New SI status *Carmen Giunta, July 27, 2018*

New SI is expected to be adopted at 26th meeting of General Conference on Weights and Measures (Conférence Générale des Poids et Mesures, CGPM), Nov. 2018. The wording to be voted on at that meeting is Draft Resolution A (https://www.bipm.org/utils/en/pdf/CGPM/Draft-Resolution-A-EN.pdf). This revision, commonly known as the "New SI" will include redefinition of four SI base units—kilogram, ampere, kelvin and mole—based on fixed numerical values of the Planck constant (h), elementary charge (e), Boltzmann constant (k_B), and Avogadro constant (N_A), respectively. All seven base units of the SI will also be given explicit-constant formulations.

In 2013, the Consultative Committee on Mass and Related Quantities (Comité Consultatif pour la Masse, CCM) recommended four conditions be met before redefining the kilogram. At its 2017 meeting, CCM noted that the conditions they had set in 2013 are all met or nearly met. They recommend proceeding in 2018 with kilogram redefinition based on Planck constant. The definition in Draft Resolution A is "The kilogram, symbol kg, is the SI unit of mass. It is defined by taking the fixed numerical value of the Planck constant h to be $6.626\ 070\ 15 \times 10^{-34}$ when expressed in the unit J s, which is equal to kg m^2 s^{-1}, where the metre and the second are defined in terms of c and $\Delta\nu_{Cs}$."

In Nov. 2016, IUPAC executive committee meeting endorsed a definition of the mole as an Avogadro's number of elementary entities: "The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly $6.022\ 140\ 8Y \times 10^{23}$ elementary entities. This number is called the Avogadro number." In April 2017, CCQM [Consultative Committee for Amount of Substance: Metrology in Chemistry and Biology (Comité Consultatif pour la Quantité de Matière)] adapted the IUPAC wording. In Sept. 2017 the CCU (Consultative Committee on Units), formulated that language that is currently in Draft Resolution A: "The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly $6.022\ 140\ 76 \times 10^{23}$ elementary entities. This number is the fixed numerical value of the Avogadro constant, N_A, when expressed in the unit mol^{-1} and is called the Avogadro number. The amount of substance, symbol n, of a system is a measure of the number of specified elementary entities. An elementary entity may be an atom, a molecule, an ion, an electron, any other particle or specified group of particles."

The report of the CCU meeting shows some pushback from some metrologists. What was wrong with the earlier definition that simply defined the mole by setting the value of the Avogadro constant? This definition looks like an explicit-unit definition more than an explicit constant definition. CCQM and especially IUPAC representatives defended the definition, saying that it better reflects chemists' understanding of the unit as well as chemists' desires. IUPAC cited input from its adhering organizations. (Recall that NTS sent its input via the National Academy of Sciences: "The mole contains exactly $6.022\ 141\ 29 \times 10^{23}$ specified entities.")

My editorial comments:

•The New SI set out in Draft Resolution A appears to be a done deal; I expect it will pass.
•NTS concerns about the kilogram got no traction either with BIPM or with IUPAC.
•IUPAC substantially improved the definition of the mole, and those efforts largely follow the NTS position. IUPAC punted on the name "amount of substance" though.