Problems

Salting out potassium nitrate. We plan to mix 1 liter of 2 M KCl with 1 liter of 8 M $NaNO_3$. How much KNO_3 will precipitate? Approximate solubility products useful in this problem are: KCl, 10; KNO_3, 1.5; NaCl, 35 and $NaNO_3$, 100. Each is given in $(mol/l)^2$;each implies an ideal solution, which is a significant approximation.

Salting out BSA. By experiment, we find that the solubility of this albumin is about 12 and 0.006 g/liter at ammonium sulfate concentrations of 2.5 and 3.5 M, respectively. What is its solubility at 3.0 M $(NH_4)_2SO_4$?

Yeast Dehydrogenase Purification. Two of these dehydrogenase have the precipitation rate constants.

$Ka = 5.0 \times 10^{57}/\text{second } e^{-380\ KJ/RT}$

$Kb = 4.2 \times 10^{64}/\text{second } e^{-415\ KJ/RT}$

You have solution containing equal activities of each enzymes. What will the activity be after 10 minutes at 20 ^{o}C? What will it be after 10 minutes at 50 ^{o}C?

Catalase precipitation. We want to precipitate catalase from an enzyme mixture which includes cholesterol oxidase, our desired product. Catalase has molecular weight of 250,000, a precipitate density of 1.3 g/cm^3, a diameter in solution of 10.4 nm, and a diffusion coefficient of 4.1 X 10^{-7} cm^2/second. It is to be precipitated by a sudden pH change in a 100 liter tank stirred with a 0.1 hp motor. The feed concentration is 0.2 g/liter and the sticking coefficient is about 0.05 sec. Estimate the following:
(a)The time over which diffusion will limit growth;
(b)The concentration of particles at the end of this time; and
(c)The time required to grow 100 μm particles for centrifugation.

Assume that nucleation is fast and flocculation is negligible, and that the solution has properties close to those of water.