Applying Chemical Potential—
Mixtures in Focus

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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 an understanding of this quantity we propose to introduce it as a basic concept in analogy to quantities such as length, mass etc. [1,2]. After characterizing μ by a set of typical and easily observable properties, this phenomenological description may be supported by a direct measuring procedure. The proposed approach is elementary, does not require any special previous knowledge, and leads immediately to results that can be utilized practically.

After a short introduction into the topic, the focus of the presentation will lie on the description of the thermodynamical behavior of mixtures. Not only in chemical thermodynamics but also in everyday life we are permanently confronted with mixtures be they homogeneous or heterogeneous. For an adequate quantitative description, the concept of chemical potential has to be extended on substances in real solutions by introducing an extra potential $\overset{+}{\mu}$. If one has the discussion of mixing processes in mind, it is useful to assign an average chemical potential to a mixture made up of two components A and B (with the mole fractions x_A and x_B), as is done for pure substances. Depending on whether the resulting mixture is homogeneous or heterogeneous the concentration dependence of this average potential is different. On this basis, concepts such as miscibility gap and lever rule are discussed.

Illustrative but nevertheless easily and safely realizable demonstration experiments arouse the students' interest, help to strengthen the understanding and forge links with everyday experience. Therefore, selected experiments will be proposed during the oral presentation.

References

[1] G. Job, R. Rüffler, Physical Chemistry from a Different Angle—an Introduction with New Concept and Numerous Experiments, Springer: Heidelberg, New York, expected publication 2014.

[2] G. Job, Proc. Taormina Conf. on Thermodynamics, Classe I di Scienze Fis. Mat. e Nat. Vol. LXX —Suppl. N. 1, 1992, 385-409.