University Center of Mila
Institute of Science and Technology **2024/2025**
Department of Natural and Life Sciences
Semester 3 - Biological Sciences / Biotechnology / Ecology and Environment / Biophysics Module

Series of TD No. 02
Generalities on Aqueous Solutions.

Exercise 1:

An aqueous solution is obtained by dissolving 0.18 g of glucose in 0.5 liters of water.

1. Calculate the molarity, molality, and mass percentage (ratio of solute mass to the total solution mass × 100) of this solution, as well as the mole fractions of its different components, knowing that the molar mass of glucose is 180 g/mol and that of water is 18 g/mol.
2. Calculate the new molarity if 1 liter of water is added to the previous solution (dilution)

Exercise 2:

Given 1 liter of a strong solution of $Ca\ Cl_2$ at 0.3 M:

1. Calculate its ionic strength.
2. **Personal work**: If this solution is mixed with 2 liters of a $CaCl_2$ solution at 0.2 M, what is the ionic strength of the resulting solution?

Exercise 3:

12 g of CH_3COOH is dissolved in 1 liter of water. Calculate the concentration values of the different ions present in the solution, its equilibrium constant, and its equivalent concentration, assuming the solution is weak with a dissociation coefficient of $\alpha = 0.3$.

Exercise 4:

39.63 g of $(NH_4)_2SO_4$ (M = 132.1 g/mol) is dissolved in 1 liter of water. Assuming the partial dissociation of the solute with a dissociation coefficient of 0.8:

1. Calculate the osmolarity of the resulting solution and its freezing temperature (with $K_e = 1.86\ °C \cdot Osm^{-1} \cdot L$).

Exercise 5 :

Determine the ionic strength of a solution containing 0.1 M Na_2SO_4 and 0.05 M KNO_3,

Exercise 6:

Calculate the length of a cylindrical tank with a cross-sectional area of 90 cm^2, an electrical resistance of 6.103 Ω, filled with a product with a resistivity of 500 Ω·m.

Exercise 7:

A conductimetric cell consists of two electrodes with a surface area S=2.0 cm, separated by a distance L=1.5cm, and subjected to a continuous voltage U=1.2V. The cell is immersed in an ionic solution, and the current passing through the cell is measured as I=7.0 mA

1. Express and calculate the **conductance** and **resistance** of the cell.
2. Express and calculate the cell constant kkk in $\mathbf{cm^{-1}}$ and $\mathbf{m^{-1}}$.
3. Express and calculate the **conductivity** of the solution in SI units.