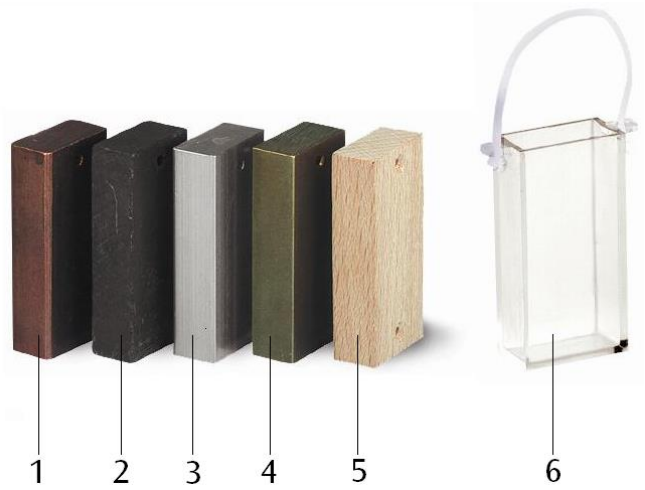
Set of Five Blocks of Various Densities 1000768

Instruction Sheet

09/15 ALF



1 Sample block - copper
2 Sample block - iron
3 Sample block - aluminium
4 Sample block - brass
5 Sample block - wood
6 Hollow body

1. Description

The set of five blocks of various densities is used to determine the densities of different materials and to demonstrate Archimedes' principle.

The set consists of five sample blocks of different materials with identical dimensions plus a transparent hollow body with internal volume equal to that of the sample blocks and a loop attached for suspending it. The sample blocks are provided with 2 mm holes for suspending them.

2. Technical data

Materials:	Wood, aluminium, iron, brass, copper
Dimensions of each block:	10 × 20 × 45 mm³

3. Experiment procedure

3.1 Determining densities of solid bodies

The following additional equipment is needed for determining the densities:

1 Electronic balance, 200 g	1009772
1 Vernier calliper, 150mm	1002601
1 Beaker, low shape, from set	1002872

3.1.1 Determining density by weighing and calculating the volume

- Measure the dimensions of the blocks using the Vernier calliper and calculate the volume.
- Determine the mass *m* by weighing.
- Calculate the densities of the samples according to the formula:

$$\rho = \frac{m}{V}.$$

Note:

The 2 mm holes introduce an error and for precise determination that must be taken into account in the calculation.

3.1.2 Determining density by measuring the buoyant force

- Push about 20 cm of nylon thread through a hole in the sample block and tie the ends to make a loop.

- Place the sample block on the balance and note the weight.
- Fill the beaker with water.
- Hang the sample block on the hook below the scale-pan of the balance.
- Immerse the sample block completely in the water and note the weight reading.

The block shows an apparent loss of weight caused by the buoyant force, which is equal to the weight of the volume of liquid that it displaces.

- Note the weight difference and from it determine the volume of the sample block, using the fact that the density of water is 1 g/cm^3.
- Calculate the density of the sample according to the formula:

$$\rho = \frac{m}{V}.$$

- Repeat the measurement with the other sample blocks and compare the results with those from Experiment 3.1.1.

Note:

For the wooden sample block the density can only be determined by the method of Experiment 3.1.1.

3.2 Confirming Archimedes' principle

Archimedes' principle states that the buoyant force F_A on a body immersed in a medium is exactly equal to the weight (force due to gravity) F_G of that volume of the medium which is displaced by the body; $F_A = F_G$.

Archimedes' principle applies to both liquids and gases.

Additional equipment needed:

1	Precision dynamometer, 1 N	1003104
1	Beaker	from set 1002872
1	Vernier caliper, 150 mm	1002601
1	Stand base, A-shape, 200mm	1001044
1	Stand rod, 750mm	1002935
1	Clamp with hook	1002828

- Set up the stand and clamp and hang the dynamometer on the hook (Fig. 1).
- Fit the sample block into the sample holder to confirm that its volume is equal to the internal volume of the hollow body.
- Calculate the volume of the sample block from its dimensions.
- Suspend the hollow body and the sample block on the dynamometer.
- Note the weight reading on the dynamometer.
- Place the beaker underneath and fill it with water.
- Lower the dynamometer until the sample block is completely immersed in the water.
- Note the new dynamometer reading.

The difference between the two readings is the buoyant force F_A on the sample block.

- Fill the hollow body with water.

As the internal volume of the hollow body is equal to the volume of the sample block, the quantity of water in it is equal to the quantity of water displaced by the sample block.

The dynamometer now shows the same reading as at the beginning. This confirms Archimedes' principle.

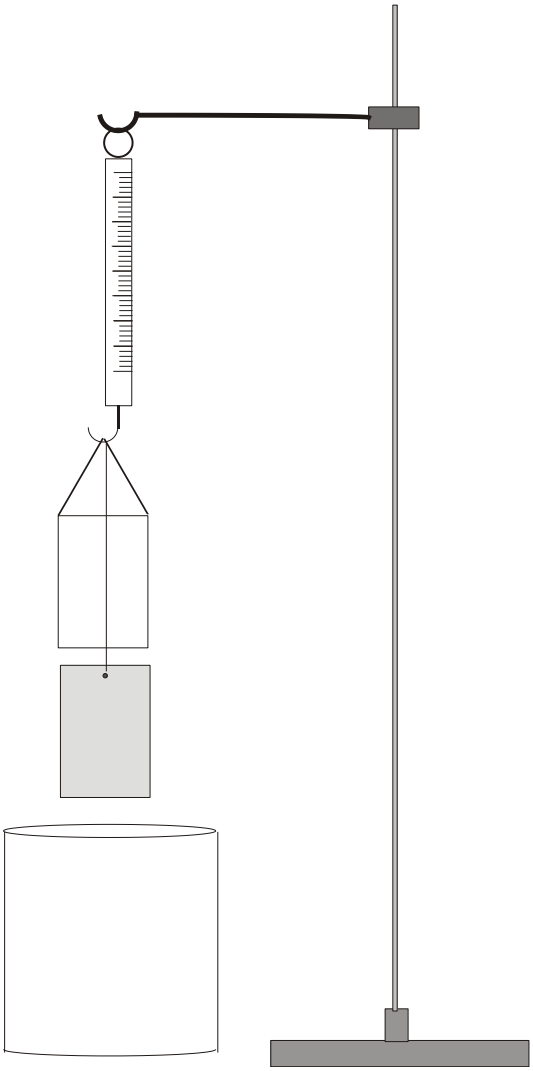


Fig. 1 Experiment setup