



ACCURACY AND PRECISION OF MEASUREMENTS USING DIFFERENT MEASURING DEVICES

ACTIVITY NO. 2:
MEASUREMENTS USING VERNIER
CALIPER & MICROMETER
(LABORATORY)

OBJECTIVES :

- 1. Become familiar with the measuring instrument commonly used in Physics Laboratory: the vernier caliper and micrometer.**
- 2. Determine the densities of various objects.**

INTRODUCTION:



In the world of science, accurate and precise measurements are crucial. To achieve this level of precision, scientists rely on specialized tools like vernier calipers and micrometers. In this activity, you will explore the capabilities of these instruments and delve into the concepts of accuracy and precision. Follow the procedures provided and answer the questions at the end of this activity.



MATERIALS :

- vernier caliper
- micrometer
- metal cylinder
- triple beam balance
- metal ball
- 50 mL graduated cylinder

PROCEDURES :

- 1. Measure the length and diameter of each of the given objects using the three measuring instruments with accuracy.**

- 2. Record the values on the preliminary written report sheet. Take five trials. Get the average.**

PROCEDURES :



3. Calculate the volume of each object using the formulas below. Use the average values of length and diameter.:

$$V_{\text{cylinder}} = \frac{\pi}{4} d^2 L$$

$$V_{\text{sphere}} = \frac{\pi}{6} d^3$$

where: V=volume m=mass d=diameter L=length



PROCEDURES :

- 4. Weigh each object using the triple beam balance.
- 5. Calculate the density of each object using the formula:

$$p = \frac{m}{V}$$

where: p = density m = mass V = volume

density of metal ball and cylinder = 7.8 g/cm^3

PROCEDURES :

6. Compute the calculated values with for the standard values of densities of each object and calculate the percentage error using:

$$\%E = \left| \frac{\text{standard value} - \text{calculated value}}{\text{standard value}} \right| \times 100$$

DATA RESULTS :
TABLE 1 : LENGTH AND DIAMETER IN
CENTIMETER OF DIFFERENT OBJECTS

a. Metal Cylinder

Trial	Length (cm)	Diameter (cm)
1	6.4	1.9
2	6.4	1.9
3	6.4	1.9
4	6.4	1.9
5	6.4	1.9
average	6.4	1.9

DATA RESULTS :

TABLE 2 : MASS, VOLUME, AND DENSITY OF
DIFFERENT OBJECTS

Object	Mass in grams	Volume in cm ³	Density in g/cm ³	Standard Value of ρ	Percentage Error
Metal cylinder	143.3g	18.15cm ³	8.31g/cm ³	7.8g/cm ³	6.5%
Metal Ball	17.2g	3.59cm ³	7.52g/cm ³	7.8g/cm ³	3.6%

COMPUTATIONS :



a. Metal Cylinder

$$\frac{\pi}{4}(1.9)^2(6.4)$$

$$= 18.14583917$$

$$\% \text{ of E} = \left| \frac{7.8\text{g/cm}^3 - 8.31\text{g/cm}^3}{7.8\text{g/cm}^3} \right| \times 100$$

$$= 6.538461538$$

b. Metal Ball

$$\frac{\pi}{6} (1.9)^3$$

$$= 3.591364002$$

$$\% \text{ of E} = \left| \frac{7.8\text{g/cm}^3 - 7.52\text{g/cm}^3}{7.8\text{g/cm}^3} \right| \times 100$$

$$= 3.58974359$$



DATA RESULTS :
TABLE 1 : LENGTH AND DIAMETER IN
CENTIMETER OF DIFFERENT OBJECTS

a. Metal Ball (sphere)

Trial	Length (cm)	Diameter (cm)
1	1.9	1.9
2	1.9	1.9
3	1.9	1.9
4	1.9	1.9
5	1.9	1.9
average	1.9	1.9

QUESTIONS :

What determines the accuracy with which you can make measurements using the Vernier caliper and micrometer?

- The least count of the instrument, its calibration, and the users proper handling determine measurement accuracy.

QUESTIONS :



Which of the three objects used, metal cylinder, the wire, and the metal ball, has the greatest error in its density? Why?

- The object with greatest error in density was the metal cylinder. This was because the value of the density was already given with a value of the density was already given with a value of 8.31g/cm^3 .



CONCLUSION :



The accuracy of measurements using instruments like vernier caliper and micrometer depends on their least count, proper calibration and the user's handling during the measurements. In this experiment, the metal cylinder showed the greatest error in the calculated density.

This suggests that even with precise instruments, the accuracy of results depends heavily on the reliability of reference data and consistent measurement technique. Overall, the proper handling of measurements and the help of the team (skipper, scribe, cracker, & digger) made the activity easier & better.



DOCUMENTATION :



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