

Warm up

## Definitions for the purist

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### WHAT IS A SECOND?

Since 1967, the international standard for a second has been defined as the time it takes for 9 192 631 770 oscillations of the microwave radiation corresponding to the transition between two hyperfine levels of the ground state of an atom of caesium-133. It sounds complex and an extremely accurate method for measuring time although a more recent proposal using a ytterbium standard is superior by a factor of more than a hundred times.

### WHAT IS A METRE?

The origins of the metre go back to the late 18th century. At that time, there were two competing proposals for how to

define a standard unit of measure, or metre. The astronomer Christian Huygens suggested that the metre be defined by the length of a pendulum having a period of one second; others favoured a metre defined as one ten-millionth the length of the earth's meridian along a quadrant (one fourth the circumference of the earth). In 1791, the French Academy of Sciences endorsed the meridian definition because the force of gravity varies slightly over the surface of the earth, affecting the period of a pendulum. On 22 June 1799, the French Academy Archives adopted its standard metre, recorded on a platinum bar. The French, however, miscalculated the flattening of the earth due to its rotation in

their quadrant calculations. As a result, the metre in the Archives is 0.2 millimetres shorter than one ten-millionth of the quadrant of the earth.

The French government made the metre the compulsory standard of measure in 1840. The Treaty of the Metre was signed in 1875, and in 1889 a platinum-iridium bar was established as the International Prototype Metre. In 1960, the General Conference on Weights and Measures redefined the metre in terms of the number of waves of a very precise colour (wavelength) of light emitted by krypton 86 atoms. In 1983, the conference discarded the krypton standard and redefined the metre in terms of the speed of light. The metre is now officially  $1/299\,792\,458$  the distance travelled by light in a vacuum in one second.

### WHAT IS REACTION TIME?

Reaction time is the time that elapses between the moment a stimulus is detected by the brain and the moment a response starts. Studies have shown that nobody can react in less than 0.110 of a second.

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