HONORS CHEMISTRY

July 30, 2013

Brain Teaser

- Place Textbook Notes on your desk
- Questions on Lab Report???
- Ch 2.1-2.5 Open Note Quizlet
  - Time: 10 minutes

Agenda

- Brain Teaser: Ch 2.1-2.5 Quizlet
- Numbers Notes:
  - Qualitative versus Quantitative
  - Accuracy versus Precision
  - Significant Figures
- Homework
  - Reading and Notes Ch 2.6-2.8
  - Quizlet (over assigned reading tomorrow)

Data Terms

Quantitative Measurements	Give results in a definite form, usually values
Examples	24L, 10 cm, 14 °C

Data Terms

☐ Qualitative Measurements	Give results in a descriptive, non-numeric form.
☐ Examples	The beaker was warm. The density was greater than that of water.

What's the difference between accuracy and precision?

Data Terms

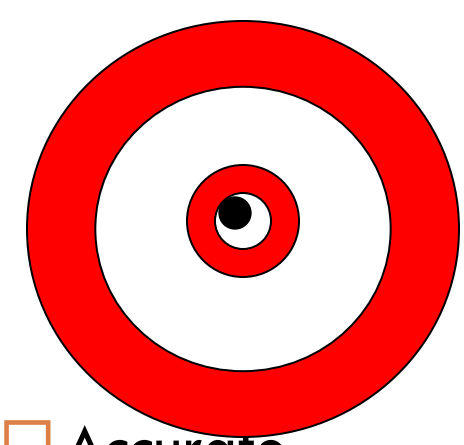
☐Accuracy	How close a measurement comes to the actual value of whatever is being measured
☐Examples	Water freezes at 0° C, and boils at 100° C. How close is the measurement to the values.

Data Terms

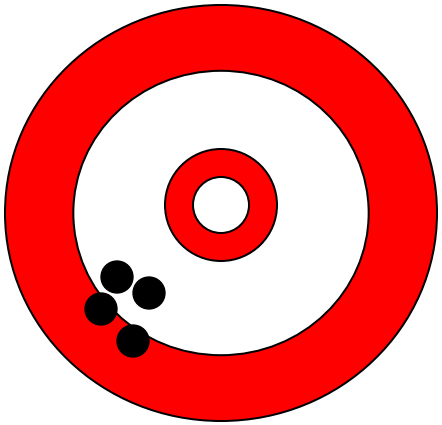
☐ Precision	Reproducibility of the measurement
☐ Examples	9 out of 10 lab groups report the temperature of boiling water to be 95° C. A basketball player shoots 20 free throws, 18 of which bounce off the right side of the rim.

Accuracy vs. Precision

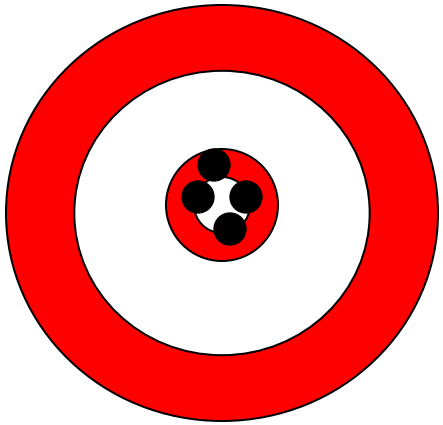
- Target Practice



- Accurate & Precise



Precise



Accurate

Percent error

$$\frac{\text{Theoretical} - \text{Experimental}}{\text{Theoretical}} \times 100 = \%\ \text{error}$$

Closure

- Give an example of a qualitative and quantitative measurement.

Units of measurement

SI Units (Le Systéme Internationale)

- Scientists need to report data that can be reproduced by other scientists. They need standard units of measurement.

Base Units

- A **base unit** is a defined unit in a system of measurement
- There are seven base units in SI.

Refer to the handout on SI Units

Base Units

SI Base Units	
Quantity	**Base Unit**
Time	second (s)
Length	meter (s)
Mass	kilogram (kg)
Temperature	Kelvin (K)
Amount of a substance	mol (mol)
Electric current	ampere (A)
Luminous intensity	candela (cd)

Prefixes Used with SI Units

Prefix	Symbol	Factor	Scientific notation	Example
giga	G	1 000 000 000	10^{9}	gigameter (Gm)
mega	M	1 000 000	10^{6}	megegram (Mg)
kilo	k	1000	10^{3}	kilometer (km)
deci	d	1/10	10^{-1}	deciliter (dL)
centi	c	1/100	10^{-2}	centimeter (cm)
milli	m	1/1000	10^{-3}	milligram (mg)
micro	μ	1/1 000 000	10^{-6}	microgram (μg)
nano	n	1/1 000 000 000	10^{-9}	nanometer (nm)
pico	p	1/1 000 000 000 000	10^{-12}	picometer (pm)

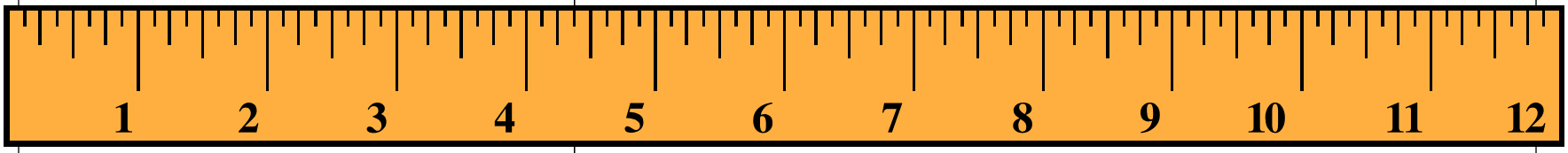
Significant Figures

- Significant Figures

Digits in a measurement that have meaning relative to the equipment being used

Significant Figures

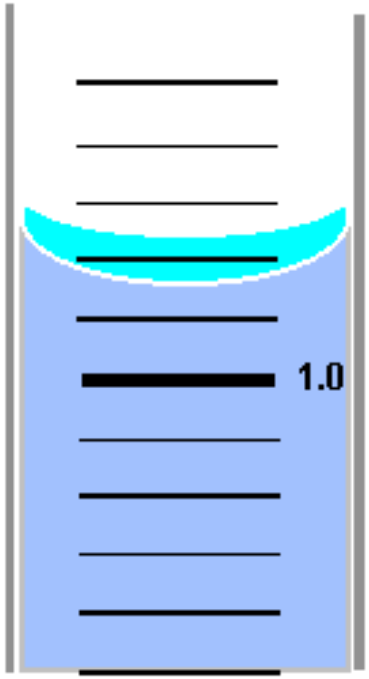
☐ Place	What is the increment on the equipment? What you know for sure.



Significant Figures

☐ Digits with meaning	Digits that can be known precisely plus a last digit that must be estimated.
Examples	Refer to Examples on the board: 1. 2. 3. 4

Uncertainty in Measurements



1.14 mL? 1.15 mL? 1.16 mL?

1.15 ± 0.01 mL

uncertain digit
(1/10 the smallest scale division)

Scale Reading and Uncertainty

- **Uncertainty:** Limit of precision of the reading (based on ability to guess the final digit).
  - Existed in measured quantities versus counted quantities
  - Refer to Example (2 rulers)

Significant Figures: Mini Lab

Equipment to Evaluate

- ☐ To what place (tenths, hundredths, etc.) can these measurement instruments accurately measure? What place is the estimation?

- ☐ Triple beam balance
- ☐ Analytical balance
- ☐ Thermometer
- ☐ Graduated cylinders
- ☐ Beakers
- ☐ Ruler
- ☐ Burette

Significant Figures

- What do you notice?

Depends on type of equipment being used.

Depends on size of equipment used.

Significant Figures

- Raw Data Rules
  - How do you know how many sig figs?

1. All digits 1-9 are significant.
2. Zeros between significant digits are always significant.
3. Trailing 0's are significant only if the number contains a decimal point
4. Zeros in the beginning of a number with a decimal point are not significant.
5. Zeros following a significant number with a decimal are significant.

Significant Figures

- Pacific to Atlantic Rule

- Examples

Pacific = Decimal **P**resent

Start from the Pacific (left hand side), every digit beginning with the first 1-9 integer is significant

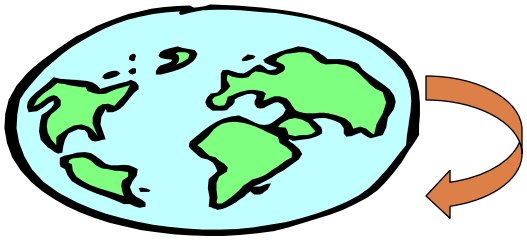
20.0 = 3 sig digits

0.00320400 = 6 sig digits

1000. = 4 sig digits

Significant Figures

- Atlantic Rule to Pacific



- Examples

Atlantic = Decimal **A**bsent

Start from the Atlantic (right hand side), every digit beginning with the first 1-9 integer is significant

100020 = 5 sig digits

1000 = 1 sig digits

Practice

- How many significant figures are in

1. 400.0
2. 4000
3. 4004
4. 0.004

Rally Rows

How many significant figures are in

1. 0.02
2. 0.020
3. 501
4. 501.0
5. 5000
6. 5000.
7. 5050
8. 01.0050
9. 50300
10. 5.0300

Summary

Things to consider

- What do significant figures tell you about the measurement equipment?
- If you wanted to measure the mass of a whale, what scale would you want to use? Would it matter if you know its mass accurately to 1 gram?
- If you wanted to measure the mass a grain of sand , what scale would you want to use? Would it matter if you know its mass accurately to 1 gram?

Instrument Measure

- Need to make sure you are measuring and recording to the correct number of digits
  - Measure what you know for sure and then guess one more digit
- Rulers
  - Draw a line on your paper and measure it to the correct number of digits
- Beaker vs. graduated cylinder
- Electronic balance vs. triple beam balance