



Statistical literacy guide

What is a billion? And other units

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What is a billion?

What constitutes a *billion* is a source of occasional confusion. In official UK statistics the term is now used to denote 1 thousand million – 1,000,000,000. Historically, however, in the UK the term billion meant 1 million million – 1,000,000,000,000 - but in the United States the term was used to refer to 1 thousand million. The US value had, however, become increasingly used in Britain and the Prime Minister, Harold Wilson confirmed in a written reply in 1974² that the meaning of "billion" would be thousand-million, in conformity with international usage.

The Oxford English Dictionary explains why UK and US usage differed.

billion, purposely formed in 16th c. to denote the second power of a million (by substituting BI- prefix for the initial letters), trillion and quadrillion being similarly formed to denote its 3rd and 4th powers. The name appears not to have been adopted in Eng. before the end of the 17th ... Subsequently the application of the word was changed by French arithmeticians, figures being divided in numeration into groups of threes, instead of sixes, so that F. *billion*, *trillion*, denoted not the second and third powers of a million, but a thousand millions and a thousand thousand millions. In the 19th century, the U.S. adopted the French convention, but Britain retained the original and etymological use (to which France reverted in 1948).

Since 1951 the U.S. value, a thousand millions, has been increasingly used in Britain, especially in technical writing and, more recently, in journalism; but the older sense 'a million millions' is still common.³

The text of the 1974 Harold Wilson PQ:

"Billion" (Definition)

Mr Maxwell-Hyslop asked the Prime Minister whether he will make it the practice of his administration that when Ministers employ the word "billion" in any official speeches, documents, or answers to Parliamentary Questions, they will, to avoid confusion, only do so in its British meaning of 1 million million and not in the sense used in the United States of America, which uses the term "billion" to mean 1,000 million.

The Prime Minister: No. The word "billion" is now used internationally to mean 1,000 million and it would be confusing if British Ministers were to use it in any other sense. I accept that it could still be interpreted in this country as 1 million million and I shall ask my colleagues to ensure that, if they do use it, there should be no ambiguity as to its meaning. (HC Deb 20.12.1974 c711-2W)

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¹ HC Deb 20 December 1974 c711-2W

² Oxford English Dictionary 1989 ed

This definition of a billion is now known as the short scale -where each new term for a number above a million is one thousand times greater than the previous one. The historical definition of a billion is now known as the long scale -where each new term for a number above a million is one million time greater than the previous one.

Other units

The table below gives a selection of other small and large numbers, their (short scale) name, SI³ prefixes and associated scientific notations. The format of scientific notations is 10^n where n is the total number of zeros. Hence 10^9 is 1,000,000,000 or one billion. Where n is negative the number is less than one and n refers to the number of decimal places.

Name	SI prefix		Scientific notation	Number
	name	symbol		
Billionth	nano-	n	10^{-9}	0.000000001
Millionth	micro-	μ	10^{-6}	0.000001
Thousandth	milli-	m	10^{-3}	0.001
One			10^0	1
Thousand	kilo-	k	10^3	1,000
Million	mega-	M	10^6	1,000,000
Billion	giga-	G	10^9	1,000,000,000
Trillion	tera-	T	10^{12}	1,000,000,000,000
Quadrillion	peta-	P	10^{15}	1,000,000,000,000,000

Hence if we are looking at energy where the basic unit is a watt hour (Wh) then a trillion watt hours is known as a terawatt hour (TWh) which is equivalent to 10^{12} or 1,000,000,000,000 watt hours. A billionth of a metre is known as a nanometre (nm) which is equivalent to 10^{-9} or 0.000000001 metres.

Increases or decreases in scale can quickly become hard to fully comprehend, as can their cumulative impact. The 1977 short film *Powers of Ten*⁵ illustrates the impact of changes in scale from extremely large to extremely small dimensions.

³ The Système International d'Unités or International System of Units. SI prefixes are applied to SI base units such as metre, second or watt.

⁴ Charles and Ray Eames, *Powers of Ten: A Film Dealing with the Relative Size of Things in the Universe and the Effect of Adding Another Zero* (1977)
http://www.powersof10.com/index.php?mod=watch_powersof10
<http://uk.youtube.com/watch?v=A2cmlhfdxuY>

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