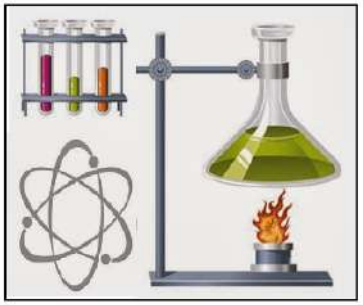
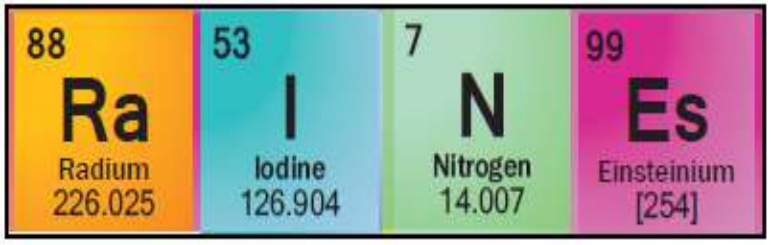
Welcome to Ms. Raines Class



1st day opener

- Sign up for class remind
  - with the app find Honors Chemistry with code: @h-chemsem1
  - Or text @h-chemsem1 to 81010



Day 1 - Agenda

- Opener: Sign up for remind (see dry erase board)
- Receive/Review:
  - Syllabus,
  - Student information sheet, [MUST be signed and returned]
  - week 1 element list, [home work make 15 flash cards]
  - periodic table,
  - Finn Safety contract
  - Supply list
  - Science Fair info [Honors]

Day 2 Opener

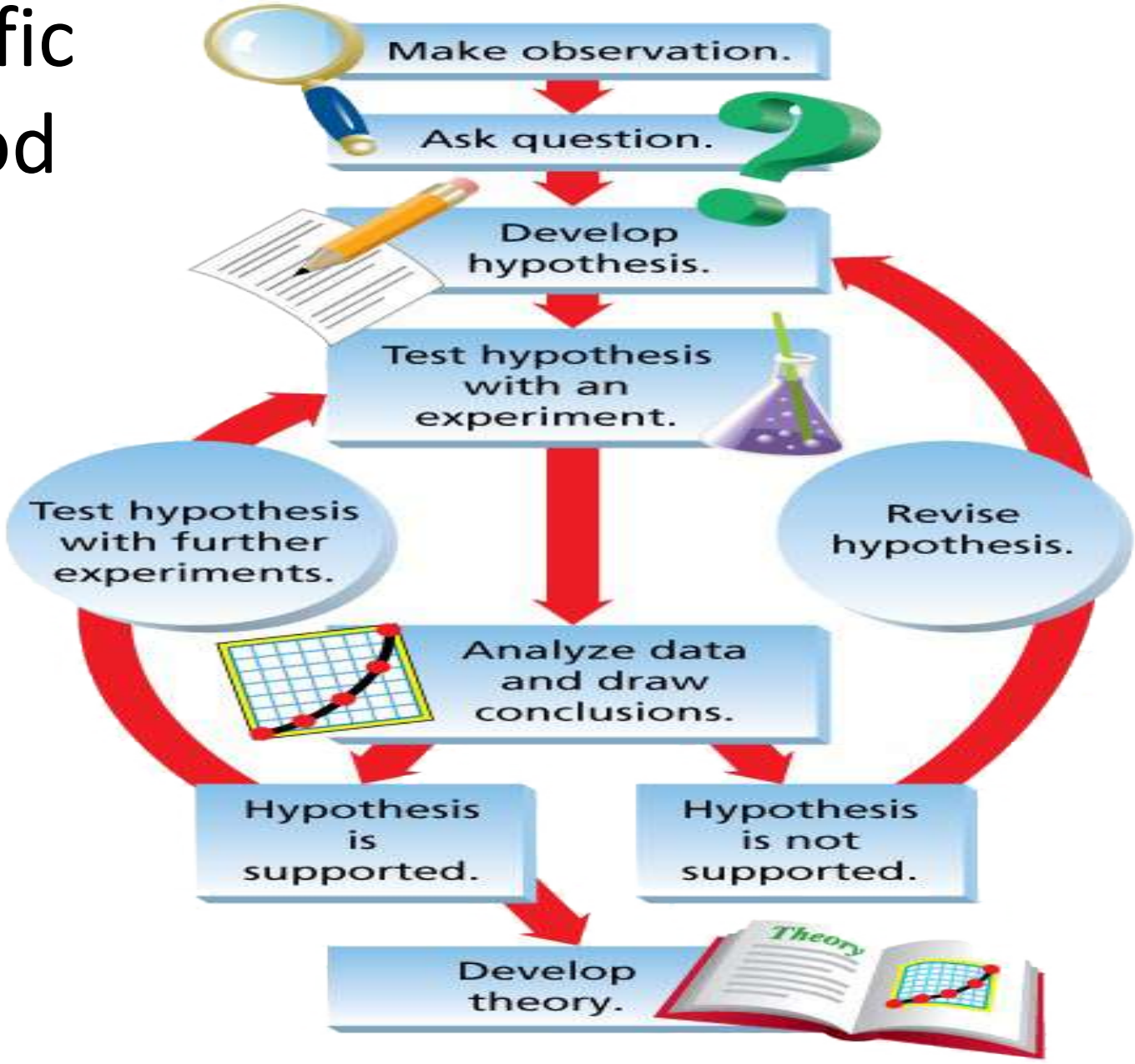
- Opener: Pick up sheet on table @ the front of the room & Complete **equipment activity**
- Safety Tour
- Scientific Method
  - Observe the beakers at the front of the room
  - Record color, phase, odor, or other identifying features
  - Test with pH paper, baking soda, & fire.

Safety Video:
https://www.youtube.com/watch?v=3ELbwzqyuhs

Scientific Method (3 beaker demo)

- Scientific method is a logical, systematic approach to the solution of a scientific problem
  1. Make observation
  2. Ask a question
  3. Form a hypothesis
  4. Experiment
  5. Analyze data
  6. Draw Conclusion
  7. Develop Theory /law or re-evaluate hypothesis

Scientific Method



Experimentation

- Variables are things that change during an experiment
- Independent variable is the one changed by the scientist [I control, I change]
- Dependent variable is the one that changes because of what the scientist did. [It depends on what I do]
- Both can be measured and both can be changed.
- Constants are things that do NOT change between trails

Scientific Theory vs Scientific Law

- Scientific Theory: a well tested explanation for observations and/or experimental result
  - Attempts to explain why or how
  - Can not be proven only can get stronger
  - Kinetic Theory of matter stated atoms are in constant motion and explains how they move
- Scientific law: a statement that summarizes the results of many observations and experiment
  - Does NOT try to explain why/how
  - Gravity

Scientific Method in the real world

- Teacher Example:
  - Observation: Hairdryer is not working
  - Question: Why is the hairdryer not working?
  - Hypothesis: not plugged in
  - Experiment: check to see if plugged completely in
  - Data: turns on
  - Conclusion: hairdryer was not plugged
- Group Example:

Day 3 Opener

Turn in the SIGNED student information sheet to the tray at the front of the room.

Have OUT your week 1 flash cards.

Answer the following questions on note book paper OR the bottom of you equipment activity. You should use a complete sentence and NOT copy the question

1. When must safety goggles be worn? (3 specific items)
2. What device do you use to get chemicals out of your eyes?
3. What should be done if clothing catches on fire? [3 possible answers]
4. What precautions are necessary for the use of volatile solvents?
5. What precautions are needed with long hair, loose clothing and neckties in the laboratory?

Measurement

Types of measurement
Units of measure
metric prefixes
Significant Figures

Types of measurement

- Qualitative measurement based on some quality or characteristic
  - Deals with descriptions.
  - Data can be observed but not measured.
    - Colors, textures, smells, tastes, appearance, beauty, etc.
- **Qualit**ative → **Qualit**y
    - Blue liquid, soft fabric, cold room

Types of measurement

- Quantitative measurement is something that is measurable in quantity
  - Deals with numbers.
  - Data which can be measured.
  - distance, volume, mass, speed, time, temperature, cost, ages, etc.
- **Quantit**ative → **Quantit**y
    - 25.0 g, 48 mL, 3 days, 45 miles

Measurement

- Measuring with SI Units
- The metric system units are based on multiples of 10 and can be converted easily
- International System of Units (SI) is a revised version of the metric system
- **The five SI standard units commonly used by chemists are the meter, the kilogram, the Kelvin, the second, and the mole.**

SI Base Unit

Quantity	**Base unit**
length	Meter (m)
Mass	Gram (g)
Temperature	Kelvin (K)
Time	Seconds (s)
Volume	Liter (L) or cubic meter (m^3)
Amount of a substance	Mole (mol)
Heat and Energy	Joules (J)

Metric Prefixes

- Added to the base unit to make it larger or smaller
- Changes by powers of 10
- Physical science prefix pneumonic: “King henry died by drinking chocolate milk”
- kilo, hecto, deca, base, deci, centi, milli

Name	Symbol	Meaning
Kilo	k	10^3
Hecto	h	10^2
Deca	da	10^1
Base	(g, l, m, s)	10^0
Deci	d	10^{-1}
Centi	c	10^{-2}
Milli	m	10^{-3}

Metric Prefix meanings

When looking at metric units a unit with only 1 letter is a BASE unit, and units with 2 or 3 letters is a prefix unit

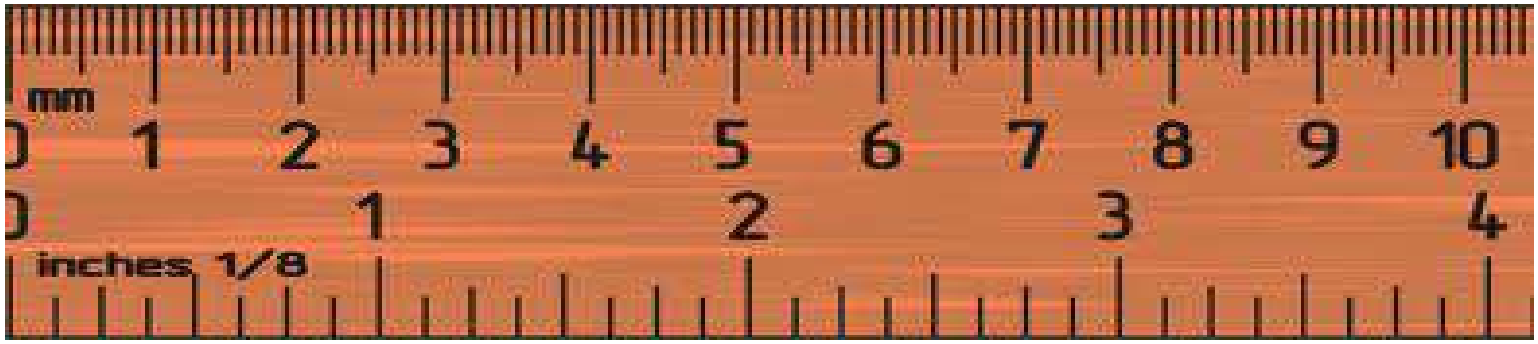
Example:

Km is kilometers

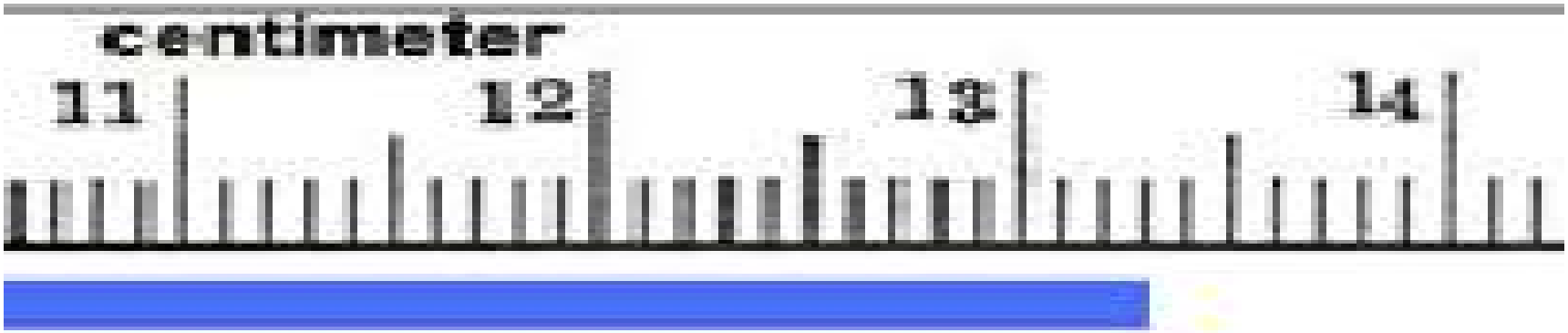
m is meters

mm is millimeters

- **In general, a calculated answer cannot be more precise than the least precise measurement from which it was calculated.**
  - Example: if measuring with a standard ruler and recording the measurements in cm you measurement can only have two decimal places.
  - The line below would be measured at 3.79 cm.



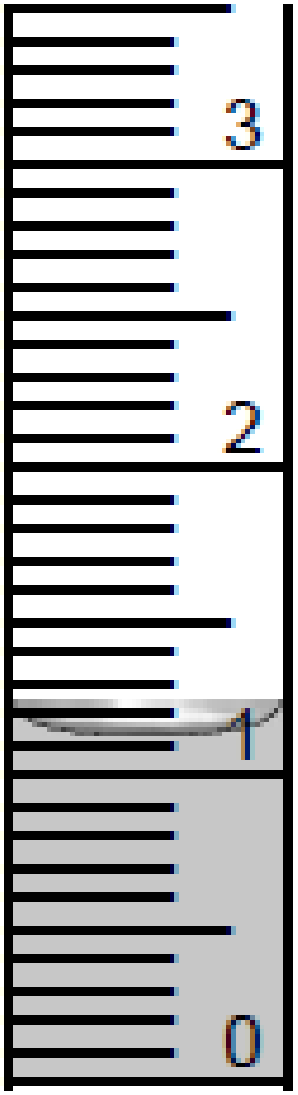
Ruler Example



- The blue line would be recorded to be 13.3_ cm long. With the _ being the estimated digit.
- 13.30 cm, 13.31 cm would both be valid measurements.
- 13.300 cm or 13.310 cm would NOT be valid
- **Read to the unit you are certain of, then estimate one more place.**

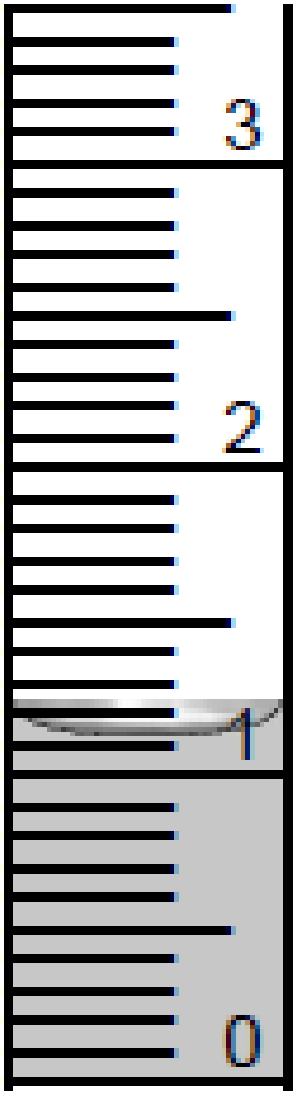
Graduated Cylinder

- In order to read the graduated cylinder correctly, it must be placed on a stable surface such as the desk top of the work area
- And you MUST be at eye level with the meniscus
- To determine the volume of liquid use the number that is directly at or below the bottom of the meniscus



Graduated Cylinder

- You must estimate one more digit that you can precisely measure.
- The graduated cylinder pictured measured in mL and 10^{th} of a mL.
- The blue liquid would have a volume of 1.11 mL or 1.12 mL.
- A measurement of 1.110 mL or 1.1120 mL is more precise than the tool allows.
- **Read to the unit you are certain of, then estimate one more place.**



Significant Figures and Calculations

Complete Significant Figure activity to identify the significant figure rules

Scientific Notation

- When writing very large or very small numbers, scientists use a kind of shorthand called scientific notation.
- This is a way of writing a number without so many zeros.
- Example 1: The speed of light is about

  300,000,000 m/s

  – Or 3.0×10^{8}
- Example 2: The mass of a proton is

0.000000000000000000000001673

  – Or 1.673×10^{-24}

All you do is move the decimal so that you **only have one** number before the decimal.

- 850,000,000.0

  8 5 0 0 0 0 0 0 0 . 0

  $= 8.5 \times 10^{8}$

For large numbers the exponent is positive!!

- 0.000,000,025

  0 . 0 0 0 0 0 0 0 2 5

  $= 2.5 \times 10^{-8}$

For small numbers the exponent is negative!!

Scientific Notation Examples

- 0.007899 = ?
  - Small number = - exponent 7.899×10^{-3}
- 898745.30 = ?
  - Large number = + exponent 8.9874530×10^{5}
- 0.00003657= ?
  - Small number = - exponent 3.657×10^{-5}
- 531120 = ?
  - Large number = + exponent 5.31120×10^{5}

Getting numbers **out of** Scientific Notation

- Look at the exponent of the number to determine if it needs to get smaller or larger
  - Positive exponent means the number get larger so the decimal moves to the right
  - Negative exponent means the number gets smaller so the decimal moves to the left
- Add zeros to fill in any “BLANK” spaces

- Example 1: 2.35×10^5
  - The exponent is positive so the number needs to get larger
  - 2 3 5 .

    
  - 2 3 5 0 0 0. or 235000
- Example 2: 8.68×10^{-4}
  - The exponent is negative so the number needs to get smaller
  - . 8 6 8

    
  - 0. 0 0 0 8 6 8 or 0.000868

Scientific Notation Examples

- 3.256×10^{4}
  - positive exponent = large number 3256
- 9.78×10^{9}
  - positive exponent = large number 978000000000
- 5.24×10^{-3}
  - Negative exponent = small number 0.00524
- 2.41×10^{-7}
  - Negative exponent = small number 0.000000241

Significant Figures Rules

- Significant Digits - Number of digits in a figure that express the precision of a measurement instead of its magnitude.
- Significant figures are just a way of keeping track of our level of precision so that when we do calculations with our data, we don't end up exaggerating it

Significant Figures Rules Simplified

- Rules for determining whether a digit in a stated value is significant
  - Non zero numbers are significant (23.456 has 5 sig figs)
  - Zeros that are between significant digits are significant (101 has 3 sig figs) sandwich rule
  - Zeros at the end of the number **AND** with a decimal are significant.
    - 35200 has 3 sig fig (no decimal)
    - 35200. has 5 sig fig (has a decimal)
    - 35.200 had 5 sig fig (has a decimal)
  - Leading zeros and trailing zeros are NOT significant
    - 0.000223 has 3 sig figs
    - 9800 has 2 sig figs (no decimal)

Significant Figures Examples

a) 2.03	a) 3
b) 1.0	b) 2
c) 0.00860	c) 3
d) 4.50×10^{12}	d) 3
e) 5.1020	e) 5
f) 780	f) 2
g) 780,000	g) 2
h) 0.78000	h) 5
i) 50.	i) 2

1-16-17 Opener

- **Turn in Scientific Notation Practice (from Friday)**
- Identify the number of significant figures in each number then write them in scientific notation

a) 0.000450
b) 2306000
c) 0.00009402
d) 78000
e) 0.002300
f) 80200

Sig figs

a) 3
b) 4
c) 4
d) 2
e) 4
f) 3

Sci Notation

a) 4.50×10^{-4}
b) 2.306×10^{6}
c) 9.402×10^{-5}
d) 7.8×10^{4}
e) 2.300×10^{-3}
f) 8.02×10^{4}

- When rounding first decide how many significant figures the **answer should have.**
- Next round to that number of digits , counting from the left.
- If the number to right of the last significant digit is 4 or less round down, if it is 5 or up round up.
- Make sure you don't significantly change the value of the original number. Can't round 556 to 6 must be 600
- Example: 5,274.827
  - 6 significant figures:
    - 5,274.83
  - 4 significant figures:
    - 5,275
  - 2 significant figures:
    - 5300

- Practice

A. Round 2.3567 to 3 significant figures
B. Round 56913 to 4 significant figures
C. Round 2.0132 to 2 significant figures
D. Round 5678 to 2 significant figure

- Answers

E. 2.36
F. 56910
G. 2.0
H. 5700

1-22-18 Opener

- Self check on rounding part of “Significant Figures WS”

4 sig figs

A. 1.200×10^5

B. 5.458

C. 0.0008769

D. 4.536

E. 43.66

F. 876500

3 sig figs

A. 1.20×10^5

B. 5.46

C. 0.000877

D. 4.54

E. 43.7

F. 876000

Significant Figures and Calculations

- With multiplication and division the calculation should be rounded to the same number of significant figures as the measurement with the LEAST number of significant figures
- Example: $2.100 \times \frac{5.32}{12} =$
- Calculator give 0.931
- 12 has only 2 significant figures so the answer must have only 2 significant figures
- Answer MUST BE 0.93

Significant Figures and Calculations

- With addition and subtraction the answer must be rounded to the same number of DECIMAL places as the value with the lease number of decimal places.
- Example: 2.450 – 14.2
- Calculator gives: -11.75
- But must be rounded to 1 decimal place so answer is -11.8

Practice

- Perform the following calculations and round correctly.

	Calculator	Rounded
❑ 2.680 x 0.0051	= 0.013668	= 0.014
❑ 3.120 / 6	= 0.52	= 0.5
❑ 2.45 + 550.9	= 553.35	= 553.4
❑ 9.056 – 4.25	= 4.806	= 4.81

- **Dimensional Analysis** is a way to analyze and solve problems using the units of the measurements.
  - It is converting one thing to another without changing its value
  - Requires equality statements and conversion factors.
- **The key to dimensional analysis is to set it up so that the UNITS cancel.**
- **All numbers must have a unit!**
  No Naked Numbers!!!!

- Many quantities can usually be expressed different several different units
- **Equality Statement** shows how two (or more) different units are related
  - Example: 1 dollar = 4 quarters
- **Conversion factor** is a ratio of equivalent measurements.
  - Example: $\frac{100\ pennies}{1\ dollar}\ or \frac{1\ dollar}{100\ pennies}$
- Whenever two measurements are equivalent, a ratio of the their measurement will equal 1

- **When a measurement is multiplied by a conversion factor, the number changes, but the actual size of the quantity measured remains the same.**
  - Example: 2.0 hours = 120 minuets = 7200 seconds
- **when using conversion factors the final answer has the same number of significant figures as the starting number**

Name	Symbol	
Kilo	k	
Hecto	h	
Deca	da	1
Base	(g, l, m, s)	0
Deci	d	0
Centi	c	
Mili	m	

Metric Equality Statement

The larger unit is 1 and the smaller unit gets the 1 followed by the same number of zeros as the units are apart.

Example 1:
Decigram and decagram
Decagram is larger so 1 dag
Decigram is smaller and is two away from deca so 100 dg
1 dag = 100 dg

Example 2:
Km and m
1 Km = 1000 m

Example 3:
cm and m
1 m = 100 cm

Steps for using dimensional analysis.

1. Write equality statement for units needed in problem
2. Write given number and unit then multiply by a fraction.
3. The unit you are getting rid of goes on bottom (starting unit)
4. The unit you are going to goes on top (ending unit)
5. Fill in the fraction with the values from the equality statement and solve.

Example 1 (metric)

- If a object has a volume of 0.0234 L how much is the volume in mL?

Equality statement: 1 L = 1000mL

$$0.0234\ \text{L} \times \frac{1000\ mL}{1\ L} = 23.4\ \text{mL}$$

Example 2 (metric)

- If a student runs 37600 dm how many Km is it?

1 Km = 10,000 dm

$$37600\ dm \times \frac{1\ Km}{10{,}000\ dm} = 3.76\ Km$$

Example 3 (metric)

- If a object has a volume of 0.00564 L how much is the volume in cL?
- 1L = 100 cL

$$0.00564\ \text{L} \times \frac{100\ cL}{1\ L} = 5.64\ \text{cL}$$

1-23 Opener

- Perform the following calculations make sure to following rounding and significant figure rules.

  + or – round to fewest # decimal place

  X or ÷ round to fewest # of significant figures

a. 22.5 + 13.00 – 8.124 =43.624 = 42.6

b. 13.6 / 3.300 =4.121212 = 4.12

c. 0.00230 x 22.4 =0.05152 = 0.0515

d. 298.50 - 24 = 274.5 = 275

Non Metric Equality Statements that you should know.

1 min =	60	seconds
1 hour =	60	minuets
1 day =	24	hours
1 week =	7	days
1 year =	52	weeks
1 year =	365	days
1 foot =	12	inches
1 yard =	3	feet

Steps for using dimensional analysis.

1. Write equality statement for units needed in problem
2. Write given number and unit then multiply by a fraction.
3. The unit you are getting rid of goes on bottom (starting unit)
4. The unit you are going to goes on top (ending unit)
5. Fill in the fraction with the values from the equality statement and solve.

Example 1

- If a move is 1.48 hours long how many minutes are you in the theater?

Step 1: 60 minutes = 1 hour

Step 2: 1.48 hours ----------

Step 3: $1.48\ hours\ \frac{\quad}{Hours}$

Step 4: $1.48\ hours\ \frac{min}{Hours}$

Step 5: $1.48\ hours\ \frac{60\ min}{1\ Hour} 88.8\ min$

Example 2 ~~ two step problem

- If a movie is 1.75 hours long how many seconds are you in the theater.
  - We don't have one equality statement that relates seconds and hours so we used two

Step 1: 1 hour= 60 min, 1 min = 60 seconds

Step 2-3: $1.75\ Hours\ \frac{\quad}{Hour}\ \frac{\quad}{\quad}$

Step 2-4 $1.75\ Hours\ \frac{min}{Hour}\ \frac{seconds}{min}$

Step 5: $1.75\ Hours\ \frac{60\ min}{1\ Hour}\ \frac{60\ seconds}{1\ min} = 6300\ seconds$

Example 3 ~~ three step problem

- A sample is 3.324×10^8 minuets old how many years old is it?

  step 1: 1 year = 365 days, 1 day = 24 hours,
  1 hour = 60 minuets

  step 2-4:

$$3.324 \times 10^8 min \frac{hour}{min} \times \frac{day}{hour} \times \frac{year}{day}$$

  step 5:

$$3.324 \times 10^8 min \frac{1\ hour}{60\ min} \times \frac{1\ day}{24\ hour} \times \frac{1\ year}{365\ day}$$

= 632.4 years

1-24-17 Opener

1. Write the metric prefixes in order

   Kilo Hecto Deca BASE deci centi milli

1. Convert the following metric units. Show ALL calculations with UNITS.

   a. 0.08300 s = ?? ms

$$0.08300\ sec\frac{1000\ ms}{1\ sec} = 83.00\ ms$$

   b. 246000 L = ?? KL

$$245000\ L\frac{1\ KL}{1000\ L} = 245\ KL$$

   c. 0.002045 Hg = ?? Dag

$$0.02045\ Hg\frac{10\ Dag}{1\ Hg} = 2.045\ Dag$$

Remember
NO NAKED NUMBERS!!!!

Show ALL units
at every step.
Round at the end.

1-25-18

- How many min are in 4.50 days?

$$4.50\ day \times \frac{24\ hr}{1\ day} \times \frac{60\ min}{1\ hr} = 6480\ min$$

- How many years are in 7.920×10^{15} seconds

$$7.920 \times 10^{15} sec \times \frac{1\ min}{60\ sec} \times \frac{1\ hr}{60\ min} \times \frac{1\ day}{24\ hr} \times \frac{1\ yr}{365\ days}$$
$$= 251{,}141{,}552\ yr = 251{,}100{,}000\ yr$$

Density

- Density is a unit of mass per unit of volume
  - SI Units of density: g/mL or g/cm^3 or Kg/m^3

$$\text{Density} = \frac{\text{mass}}{\text{volume}}.$$

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

- A block of work has a volume of 28.5 m^3 and a mass of 14.05 Kg. What is it's density?

Given	Equation	Solve
v= 28.5 m^3 m= 14.05 Kg D = ?	$D = \frac{m}{v}$	$D = \frac{14.05\,Kg}{28.5\,m^3} = 0.493\,\frac{Kg}{m^3}$

Solving word problems

- Example 1: Robin measured the mass of a metal cube to be 25.48 g and the cube measures 3.0 cm on each side. What is the cube density?

- A marble has a mass of 12.48 grams and when placed in a graduated cylinder with 20.0 mL the volume increased to 24.5 mL. What is the marbles density?
  - Given: m= 12.48g d = ?
    v initial= 20.0 mL
    v final= 24.5 mL
  - Equation: $d = m/v$ $v = v_f - v_i$
  - Solve: v = 24.5 ml – 20.0 mL
    d = (12.48 g / 4.5 mL) =2.7733 g/mL
    d = 2.77 g/mL

Using Density

- Rearranging the density equation
  - First get it in a liner format by multiplying by volume
    - Density x Volume = mass
  - If wanting volume then divide by density

$$\text{Volume} = \frac{\text{mass}}{\text{density}}.$$

  - These equations can be used to find information using known density values

- The density of copper is 8.920 g/cm^3 if you have 52.75cm^3 sample of copper how much does it weigh?
  - Given: d = 8.920 g/cm^3

    v = 52.75cm^3

    m = ?
  - Equation: d = m/v or d(v) = m
  - Solve: mass = (8.920 g/cm^3)(52.75cm^3) =

    mass = 470.5 g

- A 250.0 g sample of lead occupied what volume? [density of lead is 11.340 g/cm^3]
  - Given: m = 250 g

    d = 11.340 g/cm^3

    v = ?
  - Equation: d = m/v or v = m/d
  - Solve: v = 250.0 g / (11.340 g/cm^3)

    v = 22.05 cm^3

1. A metallic substance has a volume of 243 cm^3 and a mass of 1915 g what is it's density?

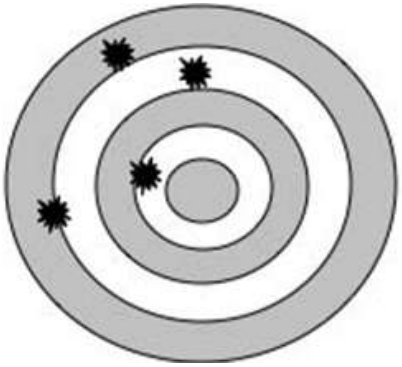
2. Knowing that the density of Zinc is 7.13 g/ cm^3, Iron is 7.87 g/ cm^3 and Nickel is 8.90 g/ cm^3. What is the substances identity?

3. If you had 3.5 kg of the substance what would its' volume be?

Limits of Measurement

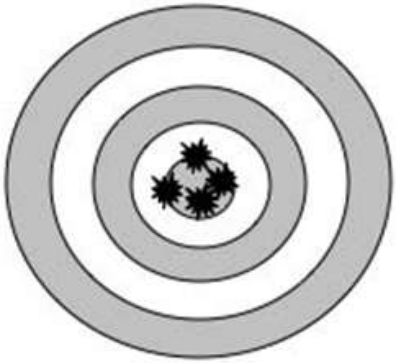
- **Precision** is a gauge of how exact a measurement is.
- Precise measurements are close to each other
- MUST have more than one measurement

- **Accuracy** is the closeness of a measurement to the actual value of what is being measured
- An accurate measure is close to the true or expected value
- MUST have true or expected value



NOT Accurate (not near center)
NOT precise (not near each other)

NOT Accurate (not near center)
Precise (close to each other)



Accurate (Near center)
Precise (close to each other)

Sally	Annie	Travis	Jeff
1.95 g/cm^3	2.69 g/cm^3	3.12 g/cm^3	2.71 g/cm^3
1.89 g/cm^3	2.73 g/cm^3	2.70 g/cm^3	
1.92 g/cm^3	2.65 g/cm^3	2.25 g/cm^3	

To the right is the data collected by students during a lab.
Actual Density of Aluminum is 2.70 g/cm^3

1. Which students data is accurate and precise?
2. Which students data is accurate but NOT precise?
3. Which students data is NOT accurate but IS precise?
4. Which students data is NEITHER accurate nor precise?

1. Annie
2. Jeff
3. Sally
4. Travis

1-29-18 Opener

- Give two examples of
  - Qualitative data
  - Quantitate data
- Identify the independent and dependent variables and any constants.
  - Student test how effective tide, gain and purex are at removing coffee stain from a white cotton towel.

Metric Conversions

a) 5250 g
b) 25,000 mL
c) 520.25 seconds
d) 25.4 mg
e) 8.91 m
f) 581 mg
g) 4,800,000 mL
h) 9.987 deca seconds
i) 52,500 mg
j) 425 cm

Non Metric

9) 0.0116 yr
10) 621.0 in
11) 0.424 mile

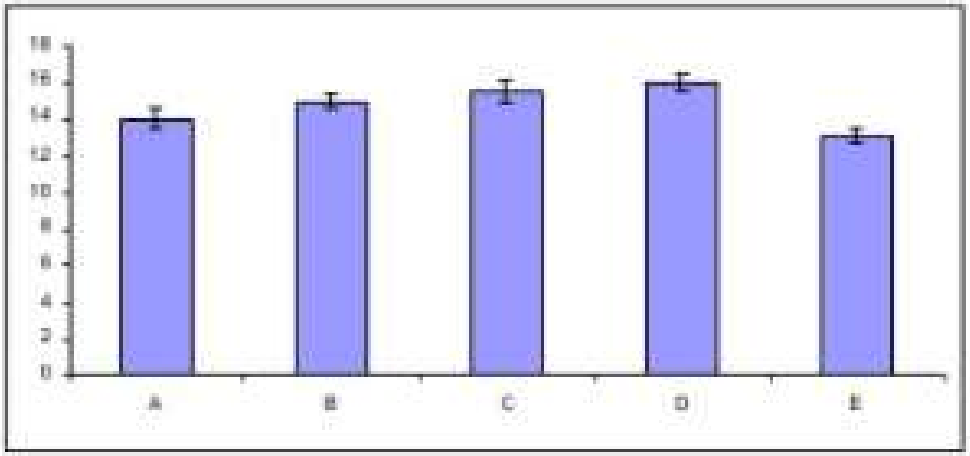
Density Practice

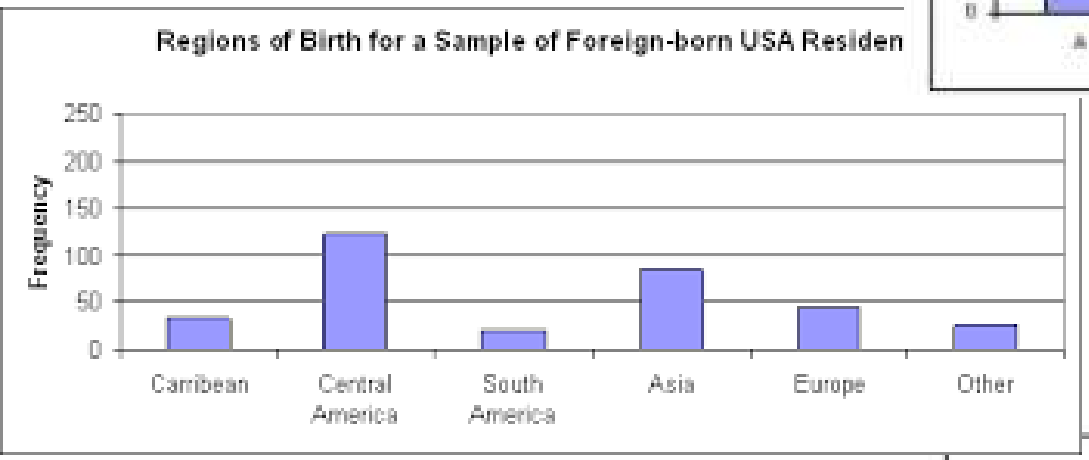
3) 13.6 g/mL
4) 158 g
5) 8.9 g/cm^3
6) 238 cm^3
7) 0.00196 g/mL
8) 219.7 g
9) 11.4 g/cm^3 [lead]
10) 18.3 cm^3
11) 0.826 g/cm^3

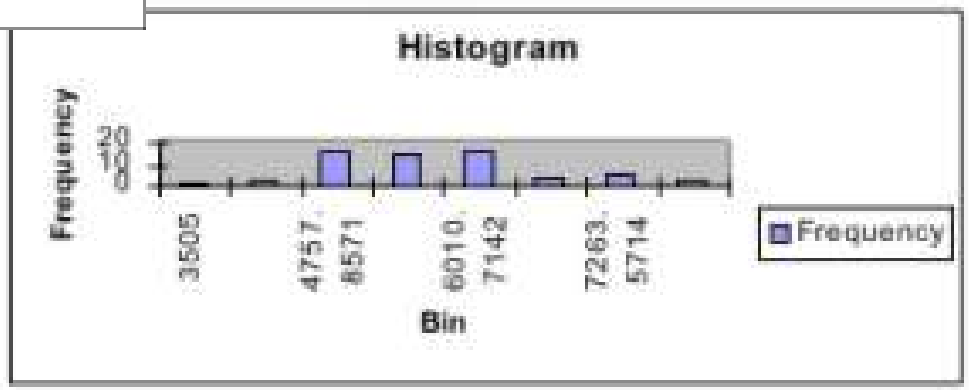
Graphing Check list

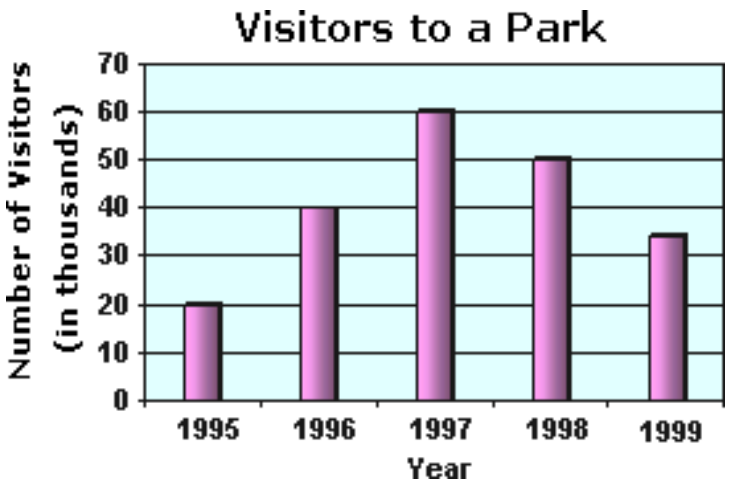
1. Do you have a title?
2. Did you label your x-axis and y-axis with the correct variable and UNITS of measurement?
   - Independent on X-axis
   - Dependent on Y-axis
3. Did you use the same number of increments when numbering your axis?
4. Are your numbers spaced evenly?
5. Did you use MOST if not all of the space on the graph?
6. Did you plot your information correctly?
7. Does your graph have a legend/key (if necessary)?

Graphing: Good, bad and ugly









Unit 1 review videos

- https://www.youtube.com/watch?v=5UjwJ9PIUvE&list=PL3hPm0ZdYhyy0PQUQ1ka94hxVQPdYGS9m [Significant Figures]
- https://www.youtube.com/watch?v=Dme-G4rc6NI [scientific notation]
- https://www.youtube.com/watch?v=hQpQ0hxVNTg&list=PL8dPuuaLjXtPHzzYuWy6fYEaX9mQQ8oGr&index=2&t=552s [Unit Conversion & Significant Figures: Crash Course Chemistry #2]
- https://www.youtube.com/watch?v=8XoDCewJ-z0 [metric conversions]
- https://www.youtube.com/watch?v=7N0lRJLwpPI&list=PL3hPm0ZdYhywMyYMt9shG_-M_pI4akJk8 [Unit Conversion (Factor Label Method)]
- https://www.youtube.com/watch?v=gUa23Rignf8 [density w/ triangle]
- https://www.youtube.com/watch?v=WoIUZ-WGVHM [density of a cube w/triangle]