

## 19 • Precipitation Reactions

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### STUDY QUESTIONS

- Predict, on the basis of the solubility rules, which of the following salts are soluble and which are insoluble. For those that are “insoluble” look up their solubility products.
  - AgI
  - Na<sub>3</sub>PO<sub>4</sub>
  - BaSO<sub>4</sub>
  - (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>
  - NiCO<sub>3</sub>
  - Cu(OH)<sub>2</sub>
- Write solubility product expressions for the following salts:
  - PbSO<sub>4</sub>
  - Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>
  - CuS
  - CaF<sub>2</sub>
- If the molar concentration of lead bromide, PbBr<sub>2</sub>, in an aqueous solution is  $1.6 \times 10^{-6}$  M, what is [Pb<sup>2+</sup>] and [Br<sup>-</sup>]?
- If the molar solubility of silver iodide is  $1.22 \times 10^{-8}$  M, what is the solubility product for AgI?
- What is the molar solubility of cadmium sulfide, CdS, if its  $K_{sp} = 3.6 \times 10^{-29}$ ?
- $K_{sp}$  of strontium fluoride, SrF<sub>2</sub>, is  $2.5 \times 10^{-9}$ . What is the [Sr<sup>2+</sup>] and [F<sup>-</sup>] in a saturated solution of SrF<sub>2</sub>? What is the molar solubility of SrF<sub>2</sub>?
- What is the [Mg<sup>2+</sup>] in a saturated solution of magnesium fluoride, MgF<sub>2</sub> if its solubility product constant is  $6.4 \times 10^{-9}$ ? What is the [Mg<sup>2+</sup>] if the solution also contains 0.30 M sodium fluoride?

8. From which of the following mixtures of silver nitrate and sodium sulfite would silver sulfite precipitate? The  $K_{sp}$  for silver sulfite =  $1.5 \times 10^{-14}$ .
- a. 50 mL of  $1.0 \times 10^{-4}$  M  $\text{Ag}^+$  and 50 mL of  $1.0 \times 10^{-4}$  M  $\text{SO}_3^{2-}$ .
- b. 25 mL of  $1.0 \times 10^{-3}$  M  $\text{Ag}^+$  and 25 mL of  $1.0 \times 10^{-5}$  M  $\text{SO}_3^{2-}$ .
- c. 50 mL of  $1.0 \times 10^{-5}$  M  $\text{Ag}^+$  and 100 mL of  $1.0 \times 10^{-3}$  M  $\text{SO}_3^{2-}$ .
9. Calculate the solubility in moles per Liter of cobalt(II) sulfide in a solution that contains 0.030 M cobalt(II) chloride.  $K_{sp}$  for cobalt sulfide  $\text{CoS} = 5.9 \times 10^{-21}$ .
10. Addition of a strong acid would increase the solubility of which of the following salts?
- |                 |                  |                   |                 |
|-----------------|------------------|-------------------|-----------------|
| $\text{AgCl}$   | $\text{CaSO}_4$  | $\text{CdS}$      | $\text{CaCO}_3$ |
| $\text{PbBr}_2$ | $\text{CaHPO}_4$ | $\text{Cd(OH)}_2$ | $\text{AuCl}$   |