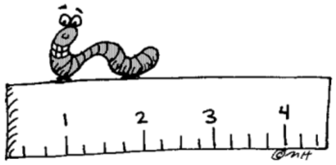


Name: ______________________________
Period: ____ Date: ____________________

IN-1: How accurate will I be in estimating different kinds of measurements?

In scientific measurement, the degree of precision required varies. Usually very precise measurements are necessary but it is still helpful to be able to make estimates. The degree of accuracy in estimating varies considerably with the individual and the extent of his/her experience. The first time a person attempts to make an estimate, his/her accuracy is probably much less than it would be the tenth time.

How accurate will you be in estimating different kinds of measurements? In this investigation you will find out by making several estimates, comparing them to the precise measurements and then calculating your percent accuracy. In the process you will also gain experience in using some of the equipment and measuring tools that we will be using throughout the year in this class.

Percent accuracy is calculated in two steps using the following formulas:

Step 1: $\frac{\text{units off}}{\text{correct units}} \times 100 = \%\ \text{error}$

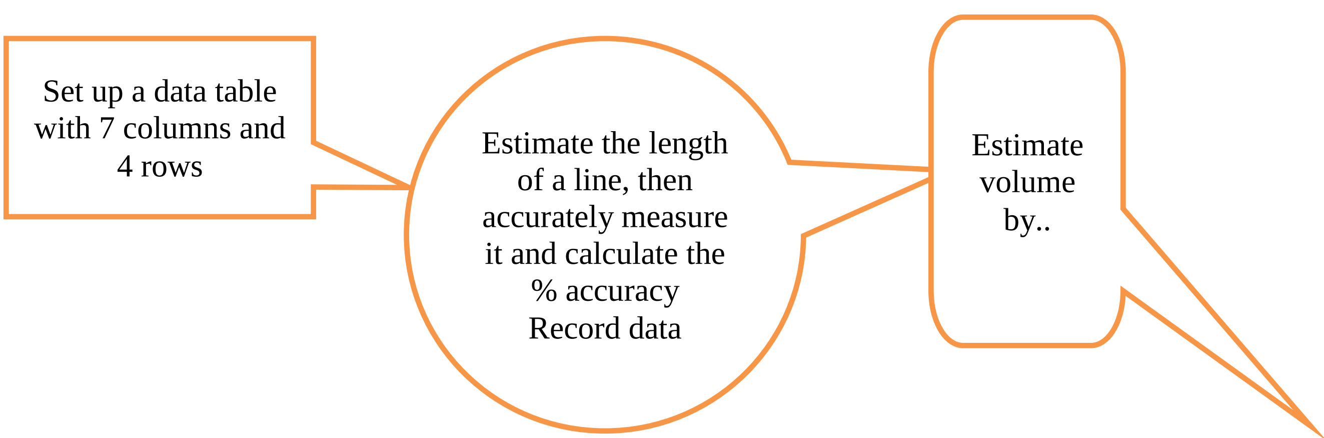
Step 2: $100\% - \%\ \text{error} = \%\ \text{accuracy}$

Pre-Lab: (1-3)

1. Objective: Write the objective of this lab in your own words. (What are we trying to figure out?)

2. Flow Chart: Make a flow chart of the lab procedures.

A flow chart gives a brief description of the procedures of the investigation. Each important part is represented in a bubble, square, flower, ……… and then connected to show the order of the procedures . See sample below



Flow Chart:

<u>3. Draw your data table as instructed in the section labeled Data Table</u>

<u>MATERIALS</u>

Metric ruler, graduated cylinder, dropper, electric balance, nickel, sand, weighing cup, clock with second hand.

<u>PROCEDURE</u>

Set up a data table as follows:

COLUMNS: Dimension, Estimate, Correct units, Units off, % error, % accuracy, Calculations. *NOTE: The "Calculations" column is where you will "show your work" for any value you enter on the table that you determined mathematically (that is, that you did NOT measure directly, rather you found it by performing a calculation).*

ROWS: 4 blank rows beneath the column headings.

A. ESTIMATING LENGTH

1. On your lab paper (below your data table) draw a line freehand that you think is 10 cm long. Do not look at a ruler as you do this (however it may help to know that 30.5 cm is approximately 12 inches). Label this line "ESTIMATE". Now, using the ruler, draw a line right below your estimate that you <u>measure</u> to be exactly 10 cm long. Label this line "CORRECT". Enter the value 10 cm in the "correct units" column on your data table.

2. Measure your "estimated" line and enter this value under "estimate" on your data table. Determine how many cm off your line was from the "correct" and enter this in the "units off" column.

3. Using the formulas given, calculate your % accuracy and record it on your data table. Be sure to "show your work" in the "Calculations" column.

B. ESTIMATING VOLUME

4. Find the 5 ml level on the graduated cylinder. Estimate the number of drops of water that it would take to fill the graduated cylinder to this level. Record this estimate on your data table.

5. Now use your dropper to determine how many drops it <u>actually</u> takes to fill it to the 5 ml mark. This is your "correct units". Record this, then determine units off and percent accuracy as you did in Part A.

C. ESTIMATING WEIGHT

In this part of the investigation you will try to guess the amount of sand it would take to equal the weight of a nickel.

1. Hold the nickel to get an idea of its weight.

2. Tare the weighing cup on the electronic scale. Now carefully spoon sand into the weighing cup until you think the amount of sand weighs the same as the nickel. *BE CAREFUL NOT TO GET ANY SAND ON THE SCALE!* The weight of the sand is your estimate. Record on your data table and place the sand back into bowl.

3. Now weigh the nickel directly on the scale. This is the “Correct” weight. Record

4 Using the formulas in the introduction calculate and record your percent accuracy.

D. ESTIMATING TIME

In this section you will try to estimate how long 30 seconds is without looking at a clock. You and your lab partner will take turns being estimator and timer.

1. Have your lab partner watch a clock with a second hand. Have your partner tell you when to start, then, when you think 30 seconds have passed, you say “Stop”.

2. The number of seconds that passed before you said “Stop” is your estimate. 30 seconds is the “correct” time you were trying to determine. Record these numbers and determine your percent accuracy as in parts A, B and C.

3. Repeat, switching roles with your partner.

E. AVERAGE PERCENT ACCURACY

1. Calculate the average of the 4 % accuracies you obtained for steps A through D. Record this figure on your data table.
2. Record your average on the clipboard at the front of the room

Data Table:

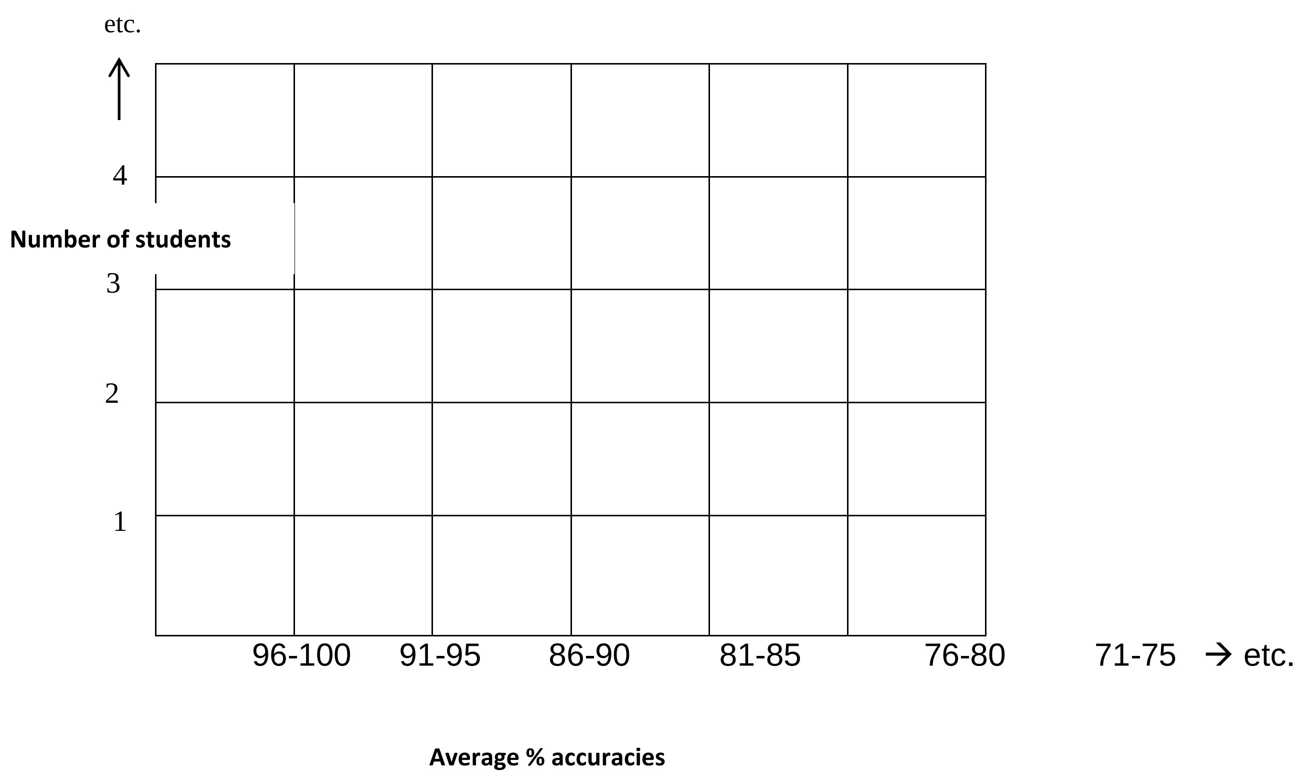
DISCUSSION QUESTIONS

1. Prepare a table (on the next blank page) similar to the one below on which you will enter the numbers of students in your class who had percent accuracies in each range.

Average % Accuracy	Number of Students
100-96	
95-91	
90-86	
etc. ↓	etc. ↓

NOTE: This is NOT the data table required on your prelab. This is for use AFTER completion of the procedures.

2. Plot the information from your table on a graph (**use graph paper**) similar to the example below.
    a. Draw a "best fit" line (in this case it will be a curve).
    b. Place an "X" on the "best fit" curve to indicate your own average % accuracy.



3. In which area of estimating were you the most accurate? Do you think your accuracy was more a matter of luck or experience? Explain.

4. Write a paragraph describing what you have learned by doing this investigation and how it will help you in the future in science.