Solubility Equilibrium

1. Define solubility and give its units

2. 2.65 grams of $Ba(OH)_2$ is dissolved in 70.0 mL of water to produce a saturated solution at 20 ^{0}C. Calculate the solubility in units of g/100 mL, g/L, and M. Molar mass of $Ba(OH)_2$ is 171.34 g/mol.

3a. Write the chemical equation that shows the dissolution of $PbBr_2$.

3b. Write the expression for the equilibrium constant (Ksp = the solubility product) for the reaction. Determine the molar solubility of $PbBr_2$ if its Ksp at 25 ˚C is 4.63×10^{-6}.

4. Calculate the solubility in g/L for $PbBr_2$, given that the molar mass of $PbBr_2$ is 367.01 g/mol.

5. The molar solubility of silver iodate ($AgIO_3$) is 1.79×10^{-4} M at 25 ^{0}C. Calculate the maximum mass of silver iodide that can be dissolved in 650 mL of water at 25 ^{0}C. Molar mass of $AgIO_3$ is 282.8 g/mol.

6. Circle the correct answer.

a. The solubility product constant of $Fe(OH)_2$ is

I. [Fe][OH] II. [Fe]/[OH]

III. $[Fe][OH]^2$ IV. $[Fe]/[OH]^2$

b. AgCl can be considered as

I. Weak electrolyte II. Strong electrolyte

III. Nonelectrolyte IV. Covalent compound

Solubility Equilibrium

Answers

1. Define solubility and give its units

The maximum amount of solute that can dissolve in a solvent at a given temperature.
Units = M, g/100 mL, g/L

2. 2.65 grams of $Ba(OH)_2$ is dissolved in 70.0 mL of water to produce a saturated solution at 20 ^{0}C. Calculate the solubility in units of g/100 mL, g/L, and M. Molar mass of $Ba(OH)_2$ is 171.34 g/mol.

2.65 g/70 mL = 2.65 g/0.070 L = 37.9 g/L
37.9 g/L = 37.9 g/100 mL = 3.79 g/100 mL
37.9 g L^{-1} /171.34 g mol^{-1} = 0.221 M

3a. Write the chemical equation that shows the dissolution of $PbBr_2$.

$PbBr_2 \rightarrow Pb^{2+} + 2\ Br^-$

3b. Write the expression for the equilibrium constant (Ksp = the solubility product) for the reaction. Determine the molar solubility of $PbBr_2$ if its Ksp at 25 °C is 4.63 x 10^{-6}.

$Ksp = [Pb^{2+}][Br^-]^2 = 4.63 \times 10^{-6}$
$\Rightarrow (x)(2x)^2 = 4.63 \times 10^{-6}$
$\Rightarrow 4x^3 = 4.63 \times 10^{-6}$

$\Rightarrow x^3 = (4.6^3 \times 10^{-6})/4 = 1.1575 \times 10^{-6}$
$\Rightarrow x = 0.0105$ mol/L

4. Calculate the solubility in g/L for $PbBr_2$, given that the molar mass of $PbBr_2$ is 367.01 g/mol.

(0.0105 mol/L) (367.01 g/mol) = 3.85 g/L

5. The molar solubility of silver iodate ($AgIO_3$) is 1.79 x 10^{-4} M at 25 ^{0}C. Calculate the maximum mass of silver iodide that can be dissolved in 650 mL of water at 25 ^{0}C. Molar mass of $AgIO_3$ is 282.8 g/mol.

Molarity = (1.79 x 10^{-4} M/L)(0.6500 L) = 1.1635 x 10^{-4} M
1.1635 x 10^{-4} M of $AgIO_3$ x 282.8 g/mol = 0.0329 g

6. Circle the correct answer.

a. The solubility product constant of $Fe(OH)_2$ is

I. [Fe][OH]
II. [Fe]/[OH]
III. $[Fe][OH]^2$
IV. $[Fe]/[OH]^2$

b. AgCl can be considered as

I. Weak electrolyte
II. Strong electrolyte
III. Nonelectrolyte
IV. Covalent compound