Conductivity of electrolyte solutions

P71. The molar specific conductivity of a 0.100 mol dm^{-3} solution of potassium chloride at 298.15 K is 129 S cm^2 mol^{-1}. A 28.44 Ω resistance is measured for this solution. The resistance of a 0.025 mol dm^{-3} formic acid solution in the same cell was measured to be 444 Ω. Calculate the pK_a of formic acid. The molar specific conductivity of formic acid in infinitely dilute solution at this temperature is 404.0 S cm^2 mol^{-1}. (pK_a = 3.74)

P72. The ion mobility of sulfate ion is $u = 8{,}29 \cdot 10^{-8}$ m^2 s^{-1} V^{-1} at 298.15 K in aqueous solution. Estimate the hydrodynamic radius of the sulfate ion. The viscosity of the dilute aqueous solution is 1.0 cP (*i.e.*, $1.0 \cdot 10^{-3}$ kg m^{-1} s^{-1}). (a_{hydr} = 205 pm)

P73. The following data apply to NaI(*aq*) at 298.15 K:

c /(mol dm^{-3})	0.00100	0.00500	0.0100	0.0200
Λ_m /(S cm^2 mol^{-1})	124.2	121.2	119.2	116.6

Determine the molar specific conductivity of the infinitely dilute solution. (126.24 S cm^2 mol^{-1})

P74. An infinitely dilute solution of potassium chloride, potassium nitrate and silver nitrate has a molar specific conductivity of 149.9, 145.0 and 133.4 S cm^2 mol^{-1}, respectively, at 25.0 °C. How much is the molar specific conductivity of an infinitely dilute silver chloride solution at this temperature? (138.3 S cm^2 mol^{-1})

P75. What proportion of the electrical current is delivered by the lithium ions in an aqueous lithium bromide solution at 25.0 °C? The mobility of lithium and bromide ion at this temperature is $4.01 \cdot 10^{-4}$ and $8.09 \cdot 10^{-4}$ cm^2 s^{-1} V^{-1}, respectively. (33.14%)

P76. Electrolysis of a dilute silver nitrate solution resulted in the deposition of 0.4256 g of silver on the cathode. Before electrolysis, 1.4332 g of silver chloride was precipitated from a given volume of the cathode space and, after electrolysis, 1.1384 g of silver chloride was precipitated from the same volume. Calculate the ion transport number of silver ions. The relative atomic masses of silver and chlorine are 107.87 and 35.45, respectively. (0.4786)

P77. Ion transport number is determined using Hittorf's method. In the Hittorf instrument, a hydrochloric acid solution is electrolyzed between platinum electrodes. The cathode solution contained 0.177 g of chloride ion prior to electrolysis and 0.149 g after it. In the silver-coulombmeter with serial connection, a total of 0.5016 g silver deposited during electrolysis. Calculate the transport number of hydrogen and chloride ions. (0.730 and 0.170)

P78. The rate of motion of the boundary between hydrochloric acid and lithium chloride is measured in an aqueous solution. In a 1.00 cm diameter tube, the boundary moved 15.0 cm in 22.0 min when the current was 11.54 mA. What is the transport number of the hydrogen ion if the concentration of hydrochloric acid was 0.01065 mol dm^{-3}? (0.7947)