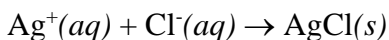


Solubility Problems (no calculator)

You can do all of these problems with or without a calculator. Answers provided were generated without a calculator.

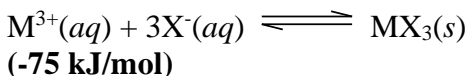
1. A *Mohr Titration* is a procedure for finding out the amount of Cl^- in a solution by titrating it with aqueous AgNO_3 :



Calculate the Ag^+ concentration at the equivalence point, that being the point in the titration where the number of moles of added silver is equal to the moles of Cl^- ion initially present.

$$\text{p}K_{\text{sp}}(\text{AgCl}) = -\log(K_{\text{sp}}(\text{AgCl})) = 9.74 \text{ [about } 1 \times 10^{-5} \text{ M]}$$

2. Calculate the molar solubility of the hypothetical compound A_3B_2 ($K_{\text{sp}} 1.08 \times 10^{-23}$) in:
 - a) Water [1×10^{-5}]
 - b) 0.10 M $\text{A}(\text{NO}_3)_2$ [About 5×10^{-11}]
3. The pH of a certain metal hydroxide of formula $\text{M}(\text{OH})_3$ is 12.48 at 25°C . What is K_{sp} for the metal hydroxide? [about 2.7×10^{-7}]
4. A solution has $[\text{Cl}^-] = 1.8 \times 10^{-2} \text{ M}$ and $[\text{Br}^-] = 0.010 \text{ M}$. AgNO_3 is slowly added to the solution. What will be the percent of the first ion remaining at the point of maximum separation of Br^- and Cl^- ? $K_{\text{sp}}(\text{AgBr}) = 5 \times 10^{-13}$, and $K_{\text{sp}}(\text{AgCl}) = 1.8 \times 10^{-10}$ [0.5% of Br^- remains]
5. $\text{M}(\text{OH})_2(s)$ is dissolved in water to produce a saturated solution. A 25.00 mL sample of the clear saturated solution required 10.00 mL of 0.1000 M HCl for its titration. What is the K_{sp} of $\text{M}(\text{OH})_2$? (3.2×10^{-5})
6. The K_{sp} of $\text{MX}_3(s)$ at 27°C is 1.0×10^{-12} . At 52°C it is 1×10^{-11} . Calculate ΔH° for the reaction:



7. The solubility product of Ag_2CrO_4 is 1.0×10^{-12} .
 - a) Can the molar solubility of Ag_2CrO_4 be lowered to 5.0×10^{-8} by using CrO_4^{2-} as the common ion? Explain by calculating the $[\text{CrO}_4^{2-}]$ that would be required. (No)
 - b) Can the molar solubility of Ag_2CrO_4 be lowered to 5.0×10^{-8} by using Ag^+ as the common ion? Explain by calculating the $[\text{Ag}^+]$ that would be required. (Yes)