Measuring with zero measurement uncertainty a primitive quantity

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Dear Sirs,

The new version of the International vocabulary of metrology (hereafter VIM) [1], in Note 2 of the entry 2.1, points out that the concept ‘measurement’ includes counting of entities. This fact, although obvious for some authors [2, 3], has a great importance for present and future wording of texts dealing with metrology, pure, or applied.

It has been common in books and articles on analytical chemistry, clinical laboratory sciences, or any other science in which measurements are necessary (probably all sciences) to state that all measuring systems, and consequently all measurements, produce metrological errors, at least random ones. However, after accepting that a count is a measurement, the above statement should be appropriately applied.

Thus, when an individual quantity having the kind-of-quantity ‘number of entities’ is measured and the measurements (the counting) are performed by visual inspection of the entire system (not using a sample of it), the measurement uncertainty is zero (example: the measurement result of the number of fingers of a particular human hand is 5). Such a clarification in articles or books may be helping in the international process of harmonization of metrological concepts.

Under another very different point of view, the explicit acceptance that the concept ‘measurement’ includes counting of entities as mentioned above can lead to some conceptual changes. In the current version of VIM, it is stated (in Note 3 of the entry 1.4) that “number of

entities”—which is the main quantity related to the counting process—“can be regarded as a base quantity in any system of quantities”. However, as the VIM definition of ‘base quantity’ is “quantity in a conventionally chosen subset of a given system of quantities, where no subset quantity can be expressed in terms of the others”, if ‘number of entities’ were regarded as a base quantity in the International System of Quantities, the currently base quantity ‘amount-of-substance’—number of elementary entities [atoms or molecules] divided by the Avogadro constant [4]—would be a derived quantity.

Perhaps it could be convenient to consider ‘number of entities’ as a ‘primitive quantity’, which could be defined as “quantity that expresses the number of objects of a given kind in a system, independently of the system of quantities taken into account”.

References

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