Doing: Lab Experiments

Safety (Video & Handout)

http://chemconnections.org/general/chem108/Lab/Safety_focus_ques-18.pdf

Chem 108: Lab

Sign in: Roster @ front of lab

Open Lab Drawer

Select a partner to work with for today's lab experiment

Turn in:

completed safety handout before beginning experiment.

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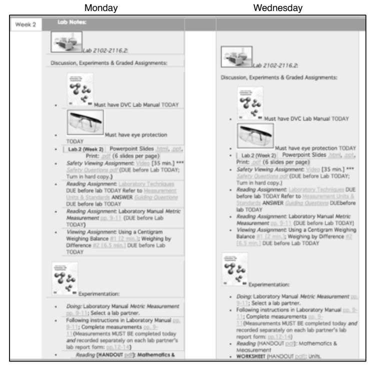
http://chemconnections.org/general/chem108/calendar-108-s19.html

CHEM 108



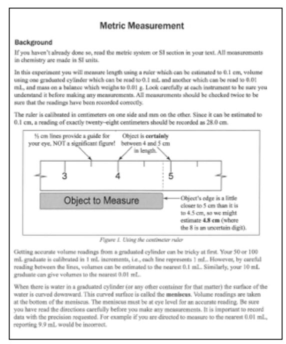
Question

The title of today's experiment is:

A. Measurement of the Properties of Gases
B. Metal Measurement
C. Measuring the Energy of Combustion
D. Metric Measurement
E. Measuring the Calories in a Can of Coca Cola

Answer D.

Experiment 1 – Metric Measurement



Metric Measurement

Background

If you haven't already done so, read the metric system or SI section in your text. All measurements in chemistry are made in SI units.

In this experiment you will measure length using a ruler which can be estimated to 0.1 cm, volume using one graduated cylinder which can be read to 0.1 mL and another which can be read to 0.01 mL, and mass on a balance which weighs to 0.01 g. Look carefully at each instrument to be sure you understand it before making any measurements. All measurements should be checked twice to be sure that the readings have been recorded correctly.

The ruler is calibrated in centimeters on one side and mm on the other. Since it can be estimated to 0.1 cm, a reading of exactly twenty-eight centimeters should be recorded as 28.0 cm.

Figure 1. Using the centimeter ruler

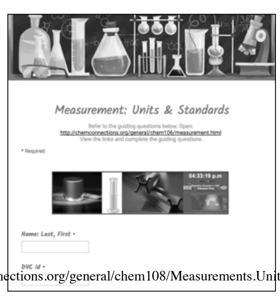
Getting accurate volume readings from a graduated cylinder can be tricky at first. Your 50 or 100 mL graduate is calibrated in 1 mL increments, i.e., each line represents 1 mL. However, by careful reading between the lines, volumes can be estimated to the nearest 0.1 mL. Similarly, your 10 mL graduate can give volumes to the nearest 0.01 mL.

When there is water in a graduated cylinder (or any other container for that matter) the surface of the water is curved downward. This curved surface is called the **meniscus**. Volume readings are taken at the bottom of the meniscus. The meniscus must be at eye level for an accurate reading. Be sure you have read the directions carefully before you make any measurements. It is important to record data with the precision requested. For example if you are directed to measure to the nearest 0.01 mL, reporting 9.9 mL would be incorrect.

Doing: Lab Experiments

Metric Measurement [Experiment #1]

Background & Preparation [Graded Guiding Questions]



http://chemconnections.org/general/chem108/Measurements.Units-Guide.html

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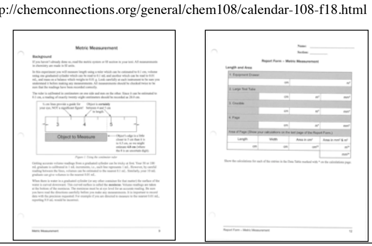
Doing: Lab Experiments

Metric Measurement [Experiment #1]

(Course/ Lab Manual pp. 9-11; pp. 12-15 [Report Form])

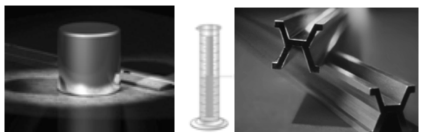
http://chemconnections.org/general/chem108/calendar-108-f18.html



Collaboration is encouraged, but individual record keeping and submissions are required. MUST use Lab Manual pages for record keeping. Black or blue ink preferred without erasures, but pencil OK for Chem 108.

Doing: Lab Experiments

Metric Measurement [Experiment #1]
(Course/ Lab Manual pp. 9-11; pp. 12-15 [Report Form])



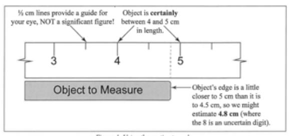


Figure 1. Using the centimeter ruler

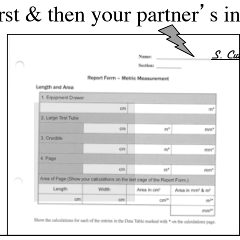
Exp. 1 – Metric Measurement

- Goal: Using instruments having different levels of precision, make accurate measurements of length, area, volume, and mass
- Convert measurements to different units using Dimensional Analysis

Exp. 1 – Metric Measurement

Work with a partner

- Keep separate records. On each partner's Lab **REPORT FORM,** write your name first & then your partner's in (____)



S. Cary (D. Green)

and on your partner's form

D. Green (S. Cary)

Exp. 1 – Metric Measurement

- Do each measurement separately and independently. Then, compare your value with your partner's. The values should be very close within the precision limits of the device used. If not, repeat the measurement together and correct the Report Form entries.

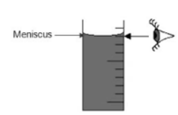
Exp. 1 – Metric Measurement

Mass Measurement with an Electronic Balance:

https://www.youtube.com/watch?v=QtnPiKSKKtI

Exp. 1 – Metric Measurement

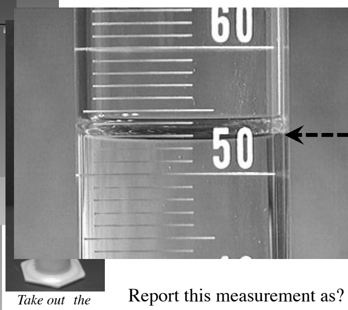
Volume Measurement (Liquids)



Measure at the ***bottom of the meniscus at eye level***

Measurements with a Graduated Cylinder:

Exp. 1 – Metric Measurement
Measurement with a 100 mL Graduated Cylinder:



meniscus

bottom of the meniscus at eye level

Take out the cylinder; pour some water into it.

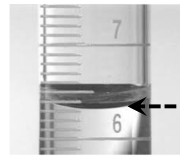
Report this measurement as?

52.9 mL

What is the volume of water in your cylinder?

Exp. 1 – Metric Measurement
Measurement with a 10 mL Graduated Cylinder:

Measure at the ***bottom of the meniscus at eye level***



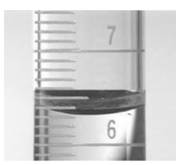
meniscus

Report this measurement as?

6.31 mL

Exp. 1 – Metric Measurement

- Important to record ***measurements*** to the correct limits of the equipment used (i.e. uncertainty/significant figures). NOTE: For this experiment the uncertainty limits (+/–) of the equipment is to be included.
- Uncertainty limits are not normally included in calculations but are inferred from the correctly reported significant figure in the experimental value.
- Estimating to 6.3**0** mL is ok if the meniscus is viewed to be exactly on the mark.



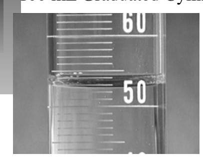
- Estimating to 6.3**1** mL is also ok if the meniscus is viewed to be off the mark.

Report: 6.3**0 +/- 0.01** mL

Report: 6.3**1 +/- 0.01** mL

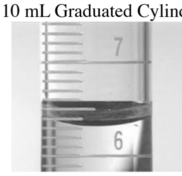
Exp. 1 – Metric Measurement
Measurement with a Graduated Cylinder:

100 mL Graduated Cylinder



Measurement: 52.9 +/– 0.1mL

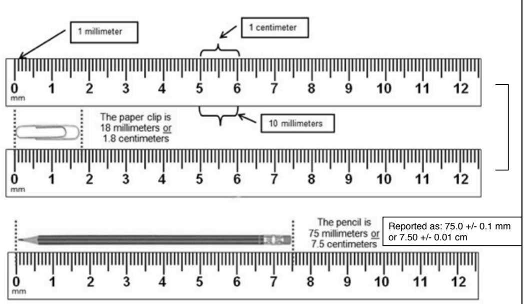
10 mL Graduated Cylinder



Measurement: 6.31 +/– 0.01mL

- Notice the difference in precision (uncertainty) with each instrument used and their maximum capacities

Exp. 1 – Metric Measurement
Measurement with a centimeter/millimeter ruler (Length)



Exp. 1 – Metric Measurement

- When measuring glassware with the ruler, use inner diameter of glassware, NOT outer diameter. Why?
- Experimental error will occur:

When pouring water out of test tube into graduated cylinder, some is always left in test tube; how does this systematic error affect accuracy of measured volume?

Is the beaker a perfect cylinder?

- Think about how equipment and handling; relate this to measurements and "systematic" errors.
- "Human Error" is **NOT** acceptable error.

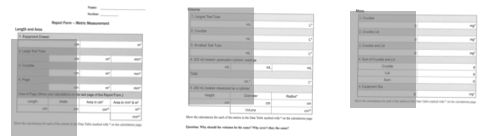
Exp. 1 – Metric Measurement

"Human Error" is **NOT** acceptable in scientific measurements……. as in aeronautics.

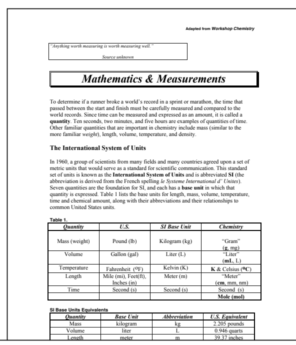
SFO July 6, 2013

Experiment 1 – Metric Measurement

Complete and record all measurements today.



Conversions and calculations due next lab.


Adapted from *Workshop Chemistry*

"Anything worth measuring is worth measuring well."

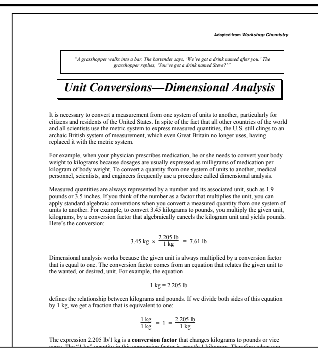
Source unknown

Mathematics & Measurements

The International System of Units

Reading (Handout)

http://chemconnections.org/general/chem108/Math%20%26%20Measurement-2018.pdf


Adapted from *Workshop Chemistry*

Unit Conversions—Dimensional Analysis

Reading (Handout)

http://chemconnections.org/general/chem108/WKS%20Reading%20Unit%20Conversion%20-%20Dimensional%20A.pdf

Converting squared or cubic units

- When using linear factors conversion factors to "square" or "cube" be sure to square or cube the factor

e.g.) Convert 6.81 mm^2 to cm^2 10 mm = 1 cm

From: 6.81 mm^2 To: cm^2

$$\frac{6.81\ mm^2}{1}$$

$$= \mathbf{6.81 \times 10^{-2}}\ \boldsymbol{cm^2}$$

Converting to squared or cubic units

- When using linear factors conversion factors to "square" or "cube" be sure to square or cube the factor

e.g.) Convert 6.81 mm^2 to cm^2 10 mm = 1 cm

From: 6.81 mm^2 To: cm^2

$$\frac{6.81\ mm^2}{1}\left(\frac{(1\ cm)^2}{(10\ mm)^2}\right) = \frac{6.81\ mm^2}{1}\left(\frac{1^2\ cm^2}{10^2\ mm^2}\right)$$

$$= \mathbf{6.81 \times 10^{-2}}\ \boldsymbol{cm^2}$$

Experiment 1 – Metric Measurement

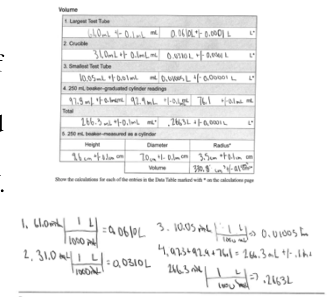
Complete and record all measurements today.

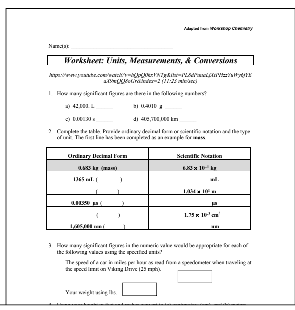
Have Dr. R. sign **individual** forms before leaving lab today.

Only your measurement data is due to be signed today.
Conversions and calculations due next lab.

Exp. 1 – Metric Measurement

Example of an acceptable set of student data, conversions, and calculations.
DO NOT COPY.
Use as a guide.





Adapted from ***Workshop Chemistry***

Name(s): ______________________

Worksheet: Units, Measurements, & Conversions

https://www.youtube.com/watch?v=hQpQ0hxVNTg&list=PL8dPuuaLjXtPHzzYuWy6fYEaX9mQQ8oGr&index=2 (11:23 min/sec)

1. How many significant figures are there in the following numbers?

   a) 42,000. L ______ b) 0.4010 g ______

   c) 0.00130 s ______ d) 405,700,000 km ______

2. Complete the table. Provide ordinary decimal form or scientific notation and the type of unit. The first line has been completed as an example for **mass**.

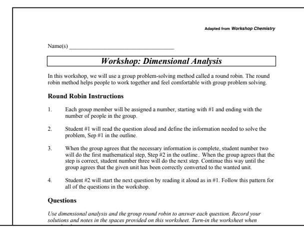
Ordinary Decimal Form	**Scientific Notation**
0.683 kg (mass)	**6.83×10^{-1} kg**
1365 mL ( )	**mL**
( )	**1.034×10^{1} m**
0.00350 μs ( )	**μs**
( )	**1.75×10^{-3} cm^3**
1,605,000 nm ( )	**nm**

3. How many significant figures in the numeric value would be appropriate for each of the following values using the specified units?

   The speed of a car in miles per hour as read from a speedometer when traveling at the speed limit on Viking Drive (25 mph).

   Your weight using lbs.

Worksheet (Handout): Due next lab. Collaboration is encouraged.
Turn in one with the names of all contributors.
http://chemconnections.org/general/chem108/Math%20%26%20Measurements-WKS.f18.pdf



Adapted from ***Workshop Chemistry***

Name(s) ______________________

Workshop: Dimensional Analysis

In this workshop, we will use a group problem-solving method called a round robin. The round robin method helps people to work together and feel comfortable with group problem solving.

Round Robin Instructions

1. Each group member will be assigned a number, starting with #1 and ending with the number of people in the group.
2. Student #1 will read the question aloud and define the information needed to solve the problem, Sep #1 in the outline.
3. When the group agrees that the necessary information is complete, student number two will do the first mathematical step, Step #2 in the outline.. When the group agrees that the step is correct, student number three will do the next step. Continue this way until the group agrees that the given unit has been correctly converted to the wanted unit.
4. Student #2 will start the next question by reading it aloud as in #1. Follow this pattern for all of the questions in the workshop.

Questions

Use dimensional analysis and the group round robin to answer each question. Record your solutions and notes in the spaces provided on this worksheet. Turn-in the worksheet when

OPTIONAL: Chem 120, General Chemistry Level Workshop/ Worksheet (Handout)
http://chemconnections.org/general/chem108/WKS%20Unit%20Conversion%20-%20Dimensional%20A.pdf

Answers will not be provided; see Dr. R. with any questions after attempting the Worksheet's problems