Chapter 1
Introduction

How can I be reached?

Knock on the door of B102

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Course breakdown

- Competency 1: Lab Mark – Practical
  - 40 % of total grade
  - It consists of formal LAB REPORTS which will be taught to you.
  - You copy, I find out.
  - Science fair is also part of your lab mark
- Competency 2: Theory Mark – Quizzes and Tests
  - 60 % of total grade
  - It consists of 3 quizzes and a summative exam at the end of the term.

How to behave in the lab

- Sensible clothing
- Closed toe shoes
- Snap a photo of the lab station BEFORE you start, making cleanup a real breeze
- Safety glasses or goggles MUST be worn at ALL TIMES
- Any violation of these rules will result possibility of revoked lab privileges.
- No foul play in the lab
- Lock down in CORNER
- Fire escape out the front door.

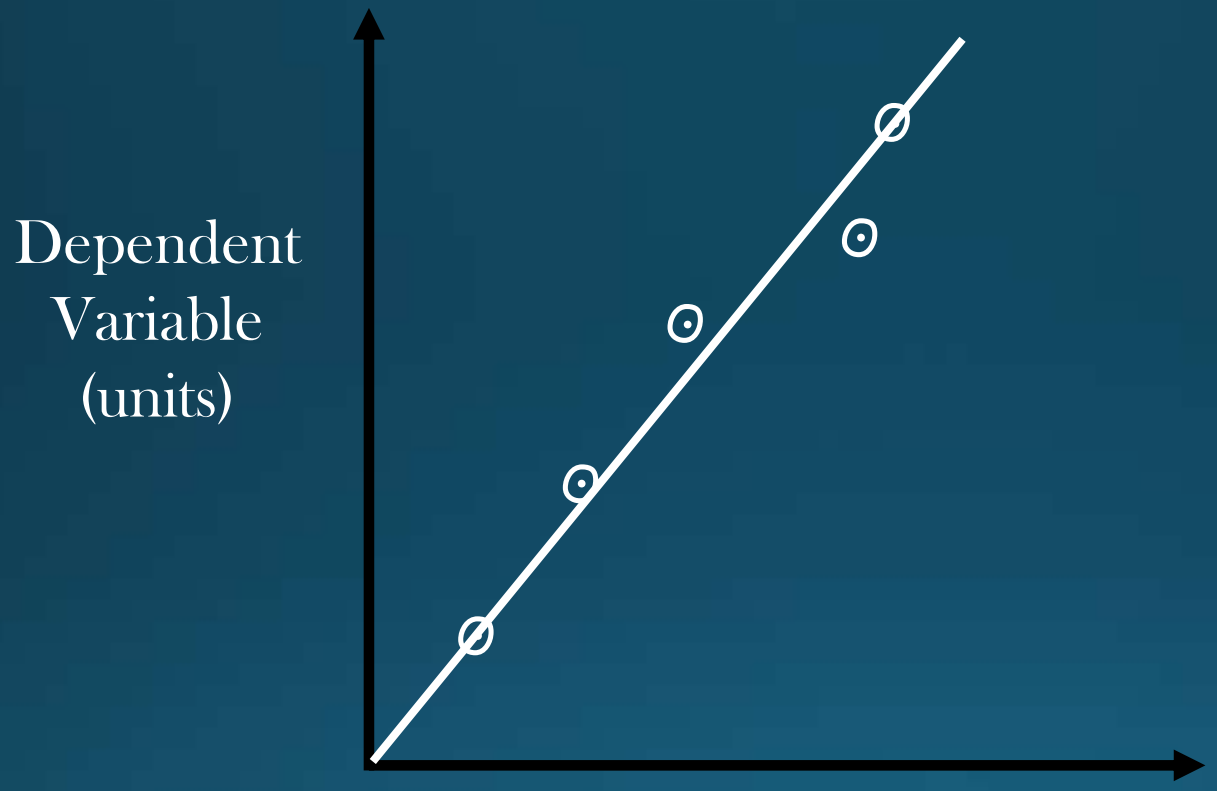
How to be successful in Chemistry

- Do ALL the work assigned (or as much as possible)
- No tardiness accepted. You will be asked to stand outside until you can come in without disturbing anyone
- Absenteeism will affect the outcome of your performance.
- Ask for help when you understand AND especially when you don't understand.
- Practice, practice and PRACTICE!
- If you run out of questions to practice, ASK FOR MORE! ☺

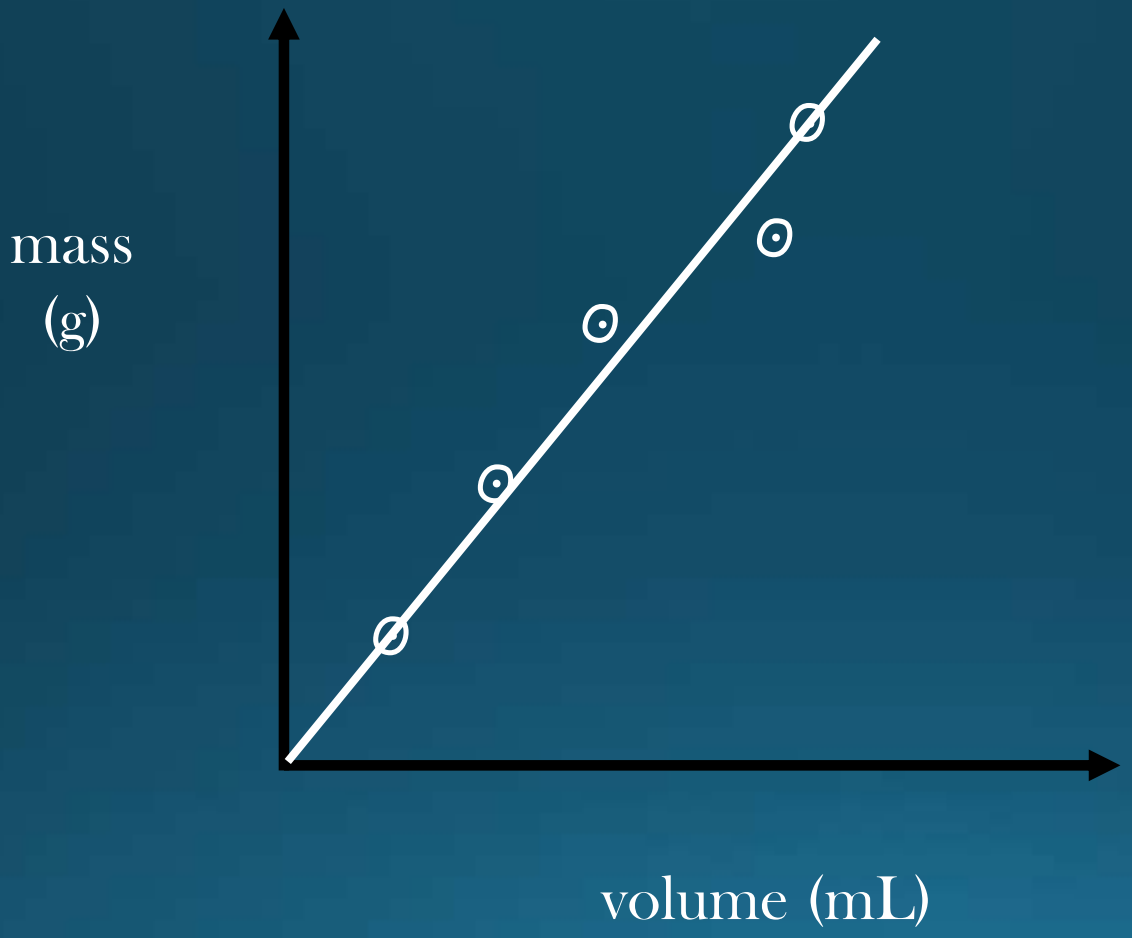
Criteria for Graphing

1. x axis - independent, y-axis dependent
2. Both Axis properly labelled with units
3. Title y(units) vs. x (units)
4. Data points circled - indicates ever present experimental error
5. Best fit "line" - straight line, curve etc.
6. Use as much of the graph paper as possible (minimum 50%)
7. Equally spaced increment on both axes
8. Points used to calculate the slope are indicated by …
   - **triangle** to show the two points selected
   - Labeled "P_1" and "P_2"
9. Slope calculation (when requested)
   - before beginning calculations list the points, P_1 and P_2
   - include units
10. Use precision paper (provided by us)
11. When required - use a key if more than one line is plotted on the same graph

Y (units) vs. X (units)



m (g) vs. V (mL)



Error Calculations

Experimental Error (E)
Observed value (O)
Accepted value (A)

E = O - A

% error = (E ÷ A) X 100

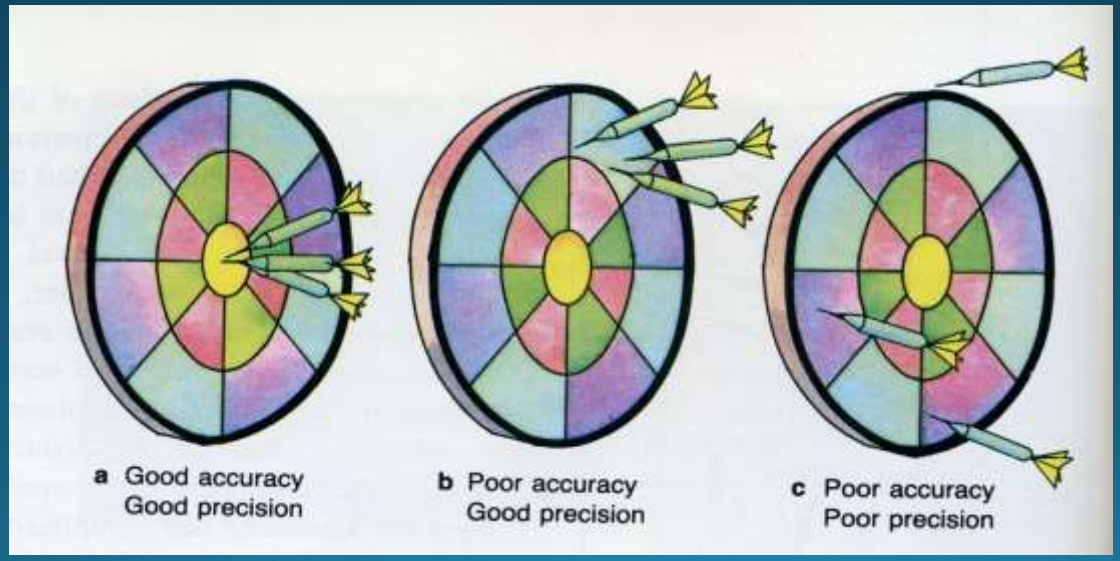
$\rho_{water\ @\ 20\ deg.\ C}$ = 0.99823 g/mL = A

Precision and Accuracy

Accuracy: How close a measurement comes to the actual or true value measured

Precision: Concerned with reproducibility of the measurement

Example:



Precision and Accuracy Lab

(Lab pg. 1-31 – Density of water)

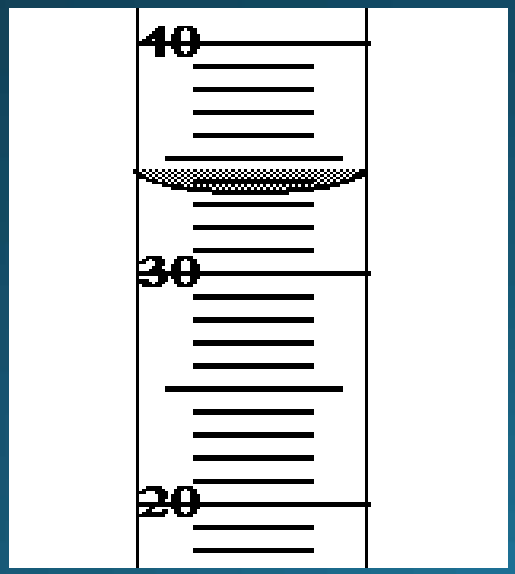
Assignment to be collected (in 2 classes)

1. Draw graph as per graphing criteria
2. Calculate:
   - Slope = $(Y_2 - Y_1)/(X_2 - X_1)$ → density = $(m_2 - m_1)/(V_2 - V_1)$
   - (indicate the selected points on your graph as P1 and P2)
3. Calculate:
   - Experimental (E)= observed value (O)– accepted value (A)
   - % error = $\frac{\text{Observed - Accepted}}{\text{Accepted}} \times 100$

Significant Figures in Measurements

- Include all the digits that can be known precisely plus a last digit that must be "estimated"
- The last digit is determined by the uncertainty of the instrument.
- The uncertainty of the instrument is determined by dividing the smallest division by 2

Ex.:



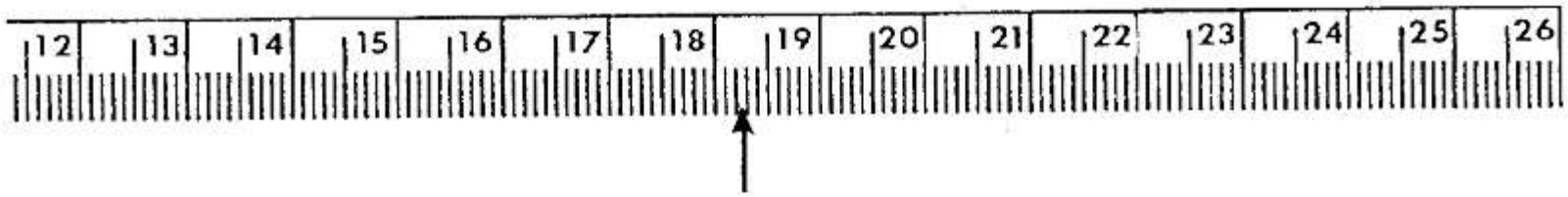
Smallest Division: 1mL

1mL÷2

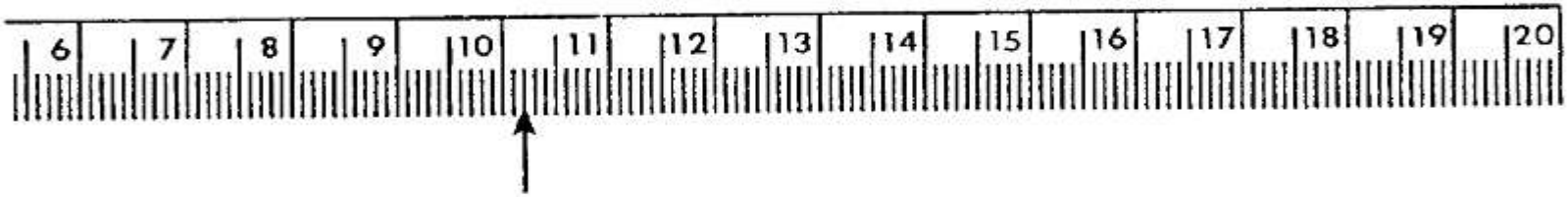
Uncertainty: = ± 0.5mL

Reading : 33.5 ± 0.5 mL

Topic 11: Reading a Metric Ruler



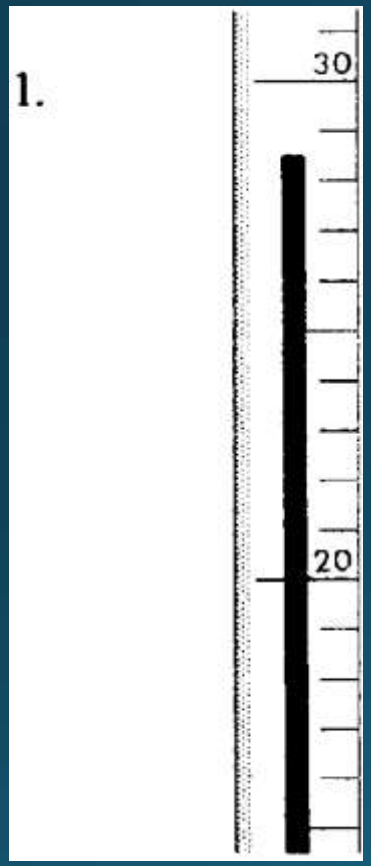
How many: 1. 18.25 cm? +_ 0.05 2. 182.5 mm? +_ 0.5 3. 0.1825 m? +_ 0.0005



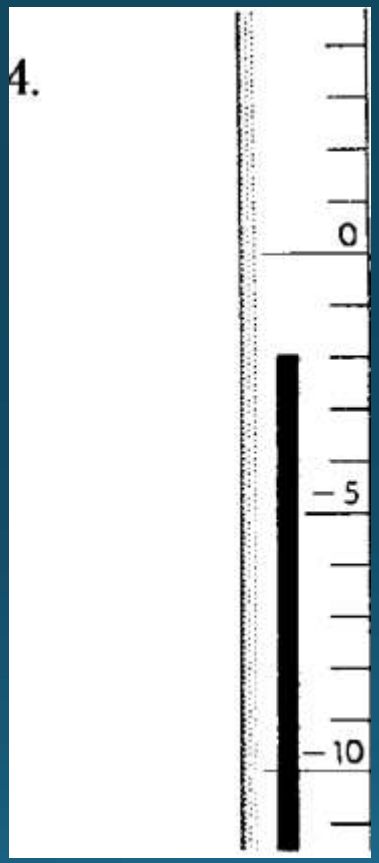
How many: 4. 0.0001020 km? +_ 0.0000005 5. 102.0 mm? +_ 0.5 6. 10.20 cm? +_ 0.05

How many: 7. 0.2030 m? +_ 0.0005 8. 20.30 cm? +_ 0.05 9. 0.0002030 km? +_ 0.0000005

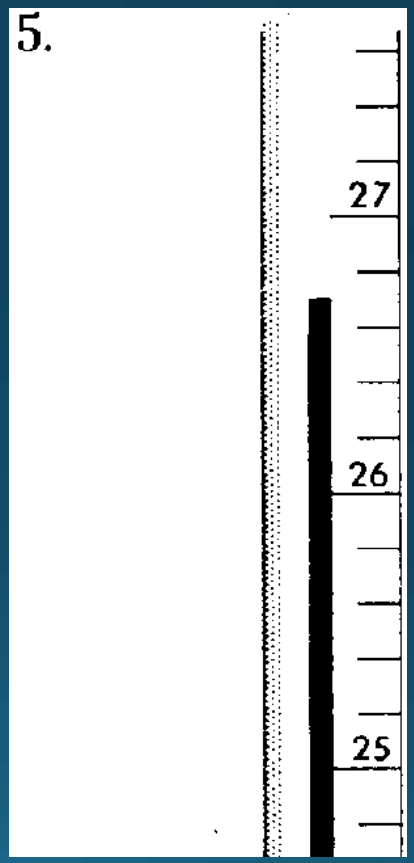
Topic 13: Reading Thermometers



28.5 +_ 0.5 °C

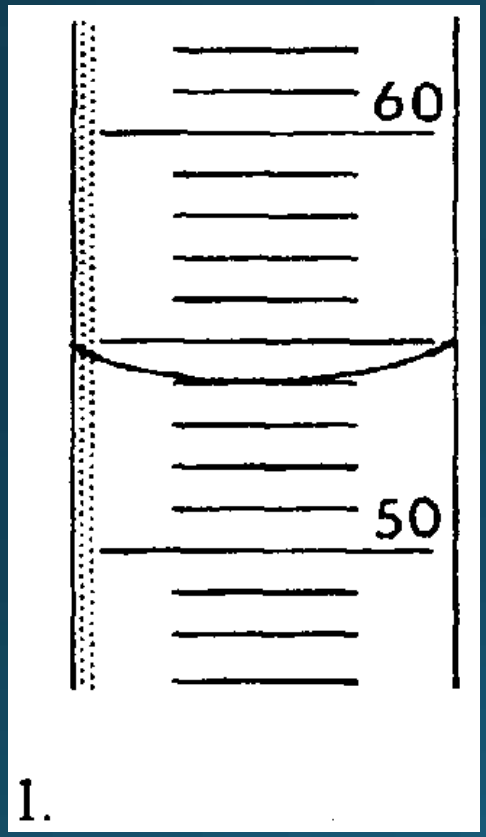


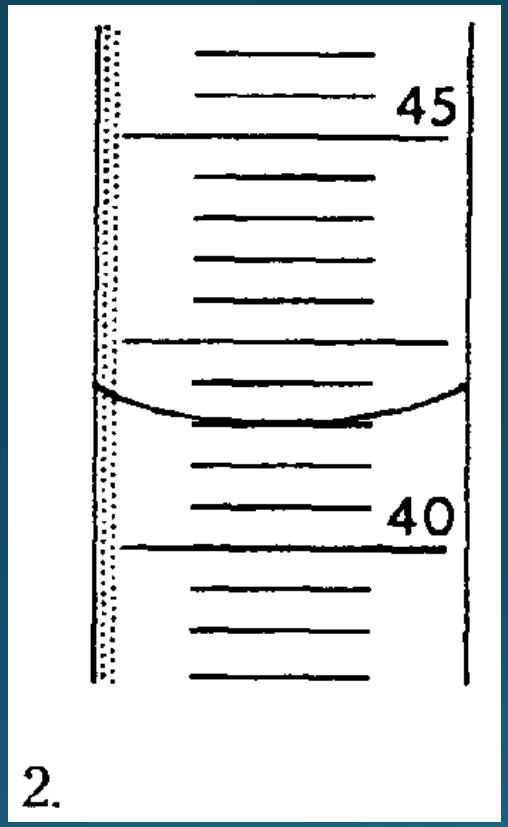
-2.0 +_ 0.5 °C

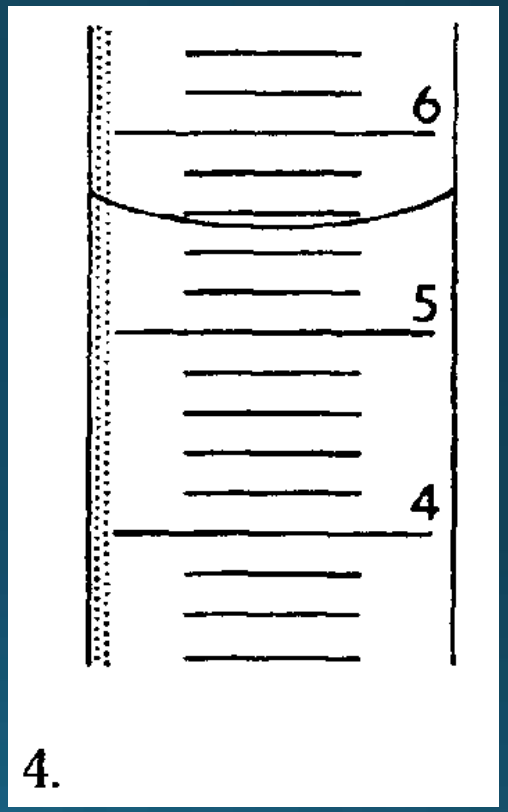


26.7 +_ 0.1 °C

Topic 14 : Reading Graduated Cylinders







54.0 $^{+}_{-}$ 0.5 mL

41.5 $^{+}_{-}$ 0.2 mL

5.5 $^{+}_{-}$ 0.1 mL

= 0.0415 $^{+}_{-}$ 0.0002 L

Uncertainty of Instruments

Instrument/Size	Smallest Division (with units)	Uncertainty (smallest division/2)
250 mL graduated cylinder		± or ±
100 mL graduated cylinder		±
50 mL graduated cylinder		±
25 mL graduated cylinder		±
10 mL graduated cylinder		±
400 mL Beaker		±
Alcohol Thermometer		±
Digital Thermometer	X	± 0.1 °C
Electronic Balance	X	± 0.001 g

Rounding off Numbers

Rule:

1. Last digit > 5, drop the last digit & round up
   i.e. 7.37 → 7.4
2. Last digit < 5, drop the last digit
   i.e. 7.34 → 7.3
3. Last digit = 5
   (i) previous digit odd – round up
   i.e. 5.35 rounded to one decimal –-> 5.4

   (ii) previous digit even – drop last digit
   i.e. 10.345 rounded to 2 decimals → 10.34

(Practice pg. 1-21)

Scientific Notation

Exercises pg. 1-22

Significant Digits

- non-zeros
  - ie. 421
- Zeros between non-zeros
  - i.e. 406
- Zeros to the right of a decimal point after significant digits
  - i.e. 45.100)

Non - Significant Digits

- Stand alone zeros left of the decimal point
  i.e. 0.421
- Zeros right of the decimal point before significant digits
  i.e. 0.00421
- Zeros after significant digits and before the decimal place
  i.e. 421000 these three zeros could be significant

To eliminate doubt → write in scientific notation

i.e 4.21×10^5 (3 significant digits)

4.21000×10^5 (6 significant digits)

Significant Digits
Addition and Subtraction

(practice pg. 1-40)

1. Do the math
2. Round off to the least number of decimal places

i.e. 2.1745

134.2 ←

56.17

18.193

210.7375

Significant Digits
Multiplication and Division

practice pg. 1-41

1. Do the math
2. # of significant digits - same as number with the least #

i.e. $$\frac{(561.1)(34731)(23)}{(112)(24.713)}$$

$$= 161\,935.4382$$

$$= 1.6 \text{ X } 10^5$$

Periodic Table Review

Hyperlink to Periodic Table Review

Topic 16: Mole Problems

What is a mole?

- Package of 6.02 X 10^{23} particles (molecules or atoms)

What is molar mass?

- Mass of 1 mole of a substance.
- Sum of the atomic masses of the elements in a substance

i.e.

molar mass of: Ne = 20.18 g/**mol**

H_2O = [**2** (1.01)+ 1(16.00)] = 18.02 g/mol

Changing between grams, moles and molecules

m = mass (g)

n = # of moles (mol)

MM = Molar Mass (g/mol)

N = Avogadro's number (6.02×10^{23} particles/mol)

Using ratios:

MM = m/n

N = # particles/n

Changing between grams, moles and molecules

m = mass (g)

n = # of moles (mol)

MM = Molar Mass (g/mol)

N = Avogadro's number (6.02 X 10^{23} particles/mol)

More on Significant Figures ….

Note the following:

- When **given** a value that can be measured with an instrument (i.e. mass) consider its significant figures.
- When **given** a value that cannot be measured with an instrument (i.e. # of moles or # or molecules) do not consider this values significant figures.
- When using a **calculated** value in another calculation consider its significant figures.