

## 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  $1.23 \times 10^3$  has three sig.figs.  
1230 written as 1230. or  $1.230 \times 10^3$  has four sig.figs.

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### 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)

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

- 1) **IN ADDITION AND SUBTRACTION, THE ANSWER MAY CONTAIN ONLY AS MANY DECIMAL PLACES 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 TOTAL DIGITS AS THE LEAST ACCURATE VALUE USED.**  
 $5 \times 10.000 = 50.000$                       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	1 fop = 18 zonks	1 zonk = 5.050 cleeks

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

$$23.66 \text{ zonks} \times \frac{1 \text{ fop}}{18 \text{ zonks}} = 1.3144444444444444 = \boxed{1.3 \text{ fops}}$$

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

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

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

$$533.96 \text{ conks} \times \frac{2.7 \text{ goobs}}{1 \text{ conk}} \times \frac{73.8 \text{ dwills}}{1 \text{ goob}} \times \frac{3.490 \text{ fops}}{1 \text{ dwill}} \times \frac{18 \text{ zonks}}{1 \text{ fop}} \times \frac{5.050 \text{ cleeks}}{1 \text{ zonk}} = 33,753,499.3087736 = \boxed{34,000,000 \text{ cleeks}}$$

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

$$0.264 \text{ zonks} \times \frac{1 \text{ fop}}{18 \text{ zonks}} \times \frac{1 \text{ dwill}}{3.490 \text{ fops}} \times \frac{1 \text{ goob}}{73.8 \text{ dwills}} = 5.694421796... \times 10^{-5} = \boxed{5.7 \times 10^{-5} \text{ goobs}} \text{ or } \boxed{0.000057 \text{ goobs}}$$