CHEM-C1230 Principles of Physical Chemistry 2021

Some questions in the exercises of chapters 8 + 9

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- I cover some questions that don’t have hints on Pearson.
- Other questions have some hints on Pearson. You will not be penalized for using hints.
- Feel free to ask me via Slack or email (han.le@aalto.fi)

Chapter 8

- **Question 1. Storing Ammonia**
- Other parts: check the hints on Pearson if needed.

- Part D. Sublimation is the conversion between the solid and the gaseous phases of matter.

- Part E
- Melting: substance changes from the solid phase to the liquid phase.

- Part F. The line between which two points would describe the process of complete melting of ammonia?
- It’s the line between 2 points that are not on the coexistence curve solid-liquid.

Chapter 8

- **Question 4. Thermo - Problem 8.38**
- Part A: triple point temperature of argon
- $T_{tp} = \frac{c(a_s - a_l)}{b_s - b_l} = ?\, K$

- Part B: triple point pressure of argon
- $P_{tp} = 10^{\left(b_s - \frac{c \cdot a_s}{T_{tp}}\right)} = ?$ Torr

Chapter 8

- **Question 4. Thermo - Problem 8.38**
- Part C: estimate the enthalpy of vaporization of argon.

$$\Delta_{\text{vap}}H = -\frac{R\ln\frac{P_f}{P_i}}{\left(\frac{1}{T_f}-\frac{1}{T_i}\right)}$$

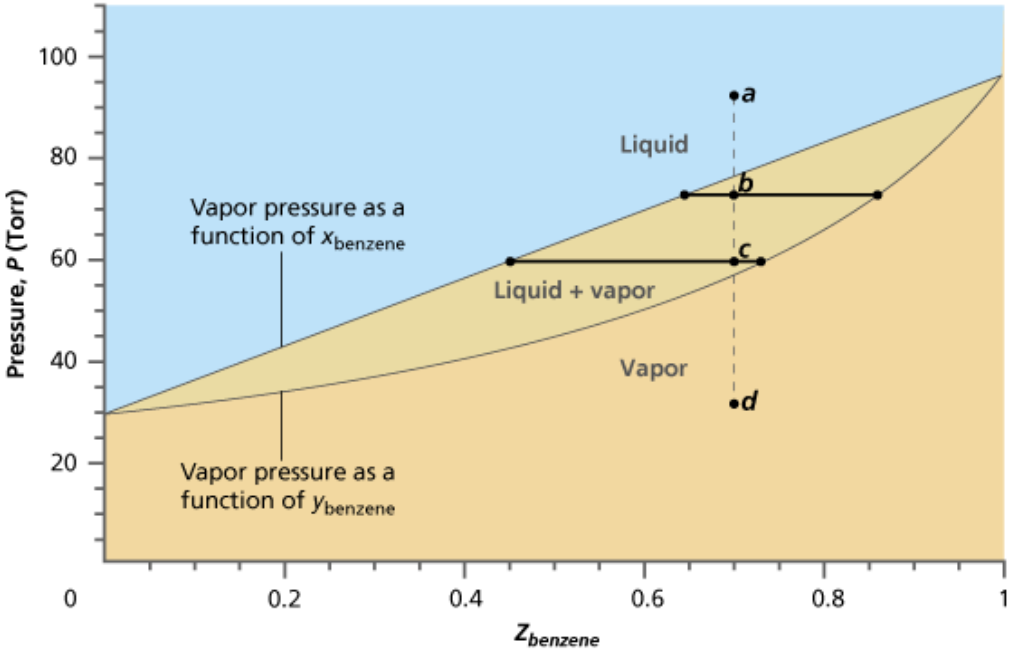
- $So\ \Delta_{vap}H = \ln(10)\,Rc_{liquid}\cdot a_{liquid}$

Chapter 8

- **Question 4. Thermo - Problem 8.38**
- Part D: estimate the enthalpy of sublimation of argon.
- Quite similar to part C
- $\Delta_{sub}H = \ln(10)\, Rc_{solid} \cdot a_{solid}$

Chapter 9

- **Question 3. Thermo - Problem 9.5**
- Part A
- You can revise chapter 9.3. The picture is below is an example about benzen from the book, chapter 9.3.



Chapter 9

- **Question 3. Problem 9.5**
- **Part B**
- Hints from the book, chapter 9.3
- What is Z_A at min/max pressure?
- Determine P_{min} from equation 9.12 (book chapter 9.3):
- $P_{tot} = \frac{P_A^* \cdot P_B^*}{P_A^* + (P_B^* - P_A^*) \cdot y_A}$
- $Z_B = 1 - Z_A$. Determine P_{max}

In the region labeled *Liquid* in Figure 9.4, the system consists entirely of a liquid phase and $Z_{benzene} = x_{benzene}$. In the region labeled *Vapor*, the system consists entirely of a gaseous phase and $Z_{benzene} = y_{benzene}$. The area separating the single-phase liquid and vapor regions corresponds to the two-phase liquid–vapor coexistence region.

Figure 9.4 A pressure–composition phase diagram for a benzene–toluene ideal solution.

Z is the average composition of a component of interest, in this case benzene. The upper curve shows the vapor pressure as a function of $x_{benzene}$. The lower curve shows the vapor pressure as a function of $y_{benzene}$. Above the two curves, the system is totally in the liquid phase, whereas below the two curves, the system is totally in the vapor phase. The elongate-shaped area between the two curves is the liquid–vapor coexistence region. The horizontal lines connecting the curves are tie lines.