5.111 Principles of Chemical Science: Week 8

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August 12th, 2019

Progress Update

Over the past week I have been introduced to:

1. Lectures 20-22 on solubility and acid-base equilibrium.

Solubility

For a reaction considering the dissolution of a solid in a pure solvent,

$$K_{sp} = \prod \text{product concentrations} \tag{1}$$

and is generally in units of mols/L. Consider the review problem

In water at 25 °C, lead (II) sulfate ($PbSO_4$) has a solubility of 4.25 x 10^{-3} g/100 mL solution. What is the K_{sp} of $PbSO_4$?

Acids and bases

A few definitions of acids and bases exist and are mentioned in every single chemistry course:

1. Arrhenius - an acid increases $[H^+]$, a base increases $[OH^-]$
2. Bronsted-Lowry - an acid donates H^+, a base accepts H^+.
3. Lewis - an acid accepts electrons, a base donates electrons

Acidity

Most chemists use pH and pOH to measure how acidic/basic a solution is;

$$pH = -\log(OH^-) \tag{2}$$
$$pOH = -\log(H^+) \tag{3}$$

where there is the relation that $pH + pOH = 14$.

Consider the following problem from the 2018 local Chemistry Olympiad exam:

32. What is the pH of a 0.20 M solution of sodium benzoate, $Na(C_6H_5COO)$? The K_a of benzoic acid, C_6H_5COOH, is 6.5×10^{-5}.

    (A) 5.26   **(B)** 8.74   **(C)** 9.09   **(D)** 11.56