Scientific Notation

What is scientific notation?

Scientific notation helps show the precision of a measurement. Significant figures are the digits that carry meaningful information about accuracy.

Scientific notation writes a number as:

$$a \times 10^n$$

where:

- $1 \leq a < 10$
- n is an integer

Example

Standard form	Scientific notation
300,000,000	3.0×10^8
63,300	6.33×10^4
0.00405	4.2×10^{-5}

Converting large numbers

When writing a large number in scientific notation a positive exponent is produced

Steps	Example
1. Place the decimal after the first non-zero digit.	72500 → 7.25
2. Count how many places the decimal moved.	7 . 2 5 0 0 Decimal moved 4 places left
3. Use a positive exponent.	∴ 72,500 = 7.25 x 10^4

Converting small numbers

When writing a small number in scientific notation a negative exponent is produced

Steps	Example
1. Place the decimal after the first non-zero digit.	0.00063 → 6.3
2. Count how many places the decimal moved.	0 . 0 0 0 6 3 Decimal moved 4 places right
3. Use a negative exponent.	∴ 0.00063 = 6.3 x 10^{-4}

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Multiplying in scientific notation

Steps	Example
1. Multiply the numbers.	$(6 \times 10^3)(5 \times 10^4)$ $6 \times 5 = 30$
2. Add the powers of 10 (Index laws).	$10^3 \times 10^4$ $10^{3+4} = 10^7$
3. Check that the first number is between 1 and 10.	30×10^7 $= \mathbf{3.0} \times 10^8$

Dividing in scientific notation

Steps	Example
1. Divide the numbers.	$\frac{3 \times 10^5}{6 \times 10^2} = 3 \div 6 = 0.5$
2. Subtract the powers of 10 (Index laws).	$10^5 \div 10^2$ $10^{5+2} = 10^3$
3. Check that the first number is between 1 and 10.	0.5×10^3 $= \mathbf{5} \times 10^2$

Significant figures

Significant figures are the digits that tell us how precise a measurement is.

Scientific notation is often used to clearly show the number of significant figures.

Rules

- All non-zero digits are significant.
- Zeros between non-zero digits are significant.
- Leading zeros are not significant.
- Trailing zeros in a decimal number are significant.

Examples

- $0.000760 = 7.60 \times 10^{-4}$ $(3\ sig\ figs)$
- $50.80 = 5.080 \times 10^1$ $(4\ sig\ figs)$

Related helpsheets

- Index Laws
- Algebraic Expression

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