Ch10.

I. Concentration:

	solution (S)	solute (U)	solvent (V)	
M	L	$n_u = \frac{m}{MW_u}$		$M = \frac{n_u}{V_S(L)}$
N		n_u		$N = M * \#_{eq}$
x		n_u		$x_u = \frac{n_u}{n_u+n_v}$, $x_v = \frac{n_v}{n_u+n_v}$
P		m_u		$m\% = \frac{m_u}{m_u+m_v}$
m		n_u	Kg	$m = \frac{n_u}{m_v(Kg)}$

$m_s = m_u + m_v$ $\quad D_s = \frac{m_s}{V_S(L)}$

Concentration conversion: *M*→ assume 1L; *m*→assume 1kg; χ_A→assume 1mole; *m*% → assume 100g

II. Solution formation:

$\Delta H_{solution} = \Delta H_{solute} + \Delta H_{solvent} + \Delta H_{mix}$

$\Delta H_{solution} < 0$, exothermic, heat released, T increase
$\Delta H_{solution} > 0$, endothermic, heat absorbed, T decrease

III. Solubility:
Liquid-liquid solution: Like dissolve like.
Solid-liquid solution: polar solid dissolve in H_2O

Factors affect solubility: Temperature, Pressure
Temperature:
Solid: T increase, Solubility increase
Gas: T increase, Solubility decrease

Pressure:
P increase, S increase,

Henry's Law: $C_g = k_H P_g$
C_g = concentration of dissolved gas
k_H = constant
P_g =partial pressure of gas solute above the solution

IV. Colligative properties:

Vapor pressure lowering: non-volatile solution:

Raoult's Law: $P_{soln} = \chi_{solv} P°_{solv}$
P_{soln} = vapor pressure of **solution**
χ_{solv} = mole fraction of **solvent**
$P°_{solv}$ = vapor pressure of **pure solvent**

volatile solution:

$P_{soln} = \sum \chi_{solv} P°_{solv}$

Boiling point elevation: $\Delta T_b = i K_b m_{solute}$

Freezing point depression: $\Delta T_f = i K_f m_{solute}$

Osmotic pressure: $\Pi = i MRT$

Ch 10

10.I

1. Calculate the molality of an aqueous solution that is 8.1% by mass calcium chloride. You might need to know that the density is 1.20 g/mL. [**0.794**]
2. What is the molality of an aqueous solution containing $FeCl_3$ (MM = 162.2 g/mol) with a mole fraction of $FeCl_3$ of 0.15? [**9.8**]
3. Determine the mass in grams of pentane that must be added to 10 g of benzene to make a 20 m solution. Give your answer to 2 decimal places. [**14.40**]
4. A 5 mass % aqueous solution of nitric acid (HNO_3) has a density of 1.05 g/mL. Calculate the molality of the solution. Give your answer to 2 decimal places. [**0.84**]
5. How many moles of solute particles are present in 50 mL of 3 *M* Na_3PO_4? Because Blackboard Learn is so messed up, then take the LOG (base 10) of your answer and put it in using 2 decimal places!!!! [**-0.22**]

10.II

6. A flask containing solid ammonium chloride becomes colder as water is added and the salt dissolves. Is the magnitude of the lattice energy of NH_4Cl **larger** or smaller than the combined hydration energy of the ions?

10.III

7. Which of the following is more soluble in water, **methanol** or $CCl_2H_{2(l)}$.

10.IV

8. Consider the solutions, 0.04 *m* urea [$(NH_2)_2C=O$)], 0.04 *m* $AgNO_3$ and 0.04 *m* $CaCl_2$. Which has (i) the highest osmotic pressure, (ii) the highest vapor pressure, (iii) the highest boiling point? **[(a) 0.04 *m* $CaCl_2$ (b) 0.04 *m* urea (c) 0.04 *m* $CaCl_2$]**
9. Calculate the boiling point (in degrees C) of a solution made by dissolving 3 g of ethylene glycol (HOC_2H_4OH) in 10 g of water. The K_{bp} of the solvent is 0.512 K/m and the normal boiling point is 373 K. Enter your answer to 2 decimal places. [**102.48**]
10. When 5 g of an unknown non-electrolyte is dissolved in 50.0 g of acetone, the boiling point increased by 2 degrees C. If the K_{bp} of the solvent is 1.71 K/m, calculate the molar mass of the unknown solute.[**85.5**]
11. When 3 grams of a protein were dissolved in 50 mL of solution at 27 degrees C, the osmotic pressure was found to be 800 torr. Calculate the molar mass of the protein. [**1403**]

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