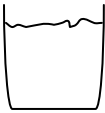


CHM152 – Chapter 15: Applications of Aqueous Equilibria – Homework

Please work all of these problems *first* then answer the questions in Blackboard.
You have one chance to place your answers in Bb so make it count! – 10 points total

1. What is the pH of a solution prepared by mixing 50.00 mL of 0.10M HCN with 50.00 mL of 0.050 M NaCN? Assume that the volumes are additive and that $K_a = 4.9 \times 10^{-10}$ for HCN.
2. What is the pH of a solution prepared by mixing 50.00 mL of 0.10 M ammonia with 25.00 mL of 0.10 M ammonium chloride? Assume that the volume of the solutions are additive and that $K_b = 1.8 \times 10^{-5}$ for ammonia.
3. Which one of the following sets of compounds is not characteristic of a buffer?
 - a. HNO_3 with NaNO_3
 - b. NaH_2PO_4 with Na_2HPO_4
 - c. NH_3 with NH_4Cl
 - d. CH_3COOH with NaCH_3COO
4. What is the pH of a buffer system made by dissolving 17.42 g of KH_2PO_4 and 20.41 g of K_2HPO_4 in water to give a volume of 200.0 mL? The K_{a2} for dihydrogen phosphate is 6.2×10^{-8} and the equilibrium reaction of interest is
$$\text{H}_2\text{PO}_4^- (\text{aq}) + \text{H}_2\text{O} (\text{l}) \rightleftharpoons \text{H}_3\text{O}^+ (\text{aq}) + \text{HPO}_4^{2-} (\text{aq}) \quad (\text{Hint: What is HA? A}^-?)$$
5. What is the pH of a buffer system made by dissolving 10.70 g of $\text{CH}_3\text{NH}_3\text{Cl}$ and 20.00 mL of 12.0 M CH_3NH_2 in enough water to make 500.0 mL of solution? $K_b = 3.7 \times 10^{-4}$ for CH_3NH_2 .
6. What is the $[\text{CH}_3\text{COO}^-] / [\text{CH}_3\text{COOH}]$ ratio necessary to make a buffer solution with a pH of 4.44? $K_a = 1.8 \times 10^{-5}$ for CH_3COOH .
7. What is the resulting pH when 0.00500 moles of KOH is added to 0.100 L of a buffer solution that is 0.100 M in H_2PO_4^- and 0.100 M HPO_4^{2-} and the $K_{a2} = 6.2 \times 10^{-8}$?
8. What is the *change* in pH when 0.00500 moles of HCl is added to 0.100 L of a buffer solution that is 0.200 M in CH_3COOH and 0.200 M NaCH_3COO ? The K_a for acetic acid is 1.8×10^{-5} .
9. Describe whether the *resulting* solution when the two reagents are mixed will be acidic, basic or neutral at the equivalence point.
 - a. CH_3COOH titrated with NaOH
 - b. KF titrated with KOH
 - c. HCl titrated with NaOH
 - d. CH_3NH_2 titrated with HCl

10. Formic acid (HCOOH , $K_a = 1.8 \times 10^{-4}$) is the principal component in the venom of stinging ants. What is the molarity of a formic acid solution if 25.00 mL of the formic acid solution requires 29.80 mL of 0.0567 M NaOH to reach the equivalence point?
11. What is the pH at the equivalence point of a weak base-strong acid titration if 20.00 mL of NaOCl requires 28.30 mL of 0.50 M HCl? $K_a = 3.0 \times 10^{-8}$ for HOCl.
12. Consider the titration of 200.0 mL of 0.150 M hydrofluoric acid in a flask with 0.175 M sodium hydroxide in a burette and answer the following: ($K_a = 3.5 \times 10^{-4}$ for HF (aq))
- How many mL of NaOH must be added to reach the equivalence point?
 - What is the pH after 38.5 mL of NaOH is added?
 - What will the resulting solution look like at the equivalence point?
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13. What is the pH of a solution made by mixing 30.00 mL of 0.10 M acetic acid with 40.00 mL of 0.10 M KOH? Assume that the volumes of the solutions are additive. $K_a = 1.8 \times 10^{-5}$ for acetic acid.
14. What is the pH of a solution made by mixing 30.00 mL of 0.10 M acetic acid with 30.00 mL of 0.10 M KOH? Assume that the volumes of the solutions are additive. $K_a = 1.8 \times 10^{-5}$ for acetic acid.
15. What is the chromium ion concentration for a saturated solution of $\text{Cr}(\text{OH})_3$ if the K_{sp} for $\text{Cr}(\text{OH})_3$ is 6.7×10^{-31} ?
16. What is the silver ion concentration for a saturated solution of Ag_2CO_3 if the K_{sp} for Ag_2CO_3 is 8.4×10^{-12} ?
17. What is the most soluble salt in the following set?
- AgCN with $K_{sp} = 6.0 \times 10^{-17}$
 - $\text{Al}(\text{OH})_3$ with $K_{sp} = 1.9 \times 10^{-33}$
 - $\text{Fe}(\text{OH})_3$ with $K_{sp} = 2.6 \times 10^{-39}$
 - $\text{Sn}(\text{OH})_2$ with $K_{sp} = 1.6 \times 10^{-19}$
18. Calculate the solubility (in g/L) of silver carbonate in water at 25°C if the K_{sp} is 8.4×10^{-12} .
19. What is the molar solubility of CaF_2 in 0.10 M NaF solution at 25°C if the K_{sp} is 1.5×10^{-10} .
20. What is the molar solubility of $\text{Mg}(\text{OH})_2$ in a basic solution with a pH of 12.00 at 25°C if the K_{sp} is 5.6×10^{-12} .
21. What will occur when calcium nitrate is added to a saturated solution of calcium hydroxide?