

AP[®] CHEMISTRY
2015 SCORING GUIDELINES

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 $\text{Ca(OH)}_2(s)$ in pure water.

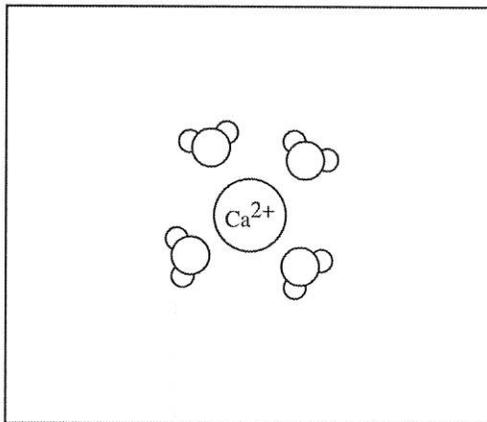
$\text{Ca(OH)}_2 \rightleftharpoons \text{Ca}^{2+} + 2 \text{OH}^-$	1 point is earned for the correct equation.
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(b) Calculate the molar solubility of Ca(OH)_2 in $0.10 \text{ M Ca(NO}_3)_2$.

$K_{sp} = [\text{Ca}^{2+}] [\text{OH}^-]^2$ $1.3 \times 10^{-6} = (0.10 + x) (2x)^2 \approx (0.10) 4x^2 \quad [\text{assuming } x \ll 0.10]$ $1.3 \times 10^{-5} = 4x^2$ $x = 0.0018 \text{ M}$ <p>Molar solubility of $\text{Ca(OH)}_2 = 0.0018 \text{ M}$</p>	<p>1 point is earned for the correct stoichiometry and setup.</p> <p>1 point is earned for the final answer.</p>
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(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.
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