Lecture General Chemistry
Winter Term 2023/24

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- Website (Slides, Excercises):
- http://www.chemie.uni-siegen.de/pc/lehre/nanoscitec/

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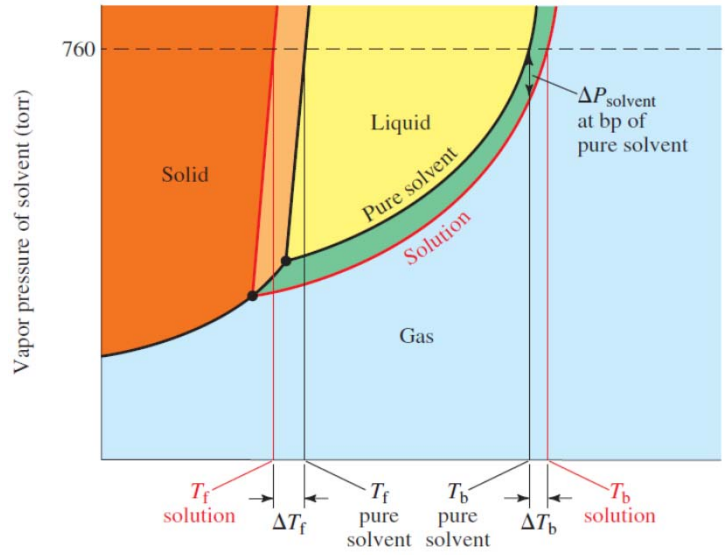
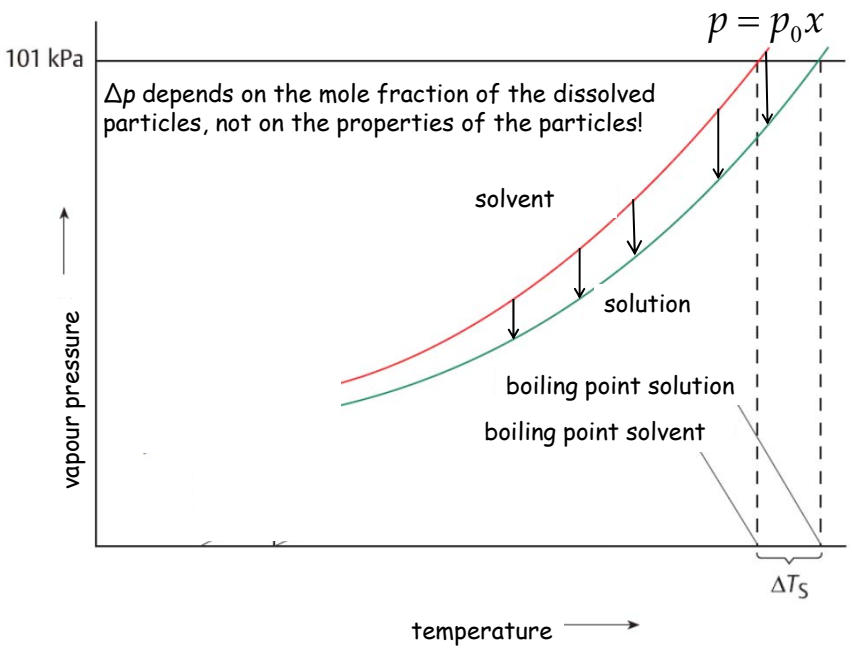
boiling and freezing temperature of solutions

- solution: solvent with solute
- different properties than pure solvent
- boiling point: temperature, where $p_{solvent}$ = 1,013 bar
- Raoult's law: $p_{solution} < p_{solvent}$
- boiling points of solutions are higher!

Change of boiling and freezing temperature





- Boiling point elevation

$$\Delta T_S = K_B \bar{m}$$

- K_B : Ebullioskopic constant
- $\bar{m}$: Molality (mol/kg)
- Dissociation: more particles!

Solvent	bp (pure)	K_b (°C/*m*)
water	100*	0.512
benzene	80.1	2.53
acetic acid	118.1	3.07
nitrobenzene	210.9	5.24
phenol	182	3.56
camphor	207.4	5.61

- Freezing point depression $\Delta T_F = K_F \bar{m}$
  - K_F: Kryoskopic constant

(d: dissolved, s: solvent)

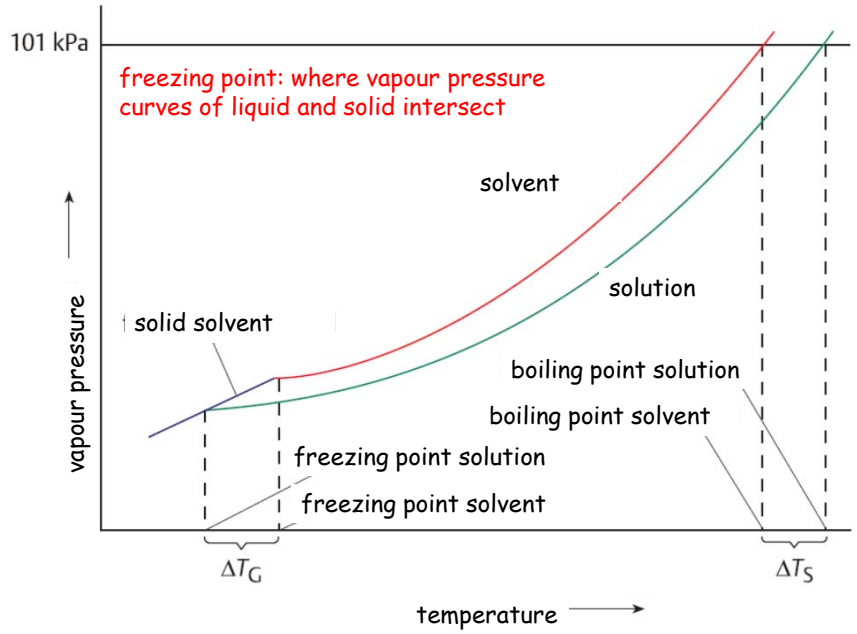
$$\Delta T_F = K_F \bar{m} = K_F \frac{n_d}{m_s} = K_F \frac{m_d}{M_d m_s}$$

$$M_d = \frac{K_F m_d}{\Delta T\, m_s}$$

Solvent	fp (pure)	K_f (°C/*m*)
water	0*	1.86
benzene	5.5	5.12
acetic acid	16.6	3.90
nitrobenzene	5.7	7.00
phenol	43	7.40
camphor	178.4	40.0

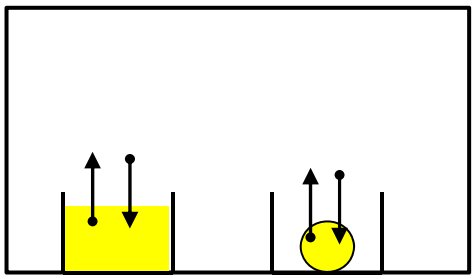
Properties of solutions

- Solubility of solids
- Solubility of gases
- Vapor pressure of solutions
- distillation
- boiling point elevation
- freezing point depression
- Stability condition of phases
- Acids and bases
- Redox-Reactions in solutions



Stability of Phases

thought experiment:



Liquid and solid are in equilibrium with gas phase

after some time the phase with higher vapour pressure is gone

the phase with lower vapour pressure is more stable