Lengths and Volumes

DETERMINING THE VOLUME OF AN IRREGULARLY SHAPED BODY

- Measure the volume *V* of an irregularly shaped body using the overflow method.
- Measure the mass *m* and determine the density ρ of the irregularly shaped body.

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GENERAL PRINCIPLES

One suitable method for determining the volume of an irregularly shaped body is the overflow method. This involves immersing the body in water inside a vessel with an overflow outlet. The water displaced by the body is then collected in a graduated measuring cylinder. The volume of water displaced is equal to the volume *V* of the body.

By also measuring the mass *m* of the body, its average density ρ can be determined as follows:

$$\rho = \frac{m}{V} \qquad (1)$$

Fig. 1: Set-up for determining the volume of an irregularly shaped body

LIST OF EQUIPMENT

1	Object for Measurement Exercises	1006889
1	Vessel with Overflow, Transparent	1003518
1	Graduated Cylinder, 100 ml	1002870
1	Beaker 500 ml low form	1025691
1	Laboratory Jack III	1002942
1	Electronic Balance 220 g	1022627
1	Fishing Line, 10 m	4009036

SET UP AND PROCEDURE

- Place the vessel with overflow on top of the laboratory jack and set it up in such a way that the overflow outlet is directly above the graduated cylinder.
- Fill the vessel with enough water using the beaker to ensure that the overflow outlet is filled with liquid and is free of bubbles with the water flowing into the graduated cylinder.
- Empty the graduated cylinder and put it back under the overflow outlet.
- Measure the mass *m* of the object for measurement exercises and make a note of it.
- Attach the object to a length of the fishing line and lower the object into the vessel until it is fully immersed in water.
- Measure the displaced volume of water *V* and make a note of it.
- Determine the average density ρ and compare it with values quoted in literature for various materials.

SAMPLE MEASUREMENT AND EVALUATION

Table 1: Mass *m*, volume *V* and density ρ of the object for measurement exercises

m / g	*V* / cm³	ρ / g/cm³
203	76	2,67

Quoted value for aluminium: ρ = 2.7 g/cm³.

The density measured matches the density quoted in literature for aluminium. The object is made from aluminium.