University of Batna2
Faculty of Medicine
Pharmacy Department
Module of Pharmaceutical Physics

Exercise N°1:

Determine the osmolarity of plasma in aqueous solution knowing that the lowering of the freezing point is *0.56°C*. (K_f for water is 1.86 $°C.osmol^{-1}.kg$).

Exercise N°2:

Calculate the freezing point of a solution obtained by adding to *1l* of water:

- 100 $g\ of\ proteins$ $\begin{cases} 30\ g\ globulin & M = 300000\ g/mol \\ 70\ g\ albumin & M = 70000\ g/mol \end{cases}$
- 0.6 $g\ \ of\ urea\ \ M = 60\ g/mol$
- 5.85 $g\ \ NaCl\ \ \ M = 58.5\ g/mol$
- 1.42 $g\ \ Na_2SO_4\ \ \ M = 142\ g/mol$

$$K_f\ for\ water = 1.86\ °C.osmol^{-1}.kg$$

Exercise N°3:

An electrolyte AB_2 partially dissociates in water, the lowering of the freezing point of a decimolar solution of this electrolyte is *-0.36°C*.

- What is the degree of dissociation of this solution?
- What is the equilibrium constant of this electrolyte?

Exercise N°4:

An organic liquid contains by mass *55.8% C*, *7% H* and *37.2 % O*. *10 g* of this compound are dissolved in *100 g* of water. The obtained non-electrolyzable solution has a lower freezing point of *2.16°C*. What is the molecular formula of the compound?

Exercise N°5:

At a temperature of *25°C*, a tank containing *1l* of pure water in equilibrium with its saturated vapor has a pressure of *3.13 atm*. A divalent sodium proteinate RNa_2 with an unknown mass *x* and a degree of dissociation of α*=0.2* is dissolved in solution. The freezing point has decreased by *9.4°C*.

Determine: the solution's molarity, osmolarity and saturation pressure.

Exercise N°6:

An aqueous $CaCl_2$ solution has a vapor pressure of *81.6 mmHg* at *50 °C*. The vapor pressure of pure water at this temperature is *92.6 mmHg*. What is the concentration of $CaCl_2$ in mass percent? (Assume complete dissociation of the solute).

Exercise N°7:

Calculate the osmotic pressure of an aqueous solution at *27°C* containing *11.7 g NaCl* in *500 ml* of water when it is opposed to a mass of pure water through a semipermeable membrane (we assume the salt totally dissociable in water).

Given *R=0.082 (atmosphere.l)/(mol.K)*

Exercise N°8:

The cell membrane of red blood cells is considered for a fairly short time as impermeable to *NaCl* and glucose, while it is permeable to urea.

Knowing that the intracellular osmolarity of the red blood cell is *310 mosmol/l*, what can be predicted if red blood cells are immersed in each of the following 7 aqueous solutions?

NaCl	glucose	urea
A *9.1 g /l* C *7.3 g/l* E *11.7 g/l*	B *55.8 g /l* D *45 g/l* F *72 g/l*	G *18.6 g/l*

We recall that

$$\left.\begin{matrix} iso-osmolar \\ and\ \ semipermeable\ membrane \end{matrix}\right\} \Leftrightarrow iso-osmotic = same\ osmotic\ pressure$$

$$\left.\begin{matrix} same\ osmotic\ pressure \\ and\ any\ membrane \end{matrix}\right\} \Leftrightarrow isotonic$$

Exercise N°9:

Calculate the vapor pressure lowering, ΔP, when *10.0 mL* of glycerol ($C_3H_8O_3$) is added to *500 mL* of water at *50°C*. At this temperature, the vapor pressure of pure water is *92.5* Torr and its density is *0.988 g/mL*. The density of glycerol is *1.26 g/mL*.