

Measurement of Length

Apparatus: meter stick 2 books
 metric ruler 2 wood blocks

Investigation:

Examine a meter stick. Notice that it is divided into one hundred equal-numbered parts. Each numbered division is one centimeter (cm) long. Thus, one centimeter is 0.01 m. Each centimeter is divided into ten equal non-numbered parts called millimeters (mm). Therefore, one millimeter is 0.001m. The length along the meter stick between 10 cm and 12.5 cm is 2.5 cm. This same length can also be expressed as 25 mm, 0.025m, and $2.5 \times 10^{-2}m$.

During this investigation you will use the metric system and practice calculations using significant digits. When you measure your wood block, do not start at the end of the metric ruler because the end may be damaged or stamped improperly. For a more accurate reading, use another marking farther along the ruler (fig. 1-1). Be sure to subtract your reading of the first mark from your final reading. In measuring with the metric ruler, notice that the ruler is placed on its marked edge. This helps to eliminate errors which can arise by viewing the scale from different angles. This apparent shift in position of an object when viewed from different angles is called parallax. Follow this same procedure for all measurements of length.

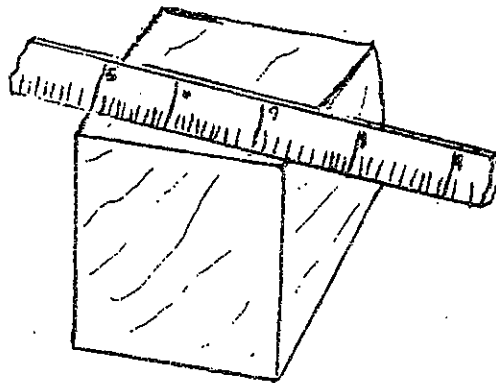


Figure 1-1

$$(7.35 \text{ cm} - 5.00 \text{ cm} = 2.35 \text{ cm})$$

Procedure:

1. Measure and record in Table 1-1 the length, width, and height in centimeters of two different wood blocks (be sure to include the block number you used). While making each measurement, read the metric ruler 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. Calculate the volume of each block. Retain in your product only as many significant digits as you have in the value for one dimension of the block. Record the volume of each block in cubic centimeters (cm^3) in Table 1-1.

3. In Table 1-2, express the dimension of the blocks in meters and the volume in cubic meters (m^3) of each of the two blocks.
4. Measure the thickness of 50, 100, and 150 sheets (not pages) of a book in centimeters and determine the average thickness of a single sheet. Repeat this process using a book with sheets that vary greatly in thickness from the book (ie, you may wish to use a telephone book, a physics handbook, or an unabridged dictionary.) Record your results in Tables 1-3 and 1-4.

Postlab Questions:

1. Why is it not a good idea to use either end of a meter stick or ruler when measuring length?

2. Express the length, width, and height of any block used in millimeters. What is the volume of this block in cubic millimeters?

3. How many cubic millimeters are in a cubic centimeter? _____
4. How many cubic centimeters are in a cubic meter? _____
5. Suppose that you are measuring the length of a wood block and the edge of your block appears to be exactly below a millimeter mark, how would you express the estimated part of a millimeter when you record the block's length?

6. How well do the average thicknesses of a single sheet of a given book (Table 1-3) compare? _____
Would you assume from this that all the sheets of the book are of equal thickness? _____
7. If the three values for the average thickness of a single sheet in a given book as recorded in Table 1-3 are slightly different, which value do you think is the most reliable? Explain. _____

8. Assume that the average volume of an adult human body is one-tenth cubic meter ($0.1 m^3$) and that there are 4 billion (4×10^9) adults in the world. a) What would be the total volume of all the adults in the world? b) Compute the length of one edge of a cubic container that would just contain a volume equal to the total adults in the world? _____

DATA TABLES

| Block # | Length (m) | Width (cm) | Height (cm) | Volume (cm ³) |
|-------------|------------|------------|-------------|---------------------------|
| Block _____ | | | | |
| Block _____ | | | | |

| Block # | Length (m) | Width (m) | Height (m) | Volume (m ³) |
|-------------|------------|-----------|------------|--------------------------|
| Block _____ | | | | |
| Block _____ | | | | |

| Number of Sheets Book _____ | Total Thickness (cm) | Average thickness of a single sheet (cm) |
|-----------------------------|----------------------|--|
| 50 | | |
| 100 | | |
| 150 | | |

| Number of Sheets Book _____ | Total Thickness (cm) | Average thickness of a single sheet (cm) |
|-----------------------------|----------------------|--|
| 50 | | |
| 100 | | |
| 150 | | |

Name: _____
 Date Due: _____ Mod _____

| Score Weight | |
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| ___ 16 | Postlab Questio |
| ___ 7 | Data |
| ___ 5 | Technique, Clea |
| ___ 28 | Total |