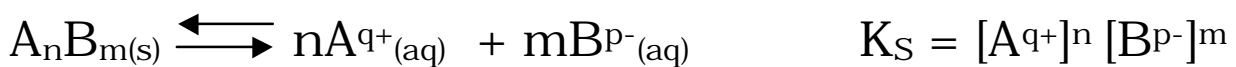
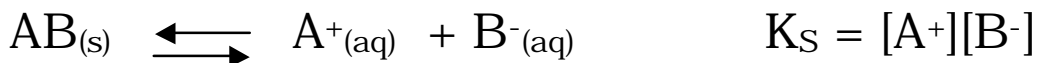


EQUILIBRI DI SOLUBILITA'

Sali solubili: fluoruri, acetati, nitriti, nitrati ed i sali dei metalli alcalini

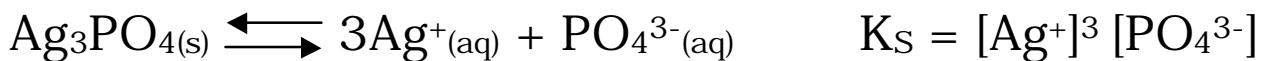
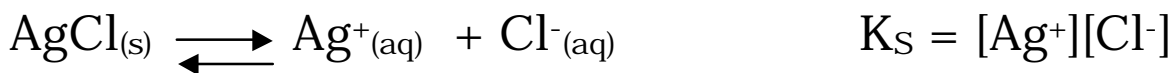
Sali poco solubili:

➤ soggetti a reazioni d'equilibrio eterogeneo!



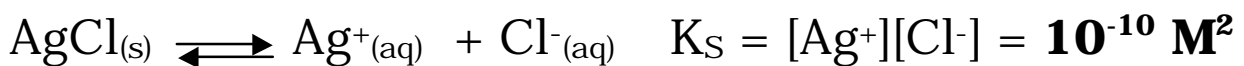
$n q^{+} = m p^{-}$ per elettroneutralità

Esempio:



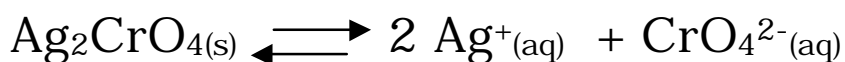
$$\mathbf{pK_S = - \log K_S}$$

Solubilità: quantità **massima** di AB (in g/L, moli/L, etc..) che può stare in soluzione, in presenza di AB solido (*corpo di fondo*)



$s(AgCl) = [Ag^{+}] = [Cl^{-}]$ (in presenza di corpo di fondo)

$$s(AgCl) = (K_S)^{1/2} = \mathbf{10^{-5} moli/L}$$



$$K_S = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}] = \mathbf{10^{-11.9} \text{ M}^3}$$

$$s(\text{Ag}_2\text{CrO}_4) = [\text{CrO}_4^{2-}] = [\text{Ag}^+]/2$$

(in presenza di corpo di fondo)

$$K_S = 10^{-11.9} \text{ M}^3 = [\text{Ag}^+]^2 ([\text{Ag}^+]/2), \text{ da cui:}$$

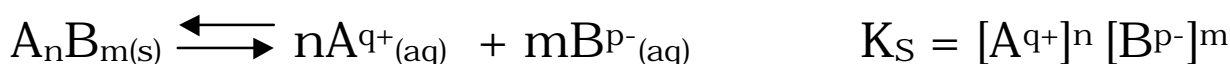
$$[\text{Ag}^+] = (2 K_S)^{1/3} = 1.36 \times 10^{-4}$$

$$s(\text{Ag}_2\text{CrO}_4) = [\text{Ag}^+]/2 = \mathbf{6.8 \times 10^{-5} \text{ moli/L}}$$

Notare che: $K_S(\text{Ag}_2\text{CrO}_4) < K_S(\text{AgCl})$ **M³ vs. M² !**

Ma: $s(\text{Ag}_2\text{CrO}_4) > s(\text{AgCl})$!

In generale, per:



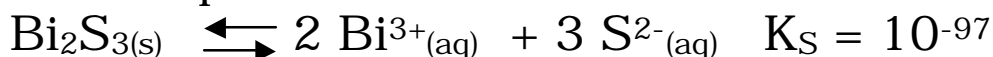
$$s(\text{A}_n\text{B}_m) = 1/n [(n/m)^m K_S]^{1/(n+m)}$$

per $K_S = 10^{-20}$

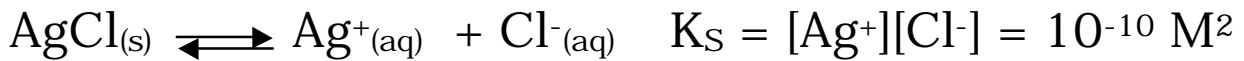
	n = 1	m = 1	n+m = 2	s = 10 ⁻¹⁰	
	n = 1	m = 2	n+m = 3	s = 1.37 x 10 ⁻⁷	
	n = 2	m = 2	n+m = 4	<u>s = 5 x 10⁻⁶</u>	
	n = 1	m = 3	n+m = 4	<u>s = 4.39 x 10⁻⁶</u>	
	n = 2	m = 3	n+m = 5	s = 3.92 x 10 ⁻⁵	
↓ complessità				solubilità in aumento	

formula

pK_S stanno tra 3 e 100 !



EFFETTO DELLO IONE COMUNE SULLA SOLUBILITA'



$$s(\text{AgCl}) \text{ (in acqua pura)} = (K_S)^{1/2} = 10^{-5} \text{ moli/L}$$

e in HCl 0.1 M ?

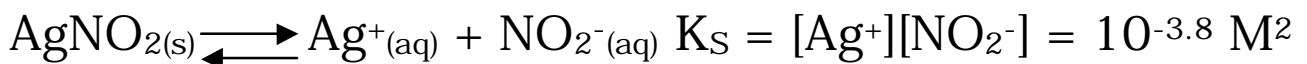
Per il principio di Le Chatelier, AgCl si scioglierà meno!

$$K_S = [\text{Ag}^{+}][\text{Cl}^{-}] = [\text{Ag}^{+}] ([\text{Cl}^{-}]_{\text{AgCl}} + [\text{Cl}^{-}]_{\text{HCl}})$$

$$\text{Ma: } [\text{Cl}^{-}]_{\text{AgCl}} < 10^{-5} \quad \text{e } : [\text{Cl}^{-}]_{\text{HCl}} = 0.1$$

←
trascurabile !

$$K_S = [\text{Ag}^{+}] 0.1 \quad [\text{Ag}^{+}] = s(\text{AgCl})_{(\text{HCl } 0.1 \text{ M})} = K_S / 0.1 = 10^{-9} \text{ M}$$



$$s(\text{AgNO}_2) \text{ (in acqua pura)} = (K_S)^{1/2} = 0.0126 \text{ moli/L}$$

e in NO₂⁻ 0.01 M ?

Per Le Chatelier, AgNO₂ si scioglierà meno!

$$K_S = 10^{-3.8} = [\text{Ag}^{+}] ([\text{NO}_{2}^{-}]_{\text{AgNO}_2} + [\text{NO}_{2}^{-}]_{\text{NO}_2^{-}})$$

$$\text{Ma: } [\text{NO}_{2}^{-}]_{\text{AgNO}_2} < 0.0126 \quad \text{e } : [\text{NO}_{2}^{-}]_{\text{NO}_2^{-}} = 0.01$$

←
non più trascurabile !

$$\text{se } x = [\text{Ag}^{+}] \quad 10^{-3.8} = x (x + 0.01) \quad \text{eq. Il grado}$$

$$x_1 < 0 \text{ (da scartare)} \quad \text{e } x_2 = 0.0085 \text{ M}$$

Esercizio: Quale concentrazione deve avere una soluzione di Na_2SO_4 perché in essa la solubilità di CaSO_4 si riduca di 10 volte? $K_S(\text{CaSO}_4) = 2.4 \times 10^{-5}$



In acqua pura, $s(\text{CaSO}_4) = (K_S)^{1/2} = 4.9 \times 10^{-3} \text{ M}$

Noi vogliamo che $s(\text{CaSO}_4) = [\text{Ca}^{2+}]$ sia $4.9 \times 10^{-4} \text{ M}$

$$[\text{SO}_4^{2-}]_{\text{TOT}} = [\text{SO}_4^{2-}]_{\text{CaSO}_4} + [\text{SO}_4^{2-}]_{\text{Na}_2\text{SO}_4} =$$

$$= [\text{Ca}^{2+}] + [\text{SO}_4^{2-}]_{\text{Na}_2\text{SO}_4} = [\text{Ca}^{2+}] + x$$

$$K_S = [\text{Ca}^{2+}] [\text{SO}_4^{2-}] = 4.9 \times 10^{-4} (4.9 \times 10^{-4} + x)$$

Da cui: $x = 0.0485 \text{ M}$