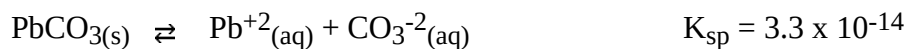


Lecture Demo: Solubility Equilibrium

Consider two "insoluble" compounds, white lead carbonate (PbCO_3) and yellow lead iodide (PbI_2). When placed in water, the following equilibria are established with the K_{sp} indicated. (We will neglect the hydrolysis reaction of the weak base carbonate.)



1. Combine 5 mL 0.10 M $\text{Na}_2\text{CO}_{3(aq)}$ and 5 mL of 0.10 M $\text{Pb}(\text{NO}_3)_{2(aq)}$

Will precipitation occur?

Ion concentrations before ppt:

$[\text{CO}_3^{-2}]_0$

$[\text{Pb}^{+2}]_0$

Q expression and value:

Conclusion: ppt no ppt

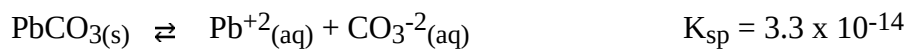
Solubility equilibrium after precipitation:

Ion concentrations after ppt:

K_{sp} expression and value:

Solubility equilibrium reaction:

Equilibrium concentrations:



2. Now combine 10 mL 0.10 M $\text{KI}_{(\text{aq})}$ and 5 mL of 0.10 M $\text{Pb}(\text{NO}_3)_2(\text{aq})$

Will precipitation occur?

Ion concentrations before ppt: $[\text{I}^{-}]_0$ $[\text{Pb}^{+2}]_0$

Q expression and value:

Conclusion: ppt no ppt

Solubility equilibrium after precipitation:

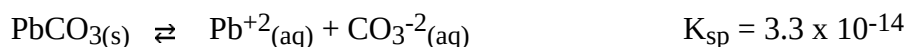
Ion concentrations after ppt:

K_{sp} expression and value:

Solubility equilibrium reaction:

Equilibrium concentrations:

Finally, we can use the equilibrium constants for the two precipitation reactions to predict what precipitate will form when we add Pb^{+2} to a mixture of I^- and CO_3^{-2} :



3. Combine 10 mL 0.10 M $\text{KI}_{(\text{aq})}$, 5 mL 0.10 M $\text{Na}_2\text{CO}_{3(\text{aq})}$, 5 mL of 0.10 M $\text{Pb}(\text{NO}_3)_2(\text{aq})$

Based on the K_{sp} values, which salt do you expect to precipitate more readily?

Will precipitation occur?

Ion concentrations before ppt: $[\text{CO}_3^{-2}]_0$ $[\text{Pb}^{+2}]_0$ $[\text{I}^-]_0$

Q expression and value for LEAST soluble salt:

Conclusion: ppt no ppt

Q expression and value for MORE soluble salt:

Conclusion: ppt no ppt

Solubility equilibrium after precipitation:

Ion concentrations after ppt:

K_{sp} expression and value:

Solubility equilibrium reaction:

Equilibrium concentrations:

Do we expect there to be any $\text{PbI}_{2(\text{s})}$? Summarize the reasons why or why not.

What is observed?

What other factors may be involved in these reactions?