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

Marks 2

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

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

The solubility equilibrium and product are :

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

Hence,

$$[Fe^{3+}(aq)] = \frac{K_{sp}}{[OH^-(aq)]^3} = \frac{(4\times10^{-38})}{(1.0\times10^{-9})^3} = 4\times10^{-11} \text{ M}$$

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

Answer: **4×10^{-11} M**