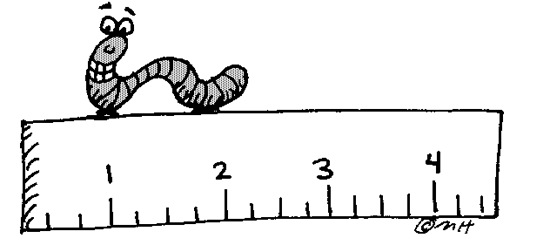
**Class Lab Guide**

**A. ESTIMATING LENGTH**

1. On your lab paper 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 measure to be exactly 10 cm long. Label this line “CORRECT”. Enter the value 10 cm in the “correct units” space on your data sheet.

2. Measure your “estimated” line and enter this value under “estimate” on your data sheet. Determine how many cm off your line was from the “correct” and enter this in the “units off” space.

3. Using the formulas given, calculate your % accuracy and record it on your data sheet. Be sure to “show your work” in the space provided.

**B. ESTIMATING VOLUME**

1. 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 sheet.

2. Now use your dropper to determine how many drops it actually 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 CONCENTRATIONS**

*“Concentration” of a substance means how much of that substance is in a solution compared to how much water. Concentration can be expressed in different ways but in this exercise it will be expressed in percent. You will attempt to estimate the concentration of methylene blue dye in an “UNKNOWN”. Then you will determine it’s actual concentration by making a series of dilutions and comparing them to the unknown.* ***(Concentration is already expressed in percent, so you will calculate % accuracy differently for this part of the procedure. Follow step 9 carefully!)***

1. Set up the 5 empty test tubes in your test tube rack and label them A, B, C, D, and E

2. In test tube A put 10 ml of 100 % methylene blue solution. In test tube E put 10 ml of water (since this test tube has no methylene blue its concentration of methylene blue is 0%).

3. Compare the color of the “UNKNOWN” test tube to the 100% solution and the 0% solution. What % methylene blue do you think is in the unknown? Record this under “Estimate” on your data table. **Be sure to do this BEFORE you go on to step 4!**

4. Now place 5 ml of water each into test tubes B, C and D.

5. Measure out 5 ml of the 100% solution from test tube A and add it to the water in test tube B. Gently stir. (Concentration of methylene blue in test tube B = \_\_\_\_\_\_\_%)

6. Measure out 5 ml of the solution in B and add it to the water in test tube C. Stir. (Concentration of methylene blue in C = \_\_\_\_\_\_\_\_\_%)

7. Measure out 5 ml of the solution in C and add it to the water in test tube D. Stir. (Concentration of methylene blue in D = \_\_\_\_\_\_\_\_\_%)

8. Now compare the color of the unknown to the solutions in test tubes A, B, C, D, and E. The concentration in the tube that best matches the unknown is the “Correct” concentration. Record this concentration on your data sheet.

9. Since concentration is already expressed as percent, the “units off” IS the “percent error”.

*Thus to calculate “% accuracy” in this case simply determine the “units off” and subtract it from 100%. Record.*

**D. 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 golf ball. In doing this section be sure to carefully follow all of the guidelines in Reference Sheet 6.*

1. Hold the golf ball to get an idea of its weight. Now carefully spoon sand into the paper weighing cup until you think the amount of sand weighs the same as the ball. *BE CAREFUL NOT TO GET ANY SAND ON THE BALANCE!*

2. Following the steps in Reference Sheet 6, find the weight of the sand. (*Careful! What do you need to do to take into account the weight of the cup??*) The weight of the sand is your estimate. Record on your data sheet.

3. Now weigh the golf ball. This is the “Correct” weight. Record.

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

**E. 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 D.

3. Repeat, switching roles with your partner.

**F. ESTIMATING TEMPERATURE**

*In this section you will estimate the temperature of lukewarm water in degrees Celsius*

1. Put your finger in the warm water and estimate the temperature in degrees Celsius. (hint water turns to ice at 0 degrees Celsius and boils at 100 degrees Celsius)
2. Record your estimate on your data table.
3. Use your thermometer to measure the actual temperature in degrees Celsius.

4. Record the correct temperature on your data sheet. The difference between your estimate and the actual temperature gives you your units off. Use this information to calculate your % Accuracy.