1. Rank the following salts from most to least soluble: Ag_2CO_3 (K_{sp} = 8.1 x 10^{-12}), BaF_2 (K_{sp} = 1.7 x 10^{-6}), $Pb(OH)_2$ (K_{sp} = 2.8 x 10^{-16}).

a. $Ag_2CO_3 > Pb(OH)_2 > BaF_2$
b. $BaF_2 > Pb(OH)_2 > Ag_2CO_3$
c. $Ag_2CO_3 > BaF_2 > Pb(OH)_2$
d. $BaF_2 > Ag_2CO_3 > Pb(OH)_2$

2. What is the molar solubility of lead iodide, PbI2, in a .1 M solution of lead nitrate, Pb(NO3)2? The Ksp of lead iodide is 10^-9.
a. 4 x 10^-6
b. 5 x 10^-5
c. 6 x 10^-4
d. 7 x 10^-3

3. After combining the following solutions, which will not produce a buffer?
a. 200 ml of .5 M ammonium chloride + 100 ml of .4 NaOH
b. 200 ml of 1 M ammonia + 200 ml of .5 M HCl
c. 200 ml of .1 M pyridinium chloride + 100 ml of .05 M NaOH
d. 100 ml of .1 M pyridine + 100 ml of .05 M NaOH

4. 1M solution of NaOH is used to titrate a 1M solution of acetic acid (Ka of acetic acid = 10^{-5}). What is the pH at equivalence point?
a. 11.5
b. 9.5
c. 4.5
d. 2.5

5. In an aqueous solution of NH_4NO_2, how many equations do you need to solve all the unknowns? what is the charge balance?
a. 6, $[NH_4+] + [H+] = [OH-] + [NO_2-]$
b. 4, $[NH_4+] + [H+] = [OH-] + [NO_2-]$
c. 6, $4[NH_4^+] = 2[NO_2-]$
d. 4, $4[NH_4^+] + [H+] = [OH-] + 2[NO_2-]$

6. You mix sulfurous acid in water. What is K_{a2}?

a. $K_{a2} = [HSO_3^-] / [H^+][SO_3^{-2}]$
b. $K_{a2} = [H^+][HSO_3^-] / [H_2SO_3]$
c. $K_{a2} = [H^+][SO_3^{-2}] / [HSO_3^-]$
d. $K_{a2} = [SO_3^{-2}] / [HSO_3^-]$

7. Calculate the pH when 100 mL of 1 M NaOH is added to 100 mL of 1 M H_2SO_3. The approximate acid dissociation constants for sulfurous acid are: pK_{a1}= 2 pK_{a2}= 7.

a. 4.5
b. 2
c. 3
d. 8

8. ranking concentrations of polyprotic acids in solution
Rank all species of sulfurous acid at pH 4.

a. $H_2SO_3 > HSO_3^- > SO_3^{-2}$
b. $HSO_3^- > H_2SO_3 > SO_3^{-2}$
c. $SO_3^{-2} > H_2SO_3 > HSO_3^-$
d. $H_2SO_3 > SO_3^{-2} > HSO_3^-$
e. $SO_3^{-2} > HSO_3^- > H_2SO_3$

f. $HSO_3^- > SO_3^{-2} > H_2SO_3$