The kilogram

The International Prototype Kilogram kept in the International Bureau of Weights and Measures (Bureau international de poids et mesures) in France.

The National Physical Laboratory in Teddington, Surrey, home of the UK's standard measurement service.

What is a kilogram? Two bags of sugar? 1000g? The kilogram is a unit of mass, a measure of how difficult it is to change an object's speed. It is also one of the base units of the SI system (the International System of units).

At the moment, the kilogram is formally defined as being equal in mass to the International Prototype Kilogram (IPK). This was made in Britain in 1879 and is an alloy of 90% platinum and 10% iridium. It is stored in a vault in Paris, France, and is a cylinder roughly the size of a golf ball.

Platinum was chosen because it is unreactive and very dense. The iridium increases its hardness. A consistent kilogram is vital because so many other units are derived from it.

Recently, however, the platinum kilogram was found to have changed in mass by about 50 micrograms. The cause of this is unclear – it could be that gases such as oxygen which were incorporated into the kilogram when it was formed have leached out; it could be that the surface has slightly corroded. It is uncertain if the kilogram has gained or lost weight – in either case it is by about as much as the mass of a grain of sand. This might not sound like much, but it is enough to cause chaos to precise calculations in a range of laboratories and engineering applications.

The kilogram needs to be re-defined by something which is not going to change over time. In late 2011, the General Conference on Weights and Measures agreed to use the Planck constant to calculate the value of the kilogram. The Planck constant relates the energy of a photon (a packet or quantum of eradiation) to its frequency.

The change will not come into effect until 2014, and before then experiments will be conducted to ensure that the Planck constant can give accurate results to within 20 parts per billion.

Most users will not even know that the kilogram has changed, but it will allow the necessary precision for those most accurate calculations.

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The seven base units in the SI system

kilogram (for mass)
metre (length)
second (time)
ampere (electric current)
kelvin (temperature)
candela (brightness)
mole (amount of substance)

Derived units are calculated by multiplying and dividing the base units. For example, the unit of speed is the metre per second, m/s.