

Solubility Equilibria

K_{sp}, molar solubility and precipitation

Name _____ Class _____ Date _____

K_{sp} VALUES AT 25 °C

AgCl 1.8×10^{-10} · BaSO₄ 1.1×10^{-10} · CaF₂ 3.9×10^{-11} · Mg(OH)₂ 1.8×10^{-11} · Ag₂CrO₄ 1.1×10^{-12}

Molar mass BaSO₄ 233.39 g/mol · K_w = 1.0×10^{-14} · pH + pOH = 14.00

1 : 1 salts: K_{sp} = s² · 1 : 2 and 2 : 1 salts: K_{sp} = 4s³

Write the dissolving equilibrium first. Allow for dilution when solutions are mixed.

A. Expressions

- Write the dissolving equilibrium and the K_{sp} expression for: (a) BaSO₄ (b) Mg(OH)₂ (c) Ag₂CrO₄ (d) Ca₃(PO₄)₂

B. Molar solubility

- Calculate the molar solubility of BaSO₄ in mol/L and in g/L.

- Calculate (a) the molar solubility of Mg(OH)₂ (b) [OH⁻] in its saturated solution (c) the pH of the saturated solution.

4. The molar solubility of Ag_2CrO_4 is $6.5 \times 10^{-5} \text{ mol/L}$. Calculate its K_{sp} .

5. AgCl has a larger K_{sp} than Ag_2CrO_4 . Show that Ag_2CrO_4 is nevertheless the more soluble salt, and explain why.

C. Common ion and precipitation

6. Calculate the molar solubility of CaF_2 in 0.010 mol/L NaF , and compare it with its solubility in pure water ($2.1 \times 10^{-4} \text{ mol/L}$).

7. 10.0 mL of $0.010 \text{ mol/L BaCl}_2$ is mixed with 40.0 mL of $0.0050 \text{ mol/L Na}_2\text{SO}_4$. Does BaSO_4 precipitate? Show your working.

D. Challenge

8. Milk of magnesia is a suspension of $\text{Mg}(\text{OH})_2$. Use Le Chatelier's principle to explain why it dissolves in stomach acid (HCl).