Elektrochemie HS 2019

Exercise 2 "Electrolyte Conductivity and Cell Constant" September 2019

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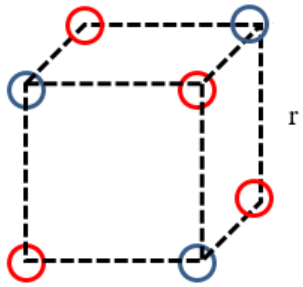
Answers can be given in German or English. Antworten können in Deutsch oder Englisch gegeben warden.

Task 1 (5 Points):

15% (wt.) of NaOH solution (Density 1.210 g·cm^{-3}) is filled into a reservoir between two electrodes with a surface area of A = 20 cm^2 that are placed at a distance of l = 4 cm. The electrical conductance of this solution is L = 1.815 S. Calculate the molar electrical conductivity of this solution (Λ_m).

Task 2 (5 Points):

Two equal portions of NaOH are given into two flasks. One is to be mixed with pure ethanol the other with pure water. What is the ratio between the volumes of water and ethanol needed to obtain the same electrostatic force between dissolved charges in both solutions? Use Coulombs Law and assume full dissociation with a distribution of charges in solution as indicated in the image below. The dielectric constants of water (78.3) and ethanol (25.8).



Task 3 (5 Points):

The resistance (R) of $La_{1.7}Bi_{0.3}Mo_2O_{9-\delta}$ solid electrolyte was measured as a function of temperature (T):

T, °C	1223	1173	1123	1073
R, Ohm	62.8	76.1	96.3	128.1

Calculate the activation energy (E_a, kJ·mol^{-1}) of conductivity (κ) assuming the following Arrhenius-like dependency:

$$\kappa = \frac{const}{T} \exp\left(-\frac{E_a}{RT}\right)$$

Task 4 (5 Points):

The conductivity of a 0.135 M solution of propionic acid κ_{acid} = 4.79×10^{-4} S×cm^{-1} and the conductivity of 0.001M solution of sodium propionate κ_{salt} = 7.54×10^{-5} S×cm^{-1}. The mobilities of Na^+ and H^+ are the following: $\Lambda_{0_{Na^+}}$ = 44.4 S×cm^2×mol^{-1}, $\Lambda_{0_{H^+}}$ = 349.8 S×cm^2×mol^{-1}. Assuming that at the given concentration the salt is fully dissociated and ions don't interact with each other, calculate the dissociation constant of propionic acid.