

DATE _____ PERIOD _____ NAME _____

EXPERIMENT 2.1 : Measuring Length

Purpose

Measure the dimensions of several objects, learn the metric system of measurement, and observe the use of significant digits to express measured values and results of calculations.

Concept and Skill Check

Proper measurement is critical in all laboratory experiments. Measurements can be made using a variety of different measuring instruments, such as an electrical meter, a thermometer, or a meter stick. Any physical measurement is *uncertain*. The degree of uncertainty depends upon the measuring instrument and the skill of the individual using it. Before continuing with this lab, review the introductory material on uncertainty in the front of this manual.

Examine a meter stick. Notice that it is divided into one hundred equal, numbered parts called centimeters (cm). Each centimeter is further divided into ten equal, nonnumbered parts called millimeters (mm). How accurately can you measure with a meter stick? Suppose that there are no subdivisions on the meter stick. Measure the height of your desk to the nearest meter. The desk should be one meter high. Actually it is less than one meter. You may have estimated that it is about 0.7 m high. If the meter stick is marked only in one-meter intervals, you will have a great deal of uncertainty about the desk's true height. A meter stick with centimeter subdivisions has greater precision than a meter stick with no subdivisions. Likewise, a meter stick with millimeter subdivisions has greater precision than does one with only centimeter subdivisions.

Place the meter stick with its marked edge along the top of the wood block. Read the measurements from directly in front of the meter stick and at eye level. Doing this will improve the accuracy of the readings. For a more accurate reading, use a mark farther along the meter stick, rather than at the beginning. The desired reading is obtained by subtracting the initial reading from the final reading, as shown in Figure 1.

Materials

meter stick
wood block
laboratory manual

Procedure

1. Measure and record in Table 1 the length, width, and height in centimeters of a block of wood. While making your measurements, read the meter stick to the nearest millimeter, and then estimate to a tenth of a millimeter. The final estimated reading and all figures to the left of it are significant digits.
2. Measure the length, width, and height in centimeters of your laboratory manual. Record the measurements in Table 1.
3. Calculate the volume of the block in cubic centimeters. Include only as many significant digits as you have in the value for one dimension of the block. Record the volume in Table 1.

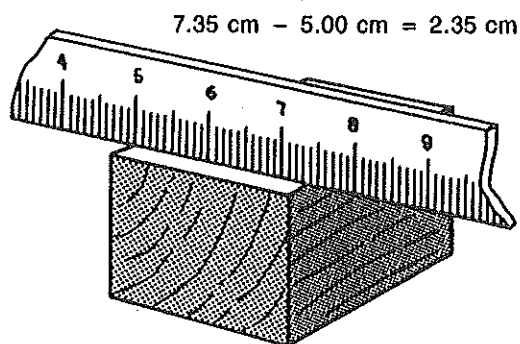


Figure 1. Subtract the first reading from the second to obtain an accurate length measurement.

EXPERIMENT

2.1 Measuring Length

NAME _____

- Calculate the volume of the laboratory manual in cubic centimeters. In your volume calculation, include only as many significant digits as you have in the value for one dimension of the laboratory manual. Record the volume in Table 1.
- Place the meter stick next to the edge of one page of your laboratory manual. Estimate the thickness of one page in millimeters. Record your estimate in Table 2.
- Measure the thickness of 50, 75, and 100 pages of your laboratory manual in millimeters. Record your results in Table 2. For each quantity of pages, determine the average thickness of a single page. Record your calculations in the table.

Observations and Data

Table 1

	Length (cm)	Width (cm)	Height (cm)	Volume (cm ³)
Wood block				
laboratory manual text book				

Table 2

Number of pages	Total thickness (mm)	Average thickness of a single page (mm)
1		
50		
75		
100		

Analysis

- Why is it less accurate to use either end of the meter stick for measuring length?
- Of all the measurements you made, which one do you feel is least precise? Explain.
- If the values in Table 2 for the average thickness of a single page are different, which value is probably the most accurate? Explain.

Application

How important are measuring instruments with a high degree of precision to a craftsman manufacturing picture frames?

2.1 Measuring Length

NAME _____

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Observations and Data

Table 1

	Length (cm)	Width (cm)	Height (cm)	Volume (cm ³)
Wood block				
Text book Laboratory manual				

Table 2

Number of pages	Total thickness (mm)	Average thickness of a single page (mm)
1	omit	
50		
75	consistency	
100		

Analysis

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Application

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omit

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graph -

- title
- scale
- labels
- data
- line

/5

b. curve - linear / 5 ml slope

/ 3

c. equation $mass = 0.79 \times volume$

d. units of slope - $\frac{mass}{cm^3}$ g

- density

30

30