

Long Live the Kilogram!

On November 16 2018, a field of scientists and diplomats found themselves into an auditorium in Versailles, France. They were there to vote on a treaty. Although Versailles has even associated with treaties in its past, this one was of particular significance. It wasn't a political issue, or a matter of social relevance. This was the 26th meeting of the General Conference on Weights and Measures.

The room was there to decide the fate of one of the scientific community's most resilient comrades - The Platinum-Iridium cylinder that has been defining the kilogram since 1899. "Le Grand K", or, "Big K" as it was fondly known, has been the international standard for the kilogram all this time. Scientists all around the world have been travelling to France to catch a glimpse of this beautiful cylinder, stored in an underground vault in Paris, and calibrate their own country's standards with it.

Even with this rich history, on November 16, 2018 – Big K's reign was dead. Democracy had thwarted our heavy ruler, as the historical vote has now put the cylinder out of business. The scientific community had voted against defining the international unit of mass, the kilogram, on the basis of a physical object (like Big K). The kilogram would now be defined on the basis of a fundamental constant of physics called the Planck's constant. Planck's constant, for all everyday intents and purposes, is just unbelievably small. With 33 zeroes after its decimal point, this infinitesimally tiny number governs the behaviour of light and its constituent photons as they travel to the far reaches of our universe. The changes proposed are said to come in effect from 20 May 2019.

So, before we get into the heavy-handed physics of it all (and why you should care about Big K being taken down at all), let's look at what exactly we're dealing with. Units and Measures. The kilogram is a part of the International System of Units (SI units), or the *Système international (d'unités)*. You're probably familiar with the SI units from a seventh grade science class. The SI Units is the modern form of the metric system and is the internationally agreed upon units used in all scientific fields. The kilogram is part of the seven base units, based on which the other units are defined. The other six base units are metre (length), second (time), ampere (electric current), kelvin (temperature), mole (amount of substance), candela (luminous intensity).

The change in the standard of the kilogram has also prompted redefinitions of the ampere and mole as well – since their definition were dependant on the kilogram, itself. The last time we saw a revision in this system of units was in 1983, when the metre was redefined in terms of the speed of light in vacuum, another invariable physical constant. The metre had been previously defined in terms of a physical object, much like Big K. Temperature and time are also defined based on absolute phenomena. Now, with the redefinition, every one of the seven base units are defined in terms of absolute constants and not physical objects.

It is important to note that the ramifications of this change will be minimal for our everyday lives. Your everyday vegetable vendor's balance and weights aren't going to change, and your diet isn't suddenly going to be deemed irrelevant by your incredible weight fluctuations. The Planck's constant is an incredibly small number, as mentioned before, and only really affects the nitty, gritty workings of the scientific community. The uncertainty and change in a few decimal point digits are not going to be reflected in any major way in real life.

What's more important, and why you should care, is because of what this change signifies. We now have effectively a system that has nothing to do with any physical objects in space. All our understanding of the world is now rooted in absolute constant of nature. Science and our quest for the truth has brought us reach a point where we have transcended the earthly realm to reach further and further to some universal truths.

Small changes like these help crystallise the allure of science. It shows us how far we've come as a species, how we, a relatively young species, are able to look around a universe and make it our own. Mankind has come to the level where it can rationalise the goings on of events happening lots of light years away. What we see with this change is that we are moving towards absolutes and not just using arbitrary cylinders to conduct our experiments.

Rest in Peace, Big K. At least we can be content in the realisation that the kilogram isn't going anywhere anytime soon, cylinder or not.