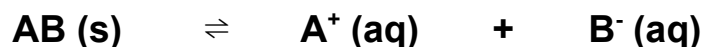


Predicting a Precipitate

Recall:



In a saturated solution at equilibrium, $K_{sp} = [A^+][B^-]$

What if $[A^+][B^-] < K_{sp}$?

There would be no precipitate (solid) formed in the beaker.

What if $[A^+][B^-] > K_{sp}$?

If this occurs, a solution is supersaturated. A precipitate will form:

$[A^+] \downarrow$ and $[B^-] \downarrow$ until their product $[A^+][B^-] = K_{sp}$.

Reaction Quotient and Formation of a Precipitate

Based on the solubility rules, calcium carbonate ($CaCO_3$) is insoluble and should form a precipitate. However, tap water contains low concentrations of both these ions. Why doesn't tap water contain a precipitate?

This is because their concentrations are too low to form a solid.



If the product of $[Ca^{2+}][CO_3^{2-}]$ is less than the K_{sp} , no precipitate forms.

Reaction Quotient (Q) or Trial Ion Product (TIP):

Takes on the same form as the equation for K_{sp} but uses the actual concentrations at that time. Once Q or TIP is calculated it can be compared to K_{sp} to see if a precipitate forms.

If:	$Q < K_{sp}$	the system is unsaturated - no precipitate forms
	$Q = K_{sp}$	the system is saturated - no precipitate forms
	$Q > K_{sp}$	the system is supersaturated - a precipitate forms

Quantitative Determination of Precipitation

1) If 1×10^{-6} mol of solid AgNO_3 and 5×10^{-4} mol of solid Na_2S are added to 10 L of water, will a precipitate form? $K_{\text{sp}}(\text{Ag}_2\text{S}) = 8.8 \times 10^{-18}$

2) If 20 mL of 0.005 mol/L barium nitrate is added to 80 mL of 0.0001 mol/L sodium carbonate, will a precipitate form? $K_{\text{sp}}(\text{BaCO}_3) = 8.1 \times 10^{-9}$

3) Will a precipitate form if 0.25 mol of Na_2CrO_4 is added to 5.0 L of a 0.020 mol/L solution of AgNO_3 ? $K_{\text{sp}}(\text{Ag}_2\text{CrO}_4) = 8.0 \times 10^{-4}$