

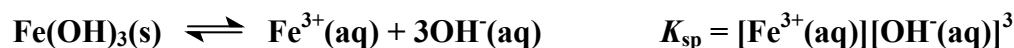
Marks
2

- Calculate the molar solubility of $\text{Fe}(\text{OH})_3$ in a $\text{pH} = 5.0$ buffer solution. The solubility product constant of $\text{Fe}(\text{OH})_3$ is $4 \times 10^{-38} \text{ M}^4$.

Using $\text{pOH} = -\log_{10}([\text{OH}^-(\text{aq})])$ and $\text{pH} + \text{pOH} = 14.0$:

$$\text{pOH} = (14.0 - 5.0) = 9.0 \text{ and} \\ [\text{OH}^-(\text{aq})] = 1 \times 10^{-9} \text{ M}$$

The solubility equilibrium and product are :



Hence,

$$[\text{Fe}^{3+}(\text{aq})] = \frac{K_{\text{sp}}}{[\text{OH}^-(\text{aq})]^3} = \frac{(4 \times 10^{-38})}{(1.0 \times 10^{-9})^3} = 4 \times 10^{-11} \text{ M}$$

As $\text{Fe}(\text{OH})_3(\text{s})$ dissolves to give 1 $\text{Fe}^{3+}(\text{aq})$, this is also the molar solubility.

Answer: $4 \times 10^{-11} \text{ M}$