Scientific Notation

Scientific Notation is used to easily represent numbers that are either very large or very small. Consider the following measurements:

Distance from the Earth to the Sun (minimum): 146 000 000 000 m
Mass of the Earth: 5 980 000 000 000 000 000 000 000 kg
Mass of an electron: 0.000 000 000 000 000 000 000 000 000 000 91 kg

In scientific notation, the significant digits are always all shown, with the decimal point after the first one. This number is shown multiplied by 10 raised to the appropriate power to give the number the correct value.

Ex: $120\ 000\ 000 = 1.2 \times 10^{8}$ and $0.000\ 000\ 0250 = 2.50 \times 10^{-8}$

Express these measurements in scientific notation

Earth to Sun distance: _____
Mass of the Earth: _____
Mass of an electron: _____

Practice Problems:

1. Express the following measurements in scientific notation.
   a) 12.5 g
   b) 132 000 000 mm
   c) 0.00301 s
   d) 100 000 000 000 W

2. Express the following measurements in floating decimal notation ("normal numbers").
   a) 1.24×10^{6} m
   b) 9.051×10^{5} A
   c) 1.2×10^{-4} cm
   d) 3.31×10^{-3} L

Multiplying in Scientific Notation:

- Multiply the coefficients--round to the number of significant figures in the coefficient with the smallest number of significant figures.
- Add the exponents.
- Convert the result to scientific notation.

Dividing in Scientific Notation:

- Divide the coefficients--round to the number of significant figures in the coefficient with the smallest number of significant figures.
- Subtract the exponents.
- Convert the result to scientific notation.

3. Perform the following calculations. Express the answers in scientific notation.
   a) 4.8×10^{6} m $\times$ 1.2×10^{3} m
   b) 4.8×10^{6} cm^3 $\div$ 1.2×10^{3} cm
   c) 9.30×10^{1} km $\times$ 3.200×10^{-3} km^2
   d) 4.90×10^{2} mm^2 $\div$ 3.5×10^{-7} mm
   e) 5.6×10^{-5} m $\times$ 4.2×10^{0} m
   f) 1.00×10^{-3} m $\div$ 2.50×10^{-3} s

Addition and Subtraction in Scientific Notation

Numbers with exponents can be added and subtracted only when they have the same base and exponent. All numbers in scientific notation have the same base, so only the exponents need to be changed.

- Determine the number by which to increase the smaller exponent by so it is equal to the larger exponent.
- Increase the smaller exponent by this number and move the decimal point of the number with the smaller exponent to the left the same number of places. (i.e. divide by the appropriate power of 10.)
- Add or subtract the new coefficients.
- If the answer is not in scientific notation (i.e. if the coefficient is not between 1 and 10) convert it to scientific notation.

4. Perform the following calculations. Express the answers in scientific notation.
   a) 4.8×10^{6} m + 1.2×10^{3} m
   b) 4.81×10^{6} cm - 1.2×10^{4} cm
   c) 2.30×10^{1} km^2 + 3.200×10^{-3} km^2
   d) 4.90×10^{2} mm - 3.5×10^{-2} mm
   e) 5.6×10^{-2} m + 4.2×10^{0} m
   f) 9.561×0^{-3} g - 2.50×10^{-2} g