

**RAVNOTEŽJA  
KISLINSKO BAZIČNI SISTEMI:**

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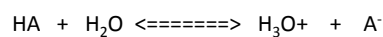
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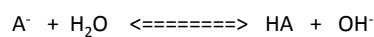
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**Pufri:**

**šibka kislina in njena konjugirana baza:**



$$K_a = \frac{[\text{H}_3\text{O}^+][\text{A}^-]}{[\text{HA}]}$$



$$K_b = \frac{[\text{HA}][\text{OH}^-]}{[\text{A}^-]}$$

$K_a \gg K_b$  raztopina je kislina

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$$C_{\text{HA}} + C_{\text{NaA}} = [\text{HA}] + [\text{A}^-] \quad (\text{I})$$

Naboji:

$$[\text{Na}^+] + [\text{H}_3\text{O}^+] = [\text{A}^-] + [\text{OH}^-] \quad [\text{Na}^+] = C_{\text{NaA}}$$

$$[\text{A}^-] = C_{\text{NaA}} + [\text{H}_3\text{O}^+] - [\text{OH}^-] \quad (\text{II})$$

I-II

$$[\text{HA}] = C_{\text{HA}} - [\text{H}_3\text{O}^+] + [\text{OH}^-]$$

$$K_a = \frac{[\text{H}_3\text{O}^+](C_{\text{NaA}} + [\text{H}_3\text{O}^+] - [\text{OH}^-])}{C_{\text{HA}} - [\text{H}_3\text{O}^+] + [\text{OH}^-]}$$

Kislina raztopina:  $[\text{H}_3\text{O}^+] \gg [\text{OH}^-]$

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$$K_a = \frac{[H_3O^+][C_{NaA}]}{C_{HA}}$$

$$-\log[H_3O^+] = -\log K_a - \log \frac{C_{HA}}{C_{NaA}}$$

Henderson-Hasselbach-ova enačba:

$$pH = pK_a + \log \frac{C_{NaA}}{C_{HA}}$$

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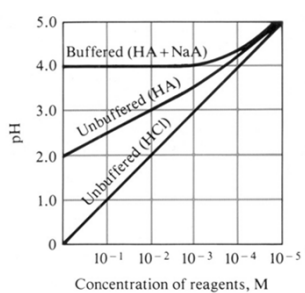
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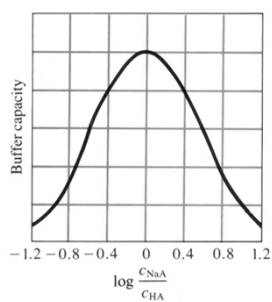
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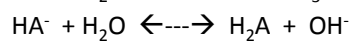
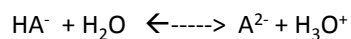
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## Amfiprotične soli

Amfiprotične soli imajo lahko kisle ali bazične lastnosti)

Izračun pH - primer NaHA:

Koncentracija soli:  $c_{\text{NaHa}}$



$$K_{a2} = \frac{[\text{H}_3\text{O}^+][\text{A}^{2-}]}{[\text{HA}^-]} \quad K_{b2} = \frac{K_w}{K_{a1}} = \frac{[\text{H}_2\text{A}][\text{OH}^-]}{[\text{HA}^-]}$$

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$$c_{\text{NaHa}} = [\text{HA}^-] + [\text{H}_2\text{A}] + [\text{A}^{2-}] \quad (\text{mase})$$

$$[\text{Na}^+] + [\text{H}_3\text{O}^+] + [\text{HA}^-] + 2[\text{A}^{2-}] + [\text{OH}^-] \quad (\text{naboji})$$

$$c_{\text{NaHa}} + [\text{H}_3\text{O}^+] = [\text{HA}^-] + 2[\text{A}^{2-}] + [\text{OH}^-]$$

$$K_w = [\text{OH}^-][\text{H}_3\text{O}^+]$$

Naboji-mase:

$$[\text{H}_3\text{O}^+] = [\text{A}^{2-}] + [\text{OH}^-] - [\text{H}_2\text{A}]$$

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$$[\text{H}_3\text{O}^+] = [\text{A}^{2-}] + [\text{OH}^-] - [\text{H}_2\text{A}]$$

$$[\text{H}_2\text{A}] = \frac{[\text{H}_3\text{O}^+][\text{HA}^-]}{K_{a1}} \quad [\text{A}^{2-}] = \frac{K_{a2}[\text{HA}^-]}{[\text{H}_3\text{O}^+]}$$

$$[\text{H}_3\text{O}^+] = \frac{K_{a2}[\text{HA}^-]}{[\text{H}_3\text{O}^+]} + \frac{K_w}{[\text{H}_3\text{O}^+]} - \frac{[\text{H}_3\text{O}^+][\text{HA}^-]}{K_{a1}}$$

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$$[H_3O^+]^2 = K_{a2}[HA^-] + K_w - \frac{[H_3O^+]^2[HA]}{K_{a1}}$$

$$[H_3O^+]^2 \left( \frac{[HA]}{K_{a1}} + 1 \right) = K_{a2}[HA^-] + K_w$$

$$[H_3O^+] = \sqrt{\frac{K_{a2}[HA^-] + K_w}{1 + \frac{[HA^-]}{K_{a1}}}}$$

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$$[H_3O^+] = \sqrt{\frac{K_{a2}c_{NaHA} + K_w}{1 + \frac{c_{NaHA}}{K_{a1}}}}$$

$$[H_3O^+] \approx \sqrt{K_{a1} \cdot K_{a2}}$$

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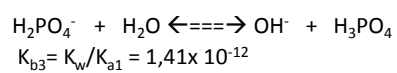
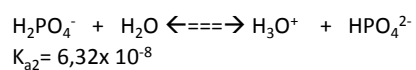
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$K_{a2} \gg K_{b3}$  Raztopina je kislina, zato jo titrimo z bazo!

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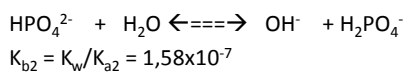
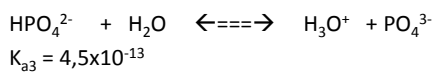
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$\text{HPO}_4^{2-}$  :



$K_{b2} \gg K_{a3}$  Raztopina je bazična. Titriramo jo s kislino!

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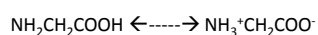
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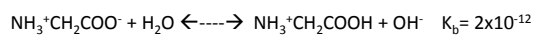
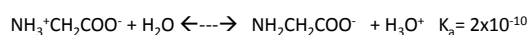
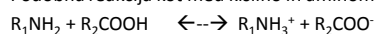
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### Amino kisline:



Podobna reakcija kot med kislino in aminom



$$K_a = \frac{[\text{H}_3\text{O}^+][\text{NH}_2\text{CH}_2\text{COO}^-]}{[\text{NH}_3^+\text{CH}_2\text{COO}^-]} \quad K_b = \frac{[\text{OH}^-][\text{NH}_3^+\text{CH}_2\text{COO}^-]}{[\text{NH}_3^+\text{CH}_2\text{COOH}]}$$

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Izoelektrična točka:  $[\text{NH}_2\text{CH}_2\text{COO}^-] = [\text{NH}_3^+\text{CH}_2\text{COOH}]$

$$\frac{K_a}{K_b} = \frac{[\text{H}_3\text{O}^+][\text{NH}_2\text{CH}_2\text{COO}^-]}{[\text{OH}^-][\text{NH}_3^+\text{CH}_2\text{COOH}]} = \frac{[\text{H}_3\text{O}^+]}{[\text{OH}^-]}$$

$$[\text{H}_3\text{O}^+] = \sqrt{\frac{K_a K_w}{K_b}}$$

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