Question 4

Answer the following questions about the solubility of Ca(OH)\(_2\) \(K_{sp} = 1.3 \times 10^{-6}\).

(a) Write a balanced chemical equation for the dissolution of Ca(OH)\(_2\)(s) in pure water.

\[
\text{Ca(OH)}_2 \leftrightharpoons \text{Ca}^{2+} + 2 \text{OH}^-\]

1 point is earned for the correct equation.

(b) Calculate the molar solubility of Ca(OH)\(_2\) in 0.10 \(M\) Ca(NO\(_3\))\(_2\).

\[
K_{sp} = [\text{Ca}^{2+}] [\text{OH}^-]^2
\]

\[
1.3 \times 10^{-6} = (0.10 + x)(2x)^2 \approx (0.10)(4x^2) \quad \text{[assuming } x \ll 0.10]\]

\[
1.3 \times 10^{-5} = 4x^2
\]

\[
x = 0.0018 \text{ M}
\]

Molar solubility of Ca(OH)\(_2\) = 0.0018 \(M\)

1 point is earned for the correct stoichiometry and setup.

1 point is earned for the final answer.

(c) In the box below, complete a particle representation diagram that includes four water molecules with proper orientation around the Ca\(^{2+}\) ion.

Represent water molecules as

[The diagram should show the oxygen side of the water molecules oriented closer to the Ca\(^{2+}\) ion.]

1 point is earned for a correct diagram that shows at least three of the four water molecules oriented as described.