Standard form is used to represent very large and very small numbers, particularly in Science.

In standard form a number is written as a number between 1 and 10 multiplied by a power of 10

Examples

$$367 = 3.67 \times 10^2$$

$$51,428 = 5.1428 \times 10^4$$

$$\text{or} \quad 5.14 \times 10^4 \quad \text{to} \quad 3 \text{ sig fig}$$

$$0.000000632 = 6.32 \times 10^{-7}$$

Mass of Earth $= 5.972 \times 10^{24}$ kg

Mass of Sun $= 1.989 \times 10^{30}$ kg

How many times greater than the mass of the Earth is the mass of the Sun?

$$\frac{\text{Mass of Sun}}{\text{Mass of Earth}} = \frac{1.989 \times 10^{30}}{5.972 \times 10^{24}}$$

$$= 333,054$$

$$\text{or} \quad 3.33 \times 10^5 \quad \text{to} \quad 3 \text{ sig fig}$$

Vol of Earth

Vol of Sun 1.4×10^{27} m^3

Radius of Earth = 6371 km

Vol of Earth = $\frac{4}{3}\pi r^3$

$= \frac{4}{3}\pi \times 6371000^3$

$= 1.083 \times 10^{21}$ m^3

$\frac{\text{Vol of Sun}}{\text{Vol of Earth}} = \frac{1.4 \times 10^{27}}{1.083 \times 10^{21}} = 1,292,705$

Mass of electron 9.109×10^{-31} Kg

0.0000000000000000000000000000009109 kg

Mass of proton 1.673×10^{-27} Kg

$\frac{\text{Mass of proton}}{\text{Mass of electron}} = \frac{1.673 \times 10^{-27}}{9.109 \times 10^{-31}} = 1837$

Arithmetic in Standard Form (Non-Calculator)

Multiplication $\left(8 \times 10^{27}\right) \times \left(2 \times 10^{19}\right)$

$$8 \times 2 \times 10^{27} \times 10^{19}$$

$$= 16 \times 10^{46}$$

$$= 1.6 \times 10^{47}$$

Division

$$\left(8 \times 10^{27}\right) \div \left(2 \times 10^{19}\right)$$

$$= \frac{8 \times 10^{27}}{2 \times 10^{19}}$$

$$= 4 \times 10^{8}$$

Addition

$$\left(5.2 \times 10^{7}\right) + \left(3.6 \times 10^{6}\right)$$

$$\begin{array}{r} 52000000 \\ 3600000 \\ \hline 55600000 \end{array}$$

$$5.56 \times 10^{7}$$

Subtraction

$$\left(5.2 \times 10^{7}\right) - \left(3.6 \times 10^{6}\right)$$

$$\begin{array}{r} 8\overset{4}{5}\overset{11}{2}\overset{1}{0}00000 \\ 3600000 \; - \\ \hline 48400000 \end{array}$$

$$4.84 \times 10^{7}$$

1 Write down the value of each of the following.

a 3.1×10 **b** 3.1×100 **c** 3.1×1000

2 Write down the value of each of the following.

a 6.5×10 **b** 6.5×10^2 **c** 6.5×10^3

3 Write down the value of each of the following.

a $3.1 \div 10$ **b** $3.1 \div 100$ **c** $3.1 \div 1000$

4 Write down the value of each of the following.

a $6.5 \div 10$ **b** $6.5 \div 10^2$ **c** $6.5 \div 10^3$

5 Evaluate the following.

a 2.5×100 **b** 3.45×10 **c** 4.67×1000

e 20.789×10 **f** 56.78×1000 **g** 2.46×10^2

i 0.999×10^6 **j** 234.56×10^2 **k** 98.7654×10^3

m $0.003\ 4578 \times 10^5$ **n** 0.0006×10^7 **o** $0.005\ 67 \times 10^4$

6 Evaluate the following.

a $2.5 \div 100$ **b** $3.45 \div 10$ **c** $4.67 \div 1000$

e $20.789 \div 100$ **f** $56.78 \div 1000$ **g** $2.46 \div 10^2$

i $0.999 \div 10^6$ **j** $234.56 \div 10^2$ **k** $98.7654 \div 10^3$

m $0.003\ 4578 \div 10^5$ **n** $0.0006 \div 10^7$ **o** $0.005\ 67 \div 10^4$