The molar solubility of PbI_2 is 1.2×10^{-3} M. What is the K_{sp} of PbI_2?

$$PbI_{2(s)} \rightleftharpoons Pb^{2+}_{(aq)} + 2\,I^-_{(aq)}$$

	Pb^{2+}	I^-
	0.0	0.0
	$+1.2 \times 10^{-3}$	2.4×10^{-3}

$$K_{sp} = [Pb^{2+}][I^-]^2 = (1.2 \times 10^{-3})(2.4 \times 10^{-3})^2$$

$$K_{sp} = 6.9 \times 10^{-9}$$

The K_{sp} of AgCl is 1.7×10^{-10}. What is the molar solubility? What is the molarity of each ion?

$$AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$$

	Ag^+	Cl^-
	0.0	0.0
	$+s$	$+s$
	s	s

$$K_{sp} = [Ag^+][Cl^-] \quad \sqrt{1.7 \times 10^{-10}} = \sqrt{s^2}$$

$$s = 1.3 \times 10^{-5}\ M$$

$$[Ag^+] = [Cl^-] = 1.3 \times 10^{-5}\ M$$

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$$s = 1.3 \times 10^{-5} M$$

$$[Ag^+] = [Cl^-] = 1.3 \times 10^{-5} M$$

$M_2X_{3(s)} \rightleftharpoons 2M^{3+}_{(aq)} + 3X^{2-}_{(aq)}$

$K_{sp} = 4.2 \times 10^{-11}$

$S = ?$

$[M^{3+}] = ?$

$[X^{2-}] = ?$

	$2M^{3+}_{(aq)}$	$3X^{2-}_{(aq)}$
I	0.0	0.0
C	+2s	+3s

$K_{sp} = 4.2 \times 10^{-11} = (2s)^2 (3s)^3$

$= 4s^2 \cdot 27s^3$

$= 108 s^5$

$\sqrt[5]{\frac{4.2 \times 10^{-11}}{108}} = \sqrt[5]{\frac{108 s^5}{108}}$

$S = 3.3 \times 10^{-3}\ M$

$[M^{3+}] = 6.6 \times 10^{-3}\ M$

$[X^{2-}] = 9.9 \times 10^{-3}\ M$

M_2X_3

$3.3 \times 10^{-3}\ M$

(4.2 EE -11 ÷ 108) ^ (1 ÷ 5)

MOLARITY OF IONS IN A SOLUTION

→ an aqueous ionic solution no longer exists as the compound

0.1M $CuSO_4$	$[Cu^{2+}] = 0.1M$ $[SO_4^{2-}] = 0.1M$
0.1M Na_3PO_4	$[Na^+] = 0.3M$ $[PO_4^{3-}] = 0.1M$
0.1M $Co(NO_3)_2$	$[Co^{2+}] = 0.1M$ $[NO_3^-] = 0.2M$
0.1M $Al_2(SO_4)_3$	$[Al^{3+}] = 0.2M$ $[SO_4^{2-}] = 0.3M$

COMMON ION EFFECT

Q: Will an ionic compound dissolve to a greater or lesser extent if there are already dissolved ions in the H_2O?

Ag_2CO_3 $K_{sp} = 8.1 \times 10^{-12}$

a) What are the molar solubility and ion concentrations if Ag_2CO_3 is dissolved in pure H_2O?

$$Ag_2CO_{3(s)} \rightleftharpoons 2Ag^+_{(aq)} + CO_3^{2-}_{(aq)}$$

	$2Ag^+_{(aq)}$	$CO_3^{2-}_{(aq)}$
	0,0	0,0
	+2s	s

$K_{sp} = [Ag^+]^2[CO_3^{2-}]$

$\sqrt[3]{\frac{8.1\times10^{-12}}{4}} = (2s)^2(s) = \sqrt[3]{4s^3}$ $\quad s = 1.3\times10^{-4}\,M$

$[Ag^+] = 2.6\times10^{-4}\,M$

$[CO_3^{2-}] = 1.3\times10^{-4}\,M$

b) What is "s" and $[Ag^+]$ if I dissolve Ag_2CO_3 into 0.1M Na_2CO_3?

$$Ag_2CO_{3(s)} \rightleftharpoons 2Ag^+_{(aq)} + CO_3^{2-}_{(aq)}$$

	$2Ag^+_{(aq)}$	$CO_3^{2-}_{(aq)}$
	0,0	0,1
	+2s	+s
	2s	0,1 +s
		≈ 0.1

$K_{sp} = (2s)^2(0.1)$

$\sqrt{\frac{8.1\times10^{-12}}{0.4}} = \frac{0.4s^2}{0.4}$

$s = 4.5\times10^{-6}\,M$; $[Ag^+] = 9.0\times10^{-6}\,M$

in pure H_2O $\quad s = 1.3\times10^{-4}\,M$ $\quad [Ag^+] = 2.6\times10^{-4}\,M$