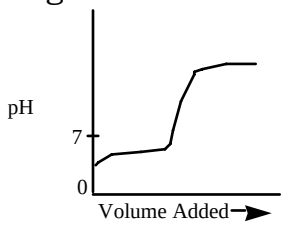
1. Calculate the acid ionization constant of an unknown monoprotic weak acid, HA, if its anion, A^-, has a hydrolysis constant of 6.2×10^{-9}.
(a) 6.0×10^{-7} (b) 4.3×10^{-6} (c) 4.5×10^{-7} (d) 5.6×10^{-8} (e) 1.6×10^{-6}

2. Which of the following titrations could the following curve describe?



(a)KOH added to HNO_3 (b)HCl added to aq. NH_3 (c)HNO_3 added to KOH
(d) NaOH added to HF (e) CH_3COOH added to aq. NH_3

3. If 100. mL of 0.040 *M* NaOH is added to 100. mL of a solution which is 0.10 *M* in CH_3COOH and 0.10 *M* in $NaCH_3COO$, what will the pH of the new soln.?

4. Write the K_{sp} expression of $Mn(OH)_3$ in terms of it's molar solubility(s).

5. Given that K_{sp} for $Cd(OH)_2$ is 1.0×10^{-14} and that K_{sp} for $Mn(OH)_3$ is 1.0×10^{-36}, answer the following questions. If gaseous NH_3 is bubbled into an acidic solution that is 1.0×10^{-2} *M* in Cd^{2+} and 1.0×10^{-12} *M* in Mn^{3+}, which metal hydroxide will precipitate first? What will the concentration of the cation of the least soluble metal hydroxide that will still be in solution when the most soluble metal hydroxide just begins to precipitate?

6. Consider solutions of the five indicated salts dissolved in water. Which one could not possibly have the pH designated?

	Salt Solution	pH
(a)	NaCl	7.00
(b)	NaF	8.16
(c)	NH_4Cl	7.64
(d)	KCN	9.48
(e)	NH_4NO_3	5.90

7. Which indicator could be used to titrate aqueous NH_3 with HCl solution

Acid Range Color	pH Range	Basic Range Color
(a) pink	1.2-2.8	yellow
(b) blue	3.4-4.6	yellow
(c) yellow	7.0-7.8	purple
(d) colorless	8.3-9.9	red
(e) none of these indicators		

8. AgCl would be least soluble at 25°C in _____.
(a) pure water (b) 0.50 *M* $AgNO_3$ (c) 0.1 *M* HCl
(d) 0.1 *M* $AgNO_3$ (e) 0.1 *M* $CaCl_2$

9. The solubility of $Ce(OH)_3$ is 9.93×10^{-4} g per liter at 25°C. Calculate the solubility product for $Ce(OH)_3$.
(a) 5.2×10^{-6} (b) 2.0×10^{-20} (c) 7.3×10^{-20}
(d) 4.0×10^{-14} (e) 1.6×10^{-18}

10. K_{sp} for CaF_2 is 3.9×10^{-11} and K_{sp} for PbF_2 is 3.7×10^{-8}. If 200 mL **each** of 5.0×10^{-3} *M* NaF, 2.0×10^{-5} *M* $Ca(NO_3)_2$, and 3.0×10^{-3} *M* $Pb(NO_3)_2$ solutions are mixed,
(a) only CaF_2 will precipitate.
(b) only PbF_2 will precipitate.
(c) both CaF_2 and PbF_2 will precipitate, and be visible.
(d) both CaF_2 and PbF_2 will precipitate, but **not** be visible.
(e) neither CaF_2 nor PbF_2 will precipitate

11. The pH of a 0.20 *M* solution of a weak monoprotic acid is 3.70. What is the value of the ionization constant for the acid?
(a) 7.0×10^{-4} (b) 4.0×10^{-6} (c) 2.0×10^{-7} (d) 1.8×10^{-5} (e) 6.1×10^{-5}

12. The hydrolysis constant for the anion, A^-, of a weak acid, HA, is 2.9×10^{-7}. What is the ionization constant for HA?
(a) 9.1×10^{-20} (b) 3.4×10^{-8} (c) 1.1×10^{-2} (d) 7.1×10^{-6} (e) 1.4×10^{-4}

13. Calculate the pH of a solution prepared by adding 115 mL of 0.100 *M* NaOH to 100 mL of 0.100 *M* HNO_3 solution.
(a) 11.60 (b) 11.68 (c) 11.76 (d) 11.85 (e) 11.92

14. Calculate the pH of a solution prepared by adding 60.0 mL of 0.100 *M* NaOH to 100 mL of 0.100 *M* CH_3COOH solution.
(a) 4.56 (b) 4.92 (c) 5.00 (d) 5.08 (e) 5.16

15. AgCl would be least soluble at 25°C in _____.
(a) pure water (b) 0.1 *M* $AgNO_3$ (c) 0.1 *M* $CaCl_2$
(d) 0.1 *M* HNO_3 (e) It is equally soluble in all of the preceding.

16. Calculate the concentration of sulfate ion in a saturated solution of barium sulfate to which barium chloride has been added until $[Ba^{+2}] = 0.1$ *M* at 25°C. K_{sp} for $BaSO_4 = 1 \times 10^{-10}$.
(a) 1×10^{-5} *M* (b) 1×10^{-8} *M* (c) 1×10^{-9} *M* (d) 1×10^{-7} *M* (e) 1×10^{-6} *M*

17. Solid Na_2SO_4 is added to a solution that is 0.30 *M* in both Sr^{2+} and Pb^{2+}. Assuming no volume change, what will be the $[Pb^{2+}]$ at the point at which $SrSO_4$ just begins to precipitate at 25°C? K_{sp} for $SrSO_4 = 2.8 \times 10^{-7}$ and for $PbSO_4 = 1.8 \times 10^{-8}$.
(a) 0.24 *M* (b) 0.16 *M* (c) 0.30 *M* (d) 0.019 *M* (e) 0.040 *M*

ANSWERS: 1 (e), 2 (d), 3 (pH = 5.11), 4 ($K_{sp} = [Mn^{3+}][OH^-]^3$), 5 ($Mn(OH)_3$ first, 1×10^{-18} *M* Mn^{3+}), 6 (c), 7 (b), 8 (b), 9 (b), 10 (e), 11 (c), 12 (b), 13 (d), 14 (b), 15 (c), 16 (c), 17 (d)