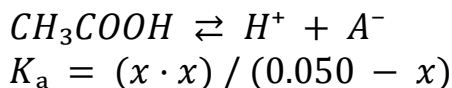


1-masala yechimi (kvadrat tenglama bilan)



$$1.8 \cdot 10^{-5} = x^2 / (0.050 - x)$$
$$x^2 = 1.8 \cdot 10^{-5} \cdot (0.050 - x)$$
$$x^2 + 1.8 \cdot 10^{-5} \cdot x - 9.0 \cdot 10^{-7} = 0$$

Diskriminant:

$$D = b^2 + 4ac = (1.8 \cdot 10^{-5})^2 + 4 \cdot 1 \cdot 9.0 \cdot 10^{-7}$$
$$\approx 3.24 \cdot 10^{-10} + 3.6 \cdot 10^{-6} \approx 3.600324 \cdot 10^{-6}$$

$$x = (-b + \sqrt{D}) / 2$$
$$x \approx (-1.8 \cdot 10^{-5} + 0.00189745) / 2 \approx 9.396 \cdot 10^{-4}$$

$$(H^+) = 9.40 \cdot 10^{-4}$$
$$pH = -\log(9.40 \cdot 10^{-4}) \approx 3 - \log(9.40) \approx 3 - 0.97 = 2.03$$

2-masala yechimi (tampon)

$$pOH = pK_b + \lg([NH_4^+]/[NH_3])$$
$$pK_b = -\lg(1.8 \cdot 10^{-5}) \approx 4.74$$

$$\lg(0.20/0.10) = \lg(2) = 0.301$$

$$pOH = 4.74 + 0.301 = 5.041$$
$$pH = 14 - 5.041 = 8.96$$

3-masala yechimi

Moddalar miqdori:

$$CH_3COOH = 0.004 \text{ mol}$$
$$OH^- = 0.001 \text{ mol}$$

$$\text{Qoldiq } CH_3COOH = 0.003 \text{ mol}$$
$$CH_3COO^- = 0.001 \text{ mol}$$

Tampon:

$$[A^-]/[HA] = 0.001 / 0.003 = 0.333$$

$$pH = pK_a + \lg(0.333) = 4.74 + (-0.477) = 4.26$$

4-masala yechimi (anion gidrolizi)

$$K_{gidr} = K_w / K_a = (1.0 \cdot 10^{-14}) / (1.8 \cdot 10^{-5}) = 5.56 \cdot 10^{-10}$$

$$(OH^-) \approx \sqrt{K_{gidr} \cdot 0.20} \approx \sqrt{1.112 \cdot 10^{-10}} \approx 1.05 \cdot 10^{-5}$$

$$pOH \approx 5 - \lg(1.05) \approx 5 - 0.02 = 4.98$$

$$pH = 14 - 4.98 = 9.02$$

5-masala yechimi

$$NH_3 = 0.010 \text{ mol}$$

$$HCl = 0.005 \text{ mol}$$

$$\text{Qoldiq } NH_3 = 0.005 \text{ mol}$$

$$NH_4^+ = 0.005 \text{ mol}$$

$$[NH_4^+] / [NH_3] = 1$$

$$pOH = pK_b = 4.74$$

$$pH = 14 - 4.74 = 9.26$$

6-masala yechimi

NH_4Cl suyultirilsa:

$$(H^+) \approx \sqrt{K_a \cdot C}$$

C 2 baravar kamayadi $\rightarrow (H^+)\sqrt{2}$ baravar kamayadi $\rightarrow pH \approx 0.15$ birlik oshadi.

Oldingi $pH \approx 4.98 \rightarrow$ yangi $pH \approx 5.13$

7-masala yechimi

$$K_a = (H^+ \cdot A^-)/(HA)$$

$$(H^+) = 2 \cdot 10^{-4}$$

$$[A^-] \approx 2 \cdot 10^{-4}$$

$$[HA] \approx 0.050 - 0.0002 = 0.0498$$

$$K_a \approx (4 \cdot 10^{-8})/(0.0498) \approx 8.03 \cdot 10^{-7}$$

8-masala yechimi (tampon + HCl qo'shish)

Boshlang'ich mol:

$$HA = 0.010 \text{ mol}$$

$$A^- = 0.040 \text{ mol}$$

$$HCl = 0.001 \text{ mol} \rightarrow A^- \rightarrow HA$$

Yangi:

$$A^- = 0.039$$

$$HA = 0.011$$

$$pH = pK_a + \lg(A^-/HA) = 4.74 + \lg(0.039/0.011) = 4.74 + \lg(3.545) \\ = 4.74 + 0.549 = 5.29$$

9–masala yechimi (berilgan pH ga mos HCl hajmi topiladi)

$$\text{Berilgan } pH = 9.00$$

$$pOH = 5.00$$

Tampon:

$$pOH = pK_b + \lg([B^+]/[BOH]) \\ 5.00 = 4.74 + \lg([NH_4^+]/[NH_3]) \\ \lg \text{ nisbat} = 0.26 \\ [NH_4^+]/[NH_3] = 10^{0.26} = 1.82$$

$$\text{Boshlang'ich } NH_3 = 0.20 \cdot V_L$$

$$NH_4^+ = \text{qo'shilgan } HCl \text{ miqdori} = n_{HCl}$$

$$n_{HCl} / (0.20 \cdot V - n_{HCl}) = 1.82 \\ n_{HCl} = 0.364 \cdot V$$

$$HCl \ 0.10 \ M \rightarrow V_{HCl} = n_{HCl} / 0.10 = (0.364 \cdot V) / 0.10 = 3.64 \cdot V$$

Demak NH_3 hajmi 100 ml bo'lsa $\rightarrow HCl \approx 364 \text{ ml}$ talab qilinadi.

10–masala yechimi

$$20\% \text{ dissotsiatsiya} \rightarrow \alpha = 0.20$$



$$(H^+) = \alpha \cdot C_0 = 0.20 \cdot 0.050 = 0.010 \ M \\ [A^-] = 0.010 \\ [HA] = 0.050 \cdot (1 - 0.20) = 0.040$$

$$K_a = (H^+ \cdot A^-) / (HA) = (0.010 \cdot 0.010) / (0.040) = 1 \cdot 10^{-4} / 0.040 \\ = 2.5 \cdot 10^{-3}$$