

Übungsaufgaben IX, von 26.06.2001

Musterlösungen

1.

$$\ln K = -\frac{\Delta G_{\text{aq}}^{\circ}}{RT} \quad \text{wobei } \Delta G_{\text{aq}}^{\circ} = +58.69 \text{ kJmol}^{-1};$$

$$\Delta G^{\circ}(\text{Fe}^{3+}) = -4.7 \text{ kJmol}^{-1}; \Delta G^{\circ}(\text{Fe}^{2+}) = -78.90 \text{ kJmol}^{-1}; \Delta G^{\circ}(\text{Cu}^{+}) = 49.98 \text{ kJmol}^{-1}; \\ \Delta G^{\circ}(\text{Cu}^{2+}) = 65.497 \text{ kJmol}^{-1}$$

$$K = \frac{[\text{Fe}^{3+}][\text{Cu}^{+}]}{[\text{Fe}^{2+}][\text{Cu}^{2+}]} = 5.2 \times 10^{-11}$$

$$\text{Daraus folgt: } [\text{Fe}^{3+}] = [\text{Cu}^{+}] = \sqrt{5.2 \times 10^{-11}} = 7.1 \times 10^{-6} \text{ molL}^{-1}$$

2.

a)

$$\Delta_r G = -RT \ln K \\ = -(8.314 \text{ J K}^{-1} \text{ mol}^{-1}) \cdot (673 \text{ K}) \cdot \ln(1.60 \cdot 10^{-4}) \\ = 48.91 \text{ kJ mol}^{-1}$$

b)

$$K = (1.60 \cdot 10^{-4})^{1/2} = 0.01265$$

$$\Delta_r G = -RT \ln 0.01265 \\ = 24.46 \text{ kJ mol}^{-1}$$

c)

$$K = \frac{1}{(1.60 \cdot 10^{-4})} = 6250$$

$$\Delta_r G = -RT \ln 6250 \\ = -48.91 \text{ kJ mol}^{-1}$$

3.

$$K_s = \frac{a(\text{H}_3\text{O}^+) \times a(\text{CN}^-)}{a(\text{HCN})} \approx \frac{a(\text{H}_3\text{O}^+)^2}{a(\text{HCN})} \approx \frac{[\text{H}_3\text{O}^+]^2}{[\text{HCN}]}$$

$$[\text{H}_3\text{O}^+] \approx (K_s [\text{HCN}])^{1/2}$$

$$\text{pH} = \frac{1}{2} \text{p}K_s - \frac{1}{2} \log([\text{HCN}]) = \frac{1}{2} \times 9.31 - \frac{1}{2} \log 0.4 = 4.85$$

4.

$$\text{a) } \quad c = s - R = 3 - 1 = 2 \\ \quad \quad F = c - P + 2 = 2 - 3 + 2 = 1$$

$$\text{b) } \quad F = 2 - 2 + 2 = 2$$