Accuracy and Precision

- two related concepts that you must understand wheh working with measured numbers!

Accuracy

- how close a measured number is to the CORRECT (or "true") value of what you are measuring

- "Is it right?"

- checked by comparing measurements against a STANDARD (a substance or object with known properties)

Precision

- how close a SET of measured numbers are to EACH OTHER

- "Can I reproduce this?"

- checked by repeated measurements

More on precison

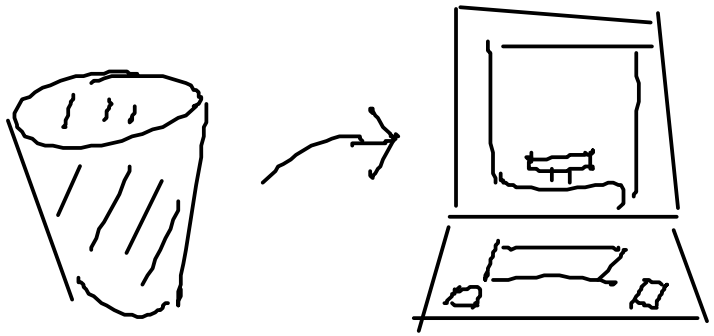
Every measurement contains some amount of ERROR, or some amount of deviation from the true value of what is being measured.

RANDOM ERROR is the variability in a measurement that cannot be traced back to a single cause. Random errors cause measurements to fluctuate around the true value, but can be averaged out given enough measurements.

When reporting measurements, we want to indicate how much random error we think is present. How?

An experiment:

Measure the mass of the RUBBER STOPPER using the BALANCE.



Record the mass on the note card. Include ALL digits given by the balance. Then, give the card to your instructor.

Our classroom experiment: Results

Class data:

Value	# students
20.9428	1
20.9429	1
20.9430	1
20.9431	1
20.9432	2
20.9433	1
20.9435	2
20.9436	1

10 measurements

20.94321 g : unrounded average

Overall average

20.943 ± 0.001 g

Certain. Little to no variation expected. Same almost every time

Uncertain. Expected to vary by about +/- 1

When reading measurements from a scale, record all CERTAIN digits and one UNCERTAIN (or estimated) digit.

When reading a digital scale, include all digits reported by the device.

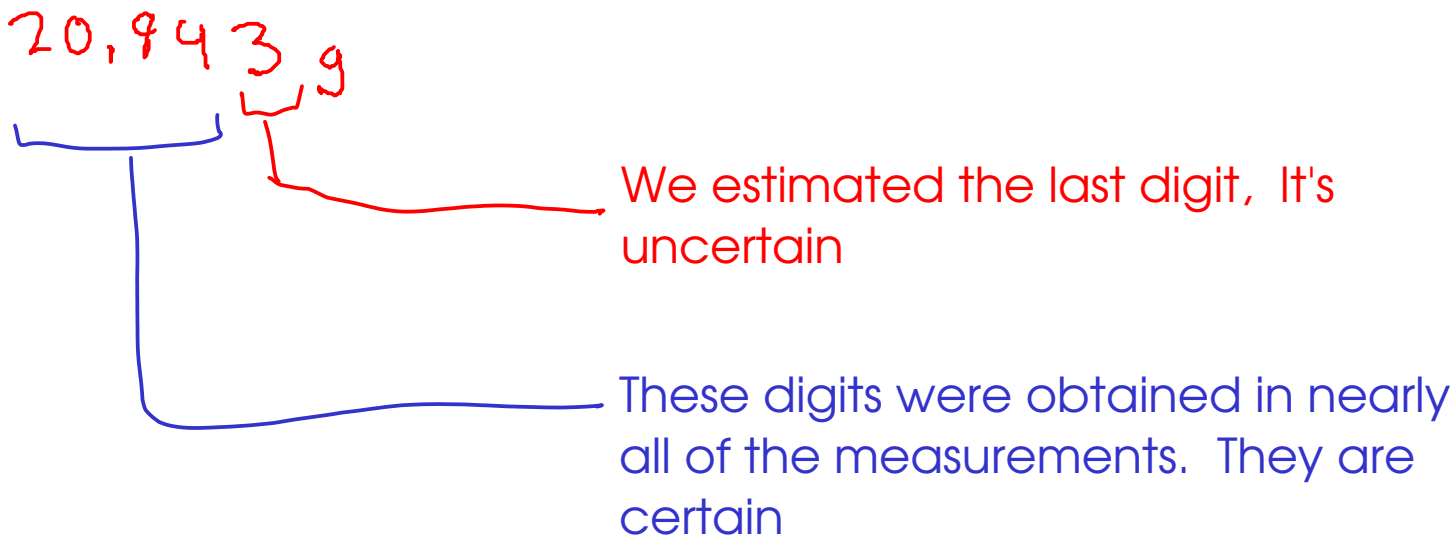
Significant figures

SIGNIFICANT FIGURES are a way to indicate the amount of uncertainty in a measurement.

The significant figures in a measurement are all of the CERTAIN DIGITS plus one and only one UNCERTAIN (or estimated) DIGIT

Example:

From our classroom experiment,



This is a FIVE SIGNIFICANT FIGURE measurement.