Ksp Lab - Data Table

Trial
1.

$Ca(OH)_2$

Mass Before – _____ g
– Mass After – _____ g

Mass $Ca(OH)_2$ used _____ g

HCl
Mass B …
Mass A …
Mass HCl …

2.
⋮

Ksp Lab Questions

1. Equilibrium equation

$$Ca(OH)_2 \rightleftharpoons Ca^{2+} + 2OH^-$$

2. $K_{sp} = [Ca^{2+}] \cdot [OH^-]^2$

3. ?

Ksp Lab Calculations

1. Moles HCl used – Given $[HCl] = 0.050$ mol/L

$\dfrac{0.41 \text{ mL} \times 1.0 \text{ L}}{1000 \text{ mL}} = 0.00041$ L   *from data*

$0.00041 \text{ L} \times \dfrac{0.050 \text{ mol}}{1.0 \text{ L}} = 0.0000205$ mol HCl   *given [HCl]*

2. Moles OH^- – neutralization

$$H^+ + OH^- \longrightarrow H_2O$$
Acid   Base   neutral

↑moles = ↑moles

∴ Moles $OH^- $ = moles $H^+ = 0.0000205$ mol OH^-

3. $[OH^-] = \dfrac{\text{mol } OH^-}{\text{L } OH^-} = \dfrac{0.0000205 \text{ mol}}{0.00070 \text{ L}} = 0.029$ mol/L   *from data*

Ksp Lab Calculations Continued

$$Ca(OH)_{2(s)} \rightleftharpoons Ca^{2+}_{(aq)} + 2OH^-_{(aq)}$$

	$Ca(OH)_2$	Ca^{2+}	$2OH^-$
I	∿	0	0
C	∿	0.015	0.029
E	∿	0.015	0.029

$$K_{sp} = [Ca^{2+}][OH^-]^2$$
$$= (0.015)(0.029)^2$$
$$= 1.3 \times 10^{-5}$$

Other values – 8.8×10^{-6}
literature – 2×10^{-6}

Ksp Problems

A. Given solubility ⟶ find Ksp (e.g. our lab)

B. Given Ksp ⟶ find solubility

A. A substance, XY, has a solubility of 1.4×10^{-5} mol/L. Calculate Ksp.

$$XY_{(s)} \rightleftharpoons X^+ + Y^-$$

	XY	X^+	Y^-
I	∿	0	0
C	∿	1.4×10^{-5}	1.4×10^{-5}
E	∿	1.4×10^{-5}	1.4×10^{-5}

$K_{sp} = [X^+][Y^-]$
$= (1.4\times10^{-5})(1.4\times10^{-5})$
$= 1.96 \times 10^{-10}$

B. Find the solubility of all ions in a saturated solution of AgCl. $K_{sp} = 1.8\times10^{-10}$

$$AgCl \rightleftharpoons Ag^+ + Cl^-$$

	AgCl	Ag^+	Cl^-
I	∿	0	0
C	∿	x	x
E	∿	x	x

$K_{sp} = [Ag^+][Cl^-]$
$1.8\times10^{-10} = x \cdot x$

$\sqrt{1.8\times10^{-10}} = \sqrt{x^2}$

$1.3\times10^{-5} = x = [Ag^+] = [Cl^-]$
mol/L

Ksp problems (handout) #1,5,10,11
Equilibrium review quest. P. 590-592