

STUDY TIPS

PME1.5 SCIENTIFIC NOTATION

Scientific Notation (or Standard Form) is a way of writing numbers in a compact form.

A number written in Scientific Notation is expressed as a number from 1 to less than 10, multiplied by a power of 10.

To write a number in Scientific Notation:

- move the decimal point so that there is **one** digit (which cannot be zero), **before** the decimal point.
- multiply by a power of 10, equal to the number of places the decimal point has been moved.

If the decimal point is moved to the **left**, the power of 10 is **positive**

If the decimal point is moved to the **right** the power of 10 is **negative**

Example 1

Write 5630 in Scientific Notation.

$$5630 = 5.63 \times 1000 = 5.63 \times 10^3 \quad (\text{remember: } 1000 = 10^3)$$

*Move the decimal point three places to the left. The number becomes 5.63.
The power of 10 is +3.*

Example 2

Write 0.00725 in Scientific Notation.

$$0.00725 = 7.25 \times 0.001 = 7.25 \times 10^{-3} \quad (\text{remember } 0.001 = 10^{-3})$$

*Move the decimal point three places to the right. The number becomes 7.25.
The power of 10 is -3.*

Always check your answer.

If the magnitude of the number is less than one, then the power of 10 will be negative.

If the magnitude of the number is greater than or equal to 10 then the power of 10 will be positive.

Example 3

The mass of the moon is: 73 600 000 000 000 000 000 kg. = 7.36×10^{22} kg.

The charge on one electron is: 0.000 000 000 000 000 000 160 2 C = 1.602×10^{-19} C

Note how the size of the number is more easily seen when written in Scientific Notation. Errors are less likely when writing the number if it is in Scientific Notation.

Calculations can be simplified by using index laws. For example:

$$3.5 \times 10^5 \times 5 \times 10^{18} = 3.5 \times 5 \times 10^{5+18} = 17.5 \times 10^{23} = 1.75 \times 10^{24}$$

Exercise 1 Write the following numbers in Scientific Notation.

(a) 58000 (b) 0.0026 (c) 70.6 (d) 0.3 (e) 2 400 000 (f) 0.000 000 684

(g) 0.0704 (h) 0.260 (i) 17600 (j) 0.04080 (k) 0.000500 (l) 357 000 000 000

Exercise 2 Write the following numbers in Scientific Notation

(a) 6 370 000 m (the mean radius of the Earth)

(b) 86 400 s (the time for the Earth to orbit the sun)

(c) 0.0018 s (the half-life of a radioactive isotope)

(d) 380 000 000 m (the average distance of the moon from the Earth)

(e) 0.000 000 000 001 1 s (the time for a ray of light to pass through a window pane)

(f) 637 000 000 000 000 000 000 kg (the mass of the planet Mars)

Exercise 3 Write the following numbers in decimal form or in whole numbers.

(a) 7×10^2 (b) 4×10^0 (c) 3.46×10^3 (d) 5.96×10^{-5}

(e) 9×10^7 (f) 3.98×10^1 (g) 2.78×10^5 (h) 6.78×10^{-1}

Answers

Exercise 1

1. (a) 5.8×10^4 (b) 2.6×10^{-3} (c) 7.06×10 (d) 3×10^{-1} (e) 2.4×10^6 (f) 6.84×10^{-7} (g) 7.04×10^{-2}

(h) 2.60×10^{-1}

(i) 1.76×10^4 (j) 4.08×10^{-2} (k) 5.00×10^{-4} (l) 3.57×10^{11}

Exercise 2

(a) 6.37×10^6 m (b) 8.64×10^4 s (c) 1.8×10^{-3} m (d) 3.8×10^8 m (e) 1.1×10^{-12} s (f) 6.37×10^{23} kg

Exercise 3

(a) 700 (b) 4 (c) 3460 (d) 0.0000596

(e) 90000000 (f) 39.8 (g) 278000 (h) 0.678