SCIENTIFIC NOTATION
(Standard Form)

1. Write in scientific notation:

(a) 12 800 (b) 340 000 000 (c) 53 000 (d) 418 200

(e) 340 million (f) 670 000 000 000 (g) 12·8 million (h) 710 300 000

(i) 0·004 68 (j) 0·000 063 (k) 0·000 000 000 5 (l) 0·000 528

(m) 0·000 007 91 (n) 0·352 (o) 0·000 063 (p) 0·000 000 302

(q) 700×10^{3} (r) 400×10^{-8} (s) $61 \cdot 7 \times 10^{12}$ (t) 15×10^{-3}

(u) $0 \cdot 7 \times 10^{5}$ (v) $0 \cdot 003 \times 10^{-4}$ (w) $0 \cdot 126 \times 10^{9}$ (x) $0 \cdot 075 \times 10^{-7}$

2. Write as a normal number:

(a) 7×10^{5} (b) 3×10^{4} (c) $4 \cdot 3 \times 10^{5}$ (d) $5 \cdot 2 \times 10^{1}$

(e) $3 \cdot 45 \times 10^{3}$ (f) $5 \cdot 24 \times 10^{7}$ (g) $9 \cdot 32 \times 10^{2}$ (h) $6 \cdot 125 \times 10^{5}$

(i) 4×10^{-5} (j) 9×10^{-1} (k) $3 \cdot 4 \times 10^{-3}$ (l) $6 \cdot 2 \times 10^{-1}$

(m) $5 \cdot 4 \times 10^{-6}$ (n) $7 \cdot 26 \times 10^{-4}$ (o) $8 \cdot 62 \times 10^{-5}$ (p) $4 \cdot 31 \times 10^{-3}$

All of the following questions will require a calculator. Write answers both before and after rounding. Write your answers in **scientific notation** and correct to **3 significant figures**.

3. (a) $\left(3 \cdot 12 \times 10^{12}\right) \times \left(4 \cdot 65 \times 10^{6}\right)$ (b) $\left(4 \cdot 7 \times 10^{7}\right) \times \left(2 \cdot 16 \times 10^{15}\right)$

(c) $\left(5 \cdot 6 \times 10^{8}\right) \times \left(3 \cdot 17 \times 10^{-4}\right)$ (d) $\left(6 \cdot 3 \times 10^{-14}\right) \times \left(5 \cdot 25 \times 10^{9}\right)$

(e) $\left(2 \cdot 86 \times 10^{-5}\right) \times \left(3 \cdot 4 \times 10^{-9}\right)$ (f) $\left(8 \cdot 72 \times 10^{-15}\right) \times \left(1 \cdot 265 \times 10^{-6}\right)$

(g) $\left(7 \cdot 2 \times 10^{19}\right) \div \left(5 \cdot 7 \times 10^{6}\right)$ (h) $\left(2 \cdot 63 \times 10^{9}\right) \div \left(1 \cdot 9 \times 10^{15}\right)$

(i) $\dfrac{9 \cdot 15 \times 10^{9}}{4 \cdot 26 \times 10^{-4}}$ (j) $\dfrac{8 \cdot 5 \times 10^{-8}}{3 \cdot 76 \times 10^{14}}$ (k) $\dfrac{6 \cdot 4 \times 10^{-12}}{8 \cdot 26 \times 10^{-5}}$ (l) $\dfrac{5 \cdot 18 \times 10^{-6}}{7 \cdot 25 \times 10^{-15}}$

4. If $A = 4 \cdot 25 \times 10^{3}$, $B = 8 \cdot 4 \times 10^{9}$ and $C = 1 \cdot 05 \times 10^{-6}$, evaluate:

(a) AB (b) BC (c) A^{2} (d) C^{2}

(e) $B^{2}C$ (f) $(BC)^{2}$ (g) $\dfrac{B}{C}$ (h) $\dfrac{C}{A}$

(i) $\dfrac{A^{2}}{B}$ (j) $\dfrac{B}{AC}$ (k) $\dfrac{A}{C} + B$ (l) $\dfrac{A}{B} + C$

5. One **milligram** of hydrogen gas contains $2 \cdot 987 \times 10^{20}$ molecules.
   Calculate: (a) the number of molecules in 1·2 **grams** of hydrogen gas.
   (b) the mass, in milligrams, of one molecule of hydrogen.

6. The density of hydrogen at 0°C is $8 \cdot 987 \times 10^{-5}$ grams for every **cubic centimetre**.
   Calculate: (a) the mass of 3 **litres** of hydrogen.
   (b) the volume, in cubic centimetres, of 6 grams of hydrogen.

7. There are $6 \cdot 022 \times 10^{23}$ atoms in 22·4 **litres** of helium gas.
   This amount of gas has a mass of 4·003 grams.
   Calculate: (a) the number of atoms in 1 **millilitre** of helium gas.
   (b) the mass, in grams, of one atom of helium.

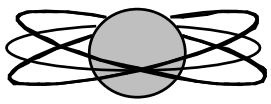
8. There are 1650 763·73 wavelengths of orange Krypton light in one metre.
   So there are $1 \cdot 65076373 \times 10^{6}$ wavelengths in 1 **metre**.
   Calculate: (a) the number of wavelengths in 80 **centimetres**.
   (b) the length in **centimetres** of 1 wavelength.

9. The second is defined as the duration of 9 192 631 770 periods of the radiation of the caesium atom.
   So there are $9 \cdot 192631770 \times 10^{9}$ periods in 1 **second**.
   Calculate: (a) the number of periods in 2 **minutes**.
   (b) the time in seconds for 1 period.

10. The surface area of a sphere, radius r , is given by the formula $A = 4\pi r^2$.
    The Moon is roughly spherical in shape.
    The radius of the Moon is $1 \cdot 738 \times 10^{3}$ kilometres.
    Calculate the surface area of the Moon in square kilometres.

Questions 11 and 12 involve calculating the volume of a sphere.
The volume of a sphere, radius r , is given by the formula $V = \frac{4}{3}\pi r^3$.

11. Gases such as helium contain atoms roughly spherical in shape.
    The radius of an atom of helium is $1 \cdot 28 \times 10^{-8}$ centimetres.



    Calculate the volume, in cubic centimetres, of one helium atom.

12. The Sun is spherical in shape.
    The radius of the Sun is $6 \cdot 960 \times 10^{5}$ kilometres.
    (a) Calculate the volume of the Sun in cubic kilometres.

    The average density of the Sun is $1 \cdot 409 \times 10^{9}$ tonnes for every cubic kilometre.
    (b) Calculate the mass of the Sun in tonnes.

ANSWERS

1. (a) $1 \cdot 28 \times 10^{4}$ (b) $3 \cdot 4 \times 10^{8}$ (c) $5 \cdot 3 \times 10^{4}$ (d) $4 \cdot 182 \times 10^{5}$
   (e) $3 \cdot 4 \times 10^{8}$ (f) $6 \cdot 7 \times 10^{11}$ (g) $1 \cdot 28 \times 10^{7}$ (h) $7 \cdot 103 \times 10^{8}$
   (i) $4 \cdot 68 \times 10^{-3}$ (j) $6 \cdot 3 \times 10^{-5}$ (k) 5×10^{-10} (l) $5 \cdot 28 \times 10^{-4}$
   (m) $7 \cdot 91 \times 10^{-6}$ (n) $3 \cdot 52 \times 10^{-1}$ (o) $6 \cdot 3 \times 10^{-5}$ (p) $3 \cdot 02 \times 10^{-7}$
   (q) 7×10^{5} (r) 4×10^{-6} (s) $6 \cdot 17 \times 10^{13}$ (t) $1 \cdot 5 \times 10^{-2}$
   (u) 7×10^{4} (v) 3×10^{-7} (w) $1 \cdot 26 \times 10^{8}$ (x) $7 \cdot 5 \times 10^{-9}$

2. (a) 700 000 (b) 30 000 (c) 430 000 (d) 52
   (e) 3450 (f) 52 400 000 (g) 932 (h) 612 500
   (i) 0·000 04 (j) 0·9 (k) 0·003 4 (l) 0·62
   (m) 0·000 005 4 (n) 0·000 726 (o) 0·000 086 2 (p) 0·004 31

3. (a) $1 \cdot 4508 \times 10^{19} = 1 \cdot 45 \times 10^{19}$ (b) $1 \cdot 0152 \times 10^{23} = 1 \cdot 02 \times 10^{23}$
   (c) $1 \cdot 7752 \times 10^{5} = 1 \cdot 78 \times 10^{5}$ (d) $3 \cdot 3075 \times 10^{-4} = 3 \cdot 31 \times 10^{-4}$
   (e) $9 \cdot 724 \times 10^{-14} = 9 \cdot 72 \times 10^{-14}$ (f) $1 \cdot 10308 \times 10^{-20} = 1 \cdot 10 \times 10^{-20}$
   (g) $1 \cdot 2631....\times 10^{13} = 1 \cdot 26 \times 10^{13}$ (h) $1 \cdot 3842....\times 10^{-6} = 1 \cdot 38 \times 10^{-6}$
   (i) $2 \cdot 1478....\times 10^{13} = 2 \cdot 15 \times 10^{13}$ (j) $2 \cdot 2606....\times 10^{-22} = 2 \cdot 26 \times 10^{-22}$
   (k) $7 \cdot 7481....\times 10^{-8} = 7 \cdot 75 \times 10^{-8}$ (l) $7 \cdot 1448....\times 10^{8} = 7 \cdot 14 \times 10^{8}$

4. (a) $3 \cdot 57 \times 10^{13}$ (b) $8 \cdot 82 \times 10^{3}$
   (c) $1 \cdot 80625 \times 10^{7} = 1 \cdot 81 \times 10^{7}$ (d) $1 \cdot 1025 \times 10^{-12} = 1 \cdot 10 \times 10^{-12}$
   (e) $7 \cdot 4088 \times 10^{13} = 7 \cdot 41 \times 10^{13}$ (f) $7 \cdot 77924 \times 10^{7} = 7 \cdot 78 \times 10^{7}$
   (g) $8 \cdot 00 \times 10^{15}$ (h) $2 \cdot 4705....\times 10^{-10} = 2 \cdot 47 \times 10^{-10}$
   (i) $2 \cdot 5598....\times 10^{-13} = 2 \cdot 56 \times 10^{-13}$ (j) $1 \cdot 8823....\times 10^{12} = 1 \cdot 88 \times 10^{12}$
   (k) $1 \cdot 2447....\times 10^{10} = 1 \cdot 24 \times 10^{10}$ (l) $1 \cdot 5559....\times 10^{-6} = 1 \cdot 56 \times 10^{-6}$

5. (a) $3 \cdot 5844 \times 10^{23} = 3 \cdot 58 \times 10^{23}$ molecules (b) $3 \cdot 3478....\times 10^{-21} = 3 \cdot 35 \times 10^{-21}$ milligrams

6. (a) $2 \cdot 6961....\times 10^{-1} = 2 \cdot 70 \times 10^{-1}$ grams (b) $6 \cdot 6763....\times 10^{4} = 6 \cdot 68 \times 10^{4}$ cm^3

7. (a) $2 \cdot 6883....\times 10^{19} = 2 \cdot 69 \times 10^{19}$ atoms (b) $6 \cdot 6472....\times 10^{-24} = 6 \cdot 65 \times 10^{-24}$ grams

8. (a) $1 \cdot 3206....\times 10^{6} = 1 \cdot 32 \times 10^{6}$ (b) $6 \cdot 0578....\times 10^{-5} = 6 \cdot 06 \times 10^{-5}$ metres

9. (a) $1 \cdot 1031....\times 10^{12} = 1 \cdot 10 \times 10^{12}$ (b) $1 \cdot 0878....\times 10^{-10} = 1 \cdot 09 \times 10^{-10}$ seconds

10. $3 \cdot 7958....\times 10^{7} = 3 \cdot 80 \times 10^{7}$ km^2

11. $8 \cdot 7845....\times 10^{-24} = 8 \cdot 78 \times 10^{-24}$ cm^3

12. (a) $1 \cdot 4122....\times 10^{18} = 1 \cdot 41 \times 10^{18}$ km^3 (b) $1 \cdot 9898....\times 10^{27} = 1 \cdot 99 \times 10^{27}$ tonnes