Chemistry 3

Set of exercises 3: Conductivity of electrolytes

Exercise 1: In a cell for measuring conductivity, the resistance of a solution of KCl (0.02M) is 82Ω ; the resistance of a solution of K_2SO_4 ($25x10^{-4}$M) is 326Ω. Calculate :

a) The cell constant.
b) The conductivity and the equivalent conductivity of K_2SO_{4-}
c) The equivalent conductivity KCl.

Data: the conductivity of KCl (0.02M) is $2.768x10^{-3}$S.cm^{-1}

Exercise 2 : At 25°C, the dissociation constant of acetic acid with a concentration of $2x10^{-3}$ M is K_d= $1.8x10^{-5}$. Knowing that:$\Lambda°_{CH3COONa}$=$91.0x10^{-4}$, $\Lambda°_{NaCl}$=$136.4x10^{-4}$, $\Lambda°_{HCl}$= $426.1x10^{-4}$ S.m^2/mol

1) What is the equivalent conductivity of this solution?
2) If the measures were done in a conductometer with cell constant of 69.25 m^{-1}, what is the resistance of this solution?

Exercise 3: Calculate the conductivity of a solution containing silver nitrate at a concentration of 0.1M and nitric acid. The pH of the solution equals to 1.
Data : λ_{H+}= 350 S.cm^2/eq , λ_{NO3-}= 71 S.cm^2/eq et λ_{Ag+}= 60 S.cm^2/eq.

Exercise 4: A conductometer displays a resistance of 122.549Ω when it contains a solution of KCl (0.01M). It displays a resistance of 313.152Ω if it contains a solution of propionic acid (C_2H_5COOH) 0.135M. If the limiting ionic mobilities of $C_2H_5COO^-$ and H^+ are respectively of $3.85x10^{-4}$ and $3.625x10^{-3}$ cm^2.V^{-1}.s^{-1} and the conductivity of KCl solution is $1.224x10^{-3}$ S/cm, Calculate :

- The conductivity of the solution of propionic acid.
- The dissociation degree and the dissociation constant of the solution of propionic acid.
- The pH of the solution. Data : F=96500 C/mol.

Exercise 5: An electrical current of 0.01 A is applied across an electrolysis cell formed by two platinium electrodes with surface area of 1cm^2 of each. The cell is filled with solution of Cesium bromide CsBr (0.1N). Knowing that λ_{Cs+}= 50 and λ_{Br-}= 52 S.cm^2.eq^{-1}, calculate the speed of ions Cs^+.

Exercise 6: The conductivity of a saturated solution of silver chloride (AgCl) at 20°C is $1.33x10^{-6}$ S.cm^{-1}. If the limiting ionic conductivities of Ag^+ and Cl^-, at this temperature, are respectively 56.9 and 68.4 S.cm^2.eq^{-1}, calculate the solubility of AgCl.

Exercise 7: At 25°C, the conductivity of water saturated by $Pb_3(PO_4)_2$ is $22.03x10^{-6}$ S.m^{-1} and the conductivity of the water used to prepare this solution is $5.5x10^{-6}$ S.m^{-1}. The equivalent ionic conductivities, at infinite dilution, of Pb^{2+} and PO_4^{3-} are respectively $7x10^{-3}$ S.m^2.eq^{-1} and $9.28x10^{-3}$ S.m^2.eq^{-1} . The molar mass of $Pb_3(PO_4)_2$ is 811g.

1) Calculate the solubility of $Pb_3(PO_4)_2$ in g/L.
2) Calculate the solubility product of $Pb_3(PO_4)_2$ at 25°C.