Equilibrium partitioning of organic compounds

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Axel's dilemma

Hello Kai,

I have the following problem that I cannot find a satisfying answer for, so I thought I'd ask you:

It is about Dalton's and Raoult's Law. Dalton's Law says that the total pressure is the sum of the individual partial pressures of all gases in a mixture. That is: gases behave independent from each other. Now I have considered the following hypothetical experiment: one has several volatile organic liquids at 25°C: e.g. dichloromethane with a saturation vapor pressure of 50 000 Pa and similar solvents.

Scenario 1: there is a closed vessel at 25°C with some liquid dichloromethane and no other compound. When equilibrium between the gas phase and the liquid phase is established, then the total pressure in the gas phase is identical to the partial pressure of dichloromethane, i.e. 50 000 Pa.

Scenario 2: there is a closed vessel at 25°C with 5 different liquids in 5 separate dishes. Each liquid possesses a saturation vapor pressure of 50 000 Pa. In this case, the total pressure should be 250 000 Pa. This seems extremely high and I cannot imagine that this is correct?

In Scenario 3 it gets even worse. What happens if I mix all 5 solvents from Scenario 2 within one vessel?

Can you help me out of this dilemma? Where do my thoughts go wrong?

Regards,

Axel





Equilibrium_66