

## $K_{sp}$ Problems - Set II – predicting precipitation

- How can we predict whether a precipitate will form when two aqueous ionic solutions are mixed?
- The  $K_{sp}$  of silver chloride ( $\text{AgCl}$ ) is  $1.7 \times 10^{-10}$ . If 60 mL of 0.002 M  $\text{NaCl}$  are added to 40 mL of  $3.0 \times 10^{-5}$  M  $\text{AgNO}_3$ ...
  - What is  $[\text{Ag}^+]$ ?
  - What is  $[\text{Cl}^-]$ ?
  - Will a precipitate form? . (yes,  $i.p. = 1.4 \times 10^{-8}$  M)
- Will lead(II) chloride ( $\text{PbCl}_2$ ), with a  $K_{sp}$  of  $1.6 \times 10^{-5}$ , precipitate if 15 mL of 0.0003 M  $\text{Pb}(\text{NO}_3)_2$  are combined with 25 mL of 0.04 M  $\text{CaCl}_2$ ?
  - What is  $[\text{Pb}^{2+}]$ ?
  - What is  $[\text{Cl}^-]$ ?
  - Will a precipitate form? (no,  $i.p. = 2.8 \times 10^{-7}$ )

4. A sample 20 ml of 0.10 M  $\text{Ba}^{2+}$  is added to 50 ml of 0.10 M  $\text{CO}_3^{2-}$ . Will  $\text{BaCO}_3$  solid form? The  $K_{\text{sp}}$  of  $\text{BaCO}_3$  is  $8.1 \times 10^{-9}$ .

a) What is  $[\text{Ba}^{2+}]$ ?

b) What is  $[\text{CO}_3^{2-}]$ ?

c) Will a precipitate form? (ans.  $ip = 2.04 \times 10^{-3} > K_{\text{sp}}$ , a solid will form)

5. Exactly 200 ml of 0.004 M  $\text{BaCl}_2$  are added to exactly 600 ml of 0.008 M  $\text{K}_2\text{SO}_4$ . Will a precipitate form? The  $K_{\text{sp}}$  of  $\text{BaSO}_4$  is  $1.1 \times 10^{-10}$ . Start by writing an equilibrium reaction.

a) What is  $[\text{Ba}^{2+}]$ ?

b) What is  $[\text{SO}_4^{2-}]$ ?

c) Will a precipitate form? (answer:  $ip = 6.0 \times 10^{-6} > K_{\text{sp}}$ , a ppt forms)

6. If 2.00 mL of 0.2 M  $\text{NaOH}$  are added to 1.00 L of 0.10 M  $\text{CaCl}_2$ , will precipitation occur? The  $K_{\text{sp}}$  of  $\text{Ca}(\text{OH})_2$  is  $8.0 \times 10^{-6}$ .

a) What is  $[\text{Ca}^{2+}]$ ?

b) What is  $[\text{OH}^-]$ ?

c) Will a precipitate form? (answer:  $ip = 1.59 \times 10^{-8} < K_{\text{sp}}$ , no ppt)