Question #7, Chemistry / / Completed

0.1M Formic Acid solution is titrated against 0.1 M NaOH solution. What would be the difference in pH between 1/5 and 4/5 stages of neutralization of acid?

Solution

$HCOOH + NaOH = HCOONa + HOH$

$HCOOH = HCOO^- + H^+$

$pH = -lg [H^+]$

$K = 1.77 \times 10^{-4}$ for formic acid

For 0.1 M HCOOH:

$K = [H^+] \times [HCOO^-] / [HCOOH]$

$[H^+] = [HCOO^-] = \sqrt{K \times [HCOOH]} = 4.207 \times 10^{-3}$ mol/L; pH = 2.376

For 1/5 stage:

$4.207 \times 10^{-3} – 1/5 \cdot 4.207 \times 10^{-3} = 0.0033656$ mol/L; pH = 2.473

For 4/5 stage:

$4.207 \times 10^{-3} – 4/5 \cdot 4.207 \times 10^{-3} = 0.0008414$ mol/L; pH = 3.075

$\Delta = 3.075 – 2.473 = 0.602 \approx 0.6$

Answer: 0.6.