REVIEW QUESTIONS
TEST 3

1. Calculate the pH of a solution containing 0.100 M sodium formate ($NaHCO_2$)and 0.180 M formic acid ($HCHO_2$). (K_a formic acid = $1.8x10^{-4}$)

2. A buffer is prepared by adding 5.00 g of NH_3 and 20.0 g of NH_4Cl to enough water to form 2.50 L of solution.
   a) Calculate the pH of this buffer.

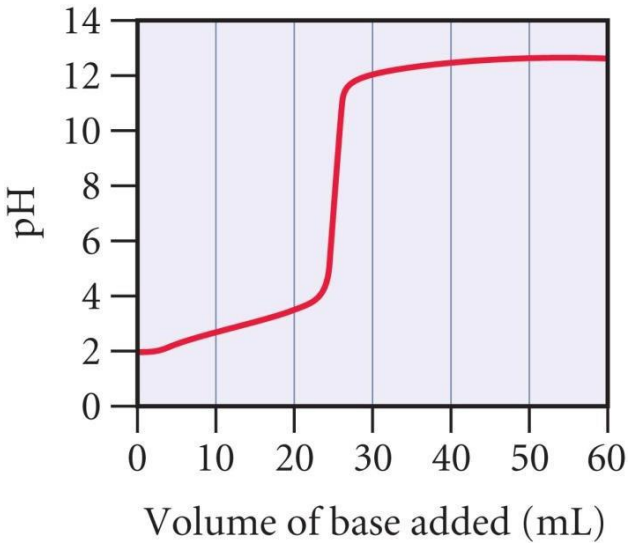
   b) Calculate the pH of the solution when 0.200 g of NaOH is added to 1.50 L of this buffer.

3. Will $Mn(OH)_2$ precipitate from solution if the pH of a 0.050 M solution of $MnCl_2$ is adjusted to 8.00? (K_{sp} of manganese hydroxide is 1.9×10^{-13})

4. Calculate the $[Cu^{2+}]$ in 1.0 L of a solution that contains 1.0×10^{-3} mole of $Cu(NO_3)_2$ and that is 0.10 M in NH_3. (K_f for $Cu(NH_3)_4^{2+} = 5.0 \times 10^{12}$)

5. Consider the titration of 25.0 mL of 0.0800 M H_2CO_3 with 0.100 M KOH. Calculate the pH of the solution after (a) addition of 10.0 mL of base, and (b) at equivalence point. (K_a for carbonic acid = 4.3×10^{-7})

6. A 0.229-g sample of an unknown monoprotic acid is titrated with 0.112 M NaOH. The resulting titration curve is shown below. Based on this information, determine the molar mass and the Ka of the acid.



7. Calculate the solubility of $Au(OH)_3$ in 1.0 M nitric acid solution. ($K_{sp}= 5.5x10^{-46}$)
Is this value greater or less than the solubility in pure water? Explain.

8. A 0.25 mol sample of a weak acid with an unknown pKa was combined with 10.0 mL of 3.00 M KOH, and the resulting solution was diluted to 1.500 L. The measured pH of the final solution was 3.85. What is the pKa of the weak acid?

9. A solution consists of 0.050 M Mg^{2+} and 0.020 M Cu^{2+}.
   (a) Which ion will precipitate first as OH^- is added to the solution?
   (b) What concentration of OH^- is necessary to begin the precipitation of each cation?
   (K_{sp} for $Mg(OH)_2 = 1.8 \times 10^{-11}$ and K_{sp} for $Cu(OH)_2 = 2.2 \times 10^{-20}$)

10. Calculate the solubility of CuX in a solution that is 0.150 M in NaCN.
    (K_{sp} for CuX = 1.27×10^{-36}; K_f for $Cu(CN)_4^{2-} = 1.0 \times 10^{25}$)

ANSWERS

1. pH = 3.48
2. a) pH = 9.15 b) pH = 9.17
3. No precipitation occurs
4. $[Cu^{2+}] = 2.4x10^{-12}$ M
5. a) pH = 6.37 b) pH = 9.50
6. molar mass = 82 g/mol Ka= $1.0x10^{-3}$
7. a) $5.5x10^{-4}$ M b) greater
8. pKa = 4.72
9. a) $Cu(OH)_2$ will precipitate first

   b) $[OH^-] = 1.0x10^{-9}$ for $Cu(OH)_2$ to precipitate

   $[OH^-] = 1.9x10^{-5}$ for $Mg(OH)_2$ to precipitate
10. $8.0x10^{-8}$ M