

Scientific Notation (Standard Form)

When numbers get very large or very small it becomes impractical to write them in full.

Scientific notation is a way of writing these numbers in shorthand. It uses the fact that our number system is base 10. Scientific notation is also known as **standard form**.

Example (from scientific notation to number in full)

Write the following numbers in full.

a 2×10^3

b 5.63×10^7

c 3.2×10^4

a Multiplying 2 by 10^3 is the same as multiplying 2 by 10 three times:

$$2 \times 10^3 = 2 \times 10 \times 10 \times 10.$$

Move the decimal point three places to the right to make the bigger number:

$$2\ 0\ 0\ 0.$$

So, $2 \times 10^3 = 2000$.

b Multiplying 5.63 by 10^7 is the same as multiplying 5.63 by 10 seven times:

$$5.63 \times 10^7 = 5.63 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10.$$

Move the decimal point seven places to the right to make the bigger number:

$$5\ 6\ 3\ 0\ 0\ 0\ 0\ 0.$$

So, $5.63 \times 10^7 = 56300000$.

c Multiplying 3.2 by 10^4 is the same as multiplying 3.2 by 10 four times:

$$3.2 \times 10^4 = 3.2 \times 10 \times 10 \times 10 \times 10.$$

Move the decimal point four places to the right to make the bigger number:

$$3\ 2\ 0\ 0\ 0.$$

So, $3.2 \times 10^4 = 32000$.

Example (from number in full to scientific notation)

Write the following numbers in scientific notation.

a 320000

b 60500000000

c 45 million

a Place the decimal point to make a number between 1 and 10. Then count how many times you would have to multiply by 10 to make the original number, which is the same as how many places you would have to move the decimal point to make the original number.

$$3.2\ 0\ 0\ 0\ 0\ 0.$$

So, $320\ 000 = 3.2 \times 10^5$.

$$6.0\ 5\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0.$$

So, $60\ 500\ 000\ 000 = 6.05 \times 10^{10}$.

c You can immediately recognise that 45 million is

$$45 \times 10^6 = 4.5 \times 10 \times 10^6 = 4.5 \times 10^7.$$

Alternatively, write 45 million in full as 45 000 000 and use the previous method.