

SCH 4UI – ACID-BASE Questions

Non Equilibrium

1. An aspirin tablet (aspirin or ASA = $C_9H_8O_4$) with a mass of 0.36g was powdered, dissolved in water and titrated with 10.8mL of 0.15M NaOH solution. What percentage mass of ASA does the tablet contain? [0.2916g -- 81%]
2. A magnesium hydroxide, $Mg(OH)_2$, antacid tablet is crushed and dissolved in 100.0mL of 0.6M HCl. The excess HCl is back-titrated with 0.200M NaOH. 24.9mL of the base solution is needed to neutralize the excess acid. What mass of magnesium hydroxide is present in the tablet? [1.604g]
3. 30.0mL of 0.05M HCl were needed to neutralize 42.0mL of NaOH. Find [NaOH]. [0.036 M]
4. What volume of 0.1M NaOH is required to neutralize 20mL of 12.0M H_2SO_4 ? [4.8 L]
5. A solution was made by mixing 250mL of 0.30M H_2SO_4 with 4.00×10^{-2} mL of 0.7M NaOH. Calculate:
a. $[H_3O^+]$ 5×10^{-14} b. $[OH^-]$ 0.2 c. pH 13.3
6. Concentrated HNO_3 is a 70% solution, density of 1.20 g/mL. What volume of this acid is required to neutralize 100mL of 4.0M KOH? [30 mL]

Equilibrium

1. Acetylsalicylic acid (aspirin or ASA = $C_9H_8O_4$) is a weak monoprotic acid. A 0.100M solution of the acid has a pH of 2.24. Calculate K_a for the acid. [$K_a = 3.5 \times 10^{-4}$]
2. What is the pH of a 0.200 M formic acid solution ($HCOOH$ $K_a = 1.76 \times 10^{-4}$)? [pH=2.23]
3. What is the approximate $[OH^-]$ in a 0.150 M NH_3 solution? [1.64×10^{-3}]
4. Find the concentration of a benzoic acid sol'n with a pH of 2.12. [0.921M]
5. What is the pH of a 0.30 M ammonia solution? [pH=11.37]
6. Find the dissociation constant of an acid if a 0.100 M solution of the acid has a pOH of 10.59. [1.52×10^{-6}]
7. Find the pH of a 0.5 M solution of sodium cyanide NaCN. [pH=11.5]
8. A solution is 0.10 M in CH_3COOH ($K_a = 1.8 \times 10^{-5}$). What are the $[H_3O^+]$ and pH of the solution? [pH=2.87]
9. What is the pH of a 0.1M solution of sodium barbiturate, $NaC_4H_3N_2O_3$, a salt related to barbiturate drugs, which are sedatives. Barbituric acid, $HC_4H_3N_2O_3$, is a weak monoprotic acid with $K_a = 9.8 \times 10^{-5}$. [pH=8.5]
10. A 1.00×10^{-2} M solution of nitrous acid, HNO_2 , is found to be 6.09% ionized at 25°C. Calculate K_a for HNO_2 at this temperature. [$K_a = 3.95 \times 10^{-5}$]
11. A solution that is initially 1.00 M in H_3PO_4 is found to be 8.1×10^{-2} M in $H_2PO_4^{-1}$ ion at equilibrium at 25°C. Calculate K_a for H_3PO_4 at this temperature. [$K_a = 7.14 \times 10^{-3}$]
12. How many moles of HF, a weak acid, must be present in 1.00 L of HF solution with pH 2.50? [pH \rightarrow H⁺ ; $K_a \rightarrow$ Initial Conc.]
13. When 100ml of 0.250M aqueous ammonia is titrated with 0.1M HCl, what is the pH at the equivalence point? What is a good indicator for this titration? Explain. [pH=5.2]
14. In a titration of 75mL of 0.1M pyridine ($K_b = 1.5 \times 10^{-9}$) with 0.1M HCl calculate the pH
 - a. of the pyridine before titration [pH=9.09]
 - b. of the solution after 30mL of HCl is added [pH=5.35]
 - c. at equivalence [pH=3.24]