

CHEMISTRY DAILY PLAN

Class:

Date:

Subject: Calculation From Ksp

Time:

CALCULATION OF SOLUBILITY

If the solubility product for a compound is known, the solubility of the compound can be calculated easily as illustrated in the following examples.

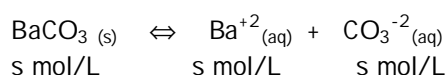
EXAMPLE 6 Calculation of Solubility

Problem : Barium carbonate, BaCO_3 , has a solubility product of 1.6×10^{-9} at 25°C . Find the solubility of BaCO_3 in a) mol/L b) g/L. $\text{BaCO}_3 = 197 \text{ g/mol}$

Solution;

a) (1) Write the equation for the dissolution reaction of BaCO_3 , and its Ksp expression
 $\text{BaCO}_3 (\text{s}) \rightleftharpoons \text{Ba}^{+2} (\text{aq}) + \text{CO}_3^{-2} (\text{aq})$ Ksp = $[\text{Ba}^{+2}] [\text{CO}_3^{-2}] = 1.6 \times 10^{-9}$

(2) Let s be the solubility of BaCO_3 in mol/L. If s mol of BaCO_3 is dissolved in 1 liter, s mol/L of Ba^{+2} and s mol/L of CO_3^{-2} ions are formed.



(3) Substitute the ion concentrations into the Ksp expression and solve the equation for s .

$$\text{Ksp} = [\text{Ba}^{+2}] [\text{CO}_3^{-2}] \Rightarrow \{s\} (s) = s^2 = 1.6 \times 10^{-9}$$

Taking the square root of both sides gives that the molar solubility of BaCO_3 at 25°C is $4 \times 10^{-5} \text{ mol/L}$.

b) To calculate the mass of BaCO_3 in one liter of saturated solution, we convert moles of BaCO_3 into grams. Mass of $\text{BaCO}_3 = n \times \text{MW of BaCO}_3 = 4 \times 10^{-5} \text{ mol/L} \times 197 \text{ g/mol} = 7.88 \times 10^{-3} \text{ g/L}$.

Here we do not suggest that the concentration of BaCO_3 is s mol/L, instead, only that s mole of solid BaCO_3 dissolves to produce saturated solution.

PROBLEMS IN CLASS: Calculation of Solubility

Problem 5: Calculate the concentration of IO_3^- in a saturated solution of $\text{La}(\text{IO}_3)_2$ for which Ksp is 4.32×10^{-10} at a given temperature.

Problem 6: How many liters of water are needed to dissolve 9.22 grams of PbI_2 for which Ksp = 4×10^{-9} at 25°C ? $\text{PbI}_2 = 461 \text{ g/mol}$