ARCHIMEDES' PRINCIPLE

OBJECTIVE

Determining buoyant updraught as a function of immersion depth.

SUMMARY

Archimedes' principle states that a body immersed in a fluid experiences an upward force (updraught or force of buoyancy) F_G. The magnitude of this force is equal to the weight of the displaced fluid. For a regularly shaped immersed body, the updraught is proportional to the depth *h* to which the body is immersed as long as this is smaller than the height *H* of the body itself.

EXPERIMENT PROCEDURE

- **Measure the force on a body immersed in water.**
- **Determine the updraught and confirm that it is proportional to the depth to which the body is immersed.**
- **Determine the density of water.**

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REQUIRED APPARATUS

Quantity	Description	Number
1	Immersion Block Al 100 cm³	1002953
1	Precision Dynamometer 5 N	1003106
1	Callipers, 150 mm	1002601
1	Set of 10 Beakers, Tall Form	1002873
1	Laboratory Jack II	1002941
1	Tripod Stand 150 mm	1002835
1	Stainless Steel Rod 750 mm	1002935
1	Clamp with Hook	1002828

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BASIC PRINCIPLES

Archimedes' principle states that a body immersed in a fluid experiences an upward force (updraught or force of buoyancy) F_G. The magnitude of this force is equal to the weight of the displaced fluid.

For a regularly shaped immersed body with a surface area *A* and height *H*, immersed to a depth *h*, the following applies:

(1) $F_G = \rho \cdot g \cdot A \cdot h$, where $h < H$

and

(2) $F_G = \rho \cdot g \cdot A \cdot H$, where $h > H$

This experiment uses a block of weight F_0. This weight acts on a dynamometer at the same time as the block is immersed in water to a depth *h*, so that the total force present is given by the following:

(3) $F(h) = F_0 - F_G(h)$

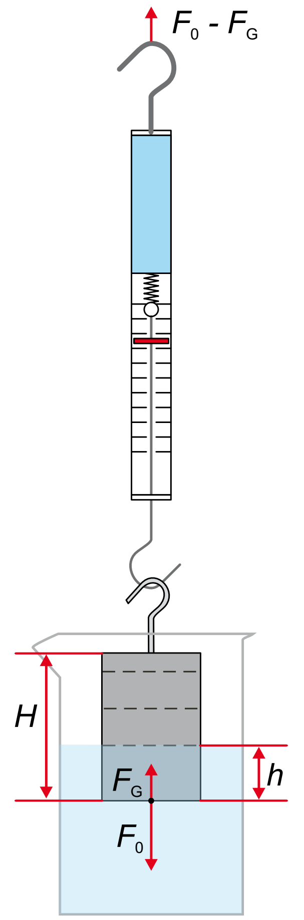

Fig. 2: Schematic representation

EVALUATION

The values measured for the updraught F_G as a function of the relative immersion depth *h*/*H* all lie on a straight line through the origin with the following gradient: $a = \rho \cdot g \cdot A \cdot H$

The density of water can be calculated from this gradient.

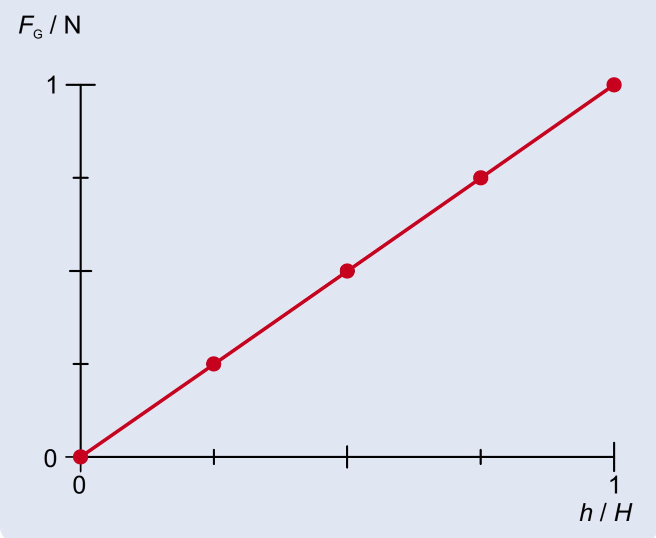

Fig. 1: Updraught F_G as a function of relative immersion depth *h*/*H*