



# Standard form

Numbers in standard form have two parts.

$7.3 \times 10^{-6}$

This part is a number greater than or equal to 1 and less than 10.

This part is a power of 10.

You can use standard form to write very large or very small numbers.

$$920000 = 9.2 \times 10^5$$

Numbers greater than 10 have a positive power of 10.

$$0.00703 = 7.03 \times 10^{-3}$$

Numbers less than 1 have a negative power of 10.

## Counting decimal places

You can count decimal places to convert between numbers in standard form and ordinary numbers.

$$7900 = 7.9 \times 10^3$$

3 jumps

$7900 > 10$   
So the power is positive

$$0.00035 = 3.5 \times 10^{-4}$$

4 jumps

$0.00035 < 1$   
So the power is negative

Be careful!

Don't just count zeros to work out the power.

## Worked example

Target grade 5

Work out the value of  $(8.3 \times 10^6) - (4.1 \times 10^5)$   
Give your answer in standard form. (2 marks)

$$\begin{array}{r} 8300000 \\ - 410000 \\ \hline 7890000 \end{array} = 7.89 \times 10^6$$

## Examiners' report

You need to be able to work with numbers in standard form on your **non-calculator paper**. To add or subtract, write the numbers as ordinary numbers first, then write your final answer in standard form.

Real students have struggled with questions like this in recent exams – **be prepared!**



## Non-calculator multiplying

1

Rearrange so powers of 10 are together

$$(3 \times 10^3) \times (5 \times 10^6)$$

Multiply the number parts

$$= (3 \times 5) \times (10^3 \times 10^6)$$

Add the powers

$$a^m \times a^n = a^{m+n}$$

Rewrite your answer in standard form if necessary

$$= 1.5 \times 10^1 \times 10^9$$

$$= 1.5 \times 10^{10}$$

2

Rearrange so powers of 10 are together

$$(1.2 \times 10^8) \div (2 \times 10^4)$$

Divide the number parts

$$= (1.2 \div 2) \times (10^8 \div 10^4)$$

Subtract the powers

$$a^m \div a^n = a^{m-n}$$

Rewrite your answer in standard form if necessary

$$= 6 \times 10^{-1} \times 10^4$$

$$= 6 \times 10^3$$

## Using a calculator

You can enter numbers in standard form using the  $\times 10^x$  key.

To enter  $3.7 \times 10^{-6}$  press

3 . 7  $\times 10^x$  (-) 6

If you are using a calculator with numbers in standard form it is a good idea to put brackets around each number.

## Now try this

Target grade 5

The mass of one *E. coli* bacterium is  $6 \times 10^{-16}$  grams. Find the total mass of  $3 \times 10^6$  bacteria. (2 marks)

Have a go at this question **without a calculator** first. Then use your calculator to check your answer.