

Worksheet 1 - Calculations

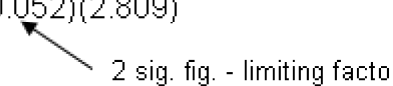
Significant Figures - the number of significant figures (sig. fig.) is a measure of the degree of **uncertainty** in a measurement. There is experimental uncertainty in the last significant figure of a measurement. The rules for sig. fig. are given in Chapter 1.5. All non-zero numbers are significant. Zeros between numbers are significant. Zeros to the left of numbers are not significant. Zeros to the right of numbers may be significant (in presence of a decimal point).

1. Express each of the following numbers in **scientific notation** and decide the number of significant figures:

	<u>Scientific notation</u>	<u>sig.fig.</u>
409.10	_____	_____
4091.00	_____	_____
0.004091	_____	_____
308,000	_____	_____
30,860	_____	_____
0.00056030	_____	_____

Calculations with significant figures - In **multiplication** or **division**, the number of sig. fig. in the answer has only as many sig. fig. as the factor with the smallest number of sig. fig.

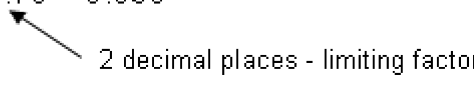
$$\frac{(0.46307)(0.0805)}{(63.54)(0.052)(2.809)} = 0.004016430$$


 2 sig. fig. - limiting factor

which rounds to .0040 or 4.0×10^{-3} (2 sig. fig.)

In **addition** and **subtraction**, the answer should be reported to the same number of decimal places as the term with the least number of decimal places.

$$37.598 - 36.76 = 0.838$$


 2 decimal places - limiting factor

which rounds to 0.84 or 8.4×10^{-1}

Do addition and subtraction first. When rounding, numbers ≥ 5 are rounded up. Do not round until the **end** of the calculations.

2. Do the following calculations and express the answers to the correct number of sig. fig.

$$\frac{29.837 - 29.241}{32.064} =$$

$$\frac{752.12 + 26.3}{1.024236842} =$$

Dimensional Analysis - This technique can be used to change units (K \rightarrow $^{\circ}$ C) and also as an aid in solving problems, by carefully keeping track of units. SI Units and conversion factors are listed in Appendix 6 (A26) in the textbook. A table of metric to English conversion factors is on page 16 of the textbook. .

A certain process yields 4.85×10^{-2} g of a chemical product per second. How many kilograms will be produced in five days of continuous reaction?

Start with what you know on the left and what you are trying to find on the right.

$$\frac{4.85 \times 10^{-2} \text{ g}}{\text{s}} = \text{ ___ kg}$$

Then find **conversion factors**, which allow you to change your units.

$$\frac{4.85 \times 10^{-2} \text{ g}}{\text{s}} \left| \frac{60 \text{ s}}{\text{min}} \right| \frac{60 \text{ min}}{\text{h}} \left| \frac{24 \text{ h}}{\text{day}} \right| \frac{5 \text{ days}}{\text{day}} \left| \frac{1 \text{ kg}}{10^3 \text{ g}} \right| = 20.95200 \text{ kg}$$

Finally, determine the number of sig. fig. The first term has 3 sig. fig. All of the other factors are definitions, and have ∞ sig. fig. So, the answer will be limited to 3 sig. fig., **21.0 kg**.

In the **conversion factors** the value of the numerator and denominator are the same; 60 seconds = 1 minute, 24 hours = 1 day. The final conversion unit illustrates the use of **metric prefixes**; 1000 grams = 1 kilogram. It is important to know these commonly used prefixes.

3. Fill in the missing information in the following chart.

Metric prefix	Symbol	Exponent
	M	
		10^{-9}
deci		
		10^{-6}
	p	
kilo		
	m	
		10^{-2}

