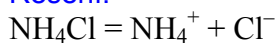


12 Simultánní reakce - bilance

Dva litry roztoku obsahují 0,2 mol NH_3 a 0,4 mol NH_4Cl . Jaké je pH tohoto roztoku při teplotě 25°C ? Konstanta acidity NH_3 je $K_a = 5,6 \cdot 10^{-10}$, iontový součin vody $K_v = 1,008 \cdot 10^{-14}$.

[pH = 8,949]

Řešení:



$$K_a = \frac{a_{\text{NH}_3} \cdot a_{\text{H}^+}}{a_{\text{NH}_4^+}} = 5,6 \cdot 10^{-10}$$



$$K_v = a_{\text{OH}^-} \cdot a_{\text{H}^+} = 1,008 \cdot 10^{-14}$$

$$c_0(\text{NH}_4\text{Cl}) = n(\text{NH}_4\text{Cl})/V = 0,4/2 = 0,2 \text{ mol dm}^{-3}$$

$$c_0(\text{NH}_3) = n(\text{NH}_3)/V = 0,2/2 = 0,1 \text{ mol dm}^{-3}$$

$$c(\text{NH}_4^+) = c_0(\text{NH}_4\text{Cl}) - x$$

$$c(\text{NH}_3) = c_0(\text{NH}_3) + x$$

$$c(\text{H}^+) = x + y$$

$$c(\text{OH}^-) = y$$

$$K_a = \frac{c_{\text{NH}_3} \cdot c_{\text{H}^+}}{c_{\text{NH}_4^+}} = \frac{(c_0(\text{NH}_3) + x) \cdot (x + y)}{c_0(\text{NH}_4\text{Cl}) - x} = 10^{-9,25} = 5,6234 \cdot 10^{-10}$$

$$K_v = (x + y) \cdot y$$

$$x \ll c_0(\text{NH}_4\text{Cl}) \text{ , } x \ll c_0(\text{NH}_3)$$

$$K_a = \frac{c_{\text{NH}_3} \cdot c_{\text{H}^+}}{c_{\text{NH}_4^+}} \cong \frac{c_0(\text{NH}_3) \cdot c_{\text{H}^+}}{c_0(\text{NH}_4\text{Cl})}$$

$$c_{\text{H}^+} \cong K_a \cdot \frac{c_0(\text{NH}_4\text{Cl})}{c_0(\text{NH}_3)} = 10^{-9,25} \cdot \frac{0,2}{0,1} = 1,12468 \cdot 10^{-9}$$

$$\text{pH} = -\log c_{\text{H}^+} = -\log (1,12468 \cdot 10^{-9}) = 8,949$$