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| **First steps!**  Calculate the concentration of Cl- ions if PbCl2 contains 0.0145 mol L-1 of Pb2+ ions  PbCl2  1 : 2  0.0145 : 2 x 0.0145  **Answer: 0.029 mol L-1** | **Ks, solubility product/constant** this is an equilibrium constant which applies to saturated solutions  a large Ks value = high solubility  a low Ks value = low solubility/insoluble | | |
| Calculate the solubility product Ks if concentration of Pb2+ is 0.0145 mol L-1  PbCl2(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, Ks  Given Ks = 1.81x 10-10 of AgCl, find the concentration of Ag+ ions  Ks = [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 CaSO4  Ks = [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 Ks  Given Ks = 6.6 x 10-6, find the  concentration of Cu2+ ions in CuBr2  Ks = [Cu2+] [Br-] [Br-]  Ks = [Cu2+] [Br-]2  [Cu2+] = x, [Br-] = 2x  Ks = x . 2x2  Ks = 4x3  ³√Ks = x  4  ³√1.65 x 10-6 = x  **Answer: 0.0118 mol L-1** | …and more working out Ks  Given Ks = 1.2 x 10-5, find the concentration of Ag+ ions in Ag2SO4  Ks = [Ag+] [Ag+] [SO42-]  Ks = [Ag+]2 [SO42-]  Ks = 2x2 . x  Ks = 4x3  ³√Ks = x  4  ³√3 x 10-6 = x  So, 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 decreases  if an ion is added to a solution that already contains that ion   |  |  | | --- | --- | | Calculate the solubility of Fe(OH)2  in a 0.05 mol L-1 solution of NaOH  Ks of Fe(OH)2 = 7.9 x 10-16  Ks = [Fe2+] [OH-]2  assume that [OH-] = 0.05molL-1  7.9 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 10-10  Ks = [Ag+] [Cl-]  assume that [Cl-] = 0.1molL-1  2 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 occur  IP = Ks a saturated solution  IP < Ks there is no ppt  Consider 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 10-9  As the two solutions are mixed together the volume doubles  so the concentration of all ions is halved  [Ca2+] = 0.05 [CO32-] = 0.05 + 0.02  2 2 2  = 0.025 = 0.035  IP = [Ca2+] [CO32-] = 0.025 x 0.035 = 8.75 x 10-4  **Answer:** IP > Ks so a precipitate **will** occur |

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