

Tutorial N° 1

Exercise 1

A commercial phosphoric acid solution contains 75% by mass of H_3PO_4 , and its density is 1.57 g/mL. Determine the molar concentration, normality, molality, mole fraction, and molar percentage of H_3PO_4 in this commercial solution.

Exercise 2

The measurement of the conductivity of a potassium chloride ($K^+ + Cl^-$) solution with concentration C gives $1.224 \text{ mS}\cdot\text{cm}^{-1}$ at 21°C .

1. Express σ , the conductivity, in $\text{S}\cdot\text{m}^{-1}$.
2. The following values are provided :
 $\lambda_{Cl^-} = 7,63 \text{ mS}\cdot\text{m}^2\cdot\text{mol}^{-1}$; $\lambda_{K^+} = 7,35 \text{ mS}\cdot\text{m}^2\cdot\text{mol}^{-1}$
 - 2.1. What does the letter λ represent?
 - 2.2. Convert these values to $\text{S}\cdot\text{m}^2\cdot\text{mol}^{-1}$.
 - 2.3. Determine the concentration C in $\text{mol}\cdot\text{L}^{-1}$.

Exercise 3

An unknown amount m_{LiCl} of lithium chloride was dissolved in a 200 mL volumetric flask.

Given: Molar conductivities at 25°C : $\lambda_{Li^+} = 3,86 \text{ mS}\cdot\text{m}^2/\text{mol}^{-1}$; $\lambda_{Cl^-} = 7,63 \text{ mS}\cdot\text{m}^2\cdot\text{mol}^{-1}$

Molar masses: $M_{Li} = 6,9 \text{ g}\cdot\text{mol}^{-1}$, $M_{Cl} = 35,5 \text{ g}\cdot\text{mol}^{-1}$

1. Determine the concentration C in $\text{mol}\cdot\text{L}^{-1}$ of this solution, knowing that its conductivity is $\sigma = 34,5 \text{ mS}\cdot\text{cm}^{-1}$ (we previously calibrated the conductometer).
2. What mass m_{LiCl} of lithium chloride was placed in the volumetric flask?

Exercise 4

A potassium chloride (KCl) solution has a concentration $C = 5\cdot 10^{-3} \text{ mol}\cdot\text{L}^{-1}$.

1. Write the equation for the dissolution reaction of potassium chloride in water.
2. The dissolution is complete. Calculate, in $\text{mol}\cdot\text{m}^{-3}$, the concentrations of the ions K^+ and Cl^- in the solution. Justify your answer clearly.
3. Calculate the conductivity of the solution.

Given :

Ionic molar conductivities: $\lambda_{Cl^-} = 7,63\cdot 10^{-3} \text{ S}\cdot\text{m}^2\cdot\text{mol}^{-1}$, $\lambda_{K^+} = 7,4\cdot 10^{-3} \text{ S}\cdot\text{m}^2\cdot\text{mol}^{-1}$

Exercise 5

We mix a volume $V_1 = 200 \text{ mL}$ of a potassium chloride ($K^+ + Cl^-$) solution with concentration $C_1 = 5,0\cdot 10^{-3} \text{ mol}/\text{L}$ with a volume $V_2 = 800 \text{ mL}$ of a sodium chloride ($Na^+ + Cl^-$) solution with concentration $C_2 = 1,25\cdot 10^{-3} \text{ mol}/\text{L}$.

1. What is the conductivity of the resulting solution?
2. In the previous mixture, a conductometer cell is placed. The surface area of the electrodes is $11,0 \text{ cm}^2$ and the distance between them is $1,1 \text{ cm}$.
 - 2.1. What is the value of the conductance?

Given:

$\lambda_{Na^+} = 5,01\cdot 10^{-3} \text{ S}\cdot\text{m}^2/\text{mol}$; $\lambda_{Cl^-} = 7,63\cdot 10^{-3} \text{ S}\cdot\text{m}^2/\text{mol}$; $\lambda_{K^+} = 7,35\cdot 10^{-3} \text{ S}\cdot\text{m}^2/\text{mol}$