

SIGNIFICANT FIGURES

	Number ¹	Significant Figures
1. All digits (1-9) are significant	1.589 m	4
	0.897 m	3
	3600 m	2 ²
2. Significant Zeroes		
a. All sandwiched zeroes	13.02 m	4
	1.0002 m	5
	10.5 m	3
b. All trailing zeroes preceeded by a digit	0.0200 m	3
	15.0 m	3
3. Nonsignificant Zeroes		
a. Leading zeroes	0.0200 (2.00 x 10 ⁻²) m	3
b. Trailing zeroes to left of decimal in a number without decmial part	360 (3.6 x 10 ²) m	2 ²
	56,000 (5.6 x 10 ⁴) m	2 ²

NOTES: ¹ Write numbers in exponential notation if you have any doubt; any zeros used to indicate the power of 10 (order of magnitude) are not significant. Note that nearly all numbers have units associated with them. These must always be written with the number.

² For these types of numbers, the zero could be counted as a significant digit if the number results from a measurement or a calculation. See rules on the next page ($K = ^\circ C + 273 = 37 + 273 = 4.50 \times 10^2$ K, for 3 significant figures). Numbers in science usually result from measurements and calculations in the laboratory.

WORKSHEET FOR SIGNIFICANT FIGURES

1. On the line beside each number below, indicate the number of significant figures for that number:

5800 _____ 0.053900 _____ 1.00 _____ 10 _____

2. Rewrite these numbers in scientific notation (exponential notation) and express the preexponential number in the correct number of significant figures:

10,450 _____

0.0004180 _____

UNCERTAINTY AND SIGNIFICANT FIGURES

THE LEAST ACCURATE NUMBER (LAN) DETERMINES THE NUMBER OF DIGITS TO WHICH THE ANSWER IS EXPRESSED

ADDITION AND SUBTRACTION

- a) The LAN is the number one with the least number of decimal places. The answer (SUM or DIFFERENCE) can have not more decimal places than the LAN.

EXAMPLE:

$$\begin{array}{r} 212 \quad \text{g water (LAN)} \\ 2.1 \quad \text{g salt} \\ 1.88 \quad \text{g sugar} \\ \hline 215.98 \quad \text{g (incorrect)} \end{array}$$

$$216 \quad \text{g (correct)}$$

- b) If a number has no decimal places, the LAN is the number with the fewer digits *and* with the last digit in the highest place.

EXAMPLE:

$$\begin{array}{r} 3600 \quad \text{mL water (LAN)} \\ 111 \quad \text{mL ethanol} \\ 55 \quad \text{mL isopropyl alcohol} \\ \hline 3766 \quad \text{mL (incorrect)} \end{array}$$

$$3800 \quad \text{mL (correct)}$$

- c) Zeros may be counted as significant digits if they are the result of a calculation in which the calculated zero is in a place that is known by the numbers used in the addition or subtraction.

EXAMPLE: Convert 37 °C to K

$$\begin{aligned} K &= ^\circ\text{C} + 273 \\ &= 37 + 273 \quad (\text{both known in ones place}) \\ &= 4.50 \times 10^2 \text{ K} \\ &= 450. \text{ K} \quad (\text{notation less commonly used}) \end{aligned}$$

MULTIPLICATION AND DIVISION

- a) The LAN is the number with the least number of significant figures.
- b) The answer (PRODUCT OR QUOTIENT) can have no more significant figures than the LAN.

EXAMPLE:

Calculate the volume of a rectangular solid that has a length of 4.16 cm, a width of 2.2 cm, and a height of 2.00 cm.

Volume

$$= \text{length} \times \text{width} \times \text{height}$$

$$= \overset{\text{LAN}}{(4.16 \text{ cm})(2.2 \text{ cm})(2.00 \text{ cm})}$$

$$= 18.304 \text{ cm}^3 \quad (\text{incorrect})$$

$$= 18 \text{ cm}^3 \quad (\text{correct})$$

WORKSHEET FOR UNCERTAINTY

1. Add the following grams together and express answer in correct significant figures:

$$\begin{array}{r} 6.29 \text{ g} \\ 0.0505 \text{ g} \\ 15.3 \text{ g} \end{array}$$

2. Subtract these numbers and express answer with units in correct sig. figs:

$$3.890 \times 10^{-7} \text{ M} - 6.804 \times 10^{-8} \text{ M}$$

3. Express answer with correct units and correct sig. figs:

$$0.0297 \text{ mol} \times 55.85 \text{ g/mol}$$

