

438. A solution of strontium hydroxide with a pH of 11.4 is to be prepared. What mass of strontium hydroxide would be required to make 1.00 L of this solution?
439. A solution of NH_3 has a pH of 11.00. What are the concentrations of hydronium and hydroxide ions in this solution?
440. Acetic acid does not completely ionize in solution. Percent ionization of a substance dissolved in water is equal to the moles of ions produced as a percentage of the moles of ions that would be produced if the substance were completely ionized. Calculate the percent ionization of acetic acid in the following solutions.
- 1.0 M acetic acid solution with a pH of 2.40
 - 0.10 M acetic acid solution with a pH of 2.90
 - 0.010 M acetic acid solution with a pH of 3.40
441. Calculate the pH of a solution that contains 5.00 g of HNO_3 in 2.00 L of solution.
442. A solution of HCl has a pH of 1.50. Determine the pH of the solutions made in each of the following ways.
- 1.00 mL of the solution is diluted to 1000. mL with water.
 - 25.00 mL is diluted to 200. mL with distilled water.
 - 18.83 mL of the solution is diluted to 4.000 L with distilled water.
 - 1.50 L is diluted to 20.0 kL with distilled water.
443. An aqueous solution contains 10 000 times more hydronium ions than hydroxide ions. What is the concentration of each ion?
444. A potassium hydroxide solution has a pH of 12.90. Enough acid is added to react with half of the OH^- ions present. What is the pH of the resulting solution? Assume that the products of the neutralization have no effect on pH and that the amount of additional water produced is negligible.
445. A hydrochloric acid solution has a pH of 1.70. What is the $[\text{H}_3\text{O}^+]$ in this solution? Considering that HCl is a strong acid, what is the HCl concentration of the solution?
446. What is the molarity of a solution of the strong base $\text{Ca}(\text{OH})_2$ in a solution that has a pH of 10.80?
447. You have a 1.00 M solution of the strong acid, HCl. What is the pH of this solution? You need a solution of pH 4.00. To what volume would you dilute 1.00 L of the HCl solution to get this pH? To what volume would you dilute 1.00 L of the pH 4.00 solution to get a solution of pH 6.00? To what volume would you dilute 1.00 L of the pH 4.00 solution to get a solution of pH 8.00?
448. A solution of chloric acid, HClO_3 , a strong acid, has a pH of 1.28. How many moles of NaOH would be required to react completely with the HClO_3 in 1.00 L of the solution? What mass of NaOH is required?
449. A solution of the weak base NH_3 has a pH of 11.90. How many moles of HCl would have to be added to 1.00 L of the ammonia to react with all of the OH^- ions present at pH 11.90?
450. The pH of a citric acid solution is 3.15. What are the $[\text{H}_3\text{O}^+]$ and $[\text{OH}^-]$ in this solution?

Titrations: Chap. 15, Sec. 2

In each of the following problems, the acids and bases react in a mole ratio of 1 mol base : 1 mol acid.

451. A student titrates a 20.00 mL sample of a solution of HBr with unknown molarity. The titration requires 20.05 mL of a 0.1819 M solution of NaOH. What is the molarity of the HBr solution?
452. Vinegar can be assayed to determine its acetic acid content. Determine the molarity of acetic acid in a 15.00 mL sample of vinegar that requires 22.70 mL of a 0.550 M solution of NaOH to reach the equivalence point.
453. A 20.00 mL sample of a solution of $\text{Sr}(\text{OH})_2$ is titrated to the equivalence point with 43.03 mL of 0.1159 M HCl. What is the molarity of the $\text{Sr}(\text{OH})_2$ solution?
454. A 35.00 mL sample of ammonia solution is titrated to the equivalence point with 54.95 mL of a 0.400 M sulfuric acid solution. What is the molarity of the ammonia solution?
- In the problems below, assume that impurities are not acidic or basic and that they do not react in an acid-base titration.*
455. A supply of glacial acetic acid has absorbed water from the air. It must be assayed to determine the actual percentage of acetic acid. 2.000 g of the acid is diluted to 100.00 mL, and 20.00 mL is titrated with a solution of sodium hydroxide. The base solution has a concentration of 0.218 M, and 28.25 mL is used in the titration. Calculate the percentage of acetic acid in the original sample. Write the titration equation to get the mole ratio.
456. A shipment of crude sodium carbonate must be assayed for its Na_2CO_3 content. You receive a small jar containing a sample from the shipment and weigh out 9.709 g into a flask, where it is dissolved in water and diluted to 1.0000 L with distilled water. A 10.00 mL sample is taken from the flask and titrated to the equivalence point with 16.90 mL of a 0.1022 M HCl solution. Determine the percentage of Na_2CO_3 in the sample. Write the titration equation to get the mole ratio.

Mixed Review

457. A 50.00 mL sample of a potassium hydroxide is titrated with a 0.8186 M HCl solution. The titration requires 27.87 mL of the HCl solution to reach the equivalence point. What is the molarity of the KOH solution?
458. A 15.00 mL sample of acetic acid is titrated with 34.13 mL of 0.9940 M NaOH. Determine the molarity of the acetic acid.
459. A 12.00 mL sample of an ammonia solution is titrated with 1.499 M HNO_3 solution. A total of 19.48 mL of acid is required to reach the equivalence point. What is the molarity of the ammonia solution?