CH204 Experiment 1

Dr. Brian Anderson
Spring 2006

Are the Densities of Coke and Diet Coke Different?

$$d = \frac{m}{V}$$

The Mummy Lives!

First, a word or two about significant digits...

Every data point is an estimate!

But how good of an estimate is it?

And if we don't know the true value, how do we know how much error there is in our measurement?

Ways of Determining Error

Single reading:

- **Precision of the equipment**
- **Tolerance of the glassware**

Many readings:

- **Statistics!**

Standard Deviation: A Measure of Error

The standard deviation of a set of numbers tells us how much random scatter there is among the numbers in the set.

Random scatter = random error.

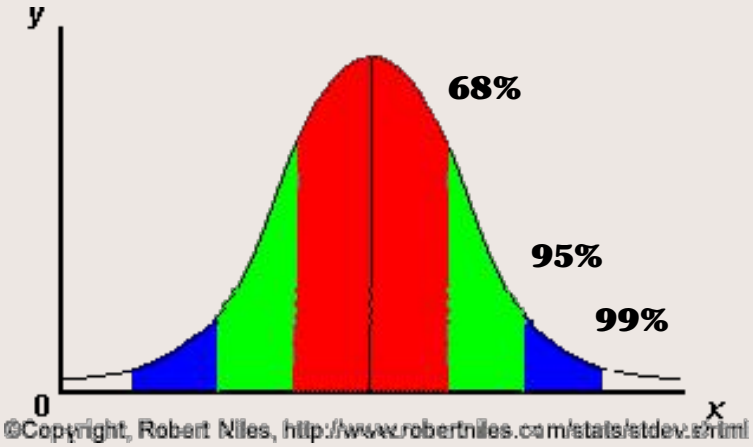
Report results as Average ± Std. Dev.

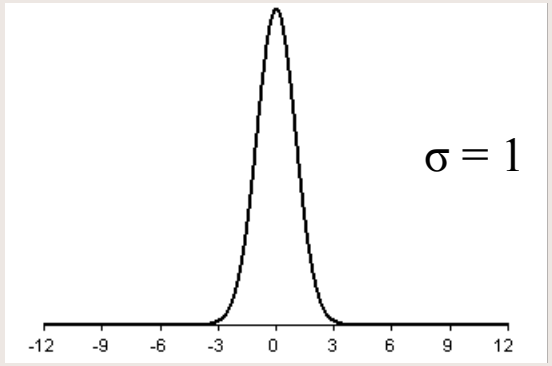
Standard deviation is sometimes called standard error.

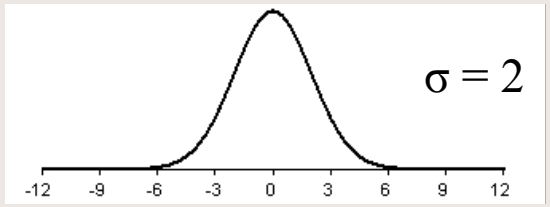
What is Standard Deviation?

How widely the data points are scattered around the average.

$$\sigma = \left[\frac{\sum (x_i - \bar{x})^2}{(n-1)} \right]^{1/2}$$







How does standard deviation impact significant digits?

Experimental error is reported to only one decimal place.

Report significant digits in the average only to the decimal place where the error occurs, even if this means reporting fewer digits than you would otherwise be allowed.

For Further Reading

Web resource: Chemistry Department web site of the University of the West Indies in Jamaica.

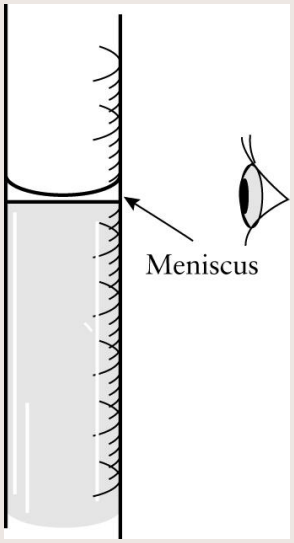
http://wwwchem.uwimona.edu.jm:1104/lab_manuals/c10appendix6.html

(This link is also available on the Announcements and Freebies pages of the class web site.)

Equipment

Graduated cylinder
Volumetric pipette
Burette

0.01 mL



Analytical balance

0.0001 grams!

Two-Part Lab

Part One:

- Measure the mass of 5 mL of sample using the analytical balance and three different types of glassware (pipette, burette, and graduated cylinder).

- Calculate density. Total of six data points.

- Enter your results into the spreadsheet on the computer nearest the printer, and use all the class data in your report.

Two-Part Lab

Part Two:

- Measure your assigned volume using a burette, and measure the mass of the sample on the analytical balance.
- Calculate density. Total of two data points.
- Enter your results into the spreadsheet on the computer nearest the door, and use all the class data in your report.

Important!

Make sure you get all three printouts:

Part One:

1 - Density chart and graph comparing different methods (includes average and standard deviation for each method).

Part Two:

2 - Mass vs volume graph for Coke

3 - Mass vs volume graph for Diet Coke

Bad data

If you know it's bad – because you know something went wrong, or because the number is simply impossible – you can discard it.

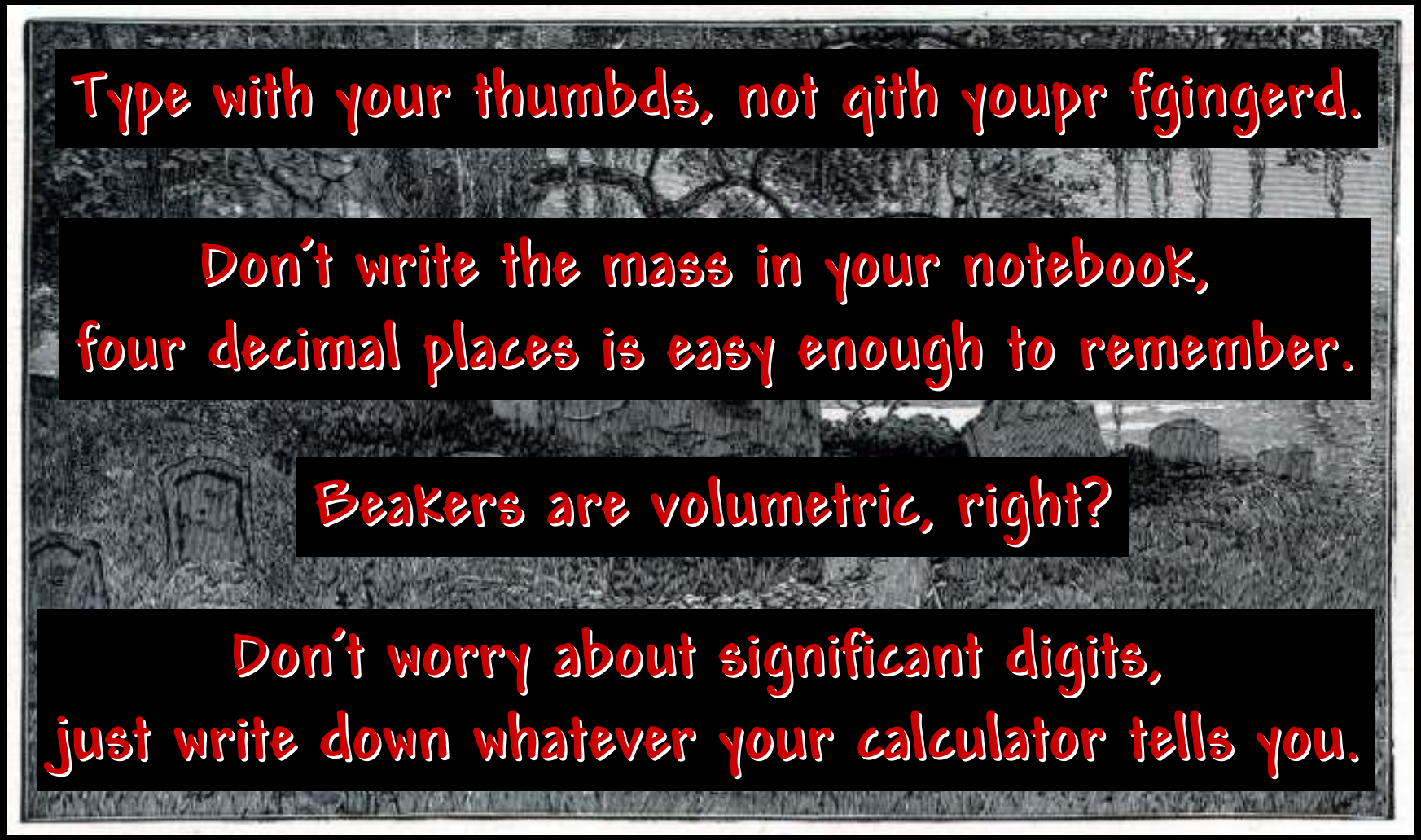
If you don't like it because it's widely scattered, you can't just toss it, you have to apply the Q-test (see the appendix of the lab manual).

Interpolation

In order to calculate the density of water at the same temperature as your Coke or Diet Coke sample, you will have to interpolate between the density values in the table on page 7 of the notebook.

To the Doc Cam!

THE GRADEYARD



Final comments

Remember to turn in pre-lab.

Quiz next week during lecture. There is a sample quiz on the web site Freebies page.

Make sure you write your combination on the green check-in sheet.