

Scientific Notation

- Convenient way to express very large and very small numbers.
- To express a final answer with the correct number of significant digits.

(more about these later!)

✓ 1.2×10^3

✗ 14×10^{-1}
not in proper
scientific notation

$n \times 10^?$

integer
...-3, -2, -1, 0, 1, 2, 3, ...

$1 \leq n < 10$

Examples: $\underline{1525} \text{ g} = 1.525 \times 10^3 \text{ g}$

$\underline{0.00471} \text{ m} = 4.71 \times 10^{-3} \text{ m}$

$\underline{7.81} \times 10^{-2} \text{ m} = 0.0781 \text{ m}$

$6.02 \times 10^{23} = 602 + 21 \text{ zeroes}$

(Avogadro's Number)

$\underline{565} \times 10^{-9} \text{ m} = 5.65 \times 10^{-7} \text{ m}$



Calculations involving scientific notation

Multiplication & Division

$$\frac{(6.6 \times 10^{-8})}{(3.3 \times 10^{-4})} = 2.0 \times 10^{-4}$$

$-8 - (-4)$

$$\frac{x^5}{x^3} = x^2$$

$$\frac{\cancel{x} \cancel{x} \cancel{x} \cancel{x} \cancel{x}}{\cancel{x} \cancel{x} \cancel{x}}$$

Subtract exponents for division

$$(2.5 \times 10^{-6}) \times (3.0 \times 10^{-7}) = 7.5 \times 10^{-13}$$

$-6 + (-7)$
add exponents for multiplication.

Addition and Subtraction

$$(2.67 \times 10^{-3}) - (9.5 \times 10^{-4})$$

The place values do not match
We need to make them match

Think about

$$\begin{array}{r} 1252 \\ 1.573 \\ 128 \\ + 17.3 \\ \hline \end{array}$$

$$= 26.7 \times 10^{-4} - 9.5 \times 10^{-4}$$

match now

$$= 17.2 \times 10^{-4} \leftarrow \text{not in proper scientific notation}$$

$$= 1.72 \times 10^{-3}$$

$$\begin{array}{l} 6.6 \text{ EXP } -8 \\ \downarrow \\ 6.6 \times 10^{-8} \\ 6.6 \quad -8 \end{array}$$

$$\begin{array}{l} 6.6 \times 10^{-8} \\ \textcircled{6.6 \text{ E } -8} \\ \div \\ 3.3 \text{ E } -4 \end{array}$$

Homework

1. a) $4.5 \times 10^7 + 6.45 \times 10^7$

b) $5.4 \times 10^7 + 7.8 \times 10^6$

c) $7.8 \times 10^{-6} - 8.4 \times 10^{-7}$

d) $2.3 \times 10^4 - 4.2 \times 10^3$

e) $6.7 \times 10^{-8} + 8.2 \times 10^{-7}$

2. a) $(4.5 \times 10^3)(2.3 \times 10^{-4})$

b) $(2.0 \times 10^6)(3.5 \times 10^{-9})$

c) $(1.2 \times 10^7)(1.2 \times 10^4)$

d)
$$\frac{6.0 \times 10^7}{1.5 \times 10^2}$$

e)
$$\frac{7.2 \times 10^{-4}}{1.2 \times 10^{-4}}$$

f)
$$\frac{(5.5 \times 10^{-5})(6.0 \times 10^4)}{(2.1 \times 10^4)}$$