Solid calcium hydroxide, Ca(OH)2, is dissolved in water until the pH of the solution is 10.23. What is the concentration of calcium ion [Ca2+]?

Solution:

In water $Ca(OH)_2$ dissociates according to the equation:

$Ca(OH)_2 \leftrightarrow 2OH^- + Ca^{2+}$

We assume that the pH of the water has been 7, after dissolved $Ca(OH)_2$ in water the pH increased to 10.23. From this it follows that the concentration of ion OH^- increase by $10^{-3.23}$mol/L or $5.89 \cdot 10^{-4}$ mol/L

(ΔpH=10.23-7=3.23, so ΔpH =ΔpOH=3.23. Due to the fact that $pOH=-lg[OH^-]$, than $[OH^-]=10^{-3.23}$ M).

Because, during the dissociates of $Ca(OH)_2$ the ions $[Ca^{2+}]$ form twice less than the ions $[OH^-]$, the concentration of $[Ca^{2+}]$ is: $5.89 \cdot 10^{-4}/2=2.945 \cdot 10^{-4}$ mol/L.

Answer: $[Ca^{2+}]=2.945 \cdot 10^{-4}$ mol/L.