

**UNIVERSITY CEU SAN PABLO
SCHOOL OF PHARMACY
DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY**

ISSUES OF PHYSICAL CHEMISTRY

2018-2019

LESSON 4

- 24.** Use Raoult's law and Dalton's law to demonstrate that in a binary mixture in equilibrium the composition of the more volatile component in the vapour is always richer than the liquid,.
- 25.** Indicate, justifying the answer, whether each of the following equations can be applied to any solution, ideal solutions, ideal dilute solutions or to the last two simultaneously:
- a) $G = \sum_i n_i \mu_i$
 - b) $\mu_i = \mu_i^* + RT \ln x_i$
 - c) $\mu_i = \mu_i^\circ + RT \ln x_i$
- 26.** Indicate, justifying your answer, and using the appropriate equations, whether the following statements are true or false:
- a) μ_i depends on the choice of the normal state.
 - b) μ_i° depends on the choice of the normal state.
 - c) γ_i is always greater than zero and approaches unity when the mole fraction of the component approaches 1.
- 27.** Justify whether the following statements are true or false:
- a) The solute-solute interactions are negligible in an ideal dilute solution.
 - b) The standard state of an ideal dilute solution is the one of the solution at the ideally
- 28.** Indicate the units of the following magnitudes and also the variables that depend on:
- a) μ° of an ideal gas.
 - b) μ° of an ideal dilute solution.

29. Indicate whether the following statements are true or false and justify the answers:

- a) When there is equilibrium between the solution and its vapour, μ of the solution should be equal to μ of the vapour
- b) When there is equilibrium between an ideal solution and its ideal vapour x_B^L must be equal to x_B^V

30. Indicate which of the following quantities can never be negative:

- a) γ_{\pm}
- b) $\log \gamma_{\pm}$
- c) I_m

Justify the answer.

31. Three solutions of NaBr, CuSO₄ and K₂SO₄, have the same ionic strength (I_m), are in the same solvent and at the same temperature:

- a) Order order of the value of γ_{\pm} from highest to lowest.
- b) Which experimental plot of $\log \gamma_{\pm}$ versus $\sqrt{I_m}$ will be closer to the one predicted by Debye-Huckel's law ?

Justify the answers.

32. What should be the molality of a solution of CuSO₄ in order to have the same value of the mean ionic activity coefficient of a 0.01 molal-KCl solution?

Data: $A = 0.509$

33. Indicate the differences and similarities of the plots of the natural logarithm of the mean ionic activity coefficient versus the square root of the ionic strength of dilute aqueous solutions of: RbI SrSO₄, Li₂CO₃ and CaCl₂.

34. Indicate and justify the answers to the following questions for an electrolyte solution that fulfills the law of Debye-Huckel.:

- a) Would γ_{\pm} be greater or less than unity?
- b) Is the solution concentrated or diluted?
- c) Is the electrolyte fully dissociated?
- d) Will the osmotic pressure of the solution be greater or lower than the one expected for no dissociation?