OULU UNIVERSITY OF APPLIED SCIENCES

Physics Lab Report Work 1
Determination of the density of the body

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Summary

In this Lab work we measure and determine the density of rectangular parallelogram and cylinder. we will measure the weight of parallelogram and cylinder with balance scale in air and then only parallelogram also in water and unknown liquid (alcohol), with 10 time measurements of diameter of the base and the height for cylinder and 3 sides of parallelogram we calculate the density. In the following pages comes the theory, calculations, formulas and the measures.

Keywords: Density, Measurements, Micrometer, Caliper, Error estimation

1 Theory

Density (ρ) is defined by following equation where m is mass and v is volume of the body.

$$\rho = \frac{m}{v}$$

According to Archimedes' principle if the weight of the water displaced is less than the weight of the object, the object will sink, Otherwise the object will float, with the weight of the water displaced equal to the weight of the object. [1] As described the buoyancy is equal to weight of displaced fluid in Archimedes' principle.

$$\rho = \frac{m_a}{m_a - m_l}.\rho_l$$

Where m_a is mass of the body that measured surrounded by air and m_l is mass of the body measured surrounded by liquid and ρ_l is density fo the liquid.

For Calculating density of rectangular parallelogram according to density formula and $v = abc$ we get:

$$\rho = \frac{m_1}{abc}$$

And for the Cylinder we substitute v in density formula $v = \frac{\pi d^2 h}{4}$.

2 Equipments

We used a variety of different equipments, the following list is the main tools we used for the tasks.

1. Micrometer (Figure 1)
2. Caliper (Figure 2)
3. Balance Scale

Figure 1: Micrometer

Figure 2: Caliper

4. Aerometer
5. Water
6. Alcohol (as unknown liquid)
7. String
8. Metal parallelogram
9. Metal Cylinder
10. Beaker

3 Measurments and Calculations

All the measurements and calculations are based on the work 1 formulas and instruction paper and signed result paper can be found on the last page of this report. on the following sections comes the detailed calculations of the lab.

3.1 Density of rectangular parallelogram

For the rectangular parallelogram we measured 3 sides of a, b and c for 10 times with Micrometer, following table shows the results of the measurements.

	a(mm)	b(mm)	c(mm)
1	20.00	20.01	14.40
2	20.01	20.00	14.38
3	20.00	20.00	14.45
4	19.98	20.02	14.47
5	20.00	20.01	14.44
6	20.00	20.00	14.39
7	20.02	19.99	14.39
8	19.99	20.00	14.42
9	20.00	19.98	14.49
10	20.00	19.99	14.37

And using balance scale we got m_1= 43.90mm with the accuracy of Δm= 0.01g. and according to density formula we have:

$$\rho = \frac{m}{v} = \frac{m}{abc} = \frac{43.90g}{20_{mm}.20_{mm}.14.42_{mm}} = \frac{43.90g}{5768_{mm^3}} \approx 0.0076 \frac{g}{m^3}$$

3.2 Density of cylinder

We measured height and diameter with Caliper the following table shows the result of the measurements.

	h(mm)	d(mm)
1	24.90	18.00
2	24.70	17.95
3	24.40	17.90
4	24.30	18.10
5	24.40	18.00
6	24.60	17.95
7	24.70	18.20
8	24.70	18.10
9	24.40	17.90
10	24.50	18.00

3.3 Density of unknown liquid

4 Error estimation

5 Conclusion

References

1. http://physics.weber.edu/carroll/archimedes/principle.htm.