

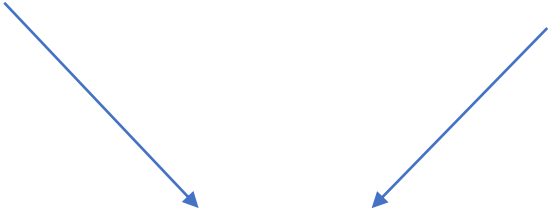
Potenciometrijska merenja

Predavanje 13, 03.04.2020.

Udžbenik: S. Mentus, Elektrohemija, 2008, strane 144-158

Koncept elektrodnog potencijala

$$\varepsilon = \left[E_{O_2/R_2}^0 + \frac{RT}{nF} \ln \frac{a_{O_2}}{a_{R_2}} \right] - \left[E_{O_1/R_1}^0 + \frac{RT}{nF} \ln \frac{a_{O_1}}{a_{R_1}} \right]$$


$$e = E_c - E_a$$

$$E = E_{O/R}^0 + \frac{RT}{nF} \ln \frac{a_O}{a_R}$$

**Nernstova jednačina
ravnotežnog elektrodnog
potencijala**

Formalni potencijal

$$E = E^0 + \frac{RT}{nF} \ln \frac{a_O}{a_R}$$

$$E = E^0 + \frac{RT}{nF} \ln \frac{\gamma_O [O]}{\gamma_R [R]} = \boxed{E^0 + \frac{RT}{nF} \ln \frac{\gamma_O}{\gamma_R}} + \frac{RT}{nF} \ln \frac{[O]}{[R]}$$

$$E = \boxed{E^{0'}} + \boxed{\frac{RT}{nF} \ln \frac{[O]}{[R]}}$$

Radimo sa koncentracijama, lakše u praksi

Možemo da pratimo ili merimo koncentraciju

Tablica standardnih elektrodnih potencijala

elektroda

elektrodna reakcija

Li⁺/Li

Li⁺ + e⁻ → Li

Na⁺/Na

Na⁺ + e⁻ → Na

Mg²⁺/Mg

Mg²⁺ + 2e⁻ → Mg

Zn²⁺/Zn

Zn²⁺ + 2e⁻ → Zn

H⁺/H₂; Pt

H⁺ + e⁻ → 1/2 H₂

OH⁻/O₂, Pt

1/2 O₂ + H₂O + 2e⁻ → 2OH⁻

J⁻/J₂, Pt

J₂ + e⁻ → 2J⁻

Hg²⁺/Hg

Hg²⁺ + 2e⁻ → Hg

Br/Br₂ Pt

Br₂ + 2e⁻ → 2Br⁻

Au³⁺/Au

Au³⁺ + 3e⁻ → Au

F⁻/F₂, Pt

F₂ + 2e⁻ → 2F⁻

Redukovana forma redukuje H⁺

E^o (V)

-3,04

-2,71

-2,38

-0,763

0,000

0,401

0,536

0,584

1,066

1,50

2,87

Oko 6 V

Oksidovana forma oksiduje H₂

Merenje pH

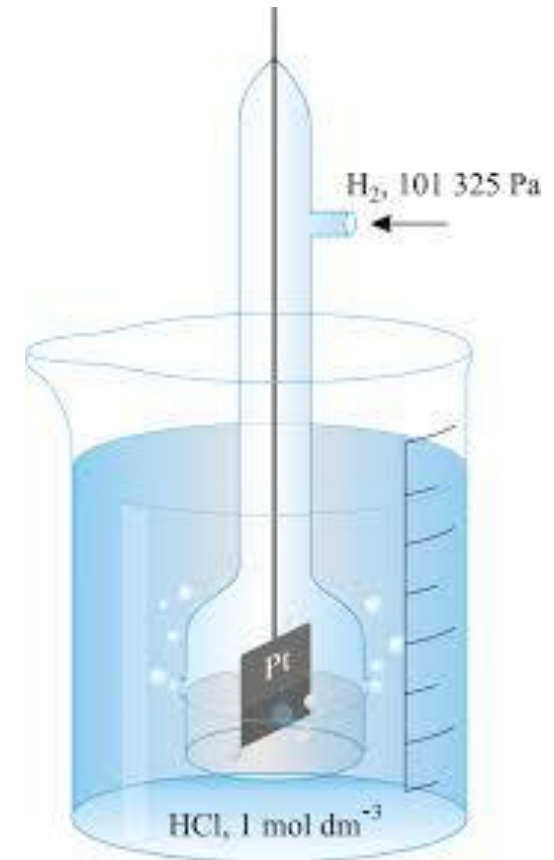
- Vodonična elektroda

$$\mathcal{E} = E_{ref} - E_{H^+/H_2}$$

$$E_{H^+/H_2} = E_{H^+/H_2}^0 + \frac{RT}{F} \ln \frac{a_{H^+}}{p_{H_2}^{1/2}}$$

$$E_{H^+/H_2} = 0,0591 \log a_{H^+} = -0,059 \text{ pH}$$

$$\mathcal{E} = E_{ref} + 0,059 \text{ pH}$$



Merenje pH

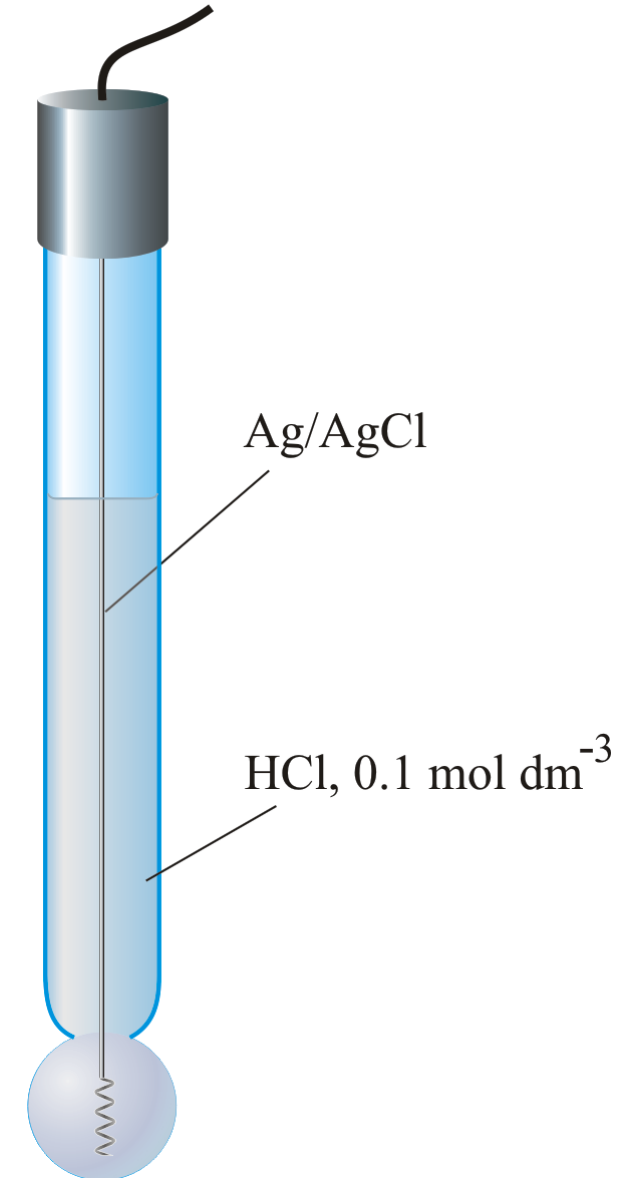
- Staklena elektroda



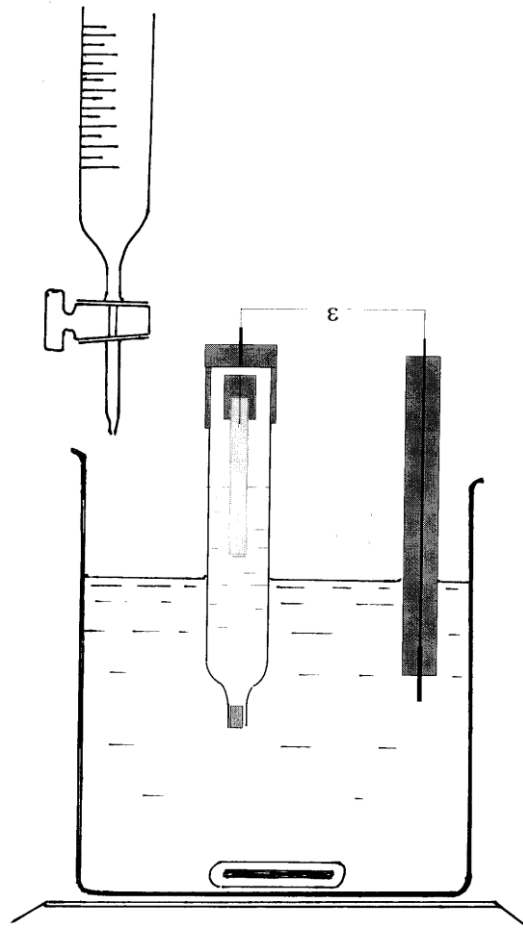
$$E = E_{as} + \frac{RT}{F} \ln \frac{a_{\text{H}^+}}{a_{\text{H}^+, \text{ref}}}$$

$$\varepsilon = E_{as} + \frac{RT}{F} \ln a_{\text{H}^+}$$

$$\varepsilon = E_{as} - 0,059 \text{ pH}$$



Potenciometrijske titracije



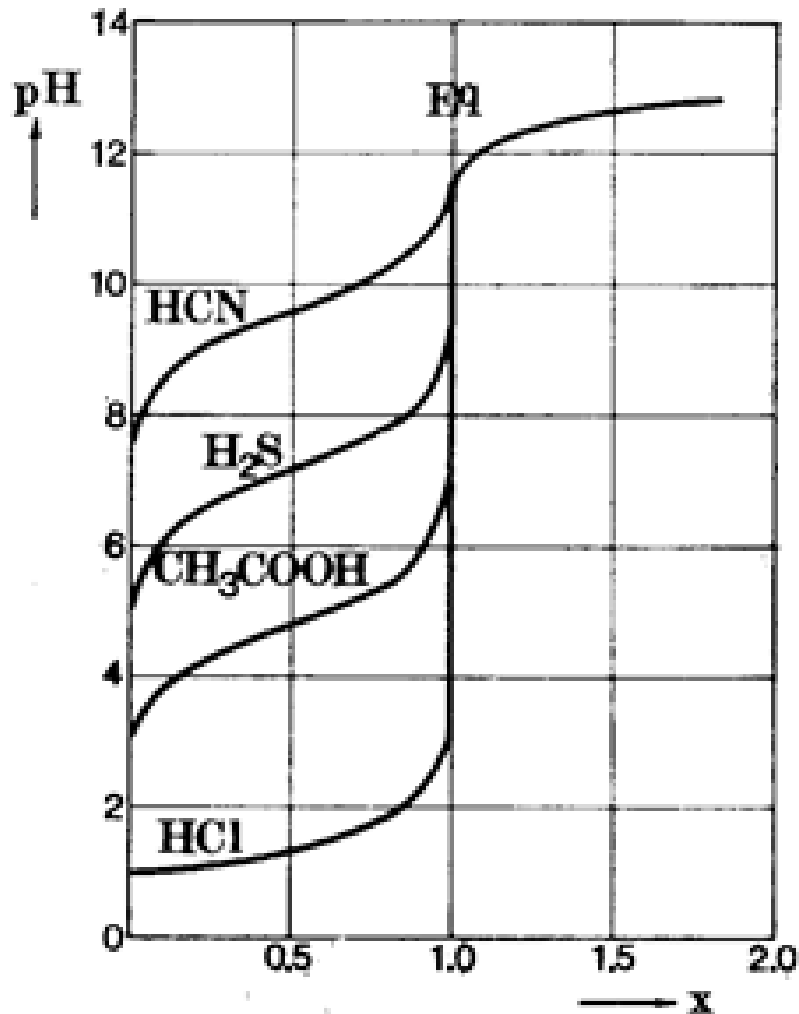
pH-metrijske

Oksidorekzione

Taložne

Kompleksirajuće

pH-metrijske titracije



Jaka kiselina jakim bazom

Slaba kiselina jakim bazom

Do ZTT

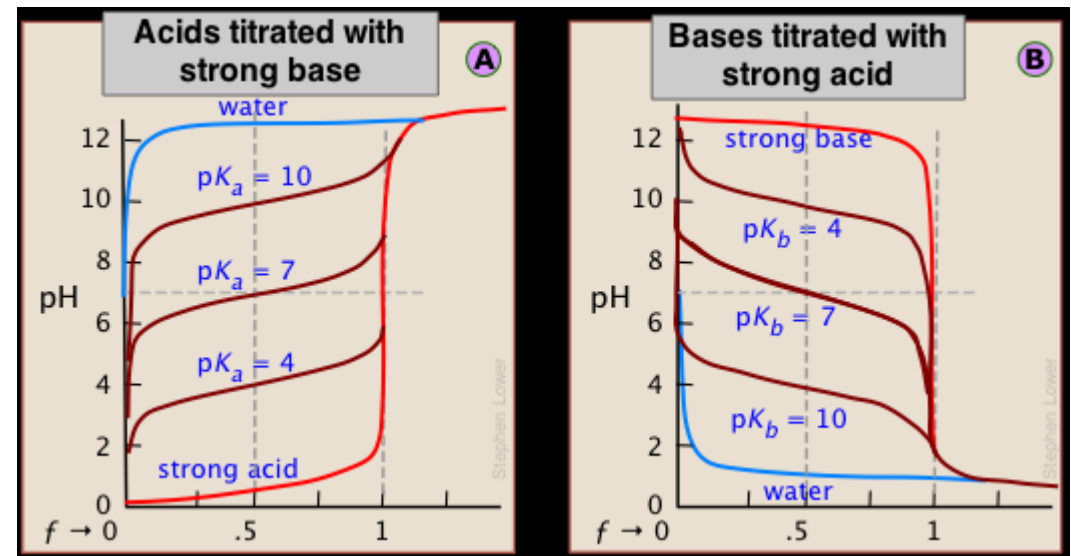
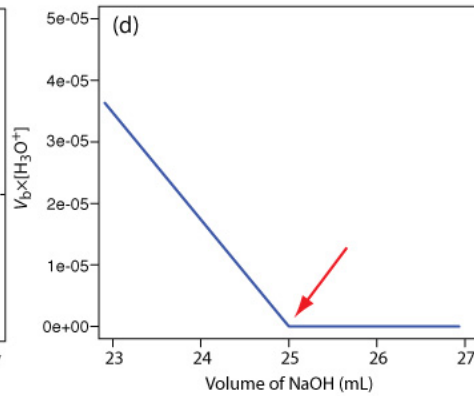
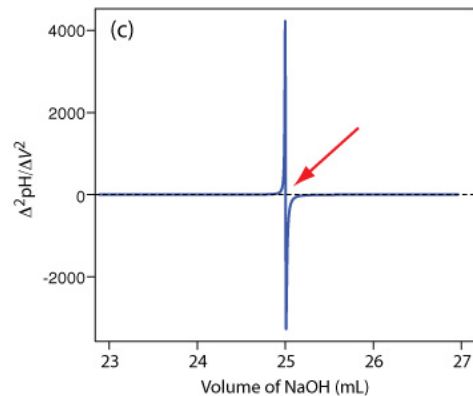
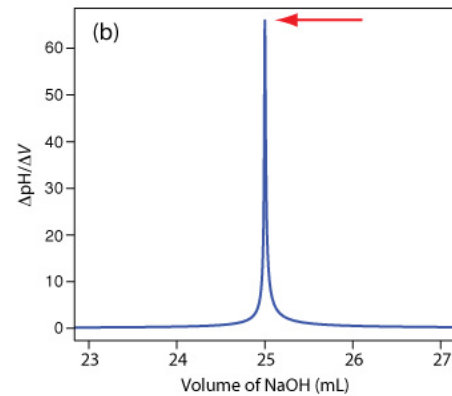
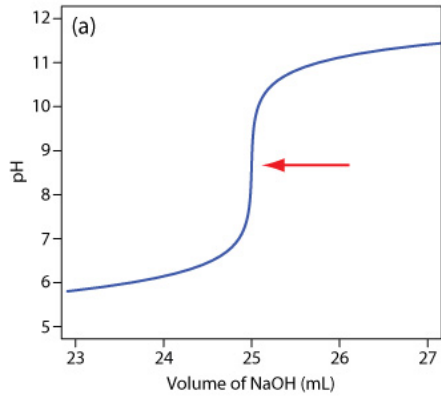
$$pH = -\log K_a + \log \frac{C_{\text{solj}}}{C_{\text{kis}}}$$

Na ZTT

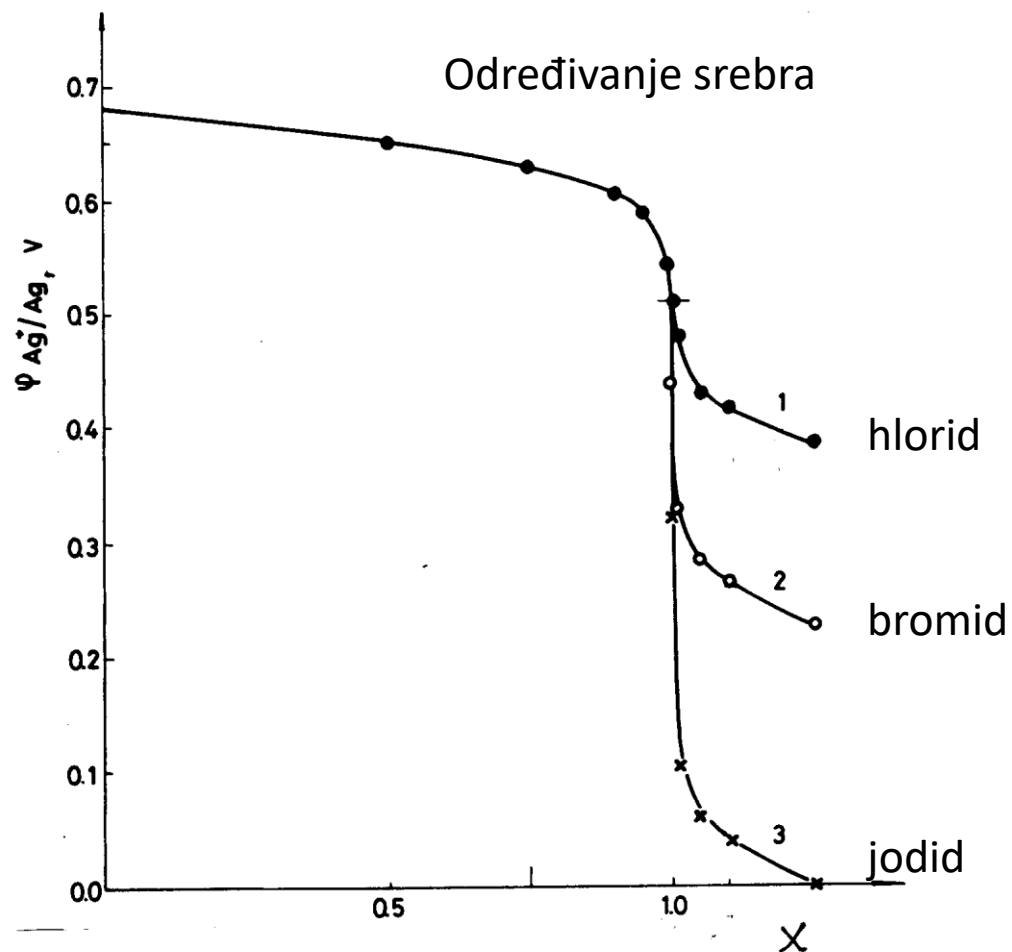
$$pH = -\frac{1}{2} \log \frac{K_w \cdot K_a}{C_{\text{solj}}}$$

Određivanje ZTT

- Diferenciranje titracione krive



Taložne i kompleksirajuće



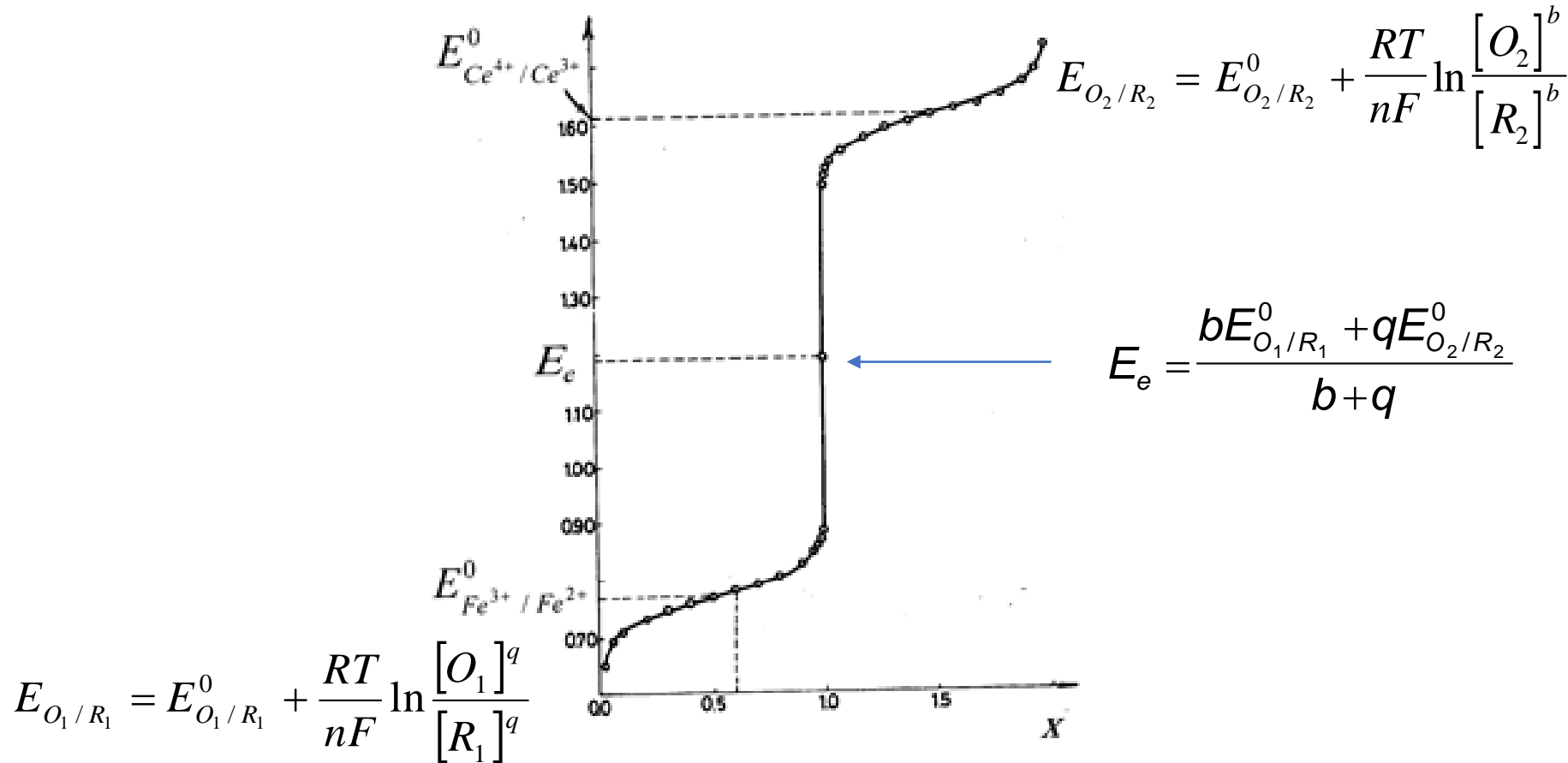
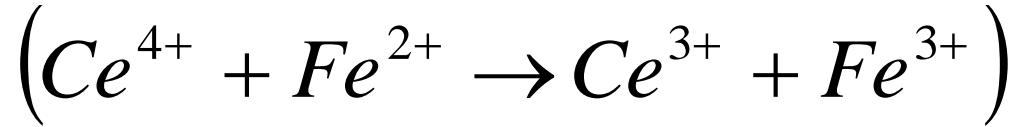
$$E_{Ag^+/Ag} = E_{Ag^+/Ag}^0 + \frac{RT}{2F} \ln L_{AgCl}$$

Titracija cijanidom

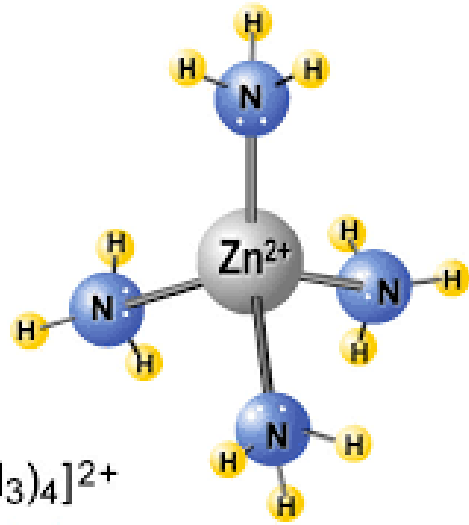
ZTT1
$$E_{Ag^+/Ag} = E_{Ag^+/Ag}^0 + \frac{RT}{F} \ln L_{AgCN}^{1/2}$$

ZTT2
$$E_{Ag^+/Ag} = E_{Ag^+/Ag}^0 + \frac{RT}{3F} \ln \frac{K}{4} + \frac{RT}{3F} \ln a_{Ag(CN)_2^-}$$

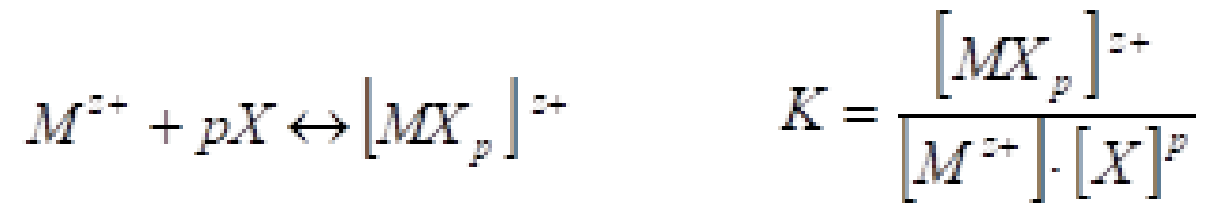
Oksidoredukciona potenciometrijska titracija



Potenciometrijsko određivanje formule kompleksnog jona

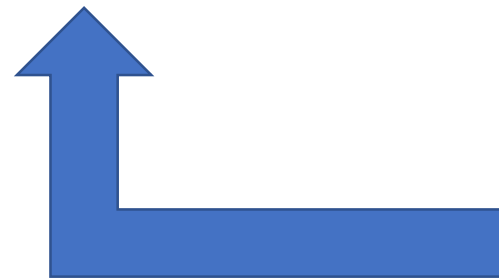


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$$E_{M^{z+}/M} = E_{M^{z+}/M}^{0'} + \frac{RT}{nF} \ln [M^{z+}]$$

$$E_{M^{z+}/M} = E_{M^{z+}/M}^{10} - \frac{RT}{nF} \ln K + \frac{RT}{nF} \ln [(MX_p)^{z+}] - \frac{RT}{nF} \ln [X]^p$$



U funkciji **ln[X]**

Korisni linkovi

- SJAJAN TEKST

[https://chem.libretexts.org/Bookshelves/General_Chemistry/Book%3A_Chem1_\(Lower\)/13%3A_Acid-Base_Equilibria/13.05%3A_Acid%2F%2FBase_Titration](https://chem.libretexts.org/Bookshelves/General_Chemistry/Book%3A_Chem1_(Lower)/13%3A_Acid-Base_Equilibria/13.05%3A_Acid%2F%2FBase_Titration)