

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

PROBLEMS OF PHYSICAL CHEMISTRY

2018-2019

LESSON 3

5. Calculate the change in pressure required to reduce the normal freezing temperature by 1 degree for:

a) water

b) a solvent A

Data: $R = 0.082 \text{ l}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 1.987 \text{ cal}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.314 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$

$\Delta\bar{H}_{m,A} = 97.7 \text{ J}\cdot\text{mol}^{-1}$; $\Delta\bar{H}_{m,H_2O} = 79.7 \text{ cal}\cdot\text{g}^{-1}$; $T_{m,A}^{\circ} = 156 \text{ K}$; $M_A = 74.12 \text{ g}\cdot\text{mol}^{-1}$;

$\rho(\text{H}_2\text{O}_{(l)}) = 0.9998 \text{ g}\cdot\text{ml}^{-1}$; $\rho(\text{H}_2\text{O}_{(s)}) = 0.9168 \text{ g}\cdot\text{ml}^{-1}$; $\rho(A_{(l)}) = 0.715 \text{ g}\cdot\text{ml}^{-1}$;

$\rho(A_{(s)}) = 0.820 \text{ g}\cdot\text{ml}^{-1}$

6. The vapour pressures of solid and liquid HCN can be expressed by the following equations:

$$\text{Solid: } \log_{10} P(\text{mmHg}) = 9.339 - \frac{1865}{T}(\text{K})$$

$$\text{Liquid: } \log_{10} P(\text{mmHg}) = 7.745 - \frac{1453}{T}(\text{K})$$

Determine:

a) the normal boiling point and the triple point

b) the sublimation, vaporization and melting heat of HCN

Data: $R = 0.082 \text{ l}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 1.987 \text{ cal}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.314 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$

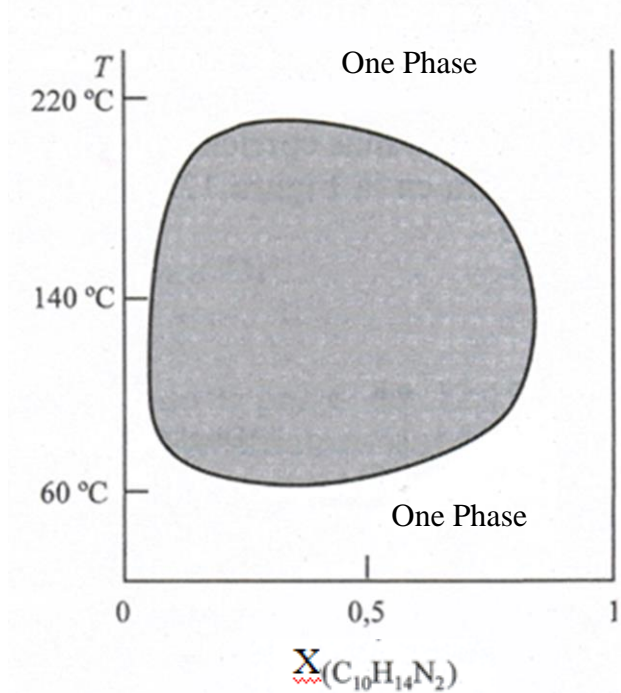
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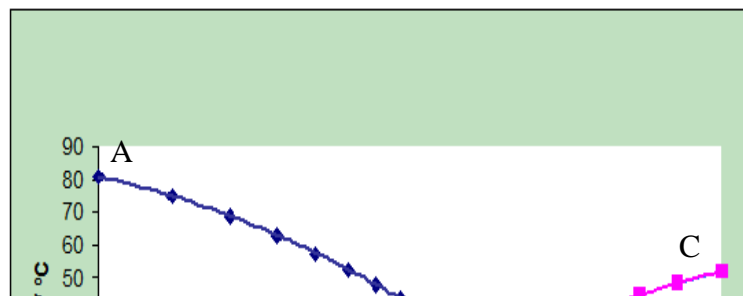
the masses of water and nicotine change if temperature is raised to 140 ° C? And if pressure is changed?

Data: $M(\text{C}_{10}\text{H}_{14}\text{N}_2) = 162 \text{ g}\cdot\text{mol}^{-1}$; $M(\text{H}_2\text{O}) = 18 \text{ g}\cdot\text{mol}^{-1}$



9.- According to the following phase diagram, obtained for naphthalene and p-nitrotoluene, indicate:

- The melting temperature of the two pure solids.
- What represent the AB and BC curves and the B point?
- What is the temperature when naphthalene starts to freeze in the cooling process of a mixture with $x_{\text{p-nitrotoluene}} = 0.20$?
- If the same solution is cooled to 40 °C, what phases are present? What are their compositions? What is the relative amount?



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