Worksheet 10: Ionization

Objectives

1. Use K_w to determine relative amounts of hydroxide and hydronium ions in solution and assess whether the solution is acidic, basic, or neutral
2. Calculate equilibrium concentrations and pH using any appropriate approximations
3. Determine the pH or pOH of a solution and identify the relationship between these quantities
4. Carry out all kinds of pH calculations and calculations using pH to find other quantities

Key Questions

1. Write the expressions for K_c and K_a of water. Recall that $[H_2O] \approx 55$ M. Using this information, the expression for the K_a of water, and the fact that water's K_a is 1.8×10^{-16}, calculate the value of $[H_3O^+] \times [OH^-]$.

2. What is the name for the value calculated in the previous problem?

3. Use the value of K_w to calculate the hydronium and hydroxide ion concentrations in pure water. Also calculate the pH and pOH of pure water.

4. For the following concentrations, state whether the associated solution will be acidic, basic, or neutral, and calculate the corresponding hydroxide or hydronium concentration.
   (a) $[H_3O^+] = 7.2\times10^{-4}$ M
   (b) $[H_3O^+] = 5.8\times10^{-10}$ M
   (c) $[OH^-] = 1.8\times10^{-6}$ M
   (d) $[OH^-] = 1.0\times10^{-7}$ M

5. Given an initial concentration of 0.5 M H_2S and its K_a of 1.1×10^{-7}, determine the equilibrium concentration of HS^-, the pH of the solution, and $[OH^-]$.

6. How many moles of NH_3 must be dissolved in 1.00 liters of aqueous solution to produce a solution with a pH of 11.47? The K_a of NH_4^+ is 5.8×10^{-10}.

7. Calculate the percent ionization of the weak acid, HA, given a 0.25 M HA solution and a K_a of 5.3×10^{-7}.