

Standard Form

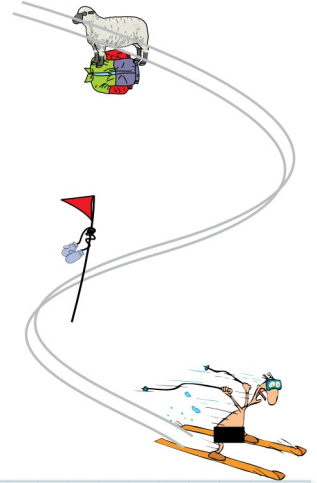
Calculations with Standard Form



These are really popular **exam questions** — you might be asked to add, subtract, multiply or divide using numbers written in **standard form**.

Multiplying and Dividing — not too bad

- 1) Rearrange to put the **front numbers** and the **powers of 10 together**.
- 2) Multiply or divide the front numbers, and use the **power rules** (see p24) to multiply or divide the powers of 10.
- 3) Make sure your answer is still in **standard form**.



EXAMPLES:

1. Find $(2.24 \times 10^3) \times (6.75 \times 10^5)$.
Give your answer in standard form.

$$\begin{aligned} & (2.24 \times 10^3) \times (6.75 \times 10^5) \\ & \text{Multiply front numbers and powers separately} \quad = (2.24 \times 6.75) \times (10^3 \times 10^5) \\ & = 15.12 \times 10^{3+5} \quad \text{Add the powers (see p24)} \\ & = 15.12 \times 10^8 \\ & \text{Not in standard form — convert it} \quad = 1.512 \times 10 \times 10^8 \\ & = 1.512 \times 10^9 \end{aligned}$$

2. Calculate $189\,000 \div (5.4 \times 10^{10})$.
Give your answer in standard form.

$$\begin{aligned} & \text{Convert 189 000 to standard form} \quad 189\,000 \div (5.4 \times 10^{10}) \\ & = \frac{1.89 \times 10^5}{5.4 \times 10^{10}} = \frac{1.89}{5.4} \times \frac{10^5}{10^{10}} \\ & \text{Divide front numbers and powers separately} \quad = 0.35 \times 10^{5-10} \quad \text{Subtract the powers (see p24)} \\ & = 0.35 \times 10^{-5} \\ & \text{Not in standard form — convert it} \quad = 3.5 \times 10^{-1} \times 10^{-5} \\ & = 3.5 \times 10^{-6} \end{aligned}$$

Adding and Subtracting — a bit trickier

- 1) Make sure the **powers of 10** are **the same** — you'll probably need to rewrite one of them.
- 2) Add or subtract the **front numbers**.
- 3) Convert the answer to **standard form** if necessary.

EXAMPLE:

Calculate $(9.8 \times 10^4) + (6.6 \times 10^3)$. Give your answer in standard form.

$$\begin{aligned} & (9.8 \times 10^4) + (6.6 \times 10^3) \\ & \text{1) Rewrite one number so both powers of 10 are equal:} \quad = (9.8 \times 10^4) + (0.66 \times 10^4) \\ & \text{2) Now add the front numbers:} \quad = (9.8 + 0.66) \times 10^4 \\ & \text{3) } 10.46 \times 10^4 \text{ isn't in standard form, so convert it:} \quad = 10.46 \times 10^4 = 1.046 \times 10^5 \end{aligned}$$



To put standard form numbers into your **calculator**, use the **EXP** or the **$\times 10^x$** button.

E.g. enter 2.67×10^{15} by pressing **2.67** **EXP** **15** **=** or **2.67** **$\times 10^x$** **15** **=**.

Your calculator might **display** an answer such as 7.986×10^{15} as **7.986 ¹⁵**. If so, **don't forget** to add in the " **$\times 10$** " bit when you write it down. Some calculators do display a little " **$\times 10$** " so check what yours does.

Or for just £25, you can upgrade to luxury form...

Make sure you understand all the examples on these pages. Then answer these Exam Practice Questions:

- Q1 Express 0.854 million and 0.00018 in standard form. [2 marks] 
- Q2 Express 4.56×10^{-3} and 2.7×10^5 as ordinary numbers. [2 marks] 
- Q3 Work out the following. Give your answers in standard form.
a) $(3.2 \times 10^7) \div (1.6 \times 10^{-4})$ [2 marks] b) $(6.7 \times 10^{10}) + (5.8 \times 10^{11})$ [2 marks] 