

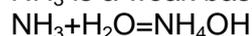
Answer on Question #56434 – Chemistry - Inorganic Chemistry

A solution contains 0.50 M NH_3 and 1.50 M NH_4Cl . What is the maximum concentration of Mg^{2+} that can be present in such a solution (without) precipitating $\text{Mg}(\text{OH})_2$?

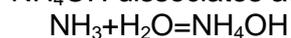
Answer:

NH_4Cl ionizes completely. So that $C(\text{NH}_4)=1.50$ M.

NH_3 is a weak base. It reacts with water as:



NH_4OH dissociates according to:



$$1 \quad 0.5 \quad 0 \quad 0$$

$$2 \quad -x \quad x \quad x$$

$$3 \quad 0.5-x \quad x \quad x$$

$$K_b = [\text{NH}_4^+][\text{OH}^-]/[\text{NH}_3]$$

$$[\text{OH}^-] = (K_b \cdot [\text{NH}_3]) / [\text{NH}_4^+]$$

$$K_b(\text{NH}_4\text{OH}) = 1.85 \cdot 10^{-5}$$

$$[\text{OH}^-] = x$$

$[\text{NH}_4^+]$ already exists in the solution from NH_4Cl . So that: $C([\text{NH}_4^+]) = 1.5 + x$. But x here can be ignored.

$$[\text{NH}_3] = 0.5 - x, \text{ where } x \text{ can be ignored}$$

$$[\text{OH}^-] = (1.85 \cdot 10^{-5} \cdot 0.5) / 1.5 = 6.16 \cdot 10^{-6}$$

$$K_{sp}(\text{Mg}(\text{OH})_2) = [\text{Mg}^{2+}][\text{OH}^-]^2$$

$$K_{sp}(\text{Mg}(\text{OH})_2) = 5.6 \cdot 10^{-12}$$

$$[\text{Mg}^{2+}] = (5.6 \cdot 10^{-12}) / (6.16 \cdot 10^{-6})^2 = 9.1 \cdot 10^{-7}$$