HONORS CHEMISTRY: SCIENTIFIC FOUNDATIONS (PART ONE) DATE:_____

Objectives: **SWBAT. . .**

… explain the importance of empirical data.
… differentiate observations & inferences (& differentiate the three types of inferences.)
… identify the key parts of the scientific method.

OVERVIEW OF 'NATURE OF SCIENCE':

Science is built on empirical data.

- **Empirical data:**

- Not all empirical data can be gained through experimentation. In that case….

- E.g., Historical investigations, astronomy, some health studies

- Your data/results must be capable of being verified or disproven by ______________________ .

Science uses both observations and inferences.

- **Observations:**

    - ex.) "That rock fell to the ground."

    - Scientific 'facts' are simply ____________________________ .

    - New evidence/technology can change previously accepted 'facts'.

    - E.g., Atomic theory, the age of the Earth, Pluto's heavenly designation

- **Inference:**

    -ex.) "Gravitational forces pulled that rock to the ground."

There are three different kinds of inference.

- **Deduction:**

    - In deduction if the premises are true the conclusion must also necessarily be _________ .

    - ex) *Premise #1: Things denser than water sink in it*

        Premise #2: Rocks are denser than water.

        Deductive conclusion:

    - Why is this example flawed?

    - E.g., Atomic theory, the age of the Earth, Pluto's heavenly designation

- **Induction:**

    -ex.) *Observation: The last twenty rocks that I dropped in water sank.*

        Inductive conclusion:

    - Unlike deduction, induction cannot…

    - E.g., 20,000,000 sinking rocks do not guarantee that the next one you drop will also sink.

    - This is why inductions often include some statement of ___________________ .

- Abduction:

- A.k.a. Inference to the best explanation
- ex) *Observation: This rock floats on water.*

  Abductive hypothesis:
- Like induction, abduction moves from specific to a more general idea, therefore there can be no guarantee that your conclusions are true.
- Abduction is, arguably, …

WATCH SHERLOCK ABDUCT.

EMPIRICAL EVIDENCE IS ACQUIRED THROUGH ______________________________ .

- This is the way we build our body of scientific knowledge.
- This is a creative, imaginative process, not a rigid, lockstep protocol.
- Still, there are several key steps in any proper scientific investigation….

1. RECOGNIZE AND STATE PROBLEM

a)

2. PROPOSE EXPLANATION aka…

b)

Scientific hypothesis:

- Not the same as a theory (will differentiate later…)
- Often '_________________ ' statements.
- ex). If I read the chapter before class,

  then I will score above the class average on the next exam.

3. TEST EXPLANATION

c)

d)

- Studying the results will cause you to either…

e) OR f)

- Conclusions must be stated in a form that others can evaluate.

- Good science must be reproducible!

"Everything should be made as simple as possible, but not one bit simpler." ~ Albert Einstein

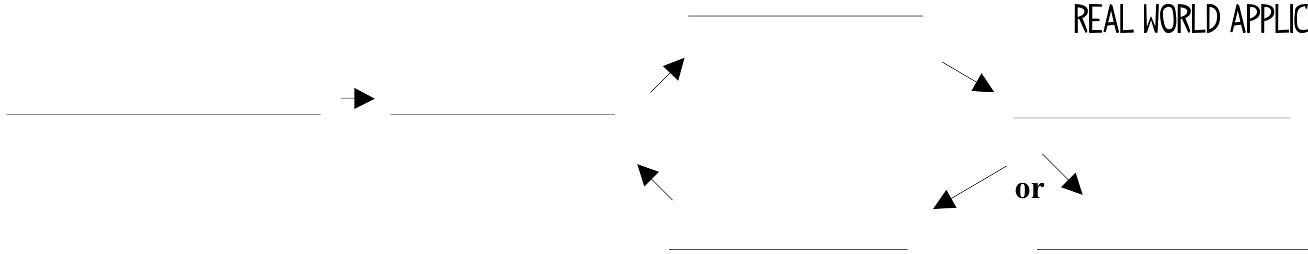
HONORS CHEMISTRY: SCIENTIFIC FOUNDATIONS (PART TWO) *DATE:_____*

Objectives: **SWBAT. . .**

… identify the key parts of the scientific method.
… differentiate theories, hypotheses and laws.

REAL WORLD APPLICATION

REVIEW THE BASIC ELEMENTS OF THE SCIENTIFIC METHOD:



SCIENTIFIC THEORIES SERVE A DIFFERENT PURPOSE THAN DO SCIENTIFIC LAWS.

- **Scientific Theory:**

- **Model:**
- Based on experimentation and inference, and it should produce ________________________ .
- Theories gain credibility as they continue to ___________________ .
- Likely to change as the body of available experimental data/analysis expands.
- E.g., theory of relativity, theory of evolution

- **Scientific Law:**

- Laws do not attempt to explain therefore:
- E.g., Newton's Three Laws of Motion, the Gas Laws

GUEST LECTURER

A SCIENTIFIC THEORY IS DIFFERENT THAN A SCIENTIFIC HYPOTHESIS.

- Although the terms are often used interchangeably in everyday life, there is an important distinction.
- Both attempt to explain phenomenon, but:
  - a scientific hypothesis…
  - a scientific theory, on the other hand, …

SCIENCE IS A DEEPLY CREATIVE AND IMAGINATIVE PROCESS.

- Theories, hypotheses, abductions all require a great imagination to create.
- Curiosity is often a scientist's greatest tool.

Science is a human endeavor that can influence (and is influenced by) society.

Some examples:

-
-
-
-

Some theories cannot be investigated using the scientific method.

- Science cannot evaluate those things which cannot be ____________________.
- E.g., Questions of faith, morality, ethics.
- Note: science and religion are not at war. Both provide vital and distinct roles in society!

Finally, you cannot prove anything (well, in science anyway).

- Science is built on finding evidence that ____________________ or ______________________.
- Just because your observations or experiments agree with your premise, doesn't mean that your ideas are correct for every other possible situation. (A.k.a. _________________________)
- Play it and safe use phrases like:

  instead of overreaching with stuff like:

DID YOU KNOW... "'The burden of proof' is the obligation resting on a party in a trial to produce the evidence that will shift the conclusion away from the default position to one's own position.

Proof "Beyond a reasonable doubt' is the highest legal standard. It has been described as, in negative terms, as a proof having been met if there is no plausible reason to believe otherwise. This is proof of such a convincing character that you would be willing to rely and act upon it without hesitation in the most important of your own affairs. However, it does not mean an absolute certainty... The term connotes that evidence establishes a particular point to a moral certainty and that it is beyond dispute that any reasonable alternative is possible. It does not mean that no doubt exists as to the accused's guilt, but only that no Reasonable Doubt is possible from the evidence presented.

The main reason that the high proof standard of reasonable doubt is used in criminal trials is that such proceedings can result in the deprivation of a defendant's liberty or even in his or her death. These outcomes are far more severe than in civil trials, in which monetary damages are the common remedy." http://www.youtube.com/watch?v=wYlVBhwfvL4

- paraphrased from http://en.wikipedia.org/wiki/Legal_burden_of_proof

"His priority did not seem to be to teach them what he knew, but rather to impress upon them that nothing, not even... knowledge, was foolproof." - J. K. Rowling, Harry Potter and the Order of the Phoenix

HONORS CHEMISTRY: SCALE READING *DATE:_____*

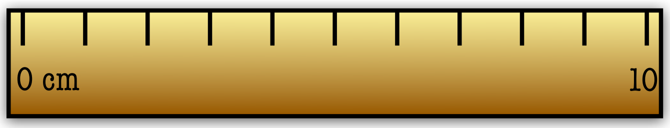
Objectives: **SWBAT. . .**

… determine the resolution of a mechanical scale.
… read a scale correctly based on its resolution.
… explain the difference between accuracy & precision.

READING SCALES CORRECTLY IS REALLY, REALLY IMPORTANT. [REALLY.]

DETERMINE THE RESOLUTION OF A MECHANICAL SCALE BEFORE USING IT..

- **Resolution:**
- You'll want to know how far out to take your numeric values before making any measurements.
- Determine what the smallest hashmarks measure.
- The resolution is one digit beyond that. For example...

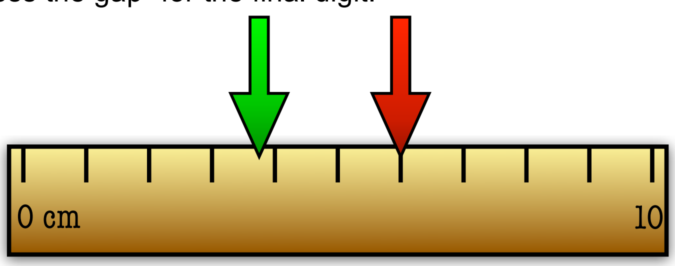


- The smallest set of lines represent:
- That means the gap between the lines represents:
- The resolution of this scale is:

ONCE YOU KNOW A SCALE'S RESOLUTION, THE REST IS EASY.

- Read the hashmarks are far as you can and then "guess the gap" for the final digit.

- If you end on a hashmark and not a gap, use the appropriate amount of zeroes to get your measurement to the scale's resolution.



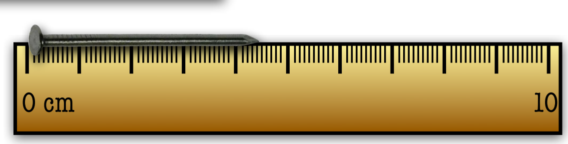
- Practice on these two arrows...

- Then determine each of the following scale's resolution and then correctly measure the items:

Resolution=
Item Length=

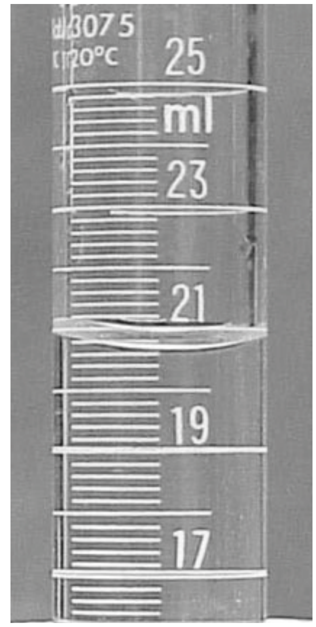
Resolution=
Item Length=

Resolution=
Item Length=



Other common scale reading mistakes:

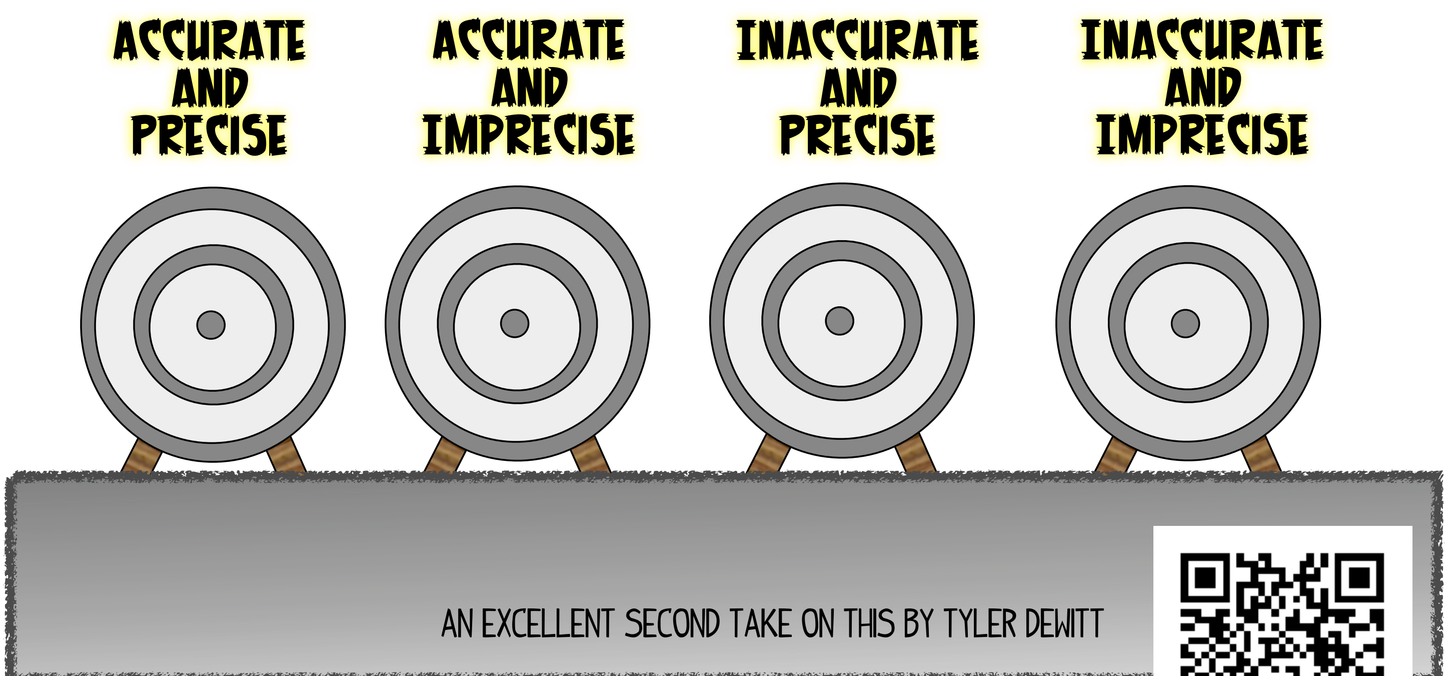
- Remember to write down the ___________!
- Never read a ___________ off of a metric scale!
- Do not ___________ a gap!
    - E.g., Guessing 2.75 cm instead of 2.7 or 2.8 cm
- Place your numbers in the correct locations!
    - E.g., Reading 10.65 cm instead of 16.5 cm.
- Some scales are downright confusing.
    - What is the resolution of this cylinder?
    - It can only be read to :



Some other scale related vocabulary....

- **Accuracy:** The degree to which a measurement relates to the actual (true) value
- **Precision:** A scale's ability to show consistent results under the same conditions (i.e., repeatability)

- Four possible situations:



"It takes a lot of things to prove you are smart, but only one thing to prove you are ignorant."
~ Don Herald

Reading a Balance

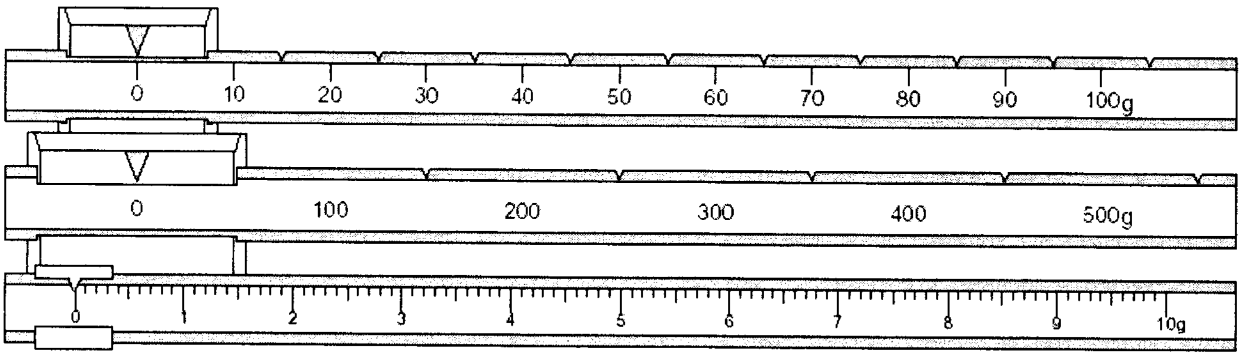
A balance is an instrument used to measure mass. The mass of an object on an electronic balance is shown on a digital display.

Rules for Using the Balance

1. Always zero the balance at the beginning.
2. Use the same balance during the same lab.
3. Never place chemicals directly on the balance pan.
4. Never place hot objects on the balance.

Measuring Mass with a Triple-Beam Balance

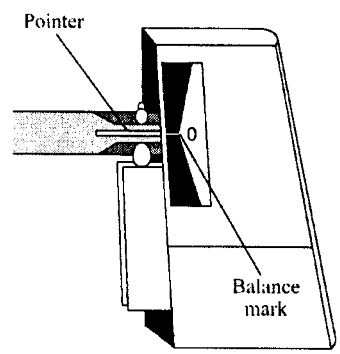
<u>Zeroing the Balance</u>: Adjust all three masses on the balance to point to 0 g.



Place an object whose mass you want to find on the pan.
Adjust the mass on the middle beam. Adjust the mass on the middle beam (0–500 g) until you find the notch where the pointer dips below the balance mark. When the pointer dips below the balance mark, the mass on the beam is heavier than the object being weighed. Bring the mass back one notch to the left.

Adjust the mass on the back beam. Next adjust the mass on the back beam (0–100 g) until you find the notch where the pointer dips below the balance mark. Bring the mass back one notch to the left.

Adjust the mass on the front beam. Adjust the mass on the front beam (0–10 g) until the pointer lines up with the balance mark. Notice that on the front beam there are no notches for the mass. This is so the mass can be adjusted to the place where the pointer lines up exactly with the balance mark.



Reading Liquid Levels

In many experiments, the results depend on your ability to correctly and accurately read the level of a liquid. It may be the temperature on a thermometer, a volume in a graduated cylinder, or the atmospheric pressure on a barometer. It is important to know how to correctly read these levels to ensure the best possible results.

READING THERMOMETERS

The thermometers you work with in the laboratory are usually marked in whole degrees or tenths of degrees. Figure A shows a thermometer with a temperature between 30°C and 40°C. The thermometer scale has 10 intervals marked between 30°C and 40°C. This means that each graduation mark represents 1°C. The middle mark, 35°C, is slightly longer than the other marks, making it a quick reference point. Figure B shows a thermometer with a temperature between 38°C and 39°C. The thermometer scale has 10 intervals marked between 38°C and 39°C. This means that each graduation mark represents 0.1°C. Notice again that the middle mark is slightly longer than the other marks.

If the marks are far enough apart, you can estimate one more digit for your reading. This is done by estimating the value between graduation marks where the liquid level lies. This intermediate value is an "uncertain" digit because it is an estimate. For example, the liquid level in the thermometer in Figure B is about halfway between 38.5°C and 38.8°C. You might estimate the reading to be 38.65°C. In Figure C, the liquid level is also between 38.5°C and 38.6°C. A good estimate of the temperature on this thermometer is 38.55°C.

FIGURE A

FIGURE B

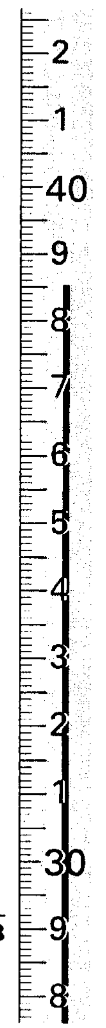


FIGURE C

READING LIQUID LEVELS TO MEASURE VOLUME

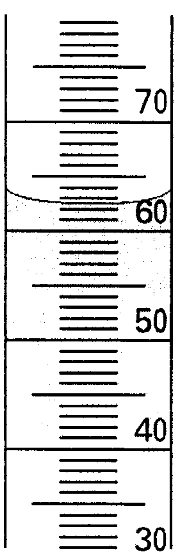


FIGURE D

Graduated cylinders, burets, and pipets are all commonly used to measure the volume of liquids. As shown in Figure D, a liquid's surface is noticeably curved in containers like these. This curved surface is called a *meniscus*. The common practice for most liquids is to use the bottom of the meniscus to take your reading.

When taking a reading, it is important to have the meniscus at eye level, as shown in Figure E. If the meniscus is not at eye level, the reading will not be accurate. It may be difficult to see the meniscus, especially with clear liquids. You may find it helpful to hold a piece of white paper behind the graduated cylinder, buret, or pipet to help you see the meniscus clearly. As with the thermometer, if the graduations are far enough apart, you can estimate the level of the meniscus between graduations. The last digit in your measurement reading is therefore uncertain.

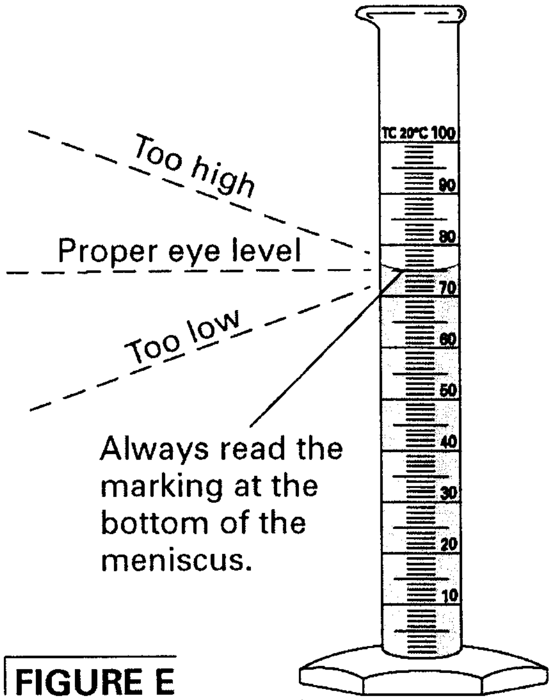


FIGURE E

Graduated cylinders

Graduated cylinders are used to measure relatively large volumes of liquids. Some common sizes for graduated cylinders are 10 mL, 50 mL, 100 mL, 500 mL and 1000 mL. A 25 mL graduated cylinder is shown in Figure F. Graduated cylinders are designed to measure the desired volume of a liquid before pouring it into another container for use in experiments. For this reason, the scale increases from bottom to top.

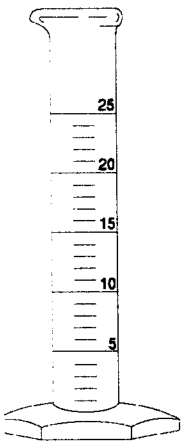


FIGURE F

Pipets

Pipets are used to deliver or measure relatively small volumes of liquids, usually less than 25 mL. The most common type of pipet that you will encounter in the laboratory is the volumetric pipet.

Volumetric pipets

The volumetric pipet, shown in Figure G, is designed to deliver a fixed quantity of liquid. This quantity and a reference mark are indicated on the pipet. The pipet is filled with liquid until the bottom of the meniscus is level with the reference mark.

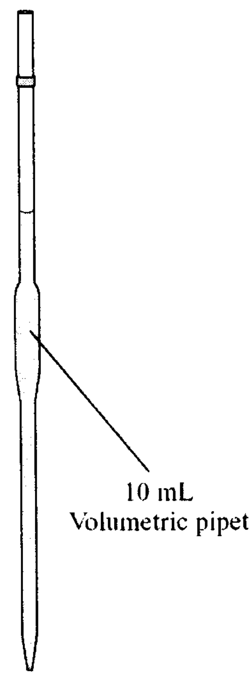


FIGURE G

Burets

Burets are similar to the measuring pipets. Burets allow you to deliver any volume of a liquid up to the maximum capacity of the buret. Their scales also increase from top to bottom, as shown in Figure J, so that you can read the volume that has been delivered.

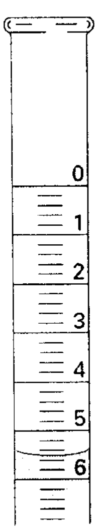


FIGURE J

READING A BAROMETER

Liquid barometers use a tube of mercury to measure atmospheric pressure. As air presses down on the mercury in the reservoir, mercury is forced into the tube. The height that the mercury rises in the tube indicates the atmospheric pressure.

At sea level, atmospheric pressure causes the mercury level in a barometer to rise to about 760 mm. At higher elevations, the atmospheric pressure decreases. Atmospheric pressure also changes based on weather conditions.

Reading a mercury barometer is a little more complicated than reading a thermometer. First the mercury level in the reservoir should be adjusted so that it is aligned with the reference pointer. Your teacher should help you with this adjustment.

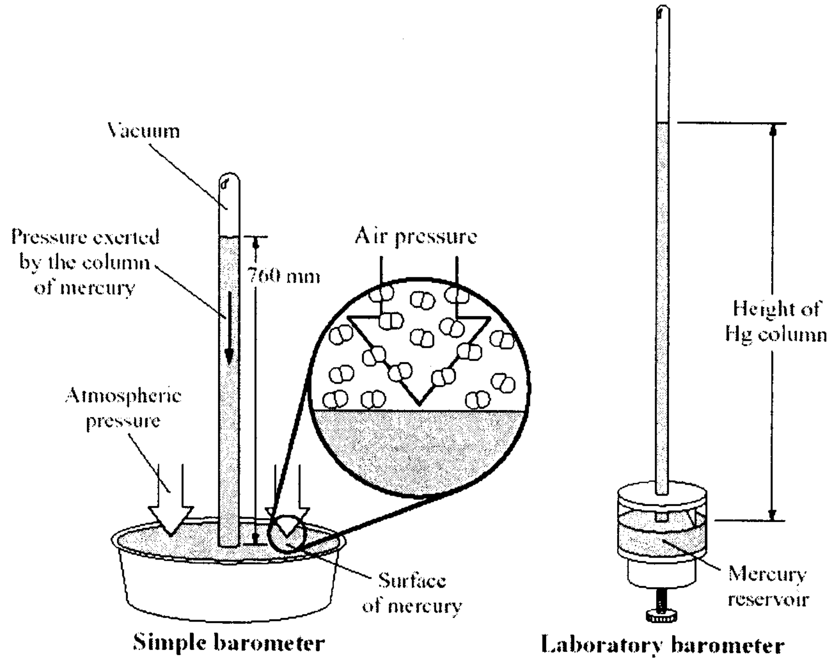


FIGURE K

Most laboratory barometers have a main scale and a vernier scale. The scales are marked in millimeters. Unlike other liquids, the mercury meniscus is inverted, or curved upward. Therefore, the reading is taken at the top of the meniscus. To take a reading, move the vernier scale so that the bottom of the scale aligns with the top of the mercury meniscus. You should be able to see light through the tube on either side of the meniscus, as shown in Figure L. Take your reading of the main scale from the base of the vernier. The estimated digit, 0.1 mm, is read from the vernier scale. In Figure L, you see that the second mark of the vernier scale aligns exactly with a mark on the main scale. Therefore, the pressure shown is 747.2 mm Hg.

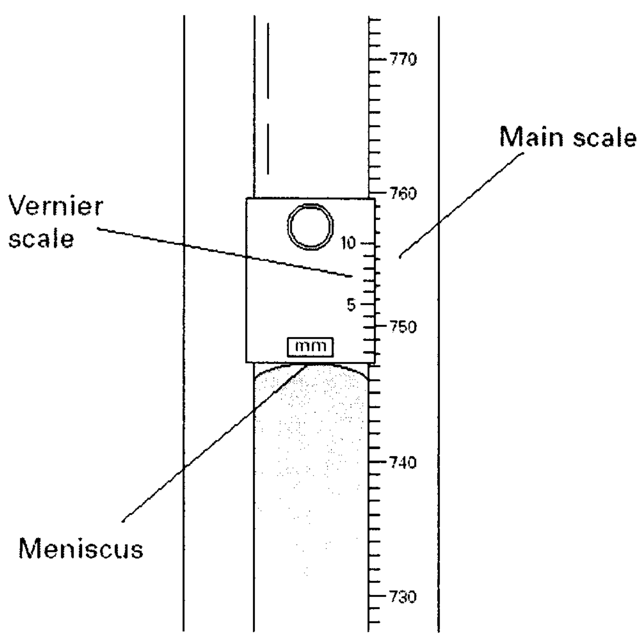
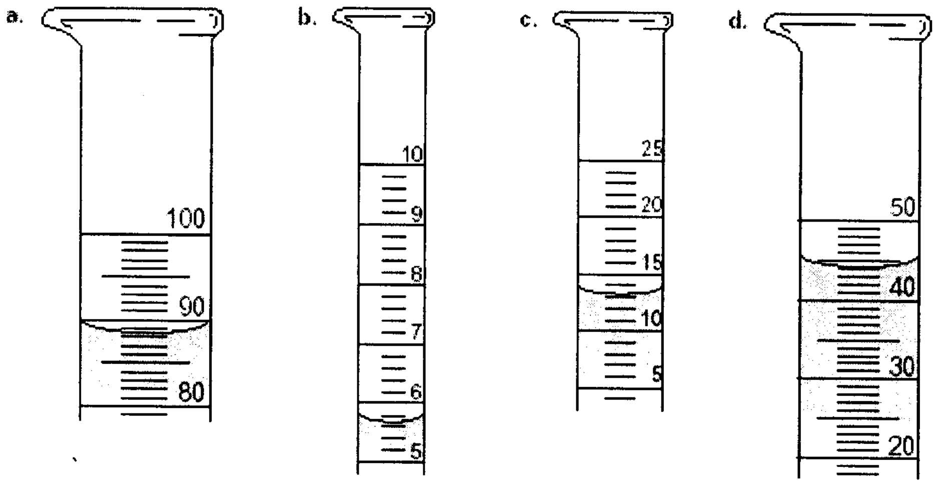


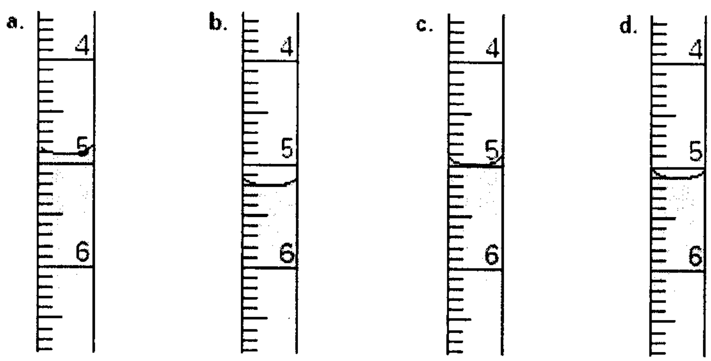
FIGURE L

2. What is the liquid volume in each of the following graduated cylinders?



Answer ____________ *Answer* ____________ *Answer* ____________ *Answer* ____________

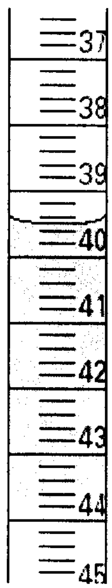
3. Which of these volumetric pipets contains 5.0 mL of liquid?



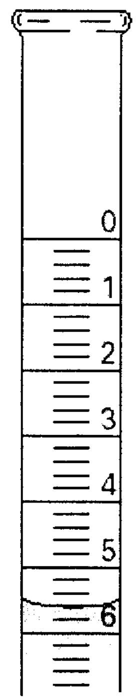
Answer ____________

4. What volume has been delivered by each of the following burets? Assume each buret was completely full before delivering the amount shown.

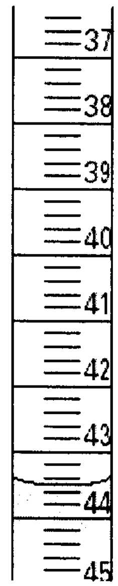
a.



b.



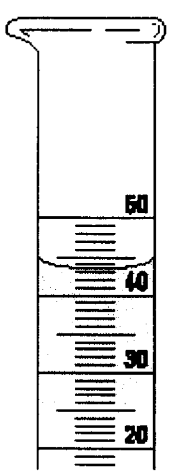
c.



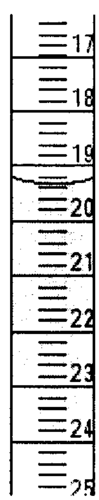
Answer ______________ *Answer* ______________ *Answer* ______________

5. Using the meniscus, read the volume for each of the following.

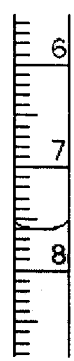
a.



b.

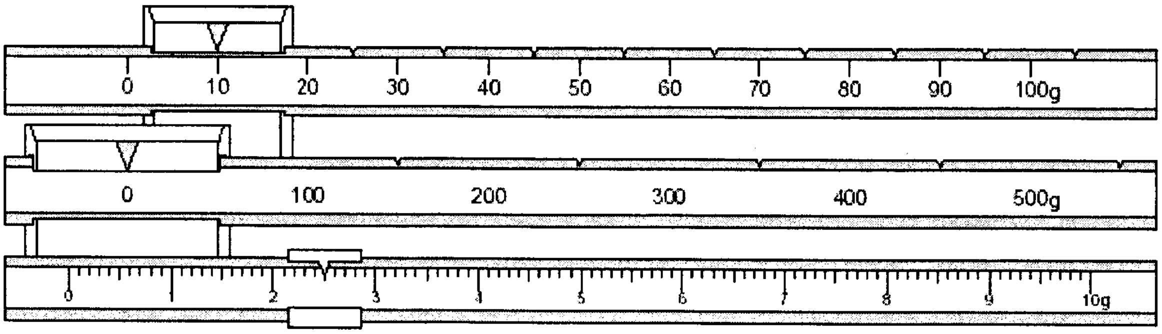


c.



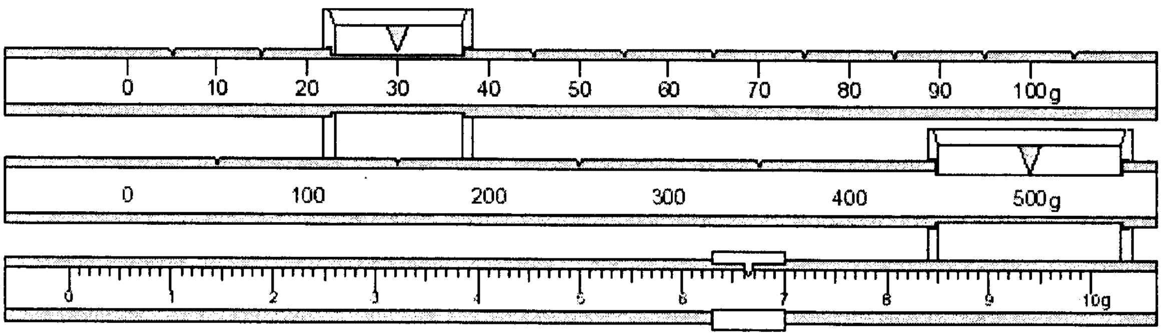
Answer ______________ *Answer* ______________ *Answer* ______________

3.



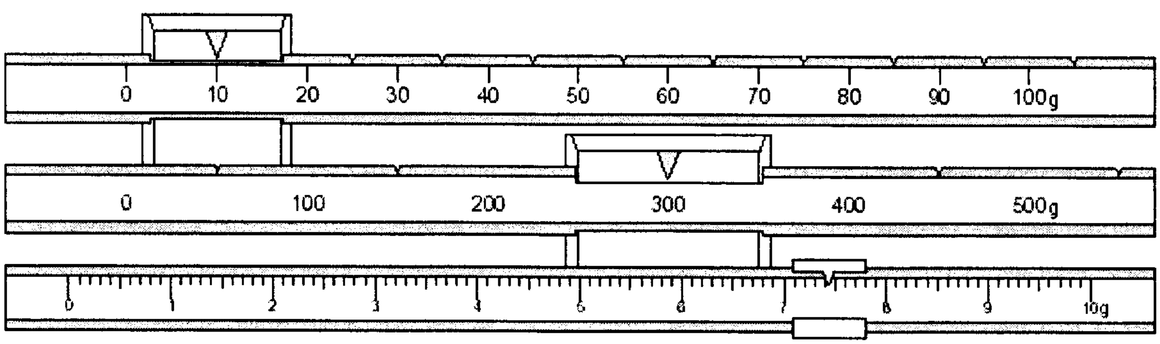
Answer ______________________

4.



Answer ______________________

5.

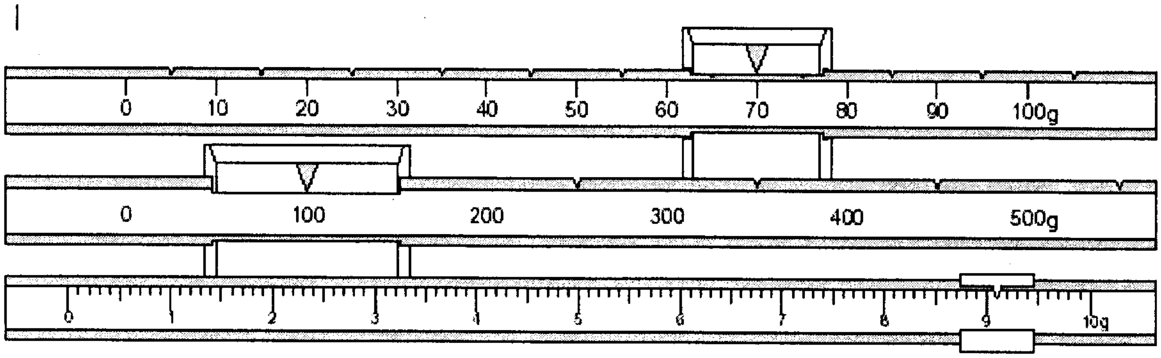


Answer ______________________

Name: ______________________ Period: ______

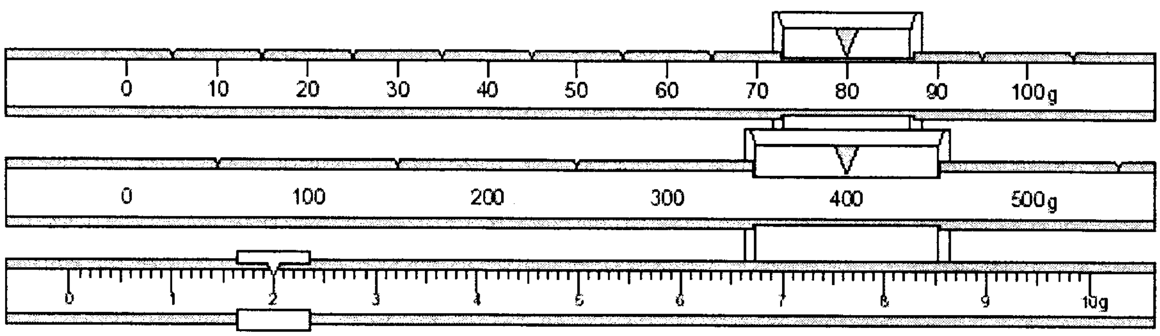
Give the correct measurement of the apparatus that follows.

1.



Answer ______________________

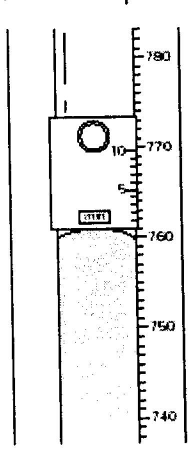
2.



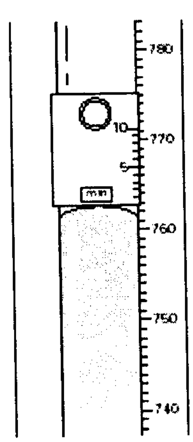
Answer ______________________

6. Read the atmospheric pressure shown on each barometer.

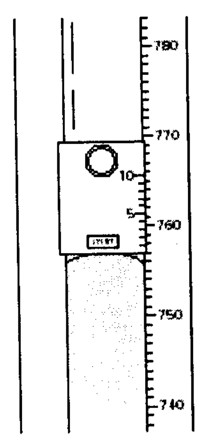
a.



b.

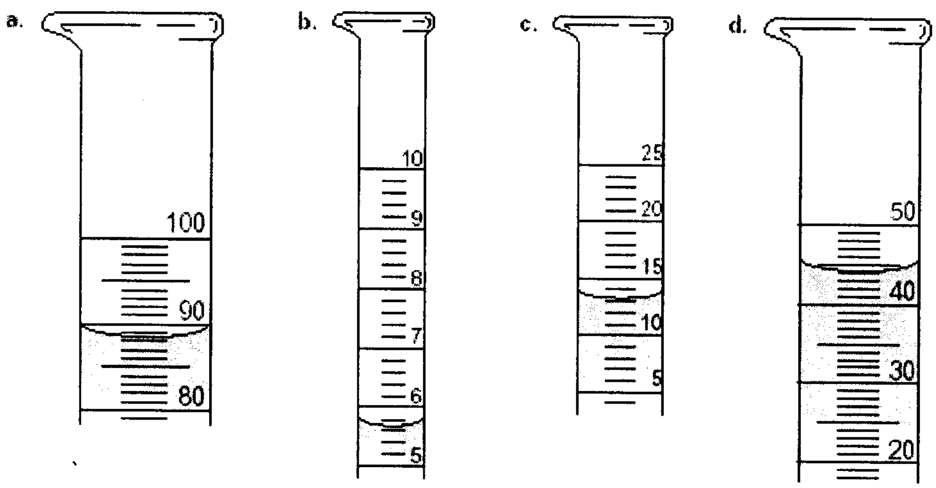


c.



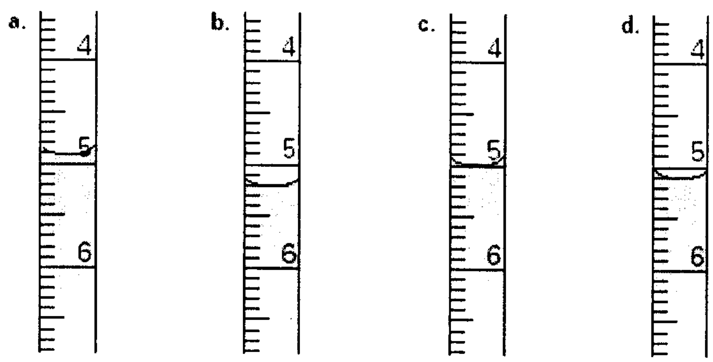
Answer __________ *Answer* __________ *Answer* __________

2. What is the liquid volume in each of the following graduated cylinders?



Answer ____________ *Answer* ____________ *Answer* ____________ *Answer* ____________

3. Which of these volumetric pipets contains 5.0 mL of liquid?

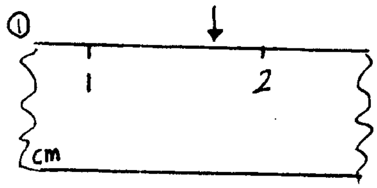


Answer ____________

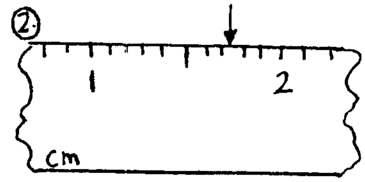
SCALE READING PRACTICE.

NAME : PERIOD:

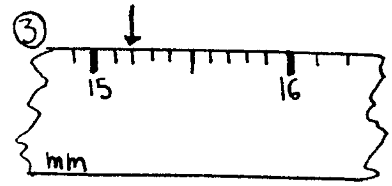
INSTRUCTIONS: READ EACH OF THE FOLLOWING SCALES TO THE CORRECT NUMBER OF SIGNIFICANT FIGURES. DO NOT FORGET UNITS!! (NOTE SCALES ARE NOT ACTUAL SIZE.)



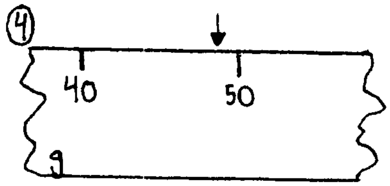
answer: ______



answer: ______



answer: ______



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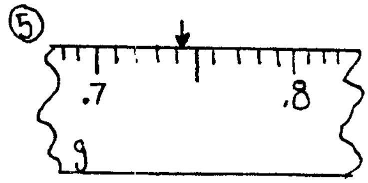

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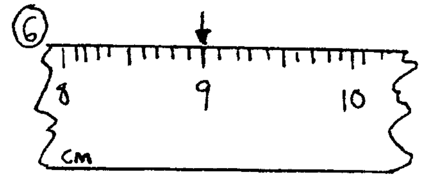

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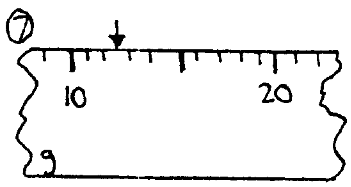
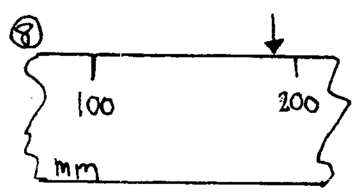
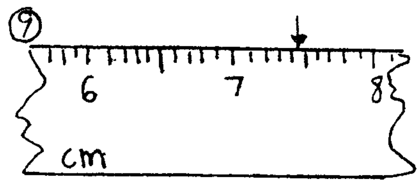


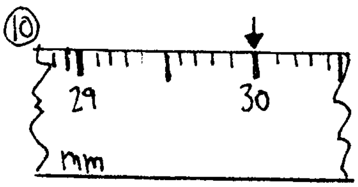
answer: ______



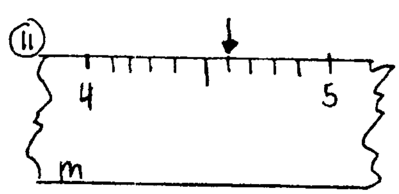
answer: ______



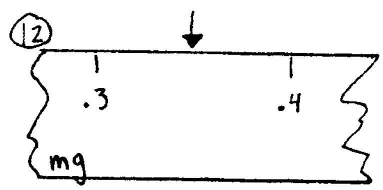
answer: ______



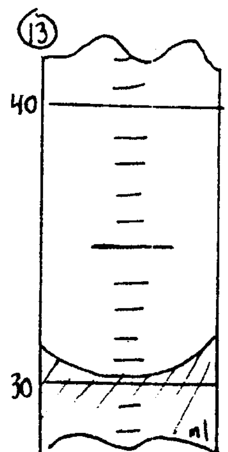
answer: ______



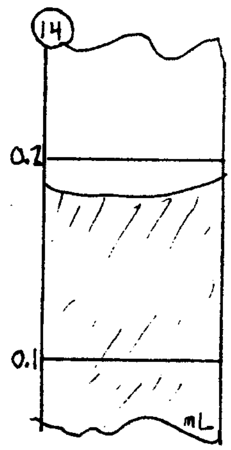
answer: ______



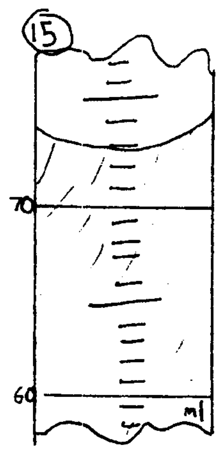
answer: ______



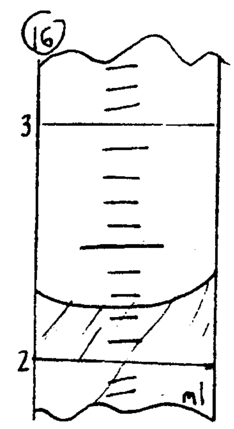
answer: ______



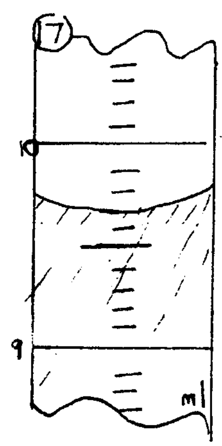
answer: ______



answer: ______



answer: ______



answer: ______

HONORS CHEMISTRY: SIGNIFICANT FIGURES! DATE:_____

Objectives: **SWBAT. . .**

…explain what significant measurements are.
... correlate the resolution of an instrument to the significance of its measurements.
... count the number of sig figs in a measurement.
... explain why some zeros are significant and some are not.
... properly manage sig figs in a variety of math problems.

NICE SCIENTIFIC NOTATION REVIEW

GREAT RESOLUTION IN YOUR EQUIPMENT IS GOING TO COST YOU MONEY.

- All other things being equal, the price ____________ as the resolution increases.

- E.g., It is going to cost more to measure something to 12.014 grams vs. 12.01 grams.

- Measurements must reflect ____________________________. Each scale can only be read so precisely.

- E.g., a measurement of 6.732 cm did NOT come from :

Significant Figures/Digits:

- Counted items are NOT 'significant' since they were not _____________________. (E.g., 15 cows)
- Metric/metric conversions (100 cm = 1 m) or English/English conversions (12 inches = 1 foot) are NOT 'significant' since ____.
- Metric/English conversions ARE significant since ______________________________________.

WHEN YOU LOOK AT A MEASUREMENT, WHAT IS SIGNIFICANT AND WHAT ISN'T?

- All non-zero numbers in a measurement are significant.

- Some zeros are significant, some are not.

IN A PRIMAL WAY, YOU PROBABLY ALREADY KNOW THIS...

- Which measurement feels more precise? 4.0 cm or 4.000 cm?
- Are 68,000,000 years old dinosaur bones EXACTLY 68 million years?

THE RULES FOR ZEROS!

1. Zeroes between non-zeros ('snuggle zeros') are always significant.

ex.) 6056 L (___ s.f.), 7.7001 min (___ s.f.)

2. Zeroes to the left of all non-zero numbers (a.k.a. 'leading zeros') are never significant.

ex.) 0027 g (___ s.f.), 0.000124 cm (___ s.f.)

3. Zeros to the right of all non-zero numbers (a.k.a. 'trailing zeros') are significant if there is a decimal somewhere in the number.

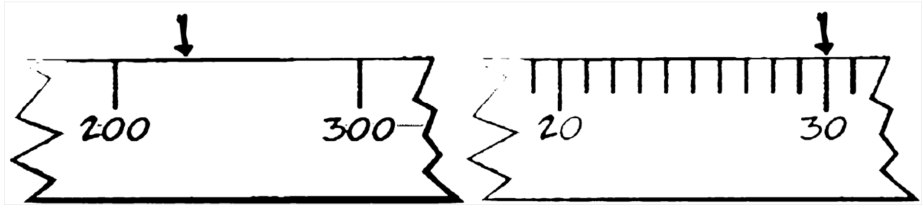
ex.) 1200 in. (___ s.f.), 120.0 kg (___ s.f.), 0.020 sec (___ s.f.)

A zero with a bar above it is the last significant digit in a series of zeros.

ex.) $54\bar{0}00$ seconds (___ s.f.)

Why all zeros are IMPORTANT, but only some are SIGNIFICANT....

So what was the difference between these readings?



- In ...
  - That zero was not read against the scale ∴ it is not ________________
- In...
  - Those zeros were read against the scale ∴ they are _______________

Sig figs in multiplication/division problems:

1. Count the number of significant figures in each number.
2. The answer cannot have more sig figs than your least significant piece of data.
3. Determine the answer normally, but then round your answer to the appropriate number of sig figs.

Ex) 23 cm x 1.0246 cm = 23.5888 cm^2 =

Sig figs in addition/subtraction problems:

1. Line up the numbers old school and determine the answer normally.
2. DON'T COUNT SIG FIGS! (No need!)
3. Starting from the left, find the first column to run out of resolution. Draw a vertical line after that column.
4. Round your answer to the left of that line.

Your answer cannot exceed the resolution of your weakest data source!

Ex) 52.0 g + 100.258 g + 71 g =

Sig figs when determining an average:

- Like addition/subtraction, an average cannot exceed the resolution of your weakest data source.

Ex) Find the average of 2.05 cm, 51.2 cm & 705 cm. =

Sig figs and cascading rounding errors in large problems:

- You should only determine sig figs ONCE no matter how involved a math problem is.
- This is only tricky if you have both multiplication/division and addition/subtraction the same problem.
- When you transition between the two, note what the sig figs would be if the problem ended there.
- Account for those transitional sig figs at the end of the problem.

Ex) Solve this: (47.25 g – 46 g) / 50.2 mL =

"Curious that we spend more time congratulating people who have succeeded than encouraging people who have not." ~ Neil deGrasse Tyson

Scientific Notation

Useful for keeping track of very big or very small numbers. An exponential expression.

For numbers greater than one:

Move the decimal point *left* until there is only one number to the left of it. Indicate the number of moves of the decimal point as an exponent of ten.

ex. 3,673,000 = 3.673×10^6 456 = 4.56×10^2

For numbers less than one:

Move the decimal point *right* until there is only one number to the left of it. Indicate the number of moves of the decimal point as a *negative* exponent of ten.

ex. 0.00034 = 3.4×10^{-4} 0.000000304 = 3.04×10^{-7}

Significant Figures

Those digits in a measurement that have actually been measured by comparison to a scale, plus one estimated digit.

How to determine which digits are significant:

All non zero-digits are significant. ex) 3456.7 five sig. figs.

How about zeros?

1. Zeros *between* non-zero numbers are significant.
2. Zeros *to the left* of non-zero numbers *(a.k.a. leading zeros)* are not significant.
3. Zeros *to the right* of non-zero numbers *(a.k.a. trailing zeros)* are significant if they are in a number with a decimal point.

(4. Zeros that have *a bar* above them are the last significant zero.)

For example. . .

0.0021 — NOT SIG! (2 s.f.)

1.0021 — SIG! (5 s.f.)

50,000 — NOT SIG! (1 s.f.)

50,000. — ALL SIG.! (5 s.f.)

10 — NOT SIG! (1 s.f.)

10. — SIG! (2 s.f.)

10.0 — SIG! (3 s.f.)

10.00 — ALL SIG! (4 s.f.)

1,001,000 — SIG! NOT SIG! (4 s.f.)

1,001,000. — SIG! SIG! (7 s.f.)

1,001,002 — SIG! SIG! (7 s.f.)

Note: Leave out insignificant zeros when putting a number in scientific notation.

How to use significant figures in calculations:

Adding / subtracting?

1. Line up the numbers and add or subtract as you would normally.
2. From left to right, determine which number (excluding the answer) runs out of significant figures first.
3. Draw a vertical line right after the last significant digit in that number. Draw the line all the way down until it bisects the answer.
4. Round off the answer to the left of the line.

For example. . .

SET UP THE NUMBERS...

52.0
100.258
+ 71.
223.258

...AND SOLVE ...

... FIND THE LAST SIGNIFICANT COLUMN...

52 : 0 ? ? *
100 : 258
+ 71 : ? ? ?
223 : 258

...AND DRAW A LINE...

* (SINCE YOU DON'T KNOW WHAT NUMBERS ARE HERE YOU CAN'T TRUST THOSE COLUMNS!)

... ROUND TO THE LEFT OF YOUR LINE!

223 : 258 '2' ROUNDS DOWN...

CORRECT ANSWER: 223 (3 s.f.)

Multiplying / dividing?

1. Determine significant digits in each number.
2. Determine the smallest number of significant digits present. That is how many significant digits the answer must have.
3. Multiply or divide as you normally would.
4. Round the answer to the number of significant figures determined in step 2.

For example. . .

COUNT THE # OF SIG FIGS IN EACH NUMBER ...

2 s.f.! & 5 s.f.!
23 x 1.0256

...SINCE 2 IS THE SMALLEST # OF SIG FIGS, IT LIMITS YOUR ANSWER TO 2 SIG FIGS! (THINK WEAK LINK!)

... THEN DO THE MATH AND ROUND ANSWER TO PROPER # OF SIG FIGS!

23 x 1.0256 = 23.5888

TO 2 SIG FIGS...

24 CORRECT ANSWER!

***Another note:** Significant figures are only needed when things are measured!! Counting numbers (3 birds) or definitions (1 foot = 12 inches) are not measured against a scale, so they do not have to deal with significant figures. If present, ignore such numbers when figuring out how many significant digits an answer should have!!*

HONORS CHEMISTRY

SCIENTIFIC NOTATION AND SIGNIFICANT FIGURE PRACTICE

For each of the following numbers determine the number of significant figures and then convert the number to scientific notation or back to normal notation if needed.

1. 0.02	_________	7. 0.0200	_________	13. 2.0002	_________
2. 5000	_________	8. 5000.	_________	14. 5001	_________
3. 920,000	_________	9. 8.72×10^{7}	_________	15. 1.2×10^{3}	_________
4. 5.4×10^{-3}	_________	10. 0.0200	_________	16. 10,000.2	_________
5. 6×10^{-1}	_________	11. 1.24×10^{3}	_________	17. 9.90×10^{6}	_________
6. 2.000×10^{2}	_________	12. 0.23001	_________	18. 3.14×10^{0}	_________

Perform the following operations expressing the answer in the correct number of significant figures. Show necessary work and pay attention to units!

1. 1.20023 m x 52 m =

2. $150\ L^3 / 4\ L$ =

3. 8.901×10^{2} g / 36.0023 mL =

4. 67.2×10^{-3} cm x 231 sec =

5. (346 mL x 200 K) / 237.12 K =

6. 23.0 cm x 0.0967 cm x 333 cm =

7. 12.01 mL + 35.274 mL =

8. 55.69 g – 2.1111 g – 34.1 g =

9. 2.3456×10^{-2} kg + 9.02×10^{-3} kg =

10. 1.000 m – 23.2 cm =

11. $\dfrac{(12.02\ kg + 0.00034\ kg + 381\ kg)}{(0.34\ m \times 12.090\ m)}$

12. $\dfrac{(12.011\ L - 0.099\ daL)}{5.020 \times 10^{2}\ mol}$

HONORS CHEMISTRY THE FACTOR-LABEL METHOD

A brand, new way to solve math problems (a.k.a.)

1. Write what you have and what you need.
2. Set up conversions (a.k.a.)
   - ~ Top and bottom of each conversion should be equal.
   - ~ (HELPFUL HINT: when setting up conversions, ask yourself "Which unit is bigger?" Make that unit equal to 'one' and then determine how many of the smaller units are equivalent.)
   - ~ ex.) 1 inch = cm 1 foot = inches
   - ~ Can flip either way, whichever is needed.
3. Cancel out units, leaving behind only units desired.
4. Do the math.
5. ▷ **USE COMMON SENSE. . . DOES ANSWER MAKE SENSE?!?**

Metric - metric conversions are usually two - step problems.

- Go to base unit, then to prefix sought (⇒ less to memorize)

ex.) How many micrometers are there in 26 millimeters?

Other conversions can have variable number of steps.

ex.) A building has 79 lightbulbs burning at 60W each. How many MW is that?

ex.) How many inches is 678 meters? How many feet is that? Miles?
(note: 5280. feet in one mile.)

Note: these are multiplication/division problems. Significance rules apply!

Conversions that are defined <u>never</u> limit significance.

~ ex.) 12 inches in a foot, 100 centimeters in a meter

Conversions that are measured can limit significance.

~ ex.) 2.54 cm in one inch, 454 grams in a pound.

HONORS CHEMISTRY FACTOR-LABEL PRACTICE

Try out these problems. Show all intermediate steps and all work! Remember, metric-metric conversions should be two steps. Other conversions can vary.

1. .045Mm = ? hm

2. 52.4 mL = ? daL

3. 960 μg = ? cg

4. .0034 GW = ? dW

5. 14 nm = ? pm

6. 2.54 hL = ? cm^3

7. exactly 2 hours = ? ms

8. 1.0 mile = ? cm

9. WELCOME TO THE FARMER'S MARKET. YOU HAVE 50 APPLES AND YOU'D LIKE SOME EGGS, BUT YOU'LL HAVE TO BARTER FOR THEM! AFTER TRADING WITH ALL THE FARMERS, HOW MANY EGGS CAN YOU GET? **INFORMATION:** FARMER A WILL TRADE 1 PIG FOR 2 CHICKENS. FARMER B WILL TRADE 3 CAKES FOR ONE SACK OF POTATOES. FARMER C WILL TRADE 1 CHICKEN FOR 25 APPLES. FARMER D WILL TRADE 1 DOZEN EGGS FOR 1 CAKE. FINALLY, FARMER E WILL TRADE 1 PIG FOR 3 SACKS OF POTATOES. ALL THE FARMERS WILL TRADE EITHER WAY (I.E. FARMER A WILL TRADE FOR CHICKENS OR APPLES.) **GOOD LUCK!**

"Eggs must not quarrel with stones." ~ Chinese Proverb

Name: ______________________________________ Period: ________

'Swapping Units' - Practice

1) Convert 75 centimeters to meters. (1 m = _________ cm)

$$\frac{75\ cm}{1} \times \frac{\_\_\_\_\ m}{\_\_\_\_\ cm} = \frac{\_\_\_\_\ m}{1}$$

2) Convert 2.5 kilograms to pounds. (1 kg = _________ lbs)

$$\frac{2.5\ kg}{1} \times \frac{\_\_\_\_\_\_}{\_\_\_\_\_\_} = \frac{\_\_\_\_\ lb}{1}$$

3) Convert 2.5 pounds to kilograms. (1 lb = _________ kg)

$$\frac{2.5\ lb}{1} \times \frac{\_\_\_\_\_\_}{\_\_\_\_\_\_} = \frac{\_\_\_\_\ kg}{1}$$

4) Convert 10,000 seconds to hours (2 steps).

$$\frac{10{,}000\ s}{1} \times \frac{\_\_\_\_\ min}{\_\_\_\_\ s} \times \frac{\_\_\_\_\ hr}{\_\_\_\_\ min} = \frac{\_\_\_\_\ hr}{1}$$

5) Convert 12 kilometers to feet (2 steps). (1 km = ________ m) (1 m = ________ft)

$$\frac{12\ km}{1} \times \frac{\_\_\_\_\_\_}{\_\_\_\_\_\_} \times \frac{\_\_\_\_\ ft}{\_\_\_\_\ m} = \frac{\_\_\_\_\ ft}{1}$$

6) Convert 2 centuries to hours.

‘Swapping Units’ - Enrichment

‘Squared’ and ‘Cubed’ Units

The key to success is realizing that a ‘squared’ or ‘cubed’ unit is nothing more than the same unit multiplied by itself. For squared units, that means you’ve got double the units to cancel out with fractions. Note in the example below, that ‘centimeters squared’ is the same as ‘centimeters x centimeters’. If you cancel out ‘centimeters twice, you’re left with ‘meters x meters’ in your conversion, which is the same as ‘meters squared’!

EXAMPLE: Convert 10,000 square centimeters to square meters. (1 m = _________ cm)

$$\frac{10{,}000\ cm^2}{1} = \frac{10{,}000\ cm\ x\ cm}{1} \times \frac{\qquad m}{cm} \times \frac{\qquad m}{cm} = \frac{\qquad m^2}{1}$$

1) Convert 25 cubic meters to cubic feet. (1 m = _________ ft)

$$\frac{25\ m^3}{1} = \frac{25\ m\ x\ m\ x\ m}{1} \times \underline{\qquad\qquad} \times \underline{\qquad\qquad} \times \underline{\qquad\qquad} = \frac{\qquad ft^3}{1}$$

‘Stacked’ Units

Some units have values on the top AND bottom of the fraction. No problem! Just adopt the ‘diagonal cancel’ technique to the new challenge. The unit still needs to cancel diagonally with units in another fraction that are on the opposite level, in this case ‘bottom’ to ‘top’. Whatever units are left on the top and bottom after all the cancelling is done shift over to the final fraction on the right.

Try converting the ‘top’ half of a stacked unit first. Then continue on and convert with the ‘bottom’ half.

Example: Convert 25 centimeters per second to inches per minute (1 in = ________ cm)

$$\frac{25\ cm}{s} \times \frac{\qquad in}{cm} \times \frac{\qquad s}{min} = \frac{\qquad in}{min}$$

2) Convert 650 grams per milliliter to kilograms per liter. (1 l = _________ ml)

$$\frac{650\ g}{ml} \times \underline{\qquad\qquad} \times \underline{\qquad\qquad} = \frac{\qquad kg}{l}$$

3) **SUPERCHALLENGE COMBO!** Convert 0.85 kilograms per cubic meter to grams per cubic centimeter.

HONORS CHEMISTRY MATHEMATICS REVIEW SHEET

Metric conversions **(show all work!)**

1) 16.8 GW to ? cW

2) 34.50 mm to ? dm

3) 106 nl to ? dal

4) 0.67 μm to ? Mm

5) .007 ps to ? minutes

6) 75.6 kg to ? Mg

Scientific Notation

Write the answers to the top six answers in scientific notation.

1)

2)

3)

4)

5)

6)

Significant Figures

Perform the following calculations, using the proper number of significant figures.

1) 45.0 + 34 - 0.0006

2) $8.2 \times 10^{-4} + 9.02 \times 10^{-4}$

3) $7.89 \times 10^{5} \times 1.4 \times 10^{4}$

4) 326.3 x 123 x 45.0066701

And finally

Count and write down the number of significant figures next to <u>each</u> number on this sheet.

"True knowledge lies in knowing how to live."
~ Gracian

HONORS CHEMISTRY APPLICATION OF BASIC PRINCIPLES

INSTRUCTIONS:

On the lab desks in front of you and your partner are three test tubes which you are to investigate. **The results of your investigation (and they could be different between groups) is less important than using this opportunity to apply as many of the concepts from last class to this simple investigation.**

Use your journals to record your questions and answers. Both partners should record all data in their lab notebook. Set up a Google Doc (as outlined in the EWU format) to answer the following questions. You DO NOT have to write up a full EWU.

In the lab:

1. List the three main components of the scientific method. Apply those three steps to the test tubes in front of you. Be sure to write down all the necessary parts before proceding to the next step.

   If you are having problems, write down your questions. See if you can then answer them or call over your instructor for help.

2. Based on what you observed and inferred above, revise your hypothesis or come up with another mini-investigation following the same format. Use the back of the paper.
   If possible, do the experiment. If you need anything, your instructor may be able to supply it.

Afterwards:

1. Give an example of one observation and one inference you came up with from your investigation.

2. In class, we talked about a six-part view of the scientific method. Diagram out and list specific parts of your investigation which fit in each part (if any). Explain why (if any) parts where left blank.

3. Define a hypothesis. Look at any hypotheses you came up with and analyze them to see if they are appropriate. If so, explain why, if not fix them.

4. Differentiate between hypotheses, theories, and laws.

"Don't be too timid and squeamish about your actions.
All life is an experiment. The more experiments you make the better."
~ Ralph Waldo Emerson (1803 - 1882)

HONORS CHEMISTRY EXPERIMENT

THE EFFECTS OF CONCENTRATED SULFURIC ACID ON BOVINE EYEBALLS

BACKGROUND:

Lab safety is incredibly important. Never assume everyone is as safety conscious as you are or that they are even using the same chemicals as you. When thinking of safety, you must always err on the side of caution. One of the ways you can protect yourself is to always wear your safety goggles. This experiment will simulate what could happen to your eyes of you are not careful protecting them.

This experiment will also give you the opportunity to practice your qualitative observation skills. You will also have a chance to write up a simple experiment in a proper format.

PROCEDURE:

1. Put on your safety goggles. Your instructor will put out five eyeballs previously treated with acid for different amounts of time.

   - The times are: 0 seconds (immediately washed), 5 seconds, 15 seconds, 30 seconds and Long-Term. (After the time noted, the eyes were washed as thoroughly as possible.)

   - There will also contain a control eyeball, or one that has not been exposed to any acid.

2. In your lab groups, pick out a table and make at least ten observations about the eyeball and the damage caused. Draw a detailed, color picture of the eyeball. Rotate to the next station when instructed to. **DO NOT TOUCH THE EYEBALLS.** You will have ~ 5- 8 minutes at each table.

WRITE-UP TIPS:

Make sure that you have the EWU format sheet at your side while you are working on the rough draft. Go through it section by section to check that you are covering everything needed.

REMEMBER:

You are personally responsible for ALL sections of the write-up. You are NOT to divvy up the work! We have partners not to make our jobs easier, but to make our final product better. Never forget that!

QUESTIONS:

a) How long do you think it would take you to get to the eyewash if you got chemicals in your eyes? Based on your data, deduce what kind of damage you might ensue.

b) What is the purpose of an experimental control? What was it in this experiment? Give an example of how another scientist might use an experimental control in her work.

c) Why should you never taste a chemical or solution in a laboratory even if you are sure you know what it is?

"Experience should teach us that it is always the unexpected that does occur."
~ Eleanor Roosevelt

Mr. Anticole's definition of academic dishonesty:

It is simple: If more people worked on a gradable assignment then are listed on the paper, then someone committed academic dishonesty! If Albert is committing academic dishonesty, circle the number and explain why.

1. Albert looks off another student's paper during a quiz.
2. Albert prints up a copy of a report on black holes that he wrote last year and turns it in for another class project.
3. Some of Albert's friends invite him over to their house to study for the big chemistry test coming up.
4. Albert asks his Aunt to read over his experimental write-up for typos.
5. Albert's Aunt finds some mistakes and rewrites his discussion for him.
6. A student signals that she wants to look off his test and Albert adjusts his paper so she can see his answers.
7. Albert and his partner flip a coin after completing an experiment. The loser writes it up up by themselves.
8. Albert tells a student in a later period that they are going to have a pop quiz today.
9. Albert jots a few symbols down on his desk before the test in case he needs them later.
10. Albert isn't too sure what one of the lab questions means so he asks Mr. Anticole.
11. Albert researches the term 'super-saturation' on the net to try and figure out what happened in his experiment.
12. Albert cuts and pastes a definition of 'super-saturation' into his paper without giving the site credit.
13. Albert e-mails his homework to another student who has some questions on it.
14. Albert and his buddies get together and work on the end of chapter problems together.
15. Albert gives his notes to a classmate so she can copy the notes which she missed.
16. Albert is falling behind in class, so he signs up to work with a tutor.
17. Albert and his partner forget to do part of the experiment, so they get the data off of another group.
18. Albert's friend hasn't taken the test yet, though Albert has. Albert gives him an idea what was on there.
19. Albert's big sister is back from college and helps him learn the factor label method.
20. Albert asks his friend in another class to e-mail him the procedure so he doesn't have to type it himself.

How many did you get right?

19 – 20: GOOD JOB! *On the shadowy path of life, you stay in the well-light areas.*
16 – 18: HMMMM… *Look over the handbook before you learn a lesson the hard way.*
15 OR LESS: DANGER! *It is only a matter of time before a referral has **your** name on it!*

An Unfortunate Series of Events...

Whoops! Mr. Anticole uncovered some academic dishonesty! Write your answers to the two questions at the bottom on a separate piece of paper. This is due tomorrow at the beginning of class.

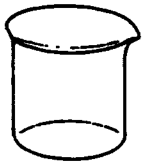
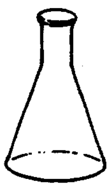
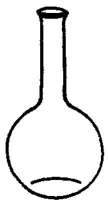
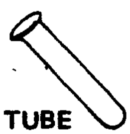
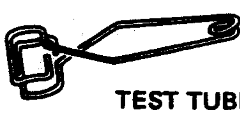
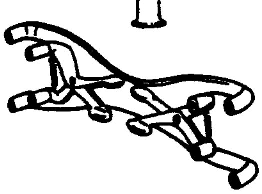
Axel and Betty are partners on an experiment. Calvin and Dawn are also partners. Axel and Betty work together fully and equally on all sections of the EWU. They even get it done early enough to have Mr. Anticole proofread it for any mistakes! Mr. Anticole is very proud of them. Life is pretty darn good.

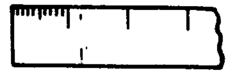
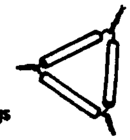
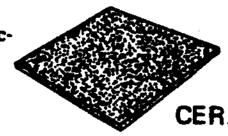
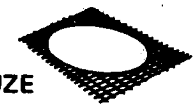
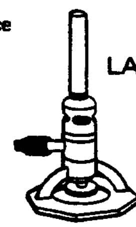
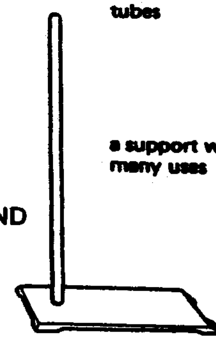
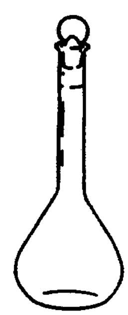
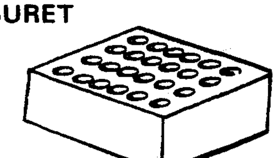
Calvin and Dawn are very busy students. They decide divvy up the different EWU sections to save some time. Before Calvin knows it, the experiment is due the next day! He texts Betty and asks her to send over her EWU... just look it over. Betty, a good friend, reluctantly agrees. Calvin, desperate for a decent night's sleep, plagiarizes parts of her EWU. He adds it to Dawn's work and turns it in the next day.

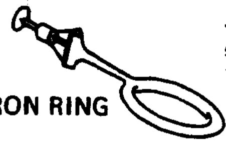
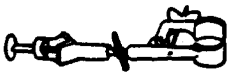
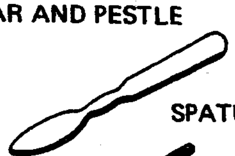
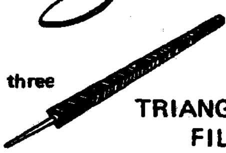
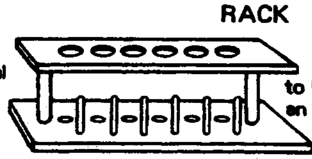
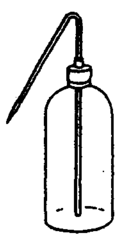
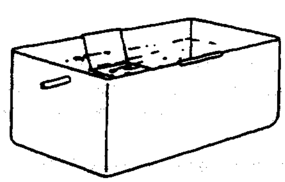
WHO GETS A ZERO? AT WHAT MOMENT DID THEY COMMIT ACADEMIC DISHONESTY?

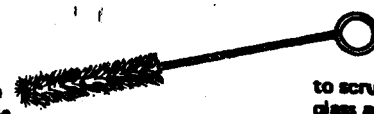
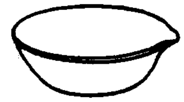
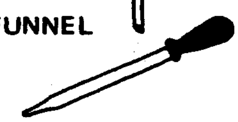
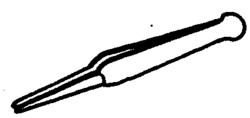
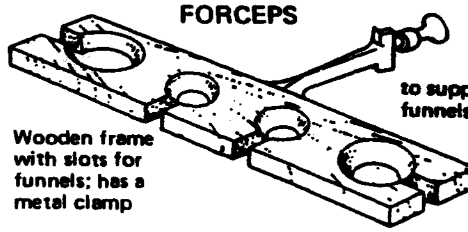
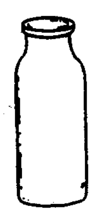
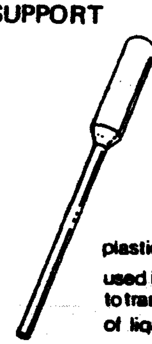
"Real integrity is doing the right thing, knowing that nobody's going to know whether you did it or not."
~ Oprah Winfrey

APPARATUS LIST FOR STUDENT USE

DESCRIPTION	APPARATUS	USE
glass common sizes 100 mL 250 mL 400 mL marked on the beaker	 BEAKER	as a container, like a cup may be heated
glass marked with a milliliter (mL) scale size / divisions 50 mL 1.0 mL 35 mL 0.2 or 0.5 mL 10 mL 0.1 mL	 GRADUATED CYLINDER	to measure volume
glass common sizes 125 mL 250 mL 500 mL marked on the flask	 ERLENMEYER FLASK  FLORENCE FLASK	may be heated
glass several sizes	 TEST TUBE	many uses can be heated
metal clamp with a spring handle	 TEST TUBE HOLDER	to hold a test tube
metal	 TONGS	to pick up and hold apparatus
glass marked with a milliliter (mL) scale	 GAS MEASURING TUBE	used to collect and measure the volumes of gases
metal clamp with flexible clips	 DOUBLE BURET CLAMP	to hold burets when titrating

DESCRIPTION	APPARATUS	USE
10 centimeter (cm) ruler, plastic divided into centimeter and millimeter (mm) divisions	 10 CM RULER	to measure length
triangular wire frame with clay material coverings	 PIPESTEM TRIANGLE	to support the crucible
small porcelain dish with cover	 CRUCIBLE AND COVER	to heat small amounts of solid material at high temperature
hardened ceramic-fibered material	 CERAMIC-FIBERED SQUARE	to place under hot apparatus
wire screen with ceramic-fibered center	 WIRE GAUZE	to spread the heat of a flame
metal heating device connected to gas outlet with rubber tubing	 LABORATORY BURNER	to heat chemicals in beakers or test tubes
metal rod upright heavy base	 RING STAND	a support with many uses
glass marked with a milliliter (mL) scale and fitted with a stopcock, pinch clamp, or glass bead	 BURET	used to withdraw and measure volumes of solutions in titrations
glass marked off to liter capacity, with a glass stopper	 VOLUMETRIC FLASK	used in the preparation of solutions
plastic	 24 WELL MICROTITRATION PLATE	used to hold liquids in micro experiment

DESCRIPTION	APPARATUS	USE
iron ring with screw fastener several sizes	 IRON RING	to fasten to the ring stand as a support for apparatus
metal clamp with 1. screw fastener 2. swivel and lock nut 3. adjusting screw 4. curved clamp	 BURET CLAMP-TEST TUBE CLAMP	to hold apparatus may be fastened to the ring stand
heavy porcelain dish with grinder	 MORTAR AND PESTLE	to grind chemicals to a powder
may be of metal or porcelain	 SPATULA	to transfer solid chemicals in weighing
metal file with three cutting edges	 TRIANGULAR FILE	to scratch glass to file
short length of rubber tubing	 RUBBER CONNECTOR	to connect parts of apparatus
metal clamp with finger grips	 PINCH CLAMP	to clamp a rubber connector
rack; may be wood, metal or plastic	TEST TUBE RACK 	to hold test tubes in an upright position
squeezable plastic bottle with angular tip	 PLASTIC WASH BOTTLE	to dispense distilled water
galvanized iron container with rolled edge, overflow tube, and bottle shelf	 PNEUMATIC TROUGH	to hold water, gas collecting bottles, and delivery tube from gas generator

DESCRIPTION	APPARATUS	USE
brush with wire handle	 TEST TUBE BRUSH	to scrub glass apparatus
glass rod	STIRRING ROD 	to stir combinations of materials to use in pouring liquids
porcelain dish	 EVAPORATING DISH	as a container for small amounts of liquid being evaporated
thick glass	 GLASS PLATE	many uses (should not be heated)
curved glass	 WATCH GLASS	may be used as a beaker cover may be used in evaporating very small amounts of liquid
glass or plastic	 FUNNEL	to hold a filter paper may be used in pouring
glass tip with rubber bulb	 MEDICINE DROPPER	to transfer small amounts of liquid
metal	 FORCEPS	to pick up or hold small objects
Wooden frame with slots for funnels; has a metal clamp	 FUNNEL SUPPORT	to support funnels
glass many uses as a container	 WIDE-MOUTH BOTTLE	
plastic	 THIN STEM PIPETTE	used in micro experiment to transfer small amounts of liquid

TITLE

PAGE NUMBER

Pg 10

EXPERIMENT - MEASUREMENT PRACTICE. 9/29/09 ← DATE

(PAGE 1 OF 5)

PARTNER - JILL TIGER

-724-555-5555 ← PARTNER & CONTACT INFO

OBJECTIVE:

BIG IDEAS →

- PRACTICE READING SCALES.
- MEASURE MASS OF PENNIES / CALC AVERAGE

TRIAL ONE PART A.

MASS OF PENNIES (4-beam balance)

DATA →

1 2.012 g ↳ 3 digits past decimal
2 2.010 g
3 2.957 g ← * WHATS WITH THIS? REMEASURE?
4 2.005 g
~~8.007 g~~
5 2.007 g

CROSS OUT MISTAKES → DONT SCRIBBLE THEM OUT

AVE $= \frac{X_1 + X_2 + X_3 + \dots X_n}{n}$

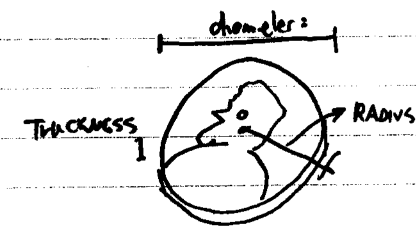
= 2.012 g
2.010 g
2.957 g
2.005 g
2.007 g
10.991 g / 5

HIGHER THAN MOST ↓ SF ✓

* TALK ABOUT #4 2.1982 g ← 10.991 g / 5

AS POTENTIAL SOURCE OF ERROR.

* MAYBE CALC STANDARD DEVIATION? (→ NEED EQUATION)



Centimeter ruler. → 2 digits past decimal.

CONT →

* NEVER RIP PAGES OUT OF A LAB BOOK

A GOOD SCIENTIST USES A PEN IN THEIR LAB JOURNALS SO PEOPLE AREN'T WORRIED ABOUT THEM ERASING STUFF.

- AGAIN, AS WITH DEMOS, THE MORE YOU WRITE DOWN, NEATLY & ORGANISED, THE BETTER YOU WILL DO!

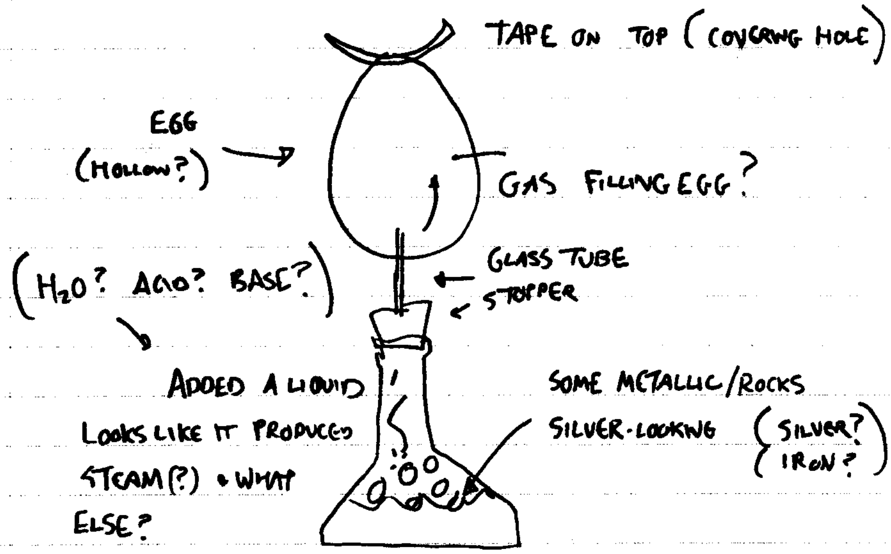
TITLE

NUMBER PAGES

P2

EXPLODING EGG (PAGE 1 OF 3) 9/09/09

DATE

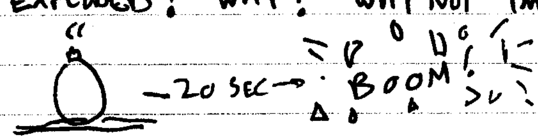


- TOOK EGG OFF ERLENMEYER FLASK, PUT ON TEST TUBE RACK, TOOK OFF TAPE, LIGHT HOLE ON FIRE? TINY FLAME, HEARD SMALL 'POP' WHEN LIT.

? FLAMMABLE GAS IN THERE? ← WHERE IS IT COMING FROM?

- LIGHT GAS? (COMING OUT TOP) METHANE? HYDROGEN? (OTHER GASES?)

- AFTER ~ 20 SECONDS EGG SUDDENLY EXPLODED! WHY? WHY NOT IMMEDIATELY?



(CONT) →

DEMO PAGE IN JOURNAL EXAMPLE.

- BE DESCRIPTIVE! DRAWINGS HELP!
- TRY TO ACTIVELY FIGURE OUT WHAT IS HAPPENING!
- WRITE DOWN CHEMICALS / TIE INTO CLASS CONCEPTS!
- WRITE DOWN QUESTIONS, THOUGHTS, ETC!

SOME HANDY STUFF

Metric Prefixes

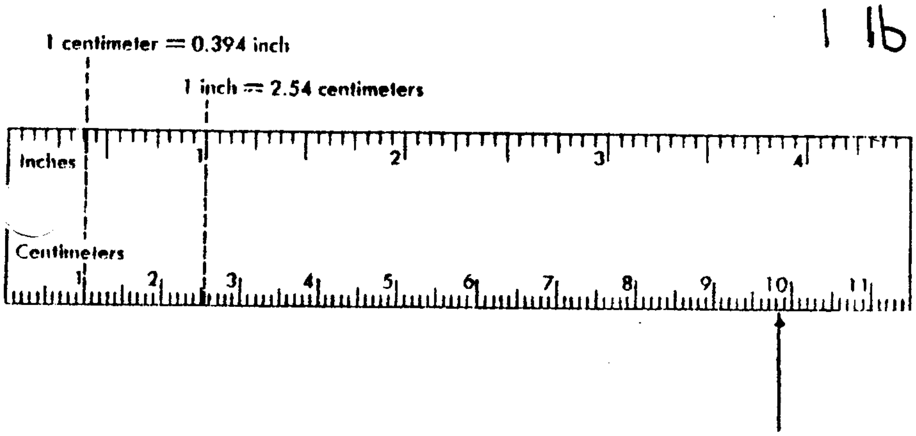
fix	Symbol	Factor of Base Unit
giga	G	1 000 000 000
mega	M	1 000 000
kilo	k	1000
hecto	h	100
deka	da	10
deci	d	0.1
centi	c	0.01
milli	m	0.001
micro	µ	0.000 001
nano	n	0.000 000 001
pico	p	0.000 000 000 001

(SI)

Physical quantity	Name of Unit	Abbreviation
Mass	kilogram	kg
length	Meter	m
Time	Second	s
Temperature	Kelvin	K
Amt. of Substance	Mole	mol

1 milliliter (mL)	=	1 cubic centimeter (cm^3)
1 cubic meter (m^3)	=	1000 L

1 lb = 454 g



Temperature Conversions:

°C = 5/9 (°F - 32)

°F = 9/5 (°C) + 32

K = °C + 273

HOW TO READ A SCALE:

READ AS FAR AS THE LINES WILL LET YOU, THEN GUESS ON THE VALUE OF THE NEXT NUMBER BASED ON THE POSITION OF THE MEASUREMENT BETWEEN THE CLOSEST LINES. THAT IS A SIGNIFICANT MEASUREMENT!!

EXAMPLE:

I CAN READ 9. CM.

I CAN READ 0.8 CM.

BUT THE ACTUAL END IS BETWEEN .8 & .9 CM SO I GUESS THE LAST VALUE. (MAYBE 9.83 CM)

NOTE: IF IT ENDS RIGHT ON THE LINE COUNT IT AS A ZERO! DON'T LEAVE IT OUT!

CLASSIC JOKE.

"The course of true anything never does run smooth." ~ Samuel Butler

SAFETY IN THE LABORATORY CONTRACT

EXPERIMENTS ARE A FUN WAY TO LEARN ABOUT CHEMISTRY. HOWEVER, SINCE CARELESSNESS OR IGNORANCE OF POTENTIAL DANGERS IN THE LAB CAN RESULT IN INJURY, IT IS EXTREMELY IMPORTANT THAT YOU FOLLOW ALL PROCEDURES AND SAFETY RULES. HERE ARE MR. ANTICOLE'S RULES ON…

1. ***…SAFETY EQUIPMENT:*** Know the location of the eye fountain, emergency shower, and fire equipment in the room.

2. ***…DIRECTIONS:*** Do not change the experimental procedures without Mr. Anticole's permission.

3. ***…ACCIDENTS:*** If an accident occurs, notify Mr. Anticole immediately.

4. ***…SPILLS:*** If you spill something, clean it up immediately. If you're not sure what you spilled, find out! If you spill something your skin or in your eyes, wash it thoroughly with water and have another student immediately notify Mr. Anticole.

5. ***…YOUR CLOTHING:*** You should wear long pants and close-toed shoes in the lab for protection against chemical spills. You shouldn't have any dangling clothing or accessories. (Keep appropriate clothing in your locker in case you forget.)

6. ***…YOUR EYES:*** Goggles must be worn at all times in the laboratory. Contact lenses add an additional layer of risk: chemicals could be drawn under the lens where they will be hard to remove and can continue to do damage. Anxiety/fear/pain can make it difficult or impossible for you or anyone else to remove your lens in an accident.

7. ***…YOUR MOUTH:*** No food or drink in the lab. Never taste anything in the lab even if you think you know what it is.

8. ***…YOUR NOSE:*** Do not directly inhale the vapors of any material. If you are instructed to sniff or smell any vapors, do not try and inhale them directly; use your open hand to waft the vapors towards your nose by moving your hand back and forth a short distance above the container.

9. ***…YOUR HAIR:*** Long hair must be tied back! Be vigilant of lit Bunsen burners in your immediate area.

10. ***…HEAT:*** Heat and flame are common sources of injury. Make sure lab equipment is cool before handling it. Never apply a direct flame to or near a container in which there is a volatile or flammable material.

11. ***…CONTAINERS:*** Always read the label on containers before using its contents. Never pour chemicals or reagents back into a stock solution; you will corrupt the supply.

12. ***…GLASS:*** Exercise caution with glassware. It could be hot, wet, or slippery. Clean up broken glassware immediately.

13. ***…TEST TUBES:*** When heating a substance in a test tube, always point the open end of the tube towards the wall (NOT towards you or other people), because the contents of the tube may spray out of the tube.

14. ***…ACID:*** In the rare case you are ever preparing a dilute aqueous solution of sulfuric acid, always add the concentrated acid to water. Never pour water into the acid or it can spatter.

15. ***…TIME MANAGEMENT:*** Do not rush, even at the end of class. This is a major source of accidents.

16. ***…MATURITY:*** No horseplay or practical jokes are ever permitted in the lab; they can cause dangerous situations.

17. **When in doubt about ANY situation in the lab, consult Mr. Anticole first.**

I, ______________________________ (PRINT NAME) HAVE READ AND AGREE TO FOLLOW ALL OF THE SAFETY RULES SET FORTH IN THIS CONTRACT. I WILL FOLLOW THE ORAL AND WRITTEN INSTRUCTIONS GIVEN BY MR. ANTICOLE. I UNDERSTAND THAT ANY VIOLATION OF THIS SAFETY CONTRACT THAT RESULTS IN UNSAFE CONDUCT IN THE LABORATORY OR MISBEHAVIOR ON MY PART, MAY RESULT IN BEING REMOVED FROM THE LABORATORY, DETENTION, REFERRAL TO THE PRINCIPAL, RECEIVING A FAILING GRADE ON THE LABORATORY, RECEIVING A FAILING GRADE IN THE CLASS, AND/OR DISMISSAL FROM THE COURSE. I WILL KEEP THIS SIGNED CONTRACT IN THE FRONT OF MY CLASS BINDER.

*STUDENT SIGNATURE:*____

*DATE:*________________

HONORS CHEMISTRY SAFETY POSTER ASSIGNMENT

Today you were given your safety contract. (It is important that you familiarize yourself with the procedures and ask questions if you need clarification.) We will be summarizing these rules in a series of posters and you'll be responsible for making one of these. Here is assignment:

- Use an 8½ " x 11" sheet of paper (No bigger, no smaller!) One side.
- Type/print the rule on the paper along with some kind of graphic to entertain/educate.
- You may summarize your rule, so that the big idea comes across.
- Should be full-color, neatly done, easily read, eye-catching, professional, etc.
- May use computers or hand-draw depending on your skills at either (or neither?).
- Will be worth 10 point and is due at the beginning of class on ____________.
- Classes will vote on the best poster for each rule.
- Winning posters will be laminated and placed in classroom or laboratory.
- Winners will bask in the admiration and respect of the entire school.

"Ah, this is obviously some strange usage of the word 'safe' that I wasn't previously aware of."
~ Douglas Adams, "The Hitchhikers Guide to the Galaxy"