Name-_____

1. A mixture of 0.75 mol of N2 and 1.20 mol of H2 are placed in a 3.0 liter container. When the reaction reaches equilibrium, [H2] = 0.100 M. What is the value of [N2] and [NH3] at equilibrium?

2. The equilibrium constant, Kp , equals 1.78 at 250oC for the decomposition reaction: PCl5 (g) <--> PCl3 (g) + Cl2 (g) Calculate the percentage of PCl5 that dissociates if 0.05 mole of PCl5 is placed in a closed vessel (constant volume) at 250oC and 2.00 atm pressure

3. Consider the endothermic reaction: N2 (g) + O2 (g) <--> 2NO(g) ΔHo= 192.5 kJ/mol At 2000 K the equilibrium constant is 5.0 x 10^(-4). What is the value of the equilibrium constant at 2500 K ?

4. Will a precipitate form in a sample of rain runoff from an old coal mine if it is neutralized to a pH of 7.0 with 1 M NaOH? Assume that the water sample contains approximately 0.001 M Fe3+ and 0.010 M H2SO4. If a precipitate forms, what is the resulting Fe3+(aq) concentration? What is the Fe3+ concentration if enough NaOH is added to raise the pH of the solution to 10.0? (Answer in M) Unbalanced reaction: Fe(OH)3 (s) $\rightleftharpoons$ Fe3+(aq) + OH-(aq) Ksp = 4x10-38

5. What is the pH range (minimum and maximum) that would precipitate heavy-metal pollutants such as cadmium, lead, and manganese from an industrial waste stream, but not magnesium and calcium? The heavy metals are present at concentrations of approximately 0.002 M, and the magnesium and calcium concentrations are 0.005 M. The relevant unbalanced reactions and solubility products for these metals are: Ca(OH)2 (s) $\rightleftharpoons$ Ca2+(aq) + OH-(aq) Ksp = 1.3x10-6 Cd(OH)2 (s) $\rightleftharpoons$ Cd2+(aq) + OH-(aq) Ksp = 5.9x10-15 Mg(OH)2 (s) $\rightleftharpoons$ Mg2+(aq) + OH-(aq) Ksp = 8.9x10-12 Mn(OH)2 (s) $\rightleftharpoons$ Mn2+(aq) + OH-(aq) Ksp = 1.9x10-13 Pb(OH)2(s) $\rightleftharpoons$ Pb2+(aq)+OH-(aq) Ksp=1.2x10-15

6. What is the pH of household bleach, which is 5.25% sodium hypochlorite, NaClO, by weight? The Ka of hypochlorous acid is 3.0x10-8

7. Calculate Kb for methylamine if a solution prepared by dissolving 0.100 moles of methylamine in 1.00 L of water has a measured pH of 11.80. Unbalanced reaction: CH3NH2(aq) + H2O $\rightleftharpoons$ CH3NH3+(aq) + OH-(aq)

8. What are the equilibrium partial pressures of N2O4 and NO2 when 0.20 mol of N2O4 and

0.80 mol of NO2 are sealed in a 2.00 L container and placed on a steam bath? Keq = 11 at 100 degrees C. (in atm) Unbalanced reaction: N2O4 (g) $\rightleftharpoons$ NO2 (g) Keq = 11 at 100C

9. Acetic acid is a weak acid that dissociates into the acetate ion and a proton in aqueous solution: HC2H3O2 (aq) C2H3O2- (aq) + H+ (aq) At equilibrium at 25 °C a 0.100 M solution of acetic acid has the following concentrations: [HC2H3O2] = 0.0990 M, [C2H3O2-] = 1.33 × 10-3 M, and [H+] = 1.33 × 10-3 M. What is the equilibrium constant, Keq, for the ionization of acetic acid at 25 °C?

10. The hydride ion has how many electrons?

11. Which of the following is NOT true of the compound K2O?
a) It is named potassium peroxide.
b) It is a basic anhydride.
c) It is a metal oxide
d) It forms potassium hydroxide when it reacts with water

12. What three elements are tied for the 3rd to highest electronegativity?

13. Is Ammonium Vanadate more or less soluble in water than Caesium Sulfate at 293K?

14. List these three compounds by solubility, least to most, at 300K: NaNO3, KNO3, KI

15. Which of the following has the lowest boiling point?
a) Methanol
b) ethanol
c) water

16. What color is cobalt (II) chloride hexahydrate?

17. Is Iron (III) Acetate soluble in water?

18. A saturated solution of Pb(OH)2 is filtered and 25.00 mL of this solution is titrated with 0.000050 M HCl. The volume required to reach the equivalence point of this solution is 6.70 mL. Calculate the concentration of OH^-, Pb2+ and the Ksp of this saturated solution

19. What is the charge of Pb(OH)4?

20. What is the charge of Ni(NH3)6?

21. What is the charge of Al(OH)4?

22. What is the balanced reaction between
    a) Potassium permanganate and glycerol?
    b) Potassium permanganate and concentrated sulfuric acid

23. What are the names of the products in reaction b above?

24. What happens when the heaviest compound produced by reaction b is placed in water

25. Balance the following reactions in a basic solution
    a) $Al(s) + H_2O(l) + O_2(g) \rightarrow [Al(OH)_4]^-(aq)$
    b) $Zn(s) + NO^{3-}(aq) \rightarrow Zn^{2+}(aq) + NO(g)$

26. Balance the following reactions
    a) $H_2O_2(aq) \longrightarrow O_2(g)$ (pH = 0)
    b) $MnO_4^-(aq) + C_2O_4^{2-}(aq) \longrightarrow CO_2(g) + Mn^{2+}(aq)$ (pH = 0)
    c) $MnO_4^-(aq) + CH_3CH_2OH(aq) \longrightarrow CH_3CHO(aq) + MnO_2(s)$ (pH = 14)

27. Describe the two reaction mechanisms in an iodine clock reaction using persulfate.