Report of the ad-hoc Working Group on the mole to the 30th CCQM meeting

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1 Activities during the last year

1.1 Membership

As agreed at the 29th CCQM meeting, the membership of the ad hoc WG mole has been refreshed, with each CCQM WG nominating one of its members to join the CCQM-ah-WG-mole. The new membership can be found here: https://www.bipm.org/en/committees/cc/ccqm/wg/ccqm-ah-wg-mole/members.

1.2 Terms of Reference

The first task of the new membership was to update the terms of reference of the CCQM-ah-WG-mole. These were previously out of date since they related exclusively to activities prior to the 2019 redefinition of the mole. The WG have now updated these to better reflect current priorities and future activities of the WG. The agreed new terms of reference are:

- To review and update, as required, the mise-en-pratique for the definition of the mole;
- To provide advice to the CCQM about the mole, and units for chemistry and biology, their overall consistency and harmonisation;
- To provide information and advice on the mole, and units for chemistry and biology, to a wide range of stakeholders.

1.3 Review of mise-en-pratique for the definition of the mole in the SI

The major activity of the CCQM-ah-WG-mole during the last year has been to review the *mise-en-pratique* (MeP) for the definition of the mole in the SI. This was last updated in May 2019 immediately after the major revision of the SI. The Chair, with the assistance of Richard Davis (ex-BIPM), made an initial proposal for an updated MeP, which the WG was asked to comment on. The draft was then updated according to the comments received. This updated version was then approved by the WG, and subsequently by the SPWG. It is now presented to the 30th CCQM meeting for final approval. Significant changes to the MeP have included:

- An update to nomenclature to align with the recent version 3.01 of the 9th Edition of the SI brochure, notably updating ‘entities’ to ‘elementary entities’ where appropriate;
- Resolving some confusion in the text between Avogadro constant and Avogadro number;
- Clarifying that the silicon sphere experiment provides the practical realisation of the definition of the mole with the smallest uncertainty in macroscopic samples. (Microscopic samples comprising just a few atoms or molecules could theoretically be realised with a lower uncertainty);
- Providing more technical detail in the section on electrolysis;

- Updating the value of the dalton following the publication of the 2022 CODATA Recommended Values of the Fundamental Physical Constants. It has been noted in the revised MeP that this results from a significant change in the 2022 CODATA recommended value of the fine-structure constant, α, since the dalton is proportional to $1/\alpha^2$. There is no suggestion that the value of the physical constant α is changing, only that new experimental data and theoretical calculations needed for its accurate measurement have been published and must be taken into account.

1.4 Update of the SI Brochure

In August 2024 the BIPM published version 3.01 of the 9th edition of the SI Brochure incorporating several improvements to the description of units for angles and of quantities with the unit one, the latter being relevant to the update to the MeP (see section 1.3). A likely future version 3.02 of the 9th edition of the SI Brochure will include the updated value of the dalton as described above.

1.5 Task Group on Terms, Quantities and Units for Bioanalytical Measurement (TG-TQUB)

This task group has been initiated and is chaired by Prof. Jim Huggett (LGC). It has recruited task group members from each bioanalysis working group and has met to agree its Terms of Reference:

- Consult with the wider stakeholder community to identify key units and quantities relevant to CCQM that are commonly used in bioanalysis;
- Review the literature to identify the variety of terms employed to represent these units and quantities;
- Produce a document, in the format of an ISO 80000 standard, proposing harmonisation of this usage, including guidelines for application to CCQM outputs;
- Engage with ISO/TC12 (Quantities and units) on a NWI to formalise this document as part of the ISO 80000 series of standards.

The TG has recently recruited external stakeholder members for the task group, based on input and recommendations from each bioanalysis working group. It is now proceeding with the wider stakeholder consultation phase and literature review exercise, with the aim to complete this by September 2025.

2 Activities in the coming year

2.1 Task Group on Terms, Quantities and Units for Bioanalytical Measurement (TG-TQUB)

The task group will continue its work, completing its review of relevant literature and consultation with stakeholders. It will then begin to draft a document proposing harmonisation of usage, including guidelines for application to CCQM outputs.

2.2 Dialogue with IUPAC

The Chair will continue to liaise with IUPAC to expedite the process of updating the IUPAC Gold Book entry for ‘elementary entity’ that, it is agreed, should match the definition in the SI Brochure.