Chemistry 6A Fall 2007

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Monday 9/10/07

Office Hrs on website.
Add's will be signed in lab this week

Announcements:

If you are trying to add chem. 6A, please go to the lab.

The lab instructor will sign you into both the lab and lecture.

Don't send me any more emails on this please.

Also, if there are any students repeating the course, please email me. You might be eligible to skip the lab.

Chem. 6A this week:

Lab: Check-in, Exercise 1 from lab manual (quiz 1)
Lecture: Chapter 1 & 2

Chem. 6A next week:

Lab: Experiment 2 *(You will need goggles!!)*
Lecture: Chapter 2

I will post a copy of exercise 1 on the website "lab page" for those of you that don't have a lab book to download.

Please review appendix "A" in your text and sections 1.5 through 1.9 prior to coming to lab this week.

Measurements

- Results of *Experiments*.
- *Experiments* yield numerical values or data.

numerical values

70 kilograms = 154 pounds

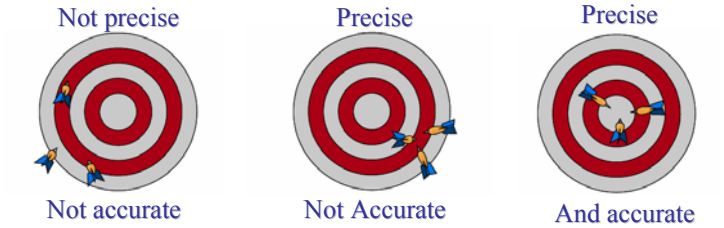
unit

Measurements:

•Measurements are limited by the precision of the measuring device.

•The lower the uncertainty (i. e. ±) the greater the number of *significant figures* that are allowed.

Accuracy is defined as the "*closeness*" to an accepted value a measurement comes.



Counting Significant Figures

1. All non zero numbers are significant
2. All zeros between non zero numbers are significant
3. Leading zeros are **NEVER** significant. (Leading zeros are the zeros to the left of your first non zero number)
4. Trailing zeros are significant **ONLY** if a decimal point is part of the number. (Trailing zeros are the zeros to the right of your last non zero number).

Determine the number of Sig. Figs. in the following numbers

1256	4 sf
1056007	7 sf
~~0.000~~345	3 sf
~~0.000~~46909	5 sf
1780	3 sf
770.0	4 sf
0.08040	4 sf

not trapped by a decimal place.

zeros written explicitly behind the decimal are significant…

Rounding Numbers:

1. Find the last digit that is to be kept
2. Check the number immediately to the right:

   If that number is less than 5 leave the last digit alone.

   If that number is 5 or greater increase the previous digit by one.

Round the following numbers to two (2) sig. figs.:

1056007 → 1100000

0.000345 → 0.00035

1780 → 1800

Scientific Notation / Exponential Numbers

In chemistry very large and very small numbers are used.
These numbers are written as a product of a real number and some power of 10.

examples:

$$234{,}500 = 2.345 \times 10^{5}$$

$$0.00038 = 3.8 \times 10^{-4}$$

Each number has specific parts

$$1.23 \times 10^{4}$$

Coefficient or ***Mantissa***

(this number is ≥1 and < 10 in scientific notation

Base **Exponent**

Exponential part

Converting Numbers to Sci.Notation

To change a number to sci. notation move the decimal point until you get a number between 1 and 10.

563,490.

5.63490

Now count each step as a power of ten to find the exponent.

563,490.

Five steps: the exponent is 5

$$5.63490 \times 10^{5}$$

since the zero was *trapped* by a decimal, it is significant

If one moves the decimal to the right then our exponent is negative.

0.0004821

Decimal moved 4 places

$$4.821 \times 10^{-4}$$

Negative exponent because we moved decimal right.

Sig. Figures in Calculations

Multiplication/Division

The number of significant figures in the answer is limited by the factor with the *smallest number* of significant figures.

Addition/Subtraction

The number of significant figures in the answer is limited by the *least precise number* (the number with its last digit at the highest place value).

NOTE: counted numbers like 10 dimes never limit calculations.

Multiplication and Division:

Determine the correct number of sig. figs. in the following calculation, express the answer in scientific notation.

$$\underset{4\ sf}{23.50} \div \underset{4\ sf}{0.2001} \times \underset{2\ sf}{17}$$

The *sf* in the result is limited to the number with the least amount of *sf*.

The answer must be rounded to 2 *sf*.

$$23.50 \div 0.2001 \times 17$$

from the calculator: 1996.501749 10 *sf*

Your calculator knows nothing of sig. figs. !!!

in sci. notation: 1.996501749×10^3

Rounding to 2 *sf*: 2.0×10^3

Sig. Figs. Addition and Subtraction

How many sig. figs. are allowed in the following calculation?

391 - 12.6 +156.1456

To determine the correct decimal to round to, align the numbers at the decimal place:

391 ← no digits here
-12.6
+156.1456

One must round the calculation to the least significant decimal.

391 ← one must round to here
-12.6
+156.1456

534.5456 (answer from calculator)

round to here (units place)

Answer: 535

Combined Operations:

When there are both addition / subtraction and multiplication / division operations, the correct number of *sf* must be determined by examination of each step.

Example: Complete the following math mathematical operation and report the value with the correct # of sig. figs.

$$(26.05 + 32.1) \div (0.0032 + 7.7) = ???$$

$$(26.05 + 32.1) \div (0.0032 + 7.7) = ???$$

$$\frac{(26.05 + 32.1)}{(0.0032 + 7.7)} =$$

1st determine the correct # of *sf* in the numerator (top)

2nd determine the correct # of *sf* in the denominator (bottom)

The result will be limited by the least # of *sf* (*division rule*)

$$\frac{(26.05 + 32.1)}{(0.0032 + 7.7)} = \frac{26.05 + 32.1}{0.0032 + 7.7} = \frac{58.150}{7.7032}$$

3 *sf*

2 *sf* → The result may only have 2 *sf*

$$\frac{(26.05 + 32.1)}{(0.0032 + 7.7)} = \frac{58.150}{7.7032}$$

3 sig figs

2 sig figs!

$= 7.5488 \quad = 7.5$

2 *sf*

Round to here

Dimensional Analysis

Dimensional analysis converts one unit to another by using ***conversion factors***.

unit (1) × *conversion factor* = unit (2)

The resulting quantity is equivalent to the original quantity, it differs only by the units.

Conversion factors come from equalities: 1 m = 100 cm

$$\frac{1\text{ m}}{100\text{ cm}} \quad \text{or} \quad \frac{100\text{ cm}}{1\text{ m}}$$

For every equality, you get two (2) conversion factors!

$12\text{ in} = 1\text{ ft}$ $\qquad \frac{12\text{ in}}{1\text{ ft}}$ or $\frac{1\text{ ft}}{12\text{ in}}$

$1\text{ mile} = 5280\text{ ft}$ $\qquad \frac{1\text{ mile}}{5280\text{ ft}}$ or $\frac{5280\text{ ft}}{1\text{ in}}$

Examples of Conversion Factors

Exact Conversion Factors: Those in the same system of units

$$1\text{ m} = 100\text{ cm}$$

$$\frac{1\text{ m}}{10^2\text{ cm}} \quad \text{or} \quad \frac{10^2\text{ cm}}{1\text{ m}}$$

Use of exact CF's will not affect significant figures.

Inexact Conversion Factors: CF's that relate quantities in different systems of units

$$1.000\text{ kg} = 2.205\text{ lb}$$

SI units British Std.

$$\frac{1.000\text{ kg}}{2.205\text{ lb}} \quad \text{or} \quad \frac{2.205\text{ lb}}{1.000\text{ kg}}$$ **(4 sig. figs.)**

Use of inexact CF's will affect significant figures.

Solving Problems with dimensional analysis:

Step 1: PUT YOUR CALCULATOR DOWN!

Don't even think about touching that puppy until you have a plan!

Step 2: Read the problem carefully.

Determine what units are to be solved for, write them down

Step 3: Tabulate the data given in the problem.

Label all factors and measurements with the proper units.