Measurement - Ch. 2, 3

I. How do scientists measure?

A. – measurements based on

B. This is the standard .

C. The units are:

1.
2.
3.
4.
5.

D. Derived Units - Combination of Base Units

1.
2.
3.

E. Other units (Non SI units that you will encounter)

1.
2.
3.
4.

F. Prefixes

1. The metric system is organized by
2. Here are the ones you need to memorize: kilo-, centi-, milli-, micro-, nano-

- 1 kilo (k) = 1000
- 1 centi (c) = 0.01
- 1 milli (m) = 0.001
- 1 micro (μ)= 0.000001 = 1 x 10^{-6}
- 1 nano (n)= 0.000000001 = 1 x 10^{-9}

- 0.001 kilo = 1
- 100 centi = 1
- 1000 milli = 1
- 1,000,000 micro = 1 x 10^{6} micro= 1
- 1,000,000,000 nano = 1 x 10^{9} nano= 1

II. Significant Figures

A. Background

1. Not all numbers are significant. Some are placeholders and do not have value.
2. Only are subject to significant digits.
3.

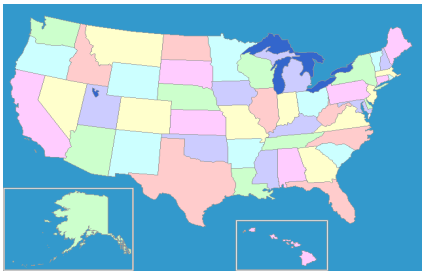
B. The - How to identify significant digits!

1. side: If a , then count the number of significant digits from the
2. side: if a , then count the number of significant digits from the

3. How many significant figures do the following numbers have?

- 12.46 g
- 0.846 mL
- 23,000,000 mm
- 24.82100 lb
- 1,240 J
- 0.008210 cal

4. Which of these numbers are in SI units?



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C. Significant Figures for Calculations
1. Addition & Subtraction: Round to as the number with the

a. Example: 952.0 cm + 1407 cm + 23.911 cm + 158.18 cm
b. Answer:
c. Only like units can be added, subtracted.
2. Multiplication & Division: Round to as the number with the

a. Example: 3.05 mm x 2.10mm x 0.75 mm
b. Answer:

D. Examples:
1. 3.95 g + 2.879 g + 213.6 g
a. Calculation:
b. Answer:
2. 12.257 m x 1.162 m
a. Calculation:
b. Answer:

E. Rounding:

III. Factor Label Method to Solve Problems (Dimensional Analysis)

A. Steps:
1. Write out the with units.
2. Write out the What conversion factors do you need?
3. Draw the "factor label table" starting with
4. Write
5. Add appropriate
6. units (the units left should be the units you are finding)
7.
8. Check

B. Do not mix up the numbers though.

C. Examples
1. How many meters are there in 203mm?

2. Express 0.746µL in milliliters.

3. How many minutes are in 45.9 fortnights? (Hint: 1 fortnight is 2 weeks)

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IV. Scientific Notation

A. "Abbreviation" for very small/large numbers using
B. Conversion of numbers:
1. Move decimal until the
ii. Count the moved. That is the .
3. If the decimal moves to the then the exponent is . If the decimal moves to the , then the exponent is .
4. Check
5. Another way: If number , exponent and vice versa.
C. Examples: Change the following numbers to scientific notation.
0.00456 in
750 g
7500.0 g
4.02110 cm

V. Reliability in Measurement

A. Precision
1. In performing an experiment:
a. You get the
b. Not necessarily the right result.
B. Accuracy
1. In performing an experiment:
a. You get the
b. Usually needs to be
C. Is the following precise, accurate, neither or both?
D. Something can be

VI. Making Measurements

A. Every instrument involves
B.
C. Always includes
D. With liquids, the of the liquid is where the reading is taken.
E. A is used to show the of a measurement.
F. 12.1 ± 0.1mL

VII. Percent Error

A. Compares a measurement with an accepted value.
B. PE =

C. PE value can be . Take the absolute value and treat it as a deviation.

VIII. Ratios: Density

A. Density: Determines if a substance
B.
C. Example: A block has a mass of 75 grams and these dimensions, 10.0 cm x 2.1 cm x 4.6 cm. What is the density of the block?