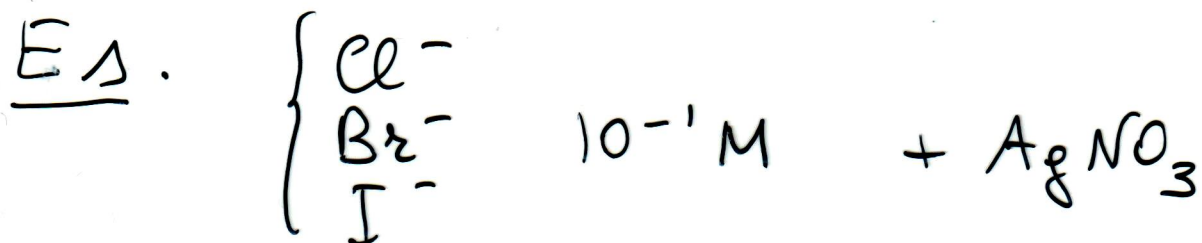


## 8. PRECIPITAZIONE FRAZIONATA

Una specie chimica è precipitata quantitativamente quando la sua concentraz. in soluz. è

$$\leq 10^{-7} \text{ M}$$



$$K_{ps} \text{AgCl} = [\text{Ag}^+][\text{Cl}^-] = 10^{-10}$$

$$K_{ps} \text{AgBr} = [\text{Ag}^+][\text{Br}^-] = 10^{-13}$$

$$K_{ps} \text{AgI} = [\text{Ag}^+][\text{I}^-] = 10^{-16}$$

AgI precipita per primo; controlliamo che  $[\text{Ag}^+]$  necessarie per iniziare la precipitazione non consente la precipitazione degli altri alogenuri:

$$[\text{Ag}^+] = \frac{K_{ps} \text{AgI}}{[\text{I}^-]} = \frac{10^{-16}}{10^{-1}} = 10^{-15} \text{ M}$$

$$[\text{Ag}^+][\text{Br}^-] = 10^{-15} \cdot 10^{-1} = 10^{-16} \ll K_{ps} \text{AgBr}$$

$$[\text{Ag}^+][\text{Cl}^-] = 10^{-15} \cdot 10^{-1} = 10^{-16} \ll K_{ps} \text{AgCl}$$

Comincio a precipitare AgBr:

$$[\text{Ag}^+] = \frac{K_{ps} \text{AgBr}}{[\text{Br}^-]} = \frac{10^{-13}}{10^{-1}} = 10^{-12} \text{ M}$$

ma la precipitazione di AgI è completa?

$$[I^-] = \frac{K_{ps} AgI}{[Ag^+]} = \frac{10^{-16}}{10^{-12}} = \underline{\underline{10^{-4} M}}$$

no!  $> 10^{-7} M$

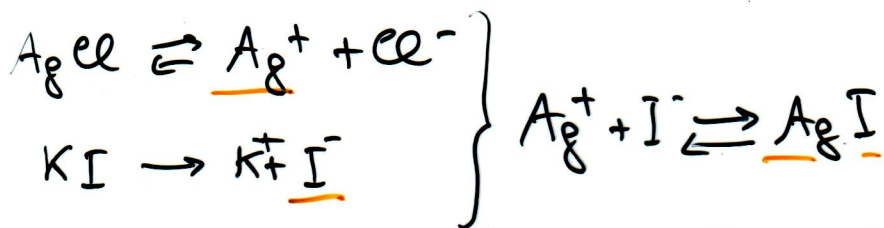
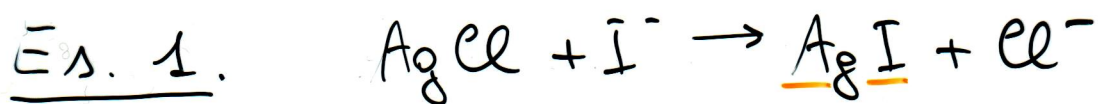
Proseguiamo con l'aggiunta di  $AgNO_3$ : precipita  $AgCl$

$$[Ag^+] = \frac{10^{-10}}{[Cl^-]} = 10^{-9} M$$

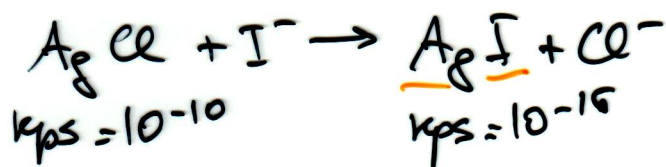
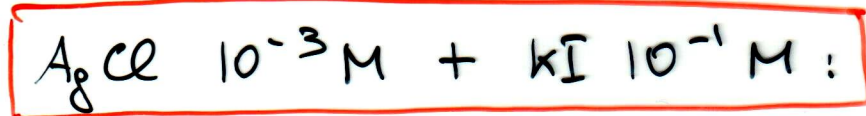
$$[I^-] = \frac{K_{ps} AgI}{[Ag^+]} = \frac{10^{-16}}{10^{-9}} = 10^{-7} M \quad AgI \downarrow \text{complete}$$

$$[Br^-] = \frac{K_{ps} AgBr}{[Ag^+]} = \frac{10^{-13}}{10^{-9}} = 10^{-4} M \quad AgBr \downarrow \text{non complete} \\ (> 10^{-7} M)$$

## 9. INTERCONVERSIONE DI SOSTANZE POCO SOLUBILI



$$K_{ps} \text{AgCl} = 10^{-10} \quad \Delta \text{AgCl} = 10^{-5} \text{ M} = [\text{Ag}^+] = [\text{Cl}^-]$$



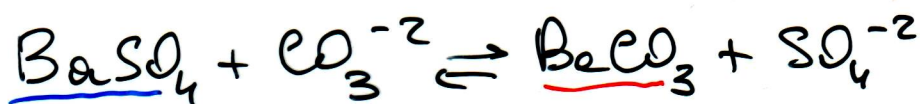
$$[\text{Ag}^+][\text{I}^-] = 10^{-5} \cdot 10^{-1} = 10^{-6} \gg 10^{-16} (K_{ps}) \quad \downarrow$$

$[\text{Ag}^+]$  che rimane in soluzione sarà:  $[\text{Cl}^-] = 10^{-3} \text{ M}$

$$[\text{Ag}^+] = \frac{K_{ps} \text{AgI}}{[\text{I}^-]} = \frac{10^{-16}}{10^{-1}} = 10^{-15} \text{ M}$$

$$[\text{Ag}^+][\text{Cl}^-] = 10^{-15} \cdot 10^{-3} = 10^{-18} \ll K_{ps} \text{AgCl}$$

Es. 2.



$$K_{ps} = 10^{-10}$$

$$\Delta = 10^{-5} \text{ M}$$

$$K_{ps} = 10^{-8}$$

$$\Delta = 10^{-4} \text{ M}$$

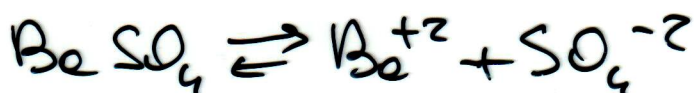
$$[\text{Ba}^{2+}] = \frac{K_{ps} \text{BaSO}_4}{[\text{SO}_4^{2-}]} ; \quad [\text{Ba}^{2+}] = \frac{K_{ps} \text{BaCO}_3}{[\text{CO}_3^{2-}]}$$



$$\frac{k_{ps} \text{BaSO}_4}{[\text{SO}_4^{2-}]} = \frac{k_{ps} \text{BaCO}_3}{[\text{CO}_3^{2-}]}$$

$$\frac{[\text{CO}_3^{2-}]}{[\text{SO}_4^{2-}]} = \frac{k_{ps} \text{BaCO}_3}{k_{ps} \text{BaSO}_4} = \frac{10^{-8}}{10^{-10}} = \underline{\underline{100}}$$

Una concentrazione di  $[\text{CO}_3^{2-}]$  100 v. superiore a quella di  $\text{SO}_4^{2-}$  è facile da ottenere poiché in nat. nature



$$[\text{SO}_4^{2-}] = \sqrt{k_{ps} \text{BaSO}_4} = 10^{-5} \text{ M}$$

è quindi sufficiente che sia  $[\text{CO}_3^{2-}] \geq 10^{-3} \text{ M}$

E s. 3.



$$k_{ps} = 10^{-16}$$

$$\Delta = 10^{-8} \text{ M}$$

$$k_{ps} = 10^{-12}$$

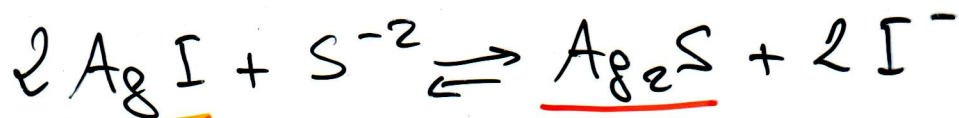
$$\Delta = 10^{-4} \text{ M}$$



$$[\text{Ag}^+] = [\text{I}^-] = \Delta = 10^{-8} \text{ M}$$

$$[\text{Ag}^+]^2 [\text{CO}_3^{2-}] = (10^{-8})^2 \cdot 1 = 10^{-16} < k_{ps} \text{Ag}_2\text{CO}_3$$

Es. 4.

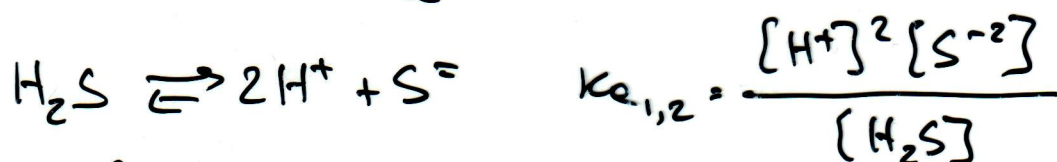
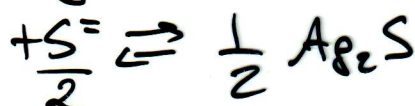
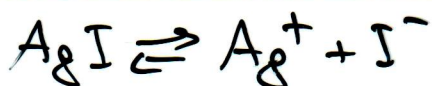


$$K_{ps} = 10^{-16}$$

$$\Delta = 10^{-8} \text{ M}$$

$$K_{ps} = 10^{-51}$$

$$\Delta = 10^{-17} \text{ M}$$



$$[\text{S}^{2-}] = \frac{K_{a1,2} \cdot [\text{H}_2\text{S}]}{[\text{H}^+]^2} = \frac{10^{-20} \cdot 10^{-1}}{(10^{-5})^2} = 10^{-11} \text{ M e pH} = 5$$

$$[\text{Ag}^+]^2 [\text{S}^{2-}] = (10^{-8})^2 \cdot 10^{-11} = 10^{-27} \gg K_{ps} \text{Ag}_2\text{S}$$

calcoliamo le  $[\text{Ag}^+]$  residue in soluzione:

$$[\text{Ag}^+] = \sqrt{\frac{K_{ps} \text{Ag}_2\text{S}}{[\text{S}^{2-}]}} = \sqrt{\frac{10^{-51}}{10^{-11}}} = 10^{-20} \text{ M}$$

le  $[\text{I}^-]$  in solus. ora è  $10^{-3} \text{ M}$ , quelle iniz. di  $\text{AgI}$ :

$$[\text{Ag}^+][\text{I}^-] = 10^{-20} \cdot 10^{-3} = 10^{-23} \ll K_{ps} \text{AgI}$$