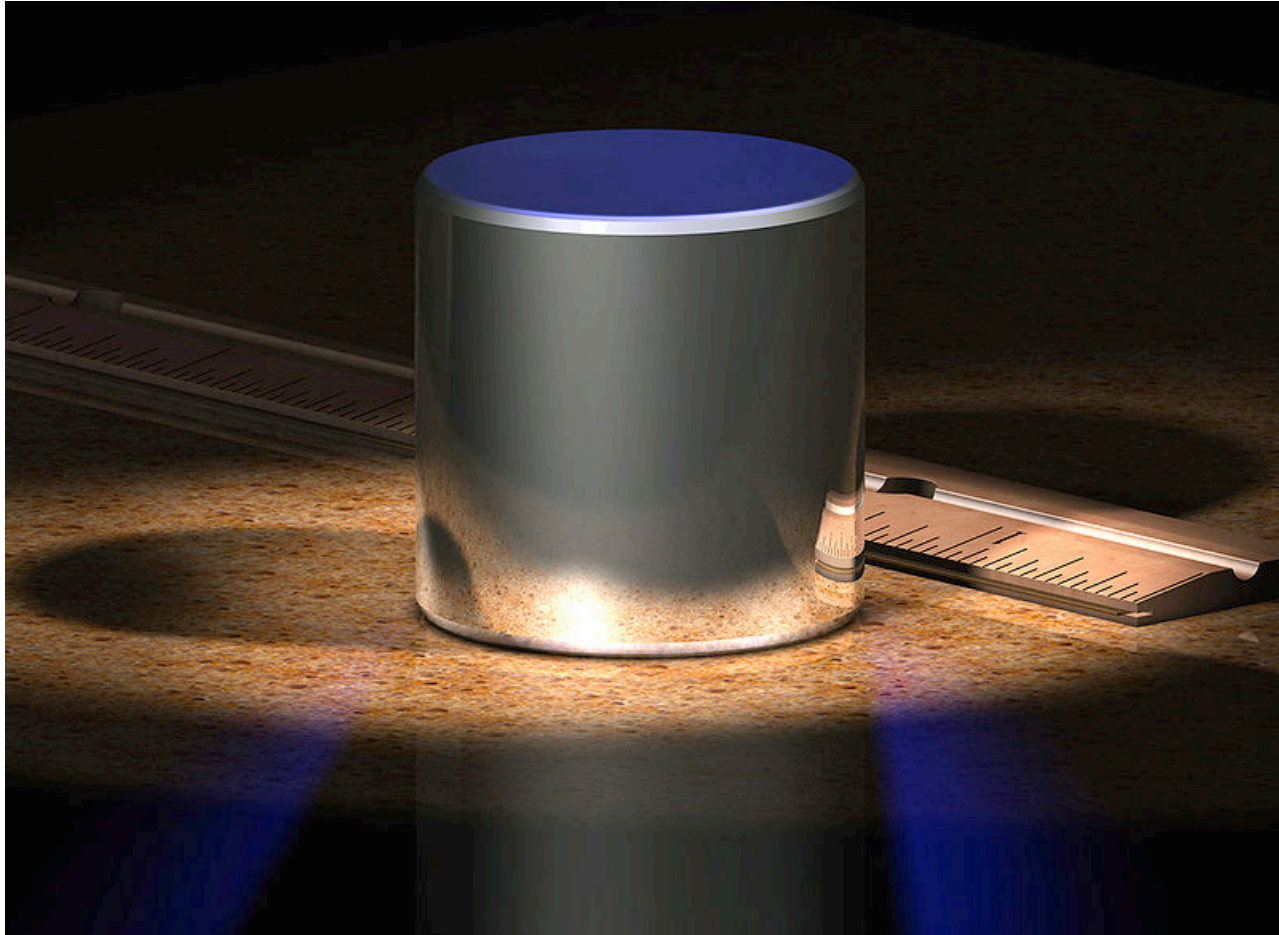
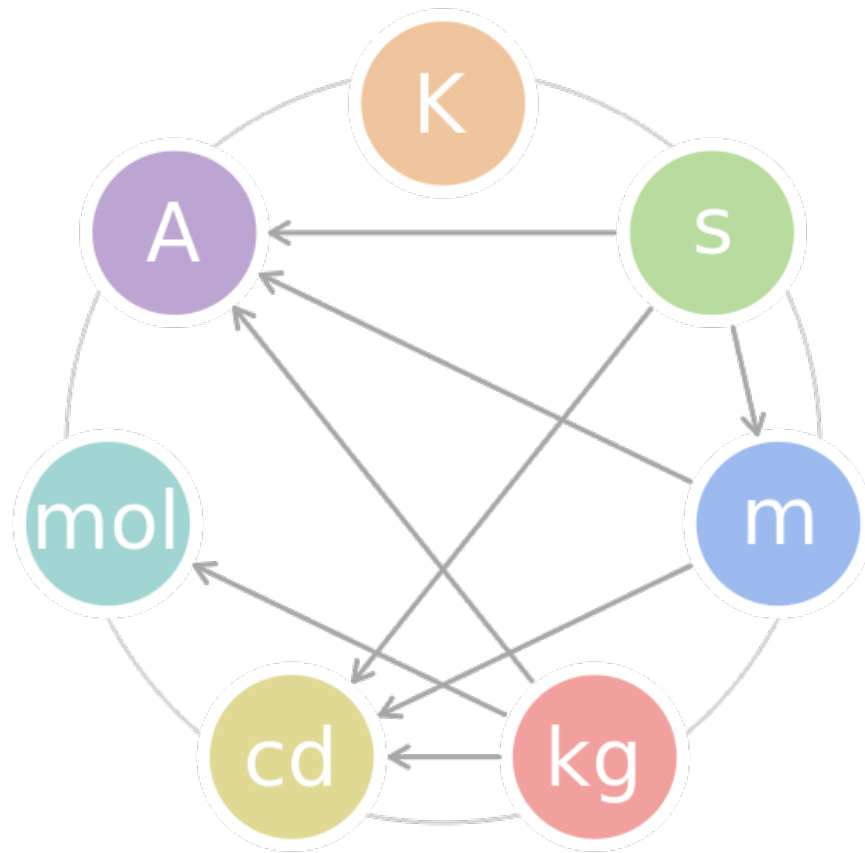


What is a kilogram?



R. Corn
Chem M3LC

The kilogram is a base SI unit.



SI: International System of Units
(from French: Le Système
international d'unités)

The kilogram is the
SI unit of mass.

The seven SI base units and the interdependency of their definitions. Clockwise from top: kelvin (temperature), second (time), meter (length), kilogram (mass), candela (luminous intensity), mole (amount of substance) and ampere (electric current).

From Wikipedia.

The **Meter** is the SI unit of length.

The meter is defined as the length of the path travelled by light in vacuum during a time interval of $1/299,792,458$ of a second.

It's definition is based on a measurement that can be made anywhere.

This definition fixes the speed of light in vacuum at exactly 299,792,458 meters per second.

From Wikipedia.

The **Second** is the SI unit of time.

The second is defined as the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of a Cesium-133 atom.

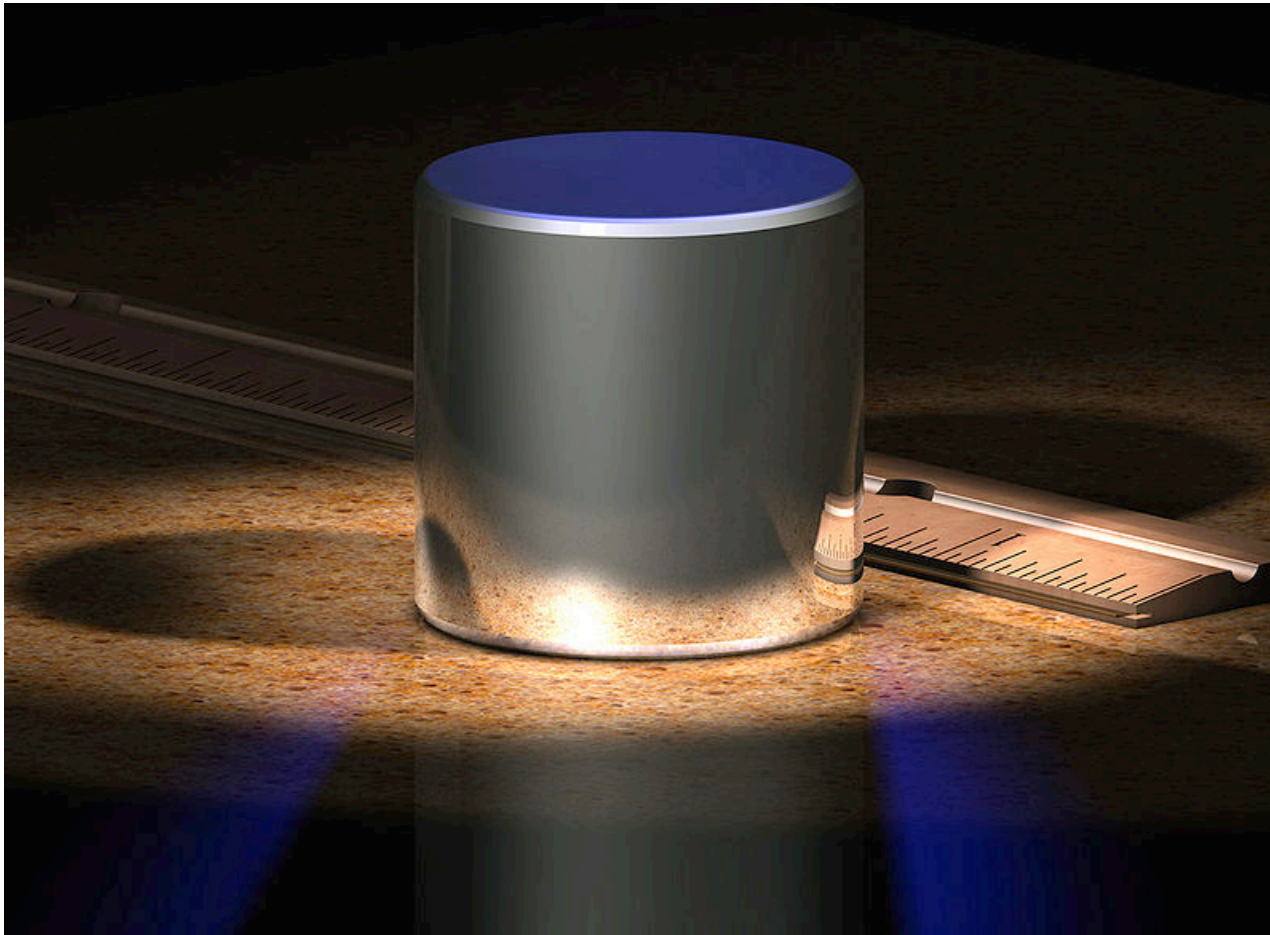
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Atomic Clocks!

From Wikipedia.

The **Kilogram** is the SI unit of mass.

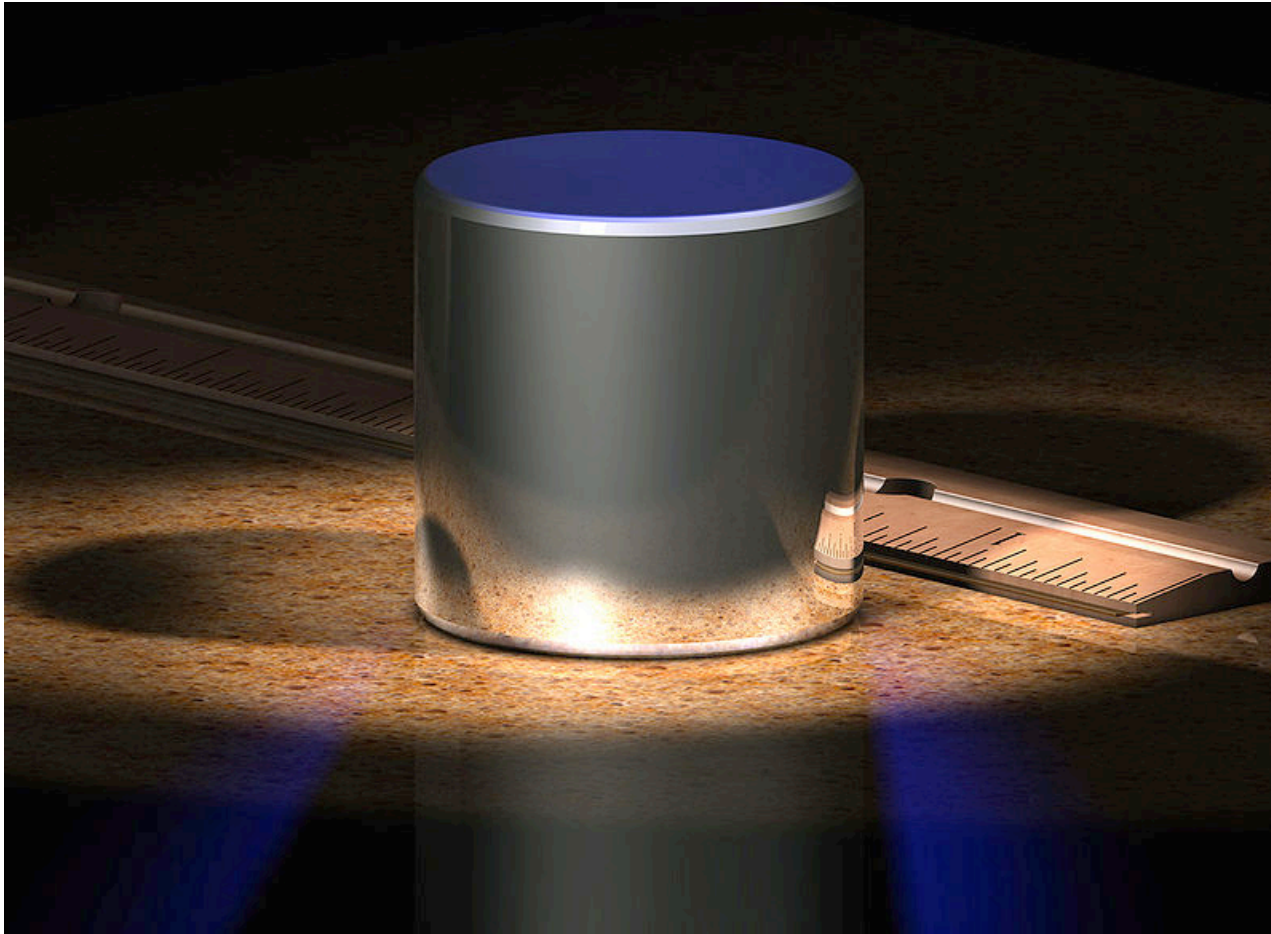
This is the current definition of a kilogram:



From Wikipedia.

The **Kilogram** is the SI unit of mass.

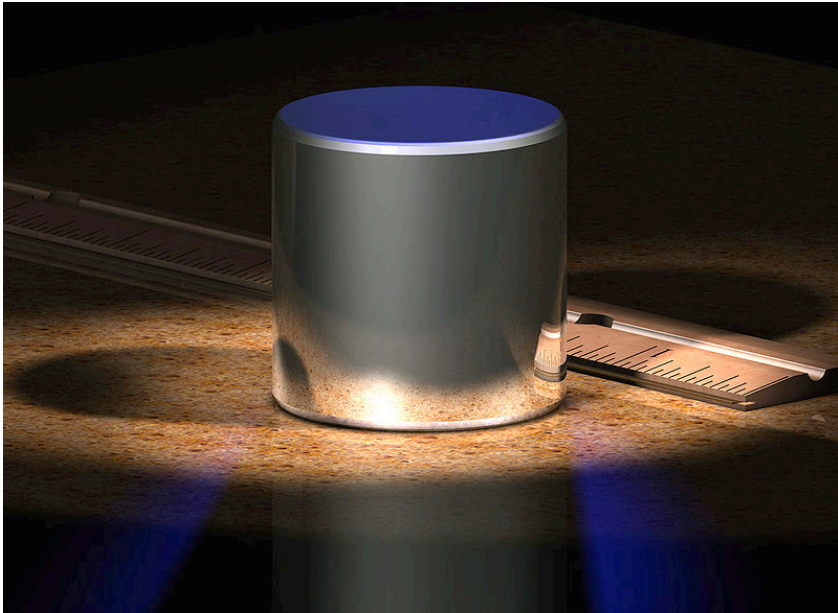
The kilogram was originally defined in 1795 as the mass one liter of water at 4°C.



From Wikipedia.

The **Kilogram** is the SI unit of mass.

The Kilogram is now defined as the mass of the "International Prototype Kilogram," a platinum-iridium (90%-10%) alloy cylinder manufactured in 1875 and kept by BIPM at Sèvres, France, near Paris.



BIPM: International Bureau of Weights and Measures
(Bureau international des poids et mesures)

From Wikipedia.

And the Kilogram is losing weight!

The New York Times

Europe

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH SPORTS OPINION

AFRICA AMERICAS ASIA PACIFIC EUROPE MIDDLE EAST

SÈVRES JOURNAL

Missing Micrograms Set a Standard on Edge

By SARAH LYALL

Published: February 12, 2011

SÈVRES, France — No one knows exactly why the international prototype of the kilogram, as pampered a hunk of platinum and iridium as ever existed, appears to weigh less than it did when it was manufactured in the late 19th century.



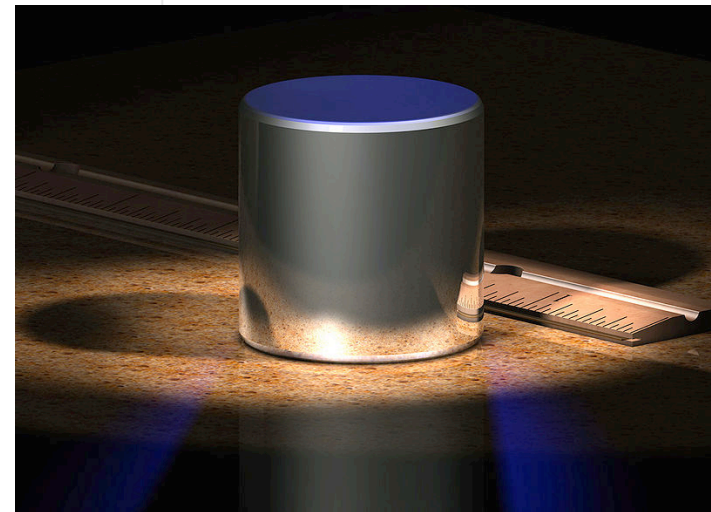
Bureau International des Poids et Mesures

The international prototype of the kilogram resides in Sèvres, France. Its vault can be opened only with three different keys.

“Your guess is as good as mine,” said Dr. Terry Quinn, emeritus director of the International Bureau of Weights and Measures in this town on the fringes of Paris.

It is here that the kilogram — the universal standard against which all other kilograms are measured — resides in controlled conditions set out in 1889, in an underground vault that can be opened only with three different keys possessed by three different people.

The change, discovered when the prototype was compared with its official copies, amounts only to some 50 micrograms, equal to the mass of a smallish grain of sand. But it shows that the prototype has fallen down on its primary job, to be a beacon of stability in a world of uncertainty.



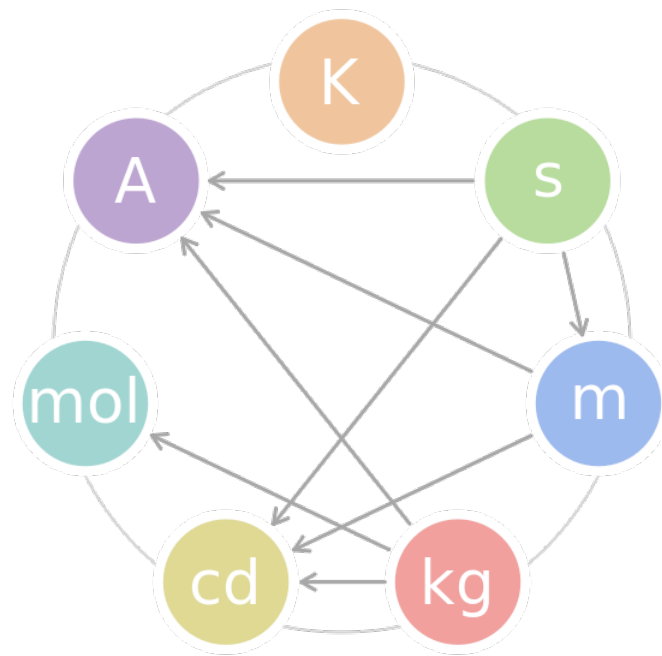
not good.

From the NY Times
2/12/2011.

What is a mole?

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The SI unit for the amount of a substance, equal to the quantity containing as many chemical units as there are atoms in exactly 12 **grams** (0.012 kg) of Carbon-12.



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This will hopefully change in your lifetime!

- a better kilogram standard.

Any ideas?

One idea: fix Avogadro's number at precisely 6.02214×10^{23} and define the kilogram on the mass of a mole of Carbon-12 atoms.

But what's the mass of a Carbon-12 atom?