Objectives

1. Describe how the molar concentrations of mono- and polyprotic weak acids and their conjugate bases vary with pH

2. Identify the principal species resulting from the dissociation of a weak acid at a given pH

3. Sketch and interpret ionic distribution graphs given appropriate pKa values

Key Questions

1. Sketch an acid-base distribution plot for hydrofluoric acid, given its pK_a is 3.17. Then, label the principal species at pH 3.00 and pH 7.00.

2. For the previous problem, what is true of the concentrations of HF and F^- where the lines cross? Write the K_a expression for the dissociation of HF in water. How can this expression be simplified at the pH where the lines cross?

3. For the triprotic acid, orthophosphoric acid, write out its three equilibria with water, and assign a pK_a value to each one. The three pK_a values are 12.15, 7.199, and 2.148. Use the equilibria and corresponding pK_as to sketch the acid-base distribution plot and identify the principal species at pH 4.000, pH 8.000, and pH 10.000.

4. For the previous problem, over what range is $HPO_4{}^{2-}$ dominant?

5. Again looking at problem 3, what pH would be required to be sure that most of the phosphate present was in the PO_4^{3-} form?

6. Decide whether the following statement is true or false. If it is false, correct it to make it true. Statement: "For any weak acid, the acid form is the dominant species at pH values above 7.00 and its conjugate base is dominant at pH values below 7.00."