 0.0020 M MgSO4. Is a precipitate expected? (Ksp Mg(OH)2 = 8.9x10-12)