THE EXACT MASS OF A KILOGRAM: THE NEW KILOGRAM

In 2011, the International Committee for Weights and Measures initiated a process to use Planck's constant to redefine the kilogram in SI units. Scientists across the world were to submit their best measurements of this constant to the Committee by 1st July, 2017.

Four of these measurements were obtained from the Avogadro Project's silicon sphere, and four through the Kibble balance. This helped demonstrate that the Avogadro sphere and the Kibble balance could repeatedly provide reliable and precise measurements of Planck's constant.

An international task force known as the Committee on Data for Science and Technology (CODATA) Task Group on Fundamental Constants (TGFC) used a sophisticated computer programme to derive a fixed value of Planck's constant (h) = $6.626070150 \times 10^{-34}$ kg m^2/s. On 21st October, 2011, the General Conference on Weights and Measures passed a resolution to redefine the kilogram in terms of Planck's constant. This definition came into force on 20th May, 2019 to commemorate the 144th anniversary of the Metre convention.

The Metre convention is a treaty that created the International Bureau of Weights and Measures (BIPM) under the supervision of the International Committee for Weights and Measures. The BIPM works towards harmonising systems of measurement across the globe.

The task of redefining the kilogram is far from over. The measurements used for this task came from sophisticated and expensive instruments under controlled conditions, like a vacuum. Many uses of the kilogram, including those in our everyday lives, require physical mass standards that can be used in air. This means that using the new kilogram to measure out a kilogram of tomatoes will have to wait till we have found a reliable way of transferring Kibble balance measurements to physical mass standards.

For now, the fact that we can relate the kilogram (used for masses at the scale of everyday lives) to Planck's constant (associated with masses at quantum scales) is a remarkable achievement. It means that 1 kg will not only be the same anywhere on earth, but also everywhere in the universe.

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