



How to use scientific notation

Have you ever seen the number 300,000,000 m/sec? It is the speed of light! And what about the number 0.000000000000095 g? It is the mass of a bacterium¹! Scientists, but also mathematicians, doctors and engineers often work with very large or very small numbers. A system was developed to help represent these numbers in a way that was easy to read and understand: scientific notation. Scientific notation is a method of expressing a value as the product of a number between 1 and 10 (except ten), and a power of 10. In scientific notation the numbers are written like this: $a \times 10^b$ (it must be read “a times ten to the power of b”), where *a* is called the coefficient and *b* is called the exponent or the power of 10. The coefficient *a* has a value of at least 1 but less than 10 ($1 \leq a < 10$). The exponent *b* is an integer, and it gives the order of magnitude of the number. The speed of light showed above, in scientific notation is written 3.0×10^8 m/sec (it must be read “three point zero times ten to the power of 8”), while the mass of a bacterium is 9.5×10^{-13} g (it must be read ‘nine point five times ten to the power of minus thirteen’).

How does scientific notation work? How can we transform large or small number using scientific notation? For a large number the decimal point is moved to the left until only one digit remains on the left. The number of places the decimal point is moved gives the exponent. For example, the mass of the earth is 5,980,000,000,000,000,000,000 kg, while in scientific notation this number becomes 5.98×10^{24} because the decimal is put after the first digit, the zeroes are dropped, and the exponent is 24 because there are twenty-four places from the decimal to the end of the number. In the same way for a small number the decimal point is moved to the right until only one digit remains to the left of the decimal point. Therefore the number 0.00000000753 kg, indicating the mass of a dust² particle, becomes 7.53×10^{-10} , because the decimal is put after the first digit found moving to the right and the exponent is -10 because there are ten places between the decimal point of the number given and the decimal in scientific notation.

Besides making it easier to represent very small or very large numbers, with scientific notation comparisons between different numbers become more evident considering the order of magnitude and calculations are easier as well.

GLOSSARY

- 1 a unicellular microorganism which may cause disease (plural: bacteria)
- 2 dry fine powdery material, such as particles of dirt or earth

ACTIVITIES

1 Answer the following questions.

- 1 Why was scientific notation developed?
- 2 How can you define scientific notation?
- 3 What value can a coefficient have?
- 4 What kind of number is the exponent?
- 5 What part of the scientific notation gives the order of magnitude?

2 Complete the table writing the right unit for each measurement and what the following numbers in scientific notation refer to.

NUMBER	UNIT	WHAT?
3.0×10^8		
5.98×10^{24}		
9.5×10^{-13}		
7.53×10^{-10}		

3 Read the text again and find words corresponding to the following definitions.

- 1 Visible radiation, illumination
- 2 A person who works applying scientific principles to the design and construction of cars, buildings etc.
- 3 To stand for, symbolize
- 4 Number obtained by multiplying two or more numbers
- 5 A whole number
- 6 The third planet of the solar system
- 7 One of the ten Arabic numerals (from 0 to 9)
- 8 The act of counting using a mathematical process