(#11-2 #11-1)

Modeling and determining equilibrium of solubility

A salt KOH is dissolved by the following reaction.

$K^+ + OH^{-1} \Leftrightarrow KOH$ S

$K_{sp} = \frac{1}{[K^+][OH^-]}$

a. Write out the equilibrium expression
b. What happens to the value of K if this substance is really soluble?

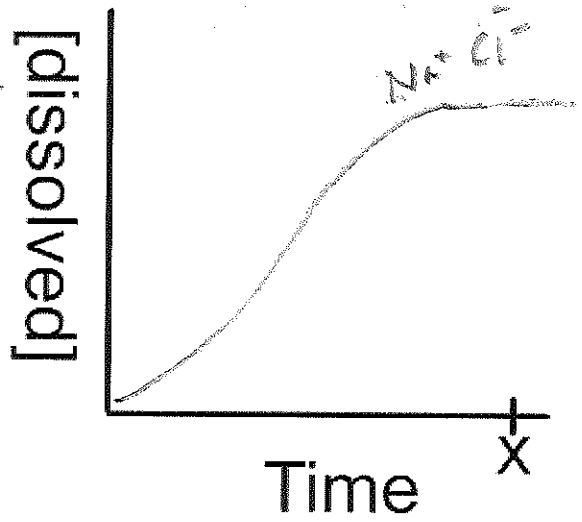
Really small

A salt KOH is dissolved by the following reaction.

$KOH \Leftrightarrow K^+ + OH^{-1}$ $K_{sp} = \frac{[K^+][OH^-]}{1}$

a. Write out the equilibrium expression.
b. What happens to the value of K if the substance is really soluble.

↑ Big



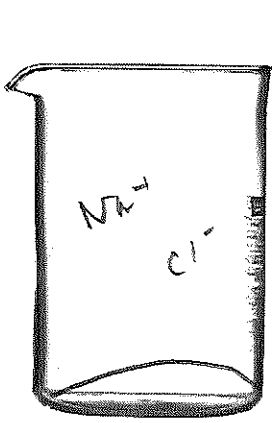
To allow K to correspond with solubility, industrial scientist who created this method chose to always write the dissolving reaction with the solid on the left as see below.

$KOH(s) \Leftrightarrow K^+(aq) + OH^{-1}$ To distinguish this method they gave it a special name "solubility product"

$K_{sp} = [K^+][OH^{-1}]$

You take a sample of salt (table) and you start to dissolve it in water. You continue to add and stir the solution. After a period of time it appears solid is forming on the bottom.

a. Write the (Ksp) solubility equation. $NaCl \rightarrow Na^+ + Cl^-$
b. This chemical reaction goes to (completion/equilibrium).
c. To the right draw a picture of table salt dissolving. The reaction gets saturated at time X.
d. A student hypothesizes that stirring increases solubility. Confirm or counter this statement. No, only get to end faster. (Catalyst)
e. How might you increase the solubility of table salt in water. alter Temp
f. Draw the picture of table salt in the beaker to the right at time X.



A student dissolved Ag_2SO_4 in 100mL of water. The student added 5g of silver sulfate to the solution and measured the concentration of SO_4^{-2} to be 0.0135M and solid is on the bottom. Answer the following questions.

2 — 1 Ratio

a. Draw the beaker.

b. Based on your picture, if the $SO4^{-2}$ = 0.0135, what is the $[Ag^+]$?

$\rightarrow$ 0.027M

c. How might these concentrations change if 5 more grams of solid is added?

None, already Saturated

d. Create an ISE reaction table, Fill it out and determine the K value.

$Ag_2SO_4 \rightleftharpoons 2Ag^+ + SO_4^{-2}$

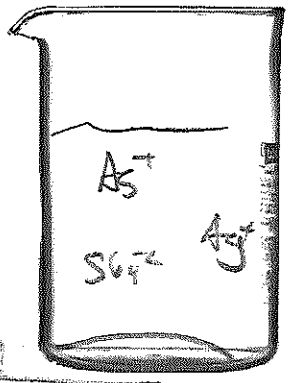
I: = 0 0

S: = +2x +x

E: = 0.027 0.0135

$[.027]^2[.0135]$

$= 9.8E-6$



Two salts are dissolving, AgBr (Ksp = 5E-13) and AgCl (Ksp = 1.6E-10), Answer the following questions.

a. Write out the dissolving equation for each.

$AgBr \rightarrow Ag^+ + Br^-$ $AgCl \rightarrow Ag^+ + Cl^-$

b. Write out the solubility expression.

$Ksp = [Ag^+][Br^-]$ $Ksp = [Ag^+][Cl^-]$

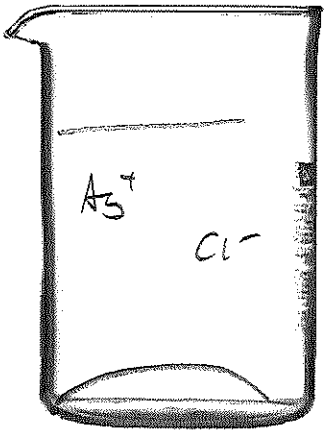
c. A large K value means what relative to solubility?

$\uparrow K \Rightarrow \uparrow$ Solubility

d. Which of the two salts is more soluble?

AgCl, K larger

e. Draw a saturated solution of the *more* soluble salt.



A student comes across a solution that is saturated solution of lead(II) chloride. The lead ion has a concentration of 1.5E-5M. Answer the following questions.

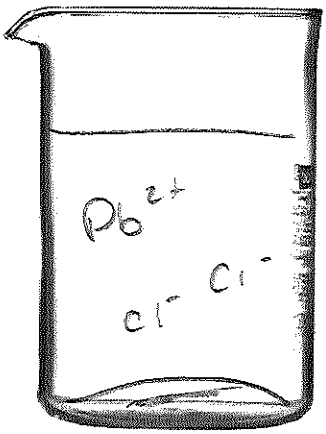
a. Write out the solubility reaction.

$PbCl_2 \rightarrow Pb^{2+} + 2Cl^-$

b. Write out the solubility equilibrium expression.

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

c. Draw a picture of this reaction mixture. $\longrightarrow$



d. What is the concentration of the Chloride ion?

$1.5E-5 \times 2 = 3.0E-5M$

e. What is the equilibrium constant for this reaction?

$(1.5E-5)(3.0E-5)^2$

$= 1.35E-14$