CHEM NOTES: MEASUREMENT REVIEW

SIGNIFICANT FIGURES / SIGNIFICANT DIGITS
SIG. FIG. (SIG.DIGS.) RULES

1) **ALL NONZERO DIGITS ARE ALWAYS SIGNIFICANT.**
   4.2 and 27 both have two sig.figs.

2) **ZEROES BETWEEN TWO NONZERO DIGITS ARE ALWAYS SIGNIFICANT.**
   ZEROES BETWEEN TWO SIGNIFICANT DIGITS ARE ALWAYS SIGNIFICANT.
   ("Sig. Fig. Sandwich") 8.909 and 1005 both have four sig.figs.

3) **ZEROES TO THE LEFT OF NONZERO DIGITS ARE NOT SIGNIFICANT.**
   0.0006 and 0.06 both have only one sig.fig.

4) **TERMINAL ZEROES AFTER THE DECIMAL POINT ARE ALWAYS SIGNIFICANT.**
   1.000 and 9.820 both have four sig.figs.

5) **TERMINAL ZEROES NOT INVOLVING A DECIMAL POINT ARE NOT SIGNIFICANT... UNLESS WRITTEN IN SCIENTIFIC NOTATION FOR CLARIFICATION or UNLESS A DECIMAL POINT IS PLACED AFTER THE LAST ZERO.**
   1230 written as 1.23×10^3 has three sig.figs.
   1230 written as 1230. or 1.230×10^3 has four sig.figs.

ROUNDING RULES

1) **round up if the number after the last sig.fig. is 5 or greater**
   (48.47 rounded to three sig.figs. is 48.5)

2) **round down if the number after the last sig.fig. is less than 5**
   (140.081 rounded to five sig.figs. is 140.08)

SIG. FIG. ADDITION, SUBTRACTION, MULTIPLICATION, AND DIVISION RULES

1) **IN ADDITION AND SUBTRACTION, THE ANSWER MAY CONTAIN ONLY AS MANY <u>DECIMAL PLACES</u> AS THE LEAST ACCURATE VALUE.**

5.2208 + 0.1 = 5.3208	5.3 adjusted
121.50 + 9000 = 9121.50	9122 adjusted

2) **IN MULTIPLICATION AND DIVISION, THE ANSWER MAY CONTAIN ONLY AS MANY <u>TOTAL DIGITS</u> AS THE LEAST ACCURATE VALUE USED.**

5 x 10.000 = 50.000	50 adjusted
49.600 / 47.40 = 1.0464135	1.046 adjusted

DIMENSIONAL ANALYSIS REVIEW

I. **dimensional analysis** (*factor unit* and *factor label*)
- using the units (dimensions) to solve problems

II. steps for success:
1) identify unknown (read carefully)
2) identify known (read carefully)
3) plan solution

"Play checkers" with the units, moving them diagonally, canceling when appropriate. All units should cancel except those of the desired answer.

4) calculate
5) check (sig.figs., units, and math)

III. **conversion factor**—*a ratio of two equivalent measurements*

(SMALL #)	(LARGE UNIT)	=	(LARGE #)	(SMALL UNIT)
1	foot	=	12	inches
1	century	=	100	years

Conversion factors that are exact are an infinite number of sig.figs. (do not limit the sig.figs.)

Dimensional analysis works even when you are not familiar with the units. Here are some examples with nonsense units to prove that point:

Here are some conversion factors to use:

1 neek = 6.1 conks	1 conk = 2.7 goobs	1 goob = 73.8 dwills
1 dwills = 3.490 fops	1fop = 18 zonks	1 zonk = 5.050 cleeks

EX1) How many fops are in 23.66 zonks? (zonks → fops)

$$23.66\ \cancel{\text{zonks}} \times \frac{1\ \text{fop}}{18\ \cancel{\text{zonks}}} = 1.314444444444444 = \boxed{1.3\ \text{fops}}$$

EX2) How many dwills are in 3.72 neeks? (neeks → dwills)

$$3.72\ \cancel{\text{neeks}} \times \frac{6.1\ \cancel{\text{conks}}}{1\ \cancel{\text{neek}}} \times \frac{2.7\ \cancel{\text{goobs}}}{1\ \cancel{\text{conk}}} \times \frac{73.8\ \text{dwills.}}{1\ \cancel{\text{goob}}} = 4521.60792 = \boxed{4500\ \text{dwills}}$$

EX3) How many cleeks are there in 533.96 conks? (conks → cleeks)

$$533.96\ \cancel{\text{conks}} \times \frac{2.7\ \cancel{\text{goobs}}}{1\ \cancel{\text{conk}}} \times \frac{73.8\ \cancel{\text{dwills.}}}{1\ \cancel{\text{goob}}} \times \frac{3.490\ \cancel{\text{fops}}}{1\ \cancel{\text{dwill}}} \times \frac{18\ \cancel{\text{zonks}}}{1\ \cancel{\text{fop}}} \times \frac{5.050\ \text{cleeks}}{1\ \cancel{\text{zonk}}} =$$

$$33{,}753{,}499.3087736 = \boxed{34{,}000{,}000\ \text{cleeks}}$$

EX4) How many goobs are in 0.264 zonks? (zonks → goobs)

$$0.264\ \cancel{\text{zonks}} \times \frac{1\ \cancel{\text{fop}}}{18\ \cancel{\text{zonks}}} \times \frac{1\ \cancel{\text{dwill}}}{3.490\ \cancel{\text{fops}}} \times \frac{1\ \cancel{\text{goob}}}{73.8\ \cancel{\text{dwills}}} = 5.694421796\ldots \times 10^{-5} =$$

$$\boxed{5.7 \times 10^{-5}\ \text{goobs}} \text{ or } \boxed{0.000057\ \text{goobs}}$$