

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 $\times 100$) 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 CaCl_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 $(\text{NH}_4)_2\text{SO}_4$ ($M = 132.1$ 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 $K_f = 1.86$ °C·Osm⁻¹·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 cm², an electrical resistance of 6.103 Ω , filled with a product with a resistivity of 500 $\Omega \cdot \text{m}$.

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Exercise 7:

A conductimetric cell consists of two electrodes with a surface area $S=2.0\text{ cm}^2$, separated by a distance $L=1.5\text{ cm}$, and subjected to a continuous voltage $U=1.2\text{ V}$. The cell is immersed in an ionic solution, and the current passing through the cell is measured as $I=7.0\text{ mA}$

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