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| **First steps!**Calculate the concentration of Cl- ions if PbCl2 contains 0.0145 mol L-1 of Pb2+ ionsPbCl21 : 20.0145 : 2 x 0.0145**Answer: 0.029 mol L-1** | **Ks, solubility product/constant** this is an equilibrium constant which applies to saturated solutionsa large Ks value = high solubilitya low Ks value = low solubility/insoluble |
| Calculate the solubility product Ks if concentration of Pb2+ is 0.0145 mol L-1PbCl2(s)⇌ Pb2+(aq) + 2Cl- (aq)Ks = [Pb2+] [Cl-]2= (0.0145) (0.029)2**Answer: 1.22 x 10-5** | Working out the solubility product, KsGiven Ks = 1.81x 10-10 of AgCl, find the concentration of Ag+ ionsKs = [Ag+] [Cl-]= x . x= x2  √Ks = x**Answer: 1.35 x 10-5 mol L-1**Given Ks = 7.1x 10-5 of CaSO4, find the conc. of SO42- ions in CaSO4Ks = [Ca2+] [SO42-]Ks = x . x√Ks = x √7.1 x 10-5 = x**Answer: 8.43 x 10-3 mol L-1** | …more working out KsGiven Ks = 6.6 x 10-6, find the concentration of Cu2+ ions in CuBr2Ks = [Cu2+] [Br-] [Br-]Ks = [Cu2+] [Br-]2[Cu2+] = x, [Br-] = 2xKs = x . 2x2Ks = 4x3³√Ks = x 4³√1.65 x 10-6 = x**Answer: 0.0118 mol L-1** | …and more working out KsGiven Ks = 1.2 x 10-5, find the concentration of Ag+ ions in Ag2SO4Ks = [Ag+] [Ag+] [SO42-] Ks = [Ag+]2 [SO42-]Ks = 2x2 . xKs = 4x3³√Ks = x 4³√3 x 10-6 = xSo, x = 0.01442 mol L-1 **Answer: the concentration of Ag+ ions** **is twice x, therefore 0.0288 mol L-1** |

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| the **“common ion”** effect: precipitation can occur ie solubility decreasesif an ion is added to a solution that already contains that ion

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| Calculate the solubility of Fe(OH)2 in a 0.05 mol L-1 solution of NaOHKs of Fe(OH)2 = 7.9 x 10-16Ks = [Fe2+] [OH-]2  assume that [OH-] = 0.05molL-17.9 x 10-16 = [Fe2+] (0.05-)2  7.9 x 10-16 = [Fe2+] (0.05)2**Answer: 3.16 x 10-13** | Calculate the solubility of AgCl in 0.1mol L-1 NaCl. Ks of AgCl is 2 x 10-10Ks = [Ag+] [Cl-]assume that [Cl-] = 0.1molL-12 x 10-10 = [Ag+] (0.1)2 x 10-10 = [Ag+] (0.1)**Answer: 2 x 10-9** |

 | If a solution is not in equilibrium the term is **Ionic product (IP)**IP > Ks a ppt will occurIP = Ks a saturated solutionIP < Ks there is no pptConsider whether a precipitate will occur if 50mL of 0.02molL-1 Na2CO3 is mixed with 50mL of 0.05mol L-1 CaCO3.Ks (CaCO3) = 3.4 x 10-9As the two solutions are mixed together the volume doublesso the concentration of all ions is halved[Ca2+] = 0.05 [CO32-] = 0.05 + 0.02 2 2 2  = 0.025 = 0.035IP = [Ca2+] [CO32-] = 0.025 x 0.035 = 8.75 x 10-4**Answer:** IP > Ks so a precipitate **will** occur |

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