- The K_{sp} for $Fe(OH)_3$ is 2.64×10^{-39}. What is its molar solubility in water?

Marks 2

The dissolution reaction and is equilibrium constant expression are:

$$\mathbf{Fe(OH)_3(s) \rightleftharpoons Fe^{3+}(aq) + 3OH^-(aq)} \qquad \mathbf{K_{sp} = [Fe^{3+}(aq)][OH^-(aq)]^3}$$

The molar solubility is the number of moles that dissolve in a litre. If *s* mol dissolves in a litre:

$$\mathbf{[Fe^{3+}(aq)] = s\ M} \quad \textbf{and} \quad \mathbf{[OH^-(aq)] = 3s\ M}$$

Hence:

$$\mathbf{K_{sp} = (s)(3s)^3 = 27s^4 = 2.64 \times 10^{-39}}$$

so

$$\mathbf{s = 9.94 \times 10^{-11}\ M}$$

Answer: $\mathbf{9.94 \times 10^{-11}\ M}$