

Mechanics of liquids and gases

Buoyancy

Dependence of the buoyancy force on the kind of liquid -
Measurement with a precision dynamometer

Object of the experiment

1. Investigating the dependence of the buoyancy force on the kind of liquid

Setup



Preparation of the aluminium body:

- Thread a 30 cm long piece of fishing line through the bore of the aluminium body and knot the ends together.

Stand setup:

- Slide the 40 cm long stand tube over the other one by about 10 cm, and connect the tubes using the universal bosshead.
- Clamp the stand tube with the smaller diameter in the stand base.
- Fasten the Leybold-multiclamp to the other stand tube.
- The height of the stand setup can now be adjusted continuously by carefully loosening the lower screw of the universal bosshead.

Apparatus

1 Aluminium block.....	362 32
1 Plastic beaker	590 06
1 Sodium chloride, 1 kg.....	673 5720
1 Methylated spirits, 1 l	670 9990
1 Precision dynamometer, 1 N.....	314 141
1 Stand base, V-shape, small	300 02
1 Stand tube, 450 mm, 10 mm diam., set of 2.....	666 609ET2
1 Stand tube, 400 mm, 13 mm diam.	666 607
1 Universal bosshead.....	666 615
1 Clamp with hook	301 08
1 Fishing line, set of 2	309 48ET2
1 Glass stirring rod, 300 mm x 8 mm diam.....	665 213

Carrying out the experiment

- Fill 1000 ml of water into the plastic beaker.
- Suspend the aluminium body from the dynamometer and determine the gravitational force G .
- Then use the height-adjustable stand to lower the body until it is completely immersed.
- Read the force F' from the dynamometer and calculate the buoyancy force F_b .
- Lift the aluminium body to its initial position.
- Add 300 g of NaCl to the water in the plastic beaker and stir thoroughly using the glass stirring rod.
- Immerse the aluminium body completely in the salt solution, read the force F' , and calculate the buoyancy force again.
- Rinse the plastic beaker and the aluminium body.
- Fill methylated spirit into the beaker, and repeat the experiment.
- Compare the forces of buoyancy to the densities of the liquids (D 1.1.3.4.a).

Measuring example

Liquid	Water	Salt water	Spirit
Gravitational force G in N	1.0	1.0	1.0
Force F' in N	0.66	0.60	0.72
Buoyancy force F_b in N	0.34	0.40	0.28
Density ρ in g/cm ³	0.99	1.13	0.83

Evaluation

The magnitude of the buoyancy force depends on the kind of liquid.

The greater the density of a liquid, the greater the buoyancy force acting on a body.