

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

**PROBLEMS OF PHYSICAL CHEMISTRY**

2018-2019

**LESSON 6**

16. When 1 g of urea,  $\text{CO}(\text{NH}_2)_2$ , is dissolved in 200 g solvent A, the melting point decreases  $0.250^\circ\text{C}$ . When 1.5 g of Y are dissolved in 125 g of the same solvent A, the melting point decreases  $0.200^\circ\text{C}$ . Calculate:

- a) the molecular weight of Y
- b) the molar melting enthalpy of A

**Data:**  $R = 0.082 \text{ l}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 1.987 \text{ cal}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.314 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$   
 $M(\text{A}) = 200 \text{ g}\cdot\text{mol}^{-1}$ ;  $M(\text{urea}) = 60 \text{ g}\cdot\text{mol}^{-1}$ ;  $T_m(\text{A}) = 12^\circ\text{C}$

17. The melting temperatures of solutions 0.1 molal of  $\text{KCl}$ ,  $\text{K}_2\text{SO}_4$  and  $\text{MgSO}_4$  are  $-0.346$ ,  $-0.452$  and  $-0.247^\circ\text{C}$ , respectively. Calculate for each:

- a) the Van't Hoff's coefficient,  $i$
- b) the degree of dissociation,  $\alpha$
- c) the melting temperature of a solution containing the three solutes together, each 0.1 molal

**Data:**  $K_f(\text{H}_2\text{O}) = 1.86 \text{ K}\cdot\text{kg}\cdot\text{mol}^{-1}$

18. The vapour pressure of an aqueous solution of urea,  $\text{CO}(\text{NH}_2)_2$ , at  $100^\circ\text{C}$  is  $743.1 \text{ mmHg}$ . Calculate the osmotic pressure of this solution at  $20^\circ\text{C}$  and its melting temperature.

**Data:**  $R = 0.082 \text{ L}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 1.987 \text{ cal}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.314 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$   
 $P_{\text{solution}} = 1.023 \text{ g}\cdot\text{mL}^{-1}$ ;  $M(\text{H}_2\text{O}) = 18 \text{ g}\cdot\text{mol}^{-1}$ ;  $M(\text{CO}(\text{NH}_2)_2) = 60 \text{ g}\cdot\text{mol}^{-1}$   
 $K_f(\text{H}_2\text{O}) = 1.86 \text{ K}\cdot\text{kg}\cdot\text{mol}^{-1}$

The logo for Cartagena99 features the text 'Cartagena99' in a stylized, blue, serif font. The '99' is significantly larger and more prominent than the 'Cartagena' part. The text is set against a light blue background with a subtle gradient and a soft shadow effect.

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