Ch12: physical properties of solution

Solution:1.solvent (مذيب)
2.solute(مذاب)

1. Molarity (M)

M=mole Solute/Volume Solution Mole = mass / molar mass
2M HCl = 2moleHCl/1L solution
11M HCl= 11moleHCl/1L solution

2. Molality (m)
m =mole of solute/ Mass Solvent. Mass Solvent = Kg
0.1m HCl = 0.1 mole HCl/1Kg Solvent

3. Mole Factor (X) (الكسر المولي)
A + B in Solution (A=2mole, B=5mole)
XA =mole A/ moleA+moleB
XA=2/2+5 =2/7
XB= 5/2+5=5/7
XA+XB=1

Physical properties of solution:
(Depend on mole of Solute)

1. Elevation for Boling points
△T =Kb*m
△T= T solution-T solvent pure
Kb= (معطى) ثابت. Mole=mass / molar mass
m= molality (m =mole of solute/ Mass Solvent)

Boiling Point of solution always Higher than pure solvent

2. Depression in freezing point:
△Tf = -Kf*m
△Tf= T solution- T solvent pure

Kf= ثابت

Freezing Point of solution always Lower than pure solvent

3. Depression in vapor solutions

Raoul's low. 1atm =760 torr=760 Hgmm

Vapor pressure of solution, P sol, equals product of mole fraction of solvent(X solvent)and its vapor pressure when pure (P solvent)

PA= XA*$\overset{\circ}{P}$A

PA= vapor pressure solution

XA= mole solvent/ mole solute + mole solute= mole fraction of the solvent

$\overset{\circ}{P}$A= vapur pressure solvent pure

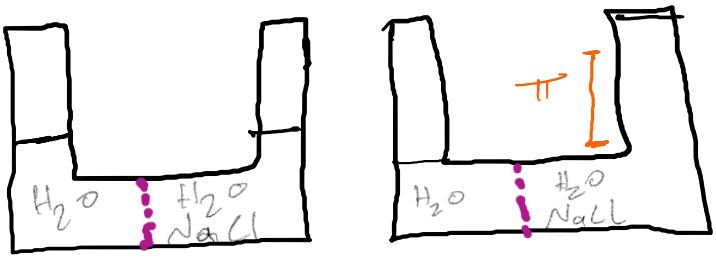
ΔP=X (solute)*P°(Solvent)

↳ $P^{\circ}_{Solvent} - P_{solution}$

P=change of Vapor pressure solvent

4. Osmatic pressure: الضغط الاسموزي

Osmotic Membrane: Semipermeable membrane that lets only solvent molecules through



الخاصية الاسموزية: انتقال الماء من التركيز الأقل للمواد الذائبه للتركيز الأعلى من المواد الذائبه

PV=nRT T=C+273 (كلڤن)

R=0.0821 atm*L / mol*K

~~π~~V=nRT ~~π~~=MRT M= n/ V

1. Isotonic solution

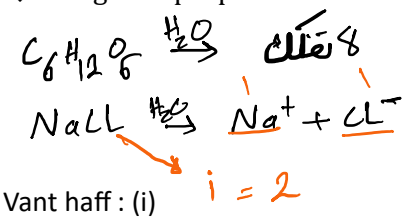
2. Hypotonic solution.

Shrink and dehydrate.

3. Hyprtonic solution.

Swelling and burst.

Colligative properties for electrolyte solution



Vant haff : (i)

Van't haff factore is equivalent to percent ionization

FeCl3 =4i. MgCl2=3i. HCl=2i
C6H12O6 = i. NaOH=2i. NaNO3=2i
MgSO4=2i

(OH,NO3,SO4,NH4,Cl) =1i

Ion pairing (تزاوج الايونات)

i (expected). i(experimantel)
i=2. i=1.9

Why i experimantel less than i expected ?

Because of Ion pairing

1. Elevation for boiling points:

$\Delta T = i\ Kb * m$

2. Depression in freezing points:

$\Delta T = -\ i\ Kf * m$

3. Depression in vapor pressure :

$PA = XA * P^{\circ}A$

$$\text{mole solvent} \over \text{mole solvent} + (i)\ \text{mole solute}$$

4. Osmatic pressure:

$\pi V = i\ nRT.$

Ion pairing. طردية *Physical properties of solution*

(س)Which one of the following solution have hair osmatic pressure:

A. 0.2 molar NaCl
B. 0.2 molar. $C_6H_{12}O_6$
C. 0.2 molar. $FeCl_3$
D. 0.2 molar. Na_2SO_4

◈ Permeable membrane that lets only solvent molecules through is Osmotic Membrane ?

False

Calculate the boiling piont (c) of solution by dissolving 30 g of sucrose have 0.088 mole in 200 g of H_2O (Kb=0.51) (TB.p H_2O= 100) ?

جواب : 100.21

Calculate the boiling piont (c) of solution by dissolving 56 g of sucrose ($C_{12}H_{22}O_{12}$)have in 300 g of H_2O (Kb=0.47) (TB.p H_2O= 100) (Mm $C_{12}H_{22}O_{12}$ =342)?

جواب : 100.26

What mass of ethylene gly (anti freezing) (Mm HCOCH2OH = 62.1) add to 12 Kg H2O to produce solution that freezss at(-33.5 C)? (Kf=1.95) (Tf H2O=0)

الجواب : 12802.2 gram

Ex-solution was made by mixing 20g ethanol (Mm= 46) with 100g H2O(MM=18), calculate the vaper pressure of this solution of 70 C (vapor pressure of pure water at 70 C =233.7 torr) ?

جواب : 216.73 torr
0.285 atm

calculate the mass of C3H8O2, that must be add too 0,5Kg H2O to decrease the vapor pressure of H2O 4.6 torr at 40 C (P H2O=55.3 torr) (Mm C=12, O=16, H=1)?

الجواب : 191.5 g

Calculate Molar mass of protein mass=1*10^-3 in 1 ml solution the osmatic pressure =1.12 , T=25 C R= 0.0821 ?

الجواب: 1.66*10^4 g/mol

Predict the vapor pressure of solution produsd by mixing 35g solid Na2SO4 (Mm=172) with 175 g H2O (Mm= 18) at25 C (p^{o} H2O =23.7 torr).

الجواب : 22torr

(س)The osmatic pressure of 0.1 M solution of Fe(NH4)2(SO4)2 at 25 C is 10.8 atm , compare the expected and experimental for (i)

الجواب : expected =5
Experimental = 4.4.

(س)When 2.36g of a nonvolatile salute dissolved in 100g of solvent, the largest change in freezing point will achived When the solvents is :

1.tret-butnol Kf=9.1
2.acetic acid Kf =3.9
3.benzene Kf=5.12
4.All are expected to have the same freezing point

(س)calculate the freezing point of a solution Contaning 20g of KCl and 2200g H2O . (Mm KCl=74.55) The Molal freezing point depression constant (Kp =1.86)

1.+0.23 C
2. -0.23 C
3. -0.45 C
4. -1.23 C
5. +0.45 C

(س)An aqucous solution has normal boiling point 102 C, what is the freezing point of this solution [for water Kb= 0.51 Kf= 1.86]

1. -3.6 C
2. -7.3 C
3. 0.55 C
4. -2.0

(س) When 0.5 g of unkown nonelectrolyte compound is dissolved in 10g of camphor (Kf=40) freezing point of the solution lower than that of pure camphor If T=4.43, calculate the unkown compound Mm?

1.55.4 g/mol
2.0.451 g/mol
3.3.54 g/mol
4.454.5 g/mol

(س)At a given temperature the Vapor pressure of benzene and toluene are 183 mmHg and 59.2 mmHg , calculated the total pressure over a solution of benzene and toluene (X benzene =0.56).

1.102 mmHg
2.242 mmHg
3.121 mmHg
4.129 mmHg

Glycerin, $C_3H_8O_3$, is a nonvolatile nonelectrolyte with a density of 1.26 g/mL at 25 °C. Calculate the change in vapor pressure as 25 °C of a solution made by adding 50.0 mL of glycerin to 500.0 mL of water. The vapor pressure of pure water at 25 °C is 23.8 torr?

الجواب : 23.2

The vapor pressure of 2-methylhexane(Mm=100.17) is 37.986 torr at 15°C. What would be the pressure of the mixture of 78.0 g 2-methylhexaneand 15 g naphthalene (Mm=128.2), which is nearly non-volatile at this temperature?

الجواب : 33torr

Consider a mixture of benzene, C_6H_6, and toluene, C_7H_8, containing 1.0 mol benzene and 2.0 mol toluene. At 20 °C, the vapor pressures of the pure substances are:
P° benzene =75torr P° toluene = 22 torr

الجواب : 40 torr

n-hexane and n-heptane are miscible in a large degree and both volatile. If the vapor pressure of pure hexane is 151.28 mm Hg, and heptane is 45.67 at 25°, which equation can be used to determine the mole fraction of hexane in the mixture if the mixture's vapor pressure is 145.5 mm Hg?

A. X(151.28 mmHg) 145.5 mmHg
B. X(151.28 mmHg) + (X)(45.67 mm Hg) 145.5 mmHg
C. X(151.28 mmHg) + (1-X) (45.67 mm Hg) = 145.5 mm Hg
D. None of these

The vapor pressure of 2-methylheptane (Mm= 114) is 233.95 torr at 55°C. 3-ethylpentane (Mm=100) has a vapor pressure of 207.68 at the same temperature. What would be the pressure of the mixture of 78.0g 2-methylheptane and 15 g 3-ethylpentane?

الجواب : 230 torr

Estimate the freezing point of a permanent type of antifreeze solution made up of 100.0 g ethylene glycol, C2H6O2, (MM = 62.07) and 100.0 g H2O (MM = 18.02)?

الجواب :: - 30 C

When 0.25 g of an unknown organic compound is added to 25.0 g of cyclohexane, the freezing point of cyclohexane is lowered by 1.6 °C. Kf for the solvent is 20.2 °C m^-1. Determine the molar mass of the unknown?

A. 505 g/mol
B. 32 g/mol
C. 315 g/mol
D. 126 g/mol
E. 130 g/mol

A 2.00 g sample of a large biomolecule was dissolved in 15.0 g of CCl4. The boiling point of this solution was determined to be 77.85 °C. Calculate the molar mass of the biomolecule. For CCl4, the Kb = 5.07 b °C/m and BP CCl4 = 76.50 °

الجواب : 497 g/mol

Eye drops must be at the same osmotic pressure as the human eye to prevent water from moving into or out of the eye. A commercial eye drop solution is 0.327 M in electrolyte particles. What is the osmotic pressure in the human eye at 25 °C?

الحواب : 8.00 atm

The osmotic pressure of an aqueous solution of certain protein was measured to determine its molar mass. The solution contained 3.50 mg of protein in sufficient H_2O to form 5.00 mL of solution. The measured osmotic pressure of this solution was 1.54 torr at 25 °C. Calculate the molar mass of the protein?

الجواب: 8.45*10^3 g/mol

A solution of D5W, 5% dextrose (C6H1206) in water is placed into the osmometer shown at right. It has a density of 1.0 g/mL. The surroundings are filled with distilled water. What is the expected osmotic pressure at 25°C?

الجواب : 7 atm

Suppose that your tap water has 250 ppb (ppb 1/1,000,000,000 or 1x10-9) of dissolved H2S, and that its density is about 1.0 g/mLWhat is its osmotic pressure at 25°C? MM: H_2S 34.076

A. 0.00058 atm
B. 0.064 atm
C. 0.059 atm
D.0.00018 atm

In preparing pasta, 2 L of water at 25°C are combined with about 15 g salt (NaCl, MM= 58.44g/mol) and the solution brought to a boil. What is the expected boiling point of the water? (Kb=0.51) (B.b H20=100)

الجواب : T=100.1 C

Suppose you run out of salt. What mass of sugar (C12H22O11, MM=342.30 g/mol) added to 2 L of water would raise the temperature of water by 0.10 °C? (Kb H2O=100)

الجواب : 134 g

(س)Which of the following liquids will have the lowest freezing point?

1.pure H2O

2. aqueous C6H12O6 (1.6m)

3. aqueous KF (0.5m)

4. aqueous C12H22O11(0.60m)

5. aqueous FeI3 (0.24m)