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**GENERAL CONFERENCE ON WEIGHTS AND MEASURES APPROVES POSSIBLE
CHANGES TO THE INTERNATIONAL SYSTEM OF UNITS, INCLUDING
REDEFINITION OF THE KILOGRAM**

23 October 2011 – Sèvres, France

- On Friday, 21 October, at its 24th meeting, the General Conference on Weights and Measures (CGPM) adopted Resolution 1: “On the possible future revision of the International System of Units, the SI”.
- Resolution 1 is now available at http://www.bipm.org/utis/en/pdf/24_CGPM_Resolution_1.pdf. Resolution 1 is succinct and written for specialists.
- Final approval of the New SI with a date for its implementation will be made by the CGPM after its prerequisite conditions have been met, this will not be before 2014.

The SI is the system of measurement units used in most of the world. Its building blocks are seven “base” units: the second, the metre, the kilogram, the ampere, the kelvin, the mole and the candela. The SI has the great advantage that these same units are used in all activities of society which involve measurement: daily life, precision engineering, advanced science, etc.

Sufficient progress has been made in National Metrology Institutes around the world to give serious consideration to updating the present definitions of the kilogram, the ampere, the kelvin and the mole. In particular, the kilogram has received much public attention because its

definition dates from 1889 and it is the last base unit still defined in terms of a manufactured object, the international prototype of the kilogram, which is conserved and used at the International Bureau of Weights and Measures (BIPM) in Sèvres, France. It would be far better, particularly for the scientific community, if the base units were defined in terms of fundamental constants of nature because these constants are invariable over time. Such definitions have been achieved for the definitions of the second and the metre, both of which have been defined for many years through such constants.

Updating the definitions of the four units mentioned above will require care. In making the change, it is a prerequisite that for all the activities of daily life, a kilogram will still be a kilogram; water will still freeze at zero degrees Celsius, etc. That is to say, none of these proposed changes will be noticeable in everyday activities. However, the changes will have immediate impact in the excruciatingly accurate measurements carried out by highly specialized laboratories.

A redefinition of the kilogram first requires highly accurate measurements of a fundamental constant of nature in terms of the mass of the international prototype of the kilogram, currently exactly equal to 1 kilogram. The numerical value of the fundamental constant will then be fixed and the same experiment will later be used to measure the mass of objects including the international prototype. Several facilities throughout the world capable of carrying out such measurements will be needed after the redefinition in order to make practical use of the new kilogram definition.

The target uncertainty for the most accurate of such measurements is 20 microgram per kilogram, which is the same as 20 parts in one thousand million. It is remarkable that at least two

experimental approaches are very close to achieving this goal. One approach uses a special electronic balance – a “watt balance” – in order to measure the kilogram in terms of the Planck constant, which is the fundamental constant of quantum mechanics. A second technique compares one kilogram to the mass of a single atom of the chemical element silicon. Physics tells us that the results of these two seemingly different approaches can be accurately compared with each other and, of course, they should agree. The present situation has been examined by the CODATA Task Group on Fundamental Constants based on work published through the end of 2010. They conclude that [the present uncertainty of the Planck constant](#) from all relevant experimental approaches is the equivalent of 44 microgram per kilogram.

The CGPM will not adopt the proposed new definitions until present difficulties are resolved. However, on Friday 21 October 2011, the General Conference took a historic step towards the revision by adopting Resolution 1 and thereby outlining the proposed New SI as well as the steps required for the final completion of this project. The text of Resolution 1 is that of Draft Resolution A, which had been publicly available for some months on the BIPM “New SI” website, with only minor changes made during the Conference. One of these asks the International Committee for Weights and Measures (CIPM) to continue its work to render the language of the New SI as far as possible understandable for users in general, while maintaining scientific rigour and clarity and without altering the basic content and structure of the New SI as set forth in Resolution 1.

In all, ten resolutions on a host of topics were adopted during the 24th meeting of the CGPM. In due course, these will all be publicly available on the BIPM website at <http://www.bipm.org/en/convention/cgpm/resolutions.html>, where previous resolutions of the CGPM can also be found.

Since 1967, the CGPM has chosen to meet every four years. However, in a break with recent tradition, the 25th meeting of the CGPM will be held in approximately three years' time.

In addition to the text of Resolution 1 adopted at the 24th meeting of the CGPM, the BIPM website on the “New SI” (http://www.bipm.org/en/si/new_si/) includes answers to the following questions:

- Why change the SI?
- When might the proposed changes take place?
- Additional FAQs

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