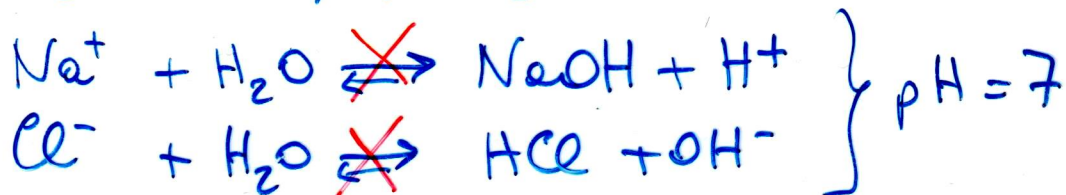


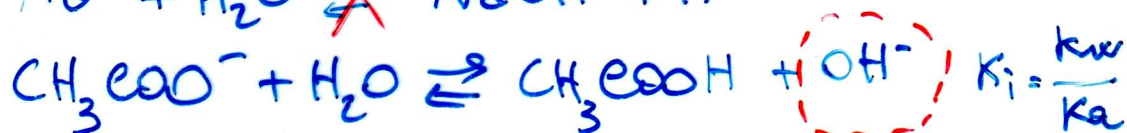
EQUILIBRI DI IDROLISI

1. SALE FORMATO DA ACIDO FORTE E BASE FORTE



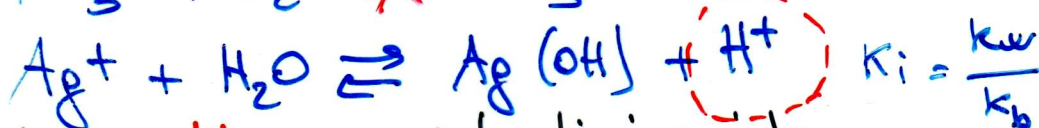
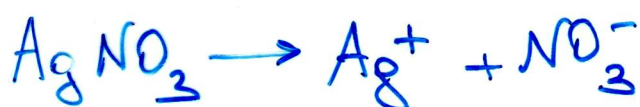
non c'è idrolisi

2. SALE FORMATO DA ACIDO DEBOLE E BASE FORTE



idrolisi dell'anione — idrolisi basica; $[\text{OH}^-] = \sqrt{K_i c_s}$

3. SALE FORMATO DA ACIDO FORTE E BASE DEBOLE



idrolisi del catione — idrolisi acida; $[\text{H}^+] = \sqrt{K_i c_s}$

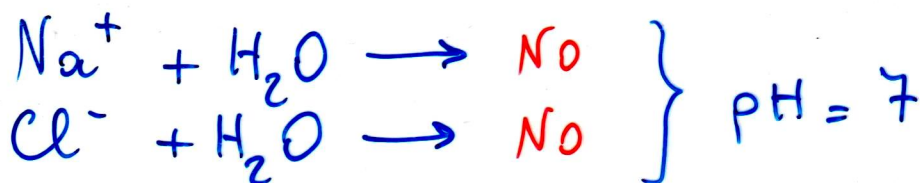
4. SALE FORMATO DA ACIDO DEBOLE E BASE DEBOLE



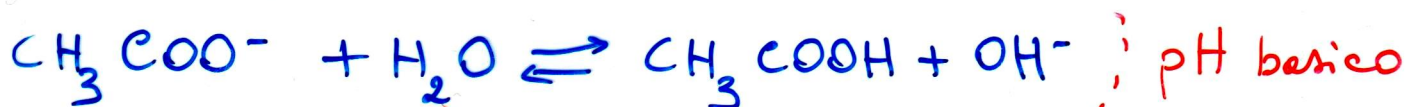
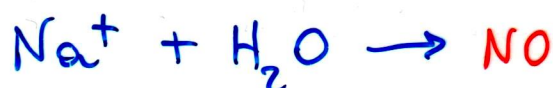
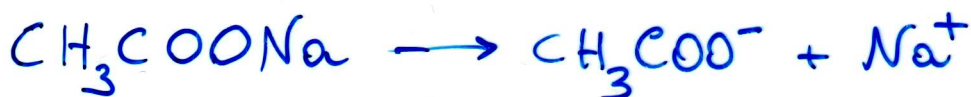
idrolisi simultanea dell'anione e del catione $[\text{H}^+] = \sqrt{K_w \frac{K_a}{K_b}}$

EQUILIBRI DI IDROLISI

1. SALE FORMATO DA ACIDO FORTE E BASE FORTE



2. SALE FORMATO DA ACIDO DEBOLE E BASE FORTE: IDROLISI DELL' ANIONE



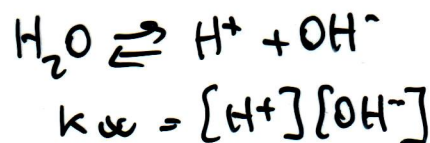
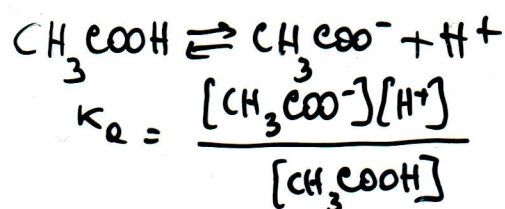
$$K_i = \frac{[\text{CH}_3\text{COOH}][\text{OH}^-]}{[\text{CH}_3\text{COO}^-]} = \frac{K_w}{K_a}$$

$$K_i \approx \frac{[\text{OH}^-]^2}{[\text{CH}_3\text{COO}^-]} \approx \frac{[\text{OH}^-]^2}{C_s}$$

Trascurando
gli OH^- che pro-
vengono da H_2O

Trascurando le
quantità di anione
che subisce idrolisi
rispetto a quelle iniziali

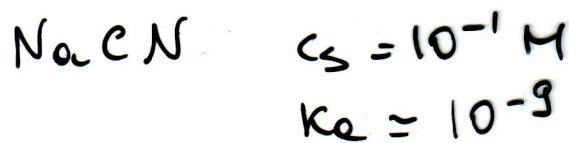
$$[\text{OH}^-] \approx \sqrt{K_i \cdot C_s}$$



A parità di concentrazione, se l'acido da cui si è formato il sale è più debole...:



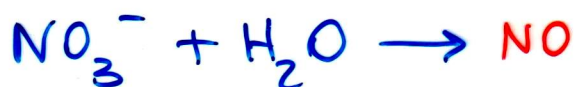
$$\alpha = 0.01\%$$



$$[\text{OH}^-] = \sqrt{K_i \cdot c_s} = 10^{-3} \text{ M}$$

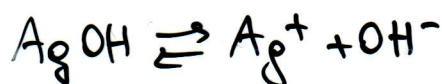
$$\alpha = \frac{[\text{OH}^-]}{c_s} = \frac{10^{-3}}{10^{-1}} = 10^{-2} = 1\%$$

3. SALE FORMATO DA ACIDO FORTE E BASE DEBOLE: IDROLISI DEL CATIONE

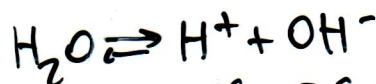


$$K_i = \frac{[\text{AgOH}][\text{H}^+]}{[\text{Ag}^+]} = \frac{K_w}{K_b}$$

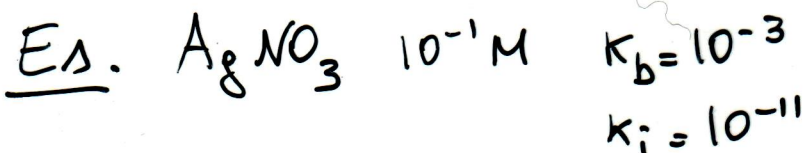
$$[\text{H}^+] = \sqrt{K_i \cdot c_s}$$



$$K_b = \frac{[\text{Ag}^+][\text{OH}^-]}{[\text{AgOH}]}$$

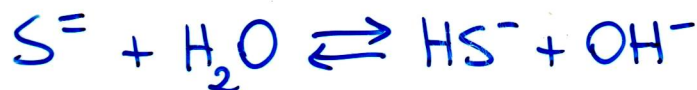


$$K_w = [\text{H}^+][\text{OH}^-]$$

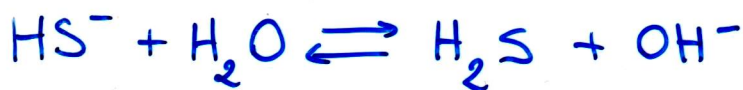


$$[\text{H}^+] = \sqrt{K_i \cdot c_s} = 10^{-6} \text{ M}$$

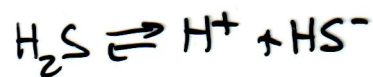
$$\alpha = \frac{[\text{H}^+]}{c_s} = 10^{-5} = 0.001\%$$



$$K_{i1} = \frac{[\text{HS}^-][\text{OH}^-]}{[\text{S}^{2-}]} = \frac{K_w}{K_{a2}}$$



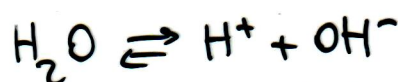
$$K_{i2} = \frac{[\text{H}_2\text{S}][\text{OH}^-]}{[\text{HS}^-]} = \frac{K_w}{K_{a1}}$$



$$K_{a1} = \frac{[\text{H}^+][\text{HS}^-]}{[\text{H}_2\text{S}]}$$



$$K_{a2} = \frac{[\text{H}^+][\text{S}^{2-}]}{[\text{HS}^-]}$$



$$K_w = [\text{H}^+][\text{OH}^-]$$

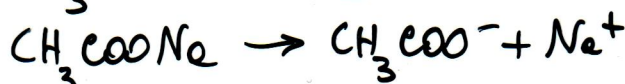
GRADO DI IDROLISI

Rapporto tra n° moli di sale idrolizzato e n° moli iniziali.



$$\alpha = \frac{[\text{HA}]}{C_s}$$

Es. CH_3COONa $C_s = 10^{-1}\text{M}$ $K_a \approx 10^{-5}$



$$[\text{CH}_3\text{COOH}] = [\text{OH}^-] ; \alpha = \frac{[\text{OH}^-]}{C_s} ; [\text{OH}^-] = \sqrt{K_i \cdot C_s} =$$

$$= \sqrt{\frac{K_w}{K_a} \cdot C_s} = \sqrt{\frac{10^{-14}}{10^{-5}} \cdot 10^{-1}} = \sqrt{10^{-9} \cdot 10^{-1}} = \sqrt{10^{-10}} = 10^{-5}\text{M}$$

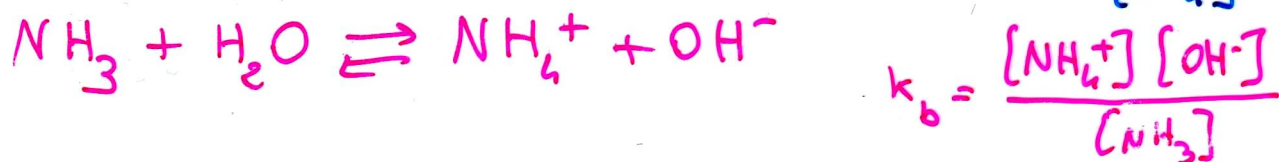
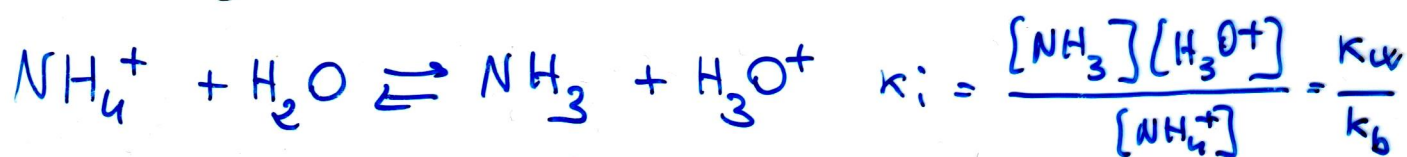
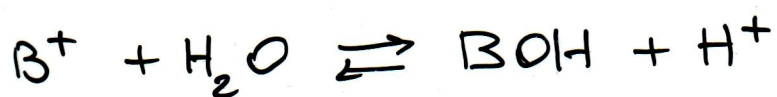
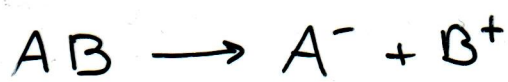
$$\alpha = \frac{[\text{OH}^-]}{C_s} = \frac{10^{-5}}{10^{-1}} \approx 10^{-4} \approx 0.01\%$$

In una soluzione più diluita ($C_s = 10^{-3}\text{M}$)

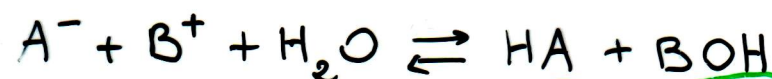
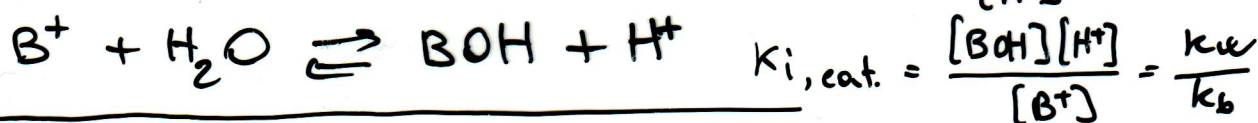
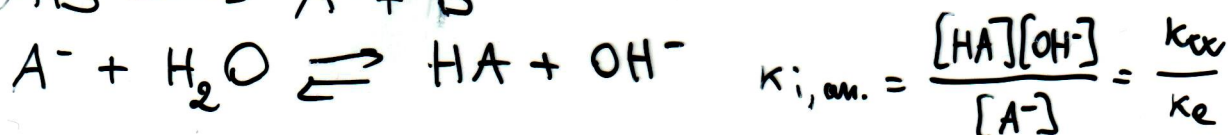
$$[\text{OH}^-] = \sqrt{K_i \cdot C_s} = \sqrt{10^{-9} \cdot 10^{-3}} = \sqrt{10^{-12}} = 10^{-6}\text{M}$$

$$\alpha = \frac{[\text{OH}^-]}{C_s} = \frac{10^{-6}}{10^{-3}} = 10^{-3} \approx 0.1\%$$

... in solut più diluita > il grado di idrolisi



4. SALE FORMATO DA ACIDO DEBOLE E BASE DEBOLE: IDROLISI SIMULTANEA DELL'ANIONE E DEL CATIONE



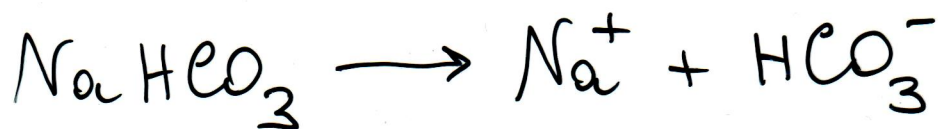
$$K_{i, tot} = \frac{[HA][BOH]}{[A^-][B^+]} = \frac{[HA][BOH][H^+][OH^-]}{[A^-][B^+][H^+][OH^-]} = \frac{K_w}{K_a \cdot K_b}$$

$$[HA] \cong [BOH] ; [A^-] \cong [B^+]$$

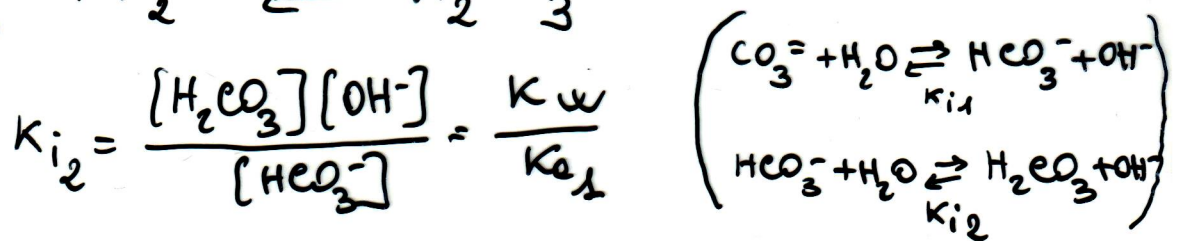
$$K_{i, tot} = \frac{K_w}{K_a \cdot K_b} = \frac{[HA]^2}{[A^-]^2} = \frac{[HA]^2 [H^+]^2}{[A^-]^2 [H^+]^2} = \frac{[H^+]^2}{K_a^2}$$

$$[H^+]^2 = \frac{K_w \cdot K_a^2}{K_a \cdot K_b} = K_w \cdot \frac{K_a}{K_b} ; [H^+] = \sqrt{K_w \cdot \frac{K_a}{K_b}}$$

CASO PARTICOLARE: SALE FORMATO DA IONE ANFOLITA



$$K_{i2} = \frac{[\text{H}_2\text{CO}_3][\text{OH}^-]}{[\text{HCO}_3^-]} = \frac{K_w}{K_{a1}}$$



$$K_{a2} = \frac{[\text{CO}_3^{2-}][\text{H}_3\text{O}^+]}{[\text{HCO}_3^-]}$$

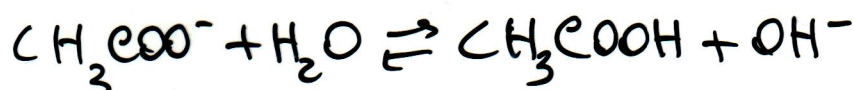
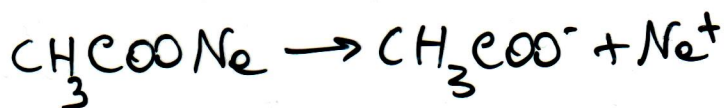
$$[\text{H}^+] = \sqrt{K_w \cdot \frac{K_a}{K_b}} = \sqrt{K_w \cdot \frac{K_{a2}}{K_{i2}}} = \sqrt{K_w \cdot \frac{K_{a2} \cdot K_{a1}}{K_w}} = \sqrt{K_{a1} K_{a2}}$$

$$\boxed{[\text{H}^+] = \sqrt{K_{a1} K_{a2}}}$$

5. EFFETTO DEL pH SULL'IDROLISI

Es. CH_3COONa $c_s = 10^{-1} \text{ M}$ $K_{a, \text{CH}_3\text{COOH}} \approx 10^{-5}$
 $\alpha_i \approx 0.01\%$

a $\text{pH} = 12$



$$K_a = \frac{[\text{A}^-][\text{H}^+]}{[\text{HA}]} \approx 10^{-5} = \frac{[\text{CH}_3\text{COO}^-] \cdot 10^{-12}}{[\text{CH}_3\text{COOH}]} \approx 10^{-5}$$

$$\frac{[\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]} = 10^7 \Rightarrow [\text{CH}_3\text{COO}^-] \gg [\text{CH}_3\text{COOH}] \approx 10^{-1} \text{ M}$$

$$[CH_3COOH] = \frac{[CH_3COO^-]}{10^7} = \frac{10^{-1}}{10^7} \approx 10^{-8} M$$

$$\alpha_i = \frac{[CH_3COOH]}{c_s} = \frac{10^{-8}}{10^{-1}} = 10^{-7} = \underline{\underline{0.00001\%}}$$

o pH = 0

$$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$$

$$K_a = \frac{[CH_3COO^-] \cdot 1}{[CH_3COOH]} \approx 10^{-5} \quad \frac{[CH_3COO^-]}{[CH_3COOH]} \approx 10^{-5}$$

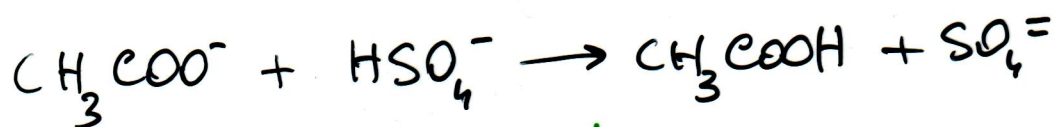
$$[CH_3COOH] \gg [CH_3COO^-] \approx 10^{-1} M$$

$$[CH_3COO^-] = 10^{-5} \cdot [CH_3COOH] = 10^{-6} M$$

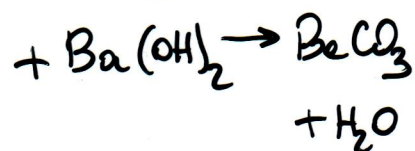
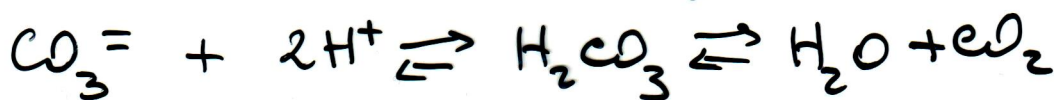
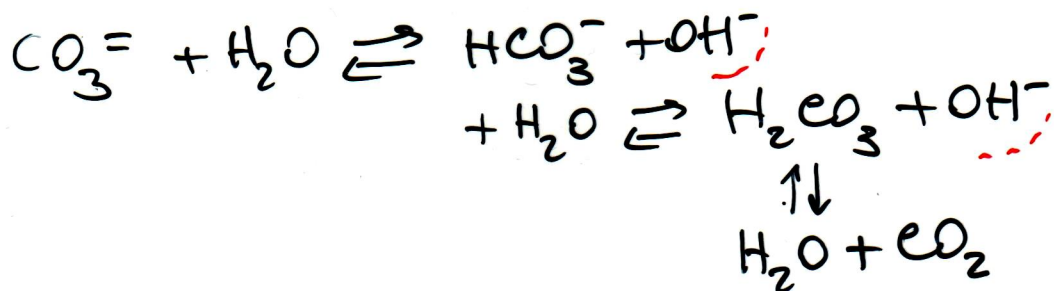
$$\alpha_i = \frac{[CH_3COOH]}{c_s} = \frac{10^{-1}}{10^{-1}} = 1 = \underline{\underline{100\%}}$$

ESEMPI DI EQUILIBRI DI IDROLISI
NELLE PROCEDURE DI ANALISI QUALITATIVA

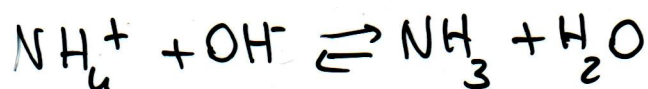
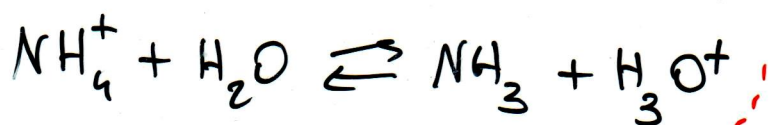
- Ricerca degli Acetati



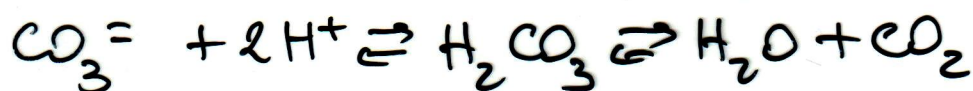
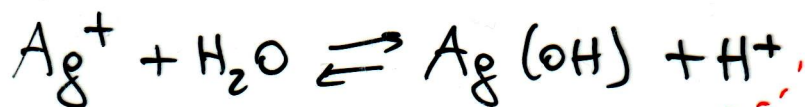
- Ricerca dei Carbonati



- Ricerca dello ione Ammonio



- Ricerca di I^- , Br^- e Cl^- dalla soluz. alcalina degli ANIONI



- Ricerca dei SOLFATI dalla soluz. alcalina degli ANIONI

