AP Equilibrium Review for the Final Exam!!!

$4\ KO_2(s) + 2\ H_2O\ (g)$ <-----> $4\ KOH(s) + 3\ O_2(g)$

$P_4(s) + 5\ O_2(g)$ <-----> $P_4O_{10}(s)$

1. a. Write an expression for Kc and for Kp for each equation, above.

b. What quantities and units should be used in Kc calcualtions? in Kp calculations?

2. Write an expression for Kc for each equation:

a. $H_2CO_{3(aq)} + 2\ H_2O_{(l)}$ ------> $2\ H_3O^{+1}_{(aq)} + CO_3^{-2}{}_{(aq)}$

b. $Cu_3(PO_4)_{2\ (s)}$ <-----> $3\ Cu^{+2}_{(aq)} + 2\ PO_4^{-3}{}_{(aq)}$

The Kc for (b) involves a specific type of Kc called a K___

3. $2\ NOCl_{(g)}$ <-----> $2\ NO_{(g)} + Cl_{2(g)}$ $\quad Kp = 1.6 \times 10^{-5}$ at 35˚C.

(assume 35˚C for this whole problem).

a. Find Kp of this rxn: $2\ NO_{(g)} + Cl_{2(g)}$ <-----> $2\ NOCl_{(g)}$

b. Find Kp of this rxn: $4\ NOCl_{(g)}$ <-----> $4\ NO_{(g)} + 2\ Cl_{2(g)}$

c. Find Kp of this rxn: $NO_{(g)} + ½\ Cl_{2(g)}$ <-----> $NOCl_{(g)}$

d. Find Kc of this rxn: $2\ NOCl_{(g)}$ <-----> $2\ NO_{(g)} + Cl_{2(g)}$

4. $CH_6N_2O_{2(s)}$ <-----> $2\ NH_{3(g)} + CO_{2(g)}$ $Kp = 0.0029$ at 25˚C.

a. Calculate the partial pressure of each gas, and the total gas pressure, at equilibrium.

b. Calculate Kc of this rxn at 25˚C.

5. $2\ HI_{(g)}$ <-----> $H_{2(g)} + I_{2(g)}$ $Kp = 0.0218$

If 3.00 atm of HI are placed into an evacuated flask, and this reaction reaches equilibrium, what will be the partial pressures of each gas at equilibrium?

6. $2\ HI_{(g)} \longleftrightarrow H_{2(g)} + I_{2(g)}$ $K_c = 0.0423$

If 3.00 moles of HI are placed into an evacuated flask with a volume of 5.00 liters, and this reaction reaches equilibrium, what will be the molarities of each gas present at equilibrium?

7. $2\ NO_{(g)} + Br_{2(g)} \longleftrightarrow 2\ NOBr_{(g)}$

0.512 moles NO, 0.502 moles Br_2, and 0.096 moles of NOBr are placed into a rigid 12.0 liter flask. Once the mixture reaches equilibrium, 0.118 moles of NOBr are present.

Calculate Kc.

8. $2\ NO_{(g)} + Br_{2(g)}$ <-----> $2\ NOBr_{(g)}$

The above 3 gases are placed into a rigid flask at the following partial pressures:
pNO = 0.1163 atm, pBr2 = 0.0478 atm, and pNOBr = 0.0132 atm.
Once equilibrium is established, NO is present at a partial pressure of 0.0526 atm.
Calculate Kp.

9. PbI_2 has a Ksp of 1.4×10^{-8}.

a. Find the molar solubility of lead iodide into water, and also calculate the concentrations of lead (II) and iodide ion in solution at equilibrium.

b. Find the molar solubility of lead iodide into a solution of 0.20 M KI, and also calculate the concentrations of lead (II) and iodide ion in solution at equilibrium.

9c. 100. mL of 0.40 M $Pb(NO_3)_2$ are mixed with 80. mL of 0.60 M KI.
Calculate the concentrations of of lead II and iodide ions once the reaction has occurred, and equilibrium has been established.

10. Ag_3PO_4 has a solubility of 0.00196 grams per liter.
a. Convert this to a molar solubility.

b. Calculate Ksp for this compound.

c. If 200. mL of 0.300 M $AgNO_3$ are mixed with 100. mL of 0.400 M Na_3PO_4, calculate the concentration of silver ion and phosphate ion after the reaction has occurred and equilibrium has been established.
Ag_3PO_4 has a Ksp of 1.3 x 10^{-20}.