



Name _____

Date _____ Period _____

HOW DO YOU MEASURE IN METRICS?

When making measurements in the laboratory, scientists use the metric system. This activity will give you practice in measuring length, volume and mass in metric units.

MATERIALS: milk carton; metric ruler; balance; water; graduated cylinder

PROCEDURE:

1. Measure the length, width, and height of the carton in centimeters. When measuring the height, only measure to the crease that folds the carton! Record the measurements to lines 1, 2, and 3 of the data table on the back of this page.
2. Calculate the volume of the carton in cubic centimeters by multiplying length X width X height. Record this calculated volume on line 4 of the data table.
3. Use a balance to find the mass of the empty milk carton in grams. Record this empty mass on line 5 of the data table.
4. Fill the milk carton with water to the crease that was the measured height. Use a balance to find the mass of the carton and water in grams. Record this mass of carton and water on line 6 of the data table.
5. Find the mass of the water in grams. To do this, subtract the mass of the empty carton from the mass of the carton and water. Record this mass of water on line 7 of the data table.
6. Use a graduated cylinder to measure the volume of water in milliliters. If the cylinders are too small to hold all of the water, you may have to pour more than one time and add all measurements to get the total volume in milliliters. Record this measured volume on line 8 of the data table.
7. Find the relationship between the volume of the carton in cubic centimeters (line 4) and the volume of the water in milliliters (line 8). Divide the volume of the carton by the volume of the water. Record this relationship of volumes on line 9 of the data table.
8. Find the relationship between the mass of the water in grams (line 7) and the volume of water in milliliters (line 8). This relationship is the density of water. Divide the mass of the water by the volume of the water. Record this relationship (density) on line 10 of the data table.

MILK CARTON DATA TABLE

1. Length of carton		Centimeters (cm)
2. Width of carton		Centimeters (cm)
3. Height of carton		Centimeters (cm)
4. Volume of carton		Cubic Centimeters (cm ³)
5. Mass of empty carton		Grams (g)
6. Mass of carton and water		Grams (g)
7. Mass of water		Grams (g)
8. Volume of water		Milliliters (ml)
9. Volume relationship		(cm ³ /ml)
10. Density of water		(g/ml)

Write in complete sentences and show your work! Answer each of the following:

1. Milliliters and cubic centimeters both are units of volume. How does the number of cubic centimeters in the carton compare to the number of milliliters of water it holds?
2. How many ml are equal to 1 cm³? What line on the data table shows this?
3. How many ml are there in 1 g of water? What line on the data table shows this?
4. According to your data, what is the density of water?
5. The actual density of water is 1 g/ml or 1 g/cm³. Percent error tells scientists how close their data is to actual values. Use the formula below to calculate your percent error (% error) for your density of water.
(SHOW YOUR WORK! = Formula - Plug - Chug)

$$\frac{(\text{your density}) - (\text{actual density})}{(\text{actual density})} \times 100 = \% \text{ error}$$
6. It is important to measure with accuracy and precision. In doing this lab, where could you have made measurement errors? (Hint: there are 3 answers to this question))
7. List other non-measurement errors that you could have made while doing this lab.