Chemical potential in focus – Osmosis and more

The benefit of chemical thermodynamics is beyond question but the field is reputed to be difficult to learn. One of its most important fundamental quantities, the *chemical potential* μ, commonly defined as the partial derivative of a quantity which involves energy and entropy, seems especially hard to grasp. As a simpler and faster way to introduce this quantity to first-year students and even pupils we propose to characterize it by a set of typical and easily observable properties, i.e. by designing a kind of “wanted poster" for μ. This phenomenological description may be supported by a direct measuring procedure, a method normally used for the quantification of basic concepts such as length, time or mass. The proposed approach can be used in school starting already with the first chemistry lessons, and it immediately leads to practical results. After a short introduction into the topic, the focus of the presentation will lie on the description of the flow of substances and its consequences such as osmosis, vapor-pressure lowering and freezing-point depression by means of the chemical potential μ. These types of transformations are found everywhere, in households and the environment as well as in nature and in engineering. For example, it is known from everyday life that juice is drawn out of sugared strawberries or that cherries swell up and burst after a long rain. Additionally, illustrative but nevertheless easily and safely realisable experiments are carried out such as demonstrating osmotic pressure by constructing an „osmometer“ by use of a carrot. This improves the understanding of such processes and forges links between textbook knowledge and everyday experiences.

Reference

G. Job, R. Rüffler, Physical Chemistry – an Introduction with New Concept and Numerous Experiments, Vieweg+Teubner,Wiesbaden, 2010 ((in German; English edition in preparation, partly already published on the webpage www.job-foundation.org)