# Solubility

## Common Ion Effect

If your coffee already has sugar in it, would it be easy or difficult to dissolve **MORE** sugar?

DIFFICULT

# "Common Ion Effect"

# Common Ion Effect:

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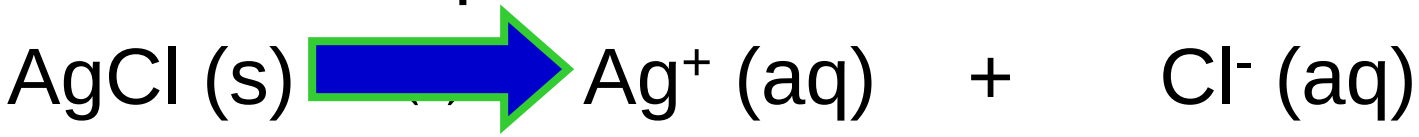
- The **solubility** of a compound is **decreased** if one of its **ions is already present** in the solvent.

- Consider the equilibrium:

- What would happen if $BaCl_2$ were added?
  - $BaCl_2$ would dissolve
  - $[Ba^{2+}]$ would inc. (common ion)
  - Some $Ba^{2+}$ will react with $CrO_4^{2-}$
  - equilibrium shifts left
  - Forming more $BaCrO_{4(s)}$
  - This means that less $BaCrO_4$ is dissolved
  - hence **solubility** is **decreased**

- If we remove an ion from solution we can *shift* the equilibrium.
- One of the ways of doing this is by making a **precipitate**
- Consider the equilibrium:




- If $Na_2S$ is added:
  - $Ag^+ + S^{2-} \rightarrow Ag_2S_{(s)}$
  - this removes Ag+ ions
  - shifting the equilibrium to the right
  - allowing more AgCl to dissolve
  - **increasing solubility**

Compare the solubility of $PbI_2$ in $H_20$ and in 0.10M NaI solution. Ksp of $PbI_2$ is $8.5 \times 10^{-9}$

PLEASE WRITE

- **In $H_2O$:**

$Ksp = [Pb^{+2}] [I^-]^2$

$8.5 \times 10^{-9} = [x][2x]^2$

$8.5 \times 10^{-9} = 4x^3$

$x = 1.29 \times 10^{-3}M$

$PbI_2 = 1.29 \times 10^{-3}M$

More $PbI_2$ is dissolved in water !!!!

**In NaI:**

$NaI \rightleftarrows Na^+ + I^-$

$0.1 \rightleftarrows 0.1 \quad \mathbf{0.1}$

$PbI_2 \rightleftarrows Pb^{+2} + 2I^-$

$x \rightleftarrows x \quad \mathbf{2x}$

$Ksp = [Pb^{+2}] [I^-]^2$

$8.5 \times 10^{-9} = [x][2x + 0.1]^2$

$8.5 \times 10^{-9} = [x][0.1]^2$

$x = 8.5 \times 10^{-7}M$

$PbI_2 = 8.5 \times 10^{-7}M$