

## Scientific Notation

### *Other Handouts:*

- Ratio and Proportion • Graphing
- Significant Figures • Logarithms
- Units • Review of Number

Scientists express numbers so as to show their order of magnitude. This way of representing numbers is called **scientific notation**.

The numeral 86,000 has 10,000 as its highest power of 10 and so could be written as

$$8.6 \times 10,000 = 8.6 \times 10^4$$

Thus 86,000 is equivalent to  $8.6 \times 10^4$  in **scientific notation**. In this form it can easily be seen that the order of magnitude of 86,000 is 4.

### Examples

$4.72 \times 10^{-2}$	=	0.0472		$3.3 \times 10^0$	=	3.3
$8 \times 10^3$	=	8,000		$9.111 \times 10^{-5}$	=	0.00009111
$1.004 \times 10^1$	=	10.04		$2.506 \times 10^4$	=	25,060

Calculators display numbers that are too large for their display in scientific notation.

The number  $7.8 \times 10^{16}$  may be displayed as 7.8 Exp 16 or 7.8 E 16. Check how your calculator displays large numbers, and how to input scientific notation.

### Practice Problems – Scientific Notation

1. Rewrite the following using scientific notation

- |               |                                       |              |
|---------------|---------------------------------------|--------------|
| (a) (i) 230 = | (ii) 46,500 =                         | (iii) 0.02 = |
| (iv) 0.0051 = | (v) $15,000 \times 3.9 \times 10^8$ = |              |

and convert these to decimal notation.

- |                              |   |
|------------------------------|---|
| (b) (i) $6.54 \times 10^3$ = | (ii) $4.317 \times 10^5$ =                |
| (iii) $1.5 \times 10^{-2}$ = | (iv) $912.65 \times 2.8 \times 10^{-6}$ = |

2. The diameter of a human hair is  $7.1 \times 10^{-5}$  m. If you placed 200 of them side by side, what width of hair would you have:

- |                                   |                                      |                     |
|-----------------------------------|--------------------------------------|---------------------|
| (a) in decimal notation in metres | (b) in scientific notation in metres | (c) in millimetres? |
|-----------------------------------|--------------------------------------|---------------------|

3. Calculate in scientific notation. Try by hand and then by calculator.

(a)  $(6.4 \times 10^3) \cdot (1.2 \times 10^5)$

(f)  $(3.04 \times 10^{-4}) \cdot (4.5 \times 10^{10})$

(b)  $(5.1 \times 10^2) \cdot (8.9 \times 10^{-1})$

(g)  $(1.6 \times 10^5) \div (3.2 \times 10^4)$

(c)  $(9.2 \times 10^6) + (8 \times 10^5)$

(h)  $(5.7 \times 10^5) - (1.2 \times 10^3)$

(d)  $(4.5 \times 10^{-1}) + (7.32 \times 10^{-2})$

(i)  $(8.84 \times 10^{10}) - (6.01 \times 10^9)$

(e)  $\frac{(7.7 \times 10^{-7}) \cdot (9 \times 10^{14})}{3.0 \times 10^8}$

(j)  $\frac{(2.6 \times 10^6) \cdot (1 \times 10^{-9})}{1.3 \times 10^{-5}}$

4. The surface areas of the moon is  $3.79 \times 10^7$  square kilometres. Only about 41% of the Moon's surface is ever visible from the Earth. Approximately how much of the moon's surface is visible from the Earth in square kilometres?

#### Solutions – Practice Problems

1. (a)(i)  $2.3 \times 10^2$  (ii)  $4.65 \times 10^4$  (iii)  $2 \times 10^{-2}$  (iv)  $5.1 \times 10^{-3}$  (v)  $5.85 \times 10^{12}$

(b)(i) 6540 (ii) 431,700 (iii) 0.015 (iv) 0.0025542

2. (a) 0.0142 m (b)  $1.42 \times 10^{-2}$  m (c) 14.2 mm

3. (a)  $7.68 \times 10^8$  (b)  $4.539 \times 10^2$  (c)  $1 \times 10^7$  (d)  $5.232 \times 10^{-1}$  (e)  $2.31 \times 10^0$

(f)  $1.368 \times 10^7$  (g)  $5 \times 10^0$  (h)  $5.688 \times 10^5$  (i)  $8.239 \times 10^{10}$  (j)  $2 \times 10^2$

4.  $1.5539 \times 10^7$  km<sup>2</sup>