7.6 The Solubility Product Constant STUDENT

- Most salt solutions are very soluble in water.
- Some are weak electrolytes and are only slightly soluble in water.

Biological Application of Solubility

- Proteins and nucleic acids produce toxic nitrogenous wastes when metabolized and different organisms have adapted different methods of dealing with them.
- Aquatic animals eliminate nitrogenous wastes as ammonia since it is highly soluble and can be eliminated via the gills. But ammonia is very toxic to living things and it has to be eliminated immediately.
- Mammals and amphibians convert nitrogenous wastes into urea, which is much less toxic and very soluble. It can be stored in the body until excreted.
- Birds and reptiles convert it to uric acid that is almost non-soluble and less toxic than ammonia.

  Why the difference?

Solubility Product

- Solubility: the concentration of a saturated solution of a solute in a particular solvent at a particular temperature; solubility is a specific maximum concentration.
- Solubility Product Constant (K_{sp}): the value obtained from the equilibrium law applied to a saturated solution. (Ignore units.)

Calculating Solubility Using K_{sp} Values

- E.g. Calculate K_{sp} for magnesium fluoride at 25°C, given a solubility of 0.00172 g/100 mL.

Predict Precipitation

- Trial Ion Product: the reaction quotient applied to the ion concentrations of a slightly soluble salt.
- E.g. Would a precipitate of lead (II) sulfate, $PbSO_{4\,(s)}$, ($K_{sp} = 1.8\times10^{-8}$) form if 255 mL of 0.00016 mol/L lead(II)nitrate, $Pb(NO_3)_{2(aq)}$,is poured into 456 mL of 0.00023 mol/L sodium sulfate, $Na_2SO_{4(aq)}$?

- $Q > K_{sp}$ Precipitate will form (supersaturated)
- $Q = K_{sp}$ Precipitate will not form (saturated)
- $Q < K_{sp}$ Precipitate will not form (unsaturated)

Common Ion Effect page 491

- Chemicals will have lower solubilities in solutions of common ions versus pure water
- Use ICE tables
- The initial ion concentration will be affected by the already present ion
- The unknown "x" is the new solubility of the chemical
- Review example question from calculating K_e notes and how it applies to Le Châtelier's Principle.

Homework

- Practice 1,2,3,4,5,6,7,8,9,10,11,12
- Questions 1,2,3,4,5,6,7,8,9,10,11