

Mechanics of liquids and gases

Buoyancy

Dependence of the buoyancy force on the mass of the body -
Measurement with a precision dynamometer

Object of the experiment

1. Measuring and comparing the buoyancy forces acting on bodies of different masses

Setup



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 clamp with hook 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.

Preparing the hollow cylinder:

- Mark the depth of immersion of the hollow cylinder with the felt tip pen or, for better visibility, with a strip of coloured adhesive tape.

Apparatus

1 Archimedes' cylinder	362 02
1 Plastic beaker	590 06
1 Precision dynamometer, 1 N.....	314 141
1 Electronic balance, CS200E	OHCS-200E
5 Slotted weights, 10 g, red	315 416
1 Stand base, V-shape, large	300 01
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 Black felt-tip pens, medium size, set of 5	667 019ET5

Carrying out the experiment

- Put the hollow cylinder on the balance, and determine its mass m .
- Determine the gravitational force G from the mass.
- Loosen the lower screw of the universal bosshead, immerse the hollow cylinder in the water up to the mark, and read the force F' .
- Put a 10 g slotted weight into the hollow cylinder.
- Determine the new mass of the hollow cylinder, and immerse the cylinder again in the water up to the mark.
- Read the force F' from the dynamometer.
- One after another put additional weights into the hollow cylinder, each time immersing it up to the mark and repeating the measurement.
- Calculate the forces of buoyancy as in experiment D 1.7.3.1.a and compare them with one another.

Measuring example

Mass m in g	100	110	120	130	140	150
*Gravitational force G in N	1	1.1	1.2	1.3	1.4	1.5
Force F' in N	0.32	0.43	0.53	0.61	0.72	0.82
Buoyancy force F_b in N	0.68	0.67	0.67	0.69	0.68	0.68

*rounded values

Evaluation

The force of buoyancy acting on a body is independent of the mass of the body.