Doing: Lab Experiments

Safety ***Chem 108: Lab***

(Video & Handout)

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

Sign in: Roster @ front of lab

Open Lab Drawer

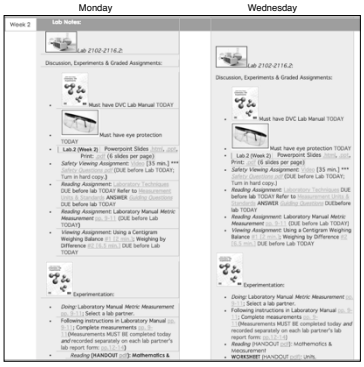
Select a partner to work with for today's lab experiment

Turn in:

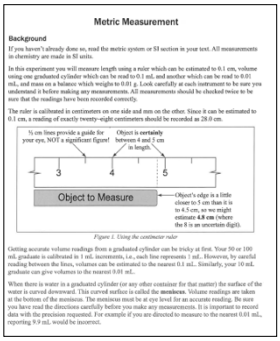
completed safety handout before beginning experiment.

http://chemconnections.org/general/chem108/calendar-108-f19.html

CHEM 108



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

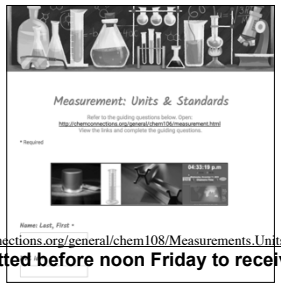
Getting accurate volume readings from a graduated cylinder can be tricky at first. Your 50 or 100 mL graduate is calibrated in 1 mL increments, i.e., each line represents 1 mL. However, by careful reading between the lines, volumes can be estimated to the nearest 0.1 mL. Similarly, your 10 mL graduate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

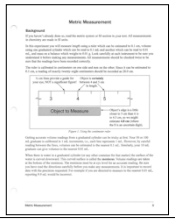
Must be submitted before noon Friday to receive any credit.

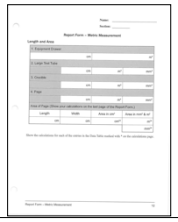
Doing: Lab Experiments

Metric Measurement [Experiment #1]

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

http://chemconnections.org/general/chem108/calendar-108-f19.html



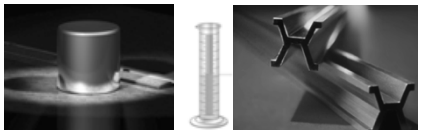


Collaboration is encouraged, but individual record keeping and submissions are required. MUST use Lab Manual pages for record keeping. Black or blue ink preferred without erasures, but pencil OK for Chem 108.

Doing: Lab Experiments

Metric Measurement [Experiment #1]

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



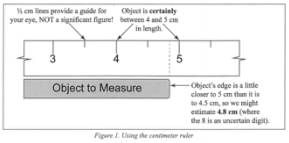


Figure 1. Using the centimeter ruler

Exp. 1 – Metric Measurement

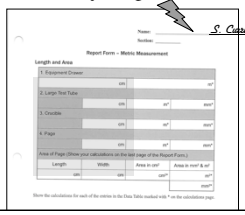
- Goal: Using instruments having different levels of precision, make accurate measurements of length, area, volume, and mass
- Convert measurements to different units using Dimensional Analysis

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. Cassy (D. Green)



and on your partner's form

D. Green (S. Cassy)

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.

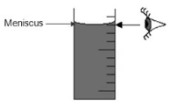
Exp. 1 – Metric Measurement

Mass Measurement with an Electronic Balance:

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

Exp. 1 – Metric Measurement

Volume Measurement (Liquids)

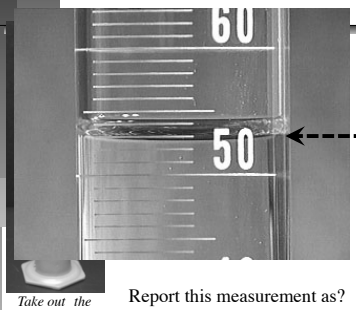


Measure at the ***bottom of the meniscus at eye level***

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.

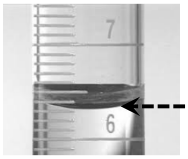
Report this measurement as?

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?

Take out the cylinder; pour some water into it.

6.31 mL

What is the volume of water in your cylinder?

Exp. 1 – Metric Measurement

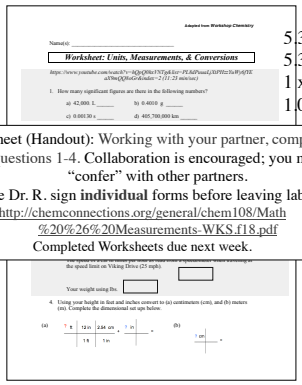
- Important to record ***measurements*** to the correct limits of the equipment used (i.e. uncertainty/significant figures). NOTE: For this experiment the uncertainty limits (+/–) of the equipment is to be included.
- Uncertainty limits are not normally included in calculations but are inferred from 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

5300. mL
5300 mL
0.01 kg
0.0100 kg



Worksheet: Units, Measurements, & Conversions

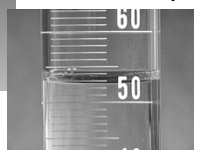
5.300 x 10^3 mL
5.3 x 10^3 mL
1 x 10^{-2} kg
1.00 x 10^{-2} kg

Worksheet (Handout): Working with your partner, complete questions 1-4. Collaboration is encouraged; you may "confer" with other partners.
Have Dr. R. sign **individual** forms before leaving lab today
http://chemconnections.org/general/chem108/Math%20%26%20Measurements-WKS.f18.pdf
Completed Worksheets due next week.

Exp. 1 – Metric Measurement

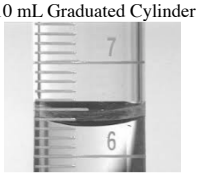
Measurement with a Graduated Cylinder:

100 mL Graduated Cylinder



Measurement: 52.9 +/– 0.1mL

10 mL Graduated Cylinder

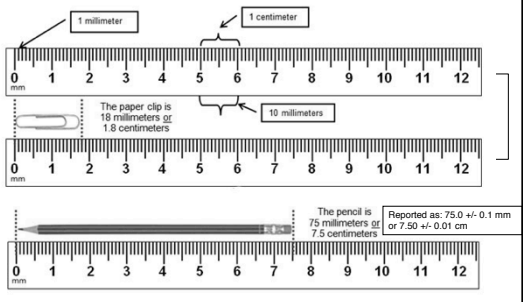


Measurement: 6.31 +/– 0.01mL

- 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.

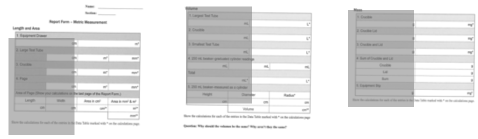
Exp. 1 – Metric Measurement

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

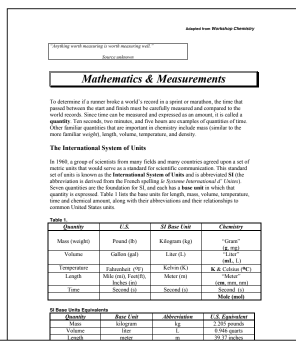
SFO July 6, 2013

Experiment 1 – Metric Measurement

Complete and record all measurements today.

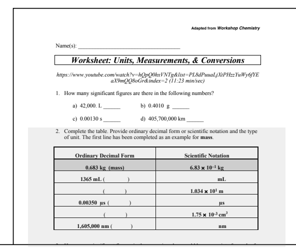


Conversions and calculations due next lab.

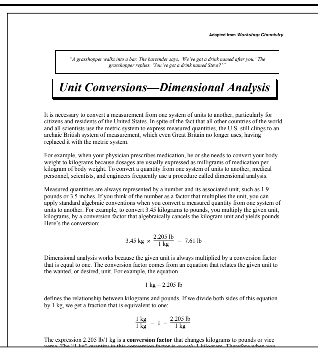

Mathematics & Measurements

The International System of Units

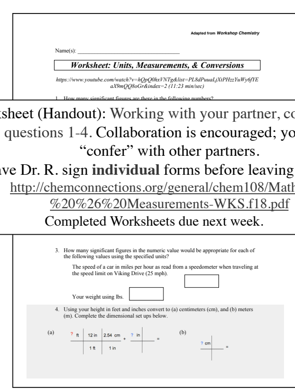
Reading (Handout)
http://chemconnections.org/general/chem108/Math%20%26%20Measurement-2018.pdf


Worksheet: Units, Measurements, & Conversions

Worksheet (Handout): Working with your partner, complete questions 1-4. Collaboration is encouraged; you may "confer" with other partners.
Have Dr. R. sign **individual** forms before leaving lab today
http://chemconnections.org/general/chem108/Math%20%26%20Measurements-WKS.f18.pdf
Completed Worksheets due next week.


Unit Conversions—Dimensional Analysis

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


Worksheet: Units, Measurements, & Conversions

Worksheet (Handout): Working with your partner, complete questions 1-4. Collaboration is encouraged; you may "confer" with other partners.
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Completed Worksheets due next week.

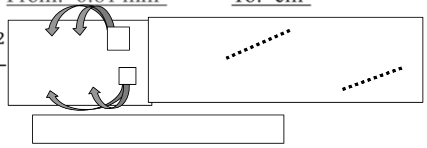
Converting squared or cubic units

- 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

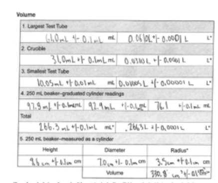
Complete and record all measurements today.

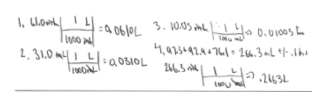
Have Dr. R. sign **individual** forms before leaving lab today.

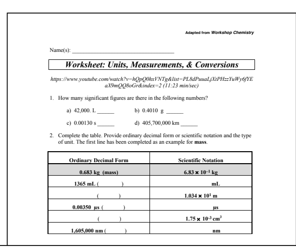
Only your measurement data is due to be signed today.
Conversions and calculations due next lab.

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

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