UE1020850 | ARCHIMEDES' PRINCIPLE

OBJECTIVE

Determining buoyant updraft as a function of immersion depth

SUMMARY

Archimedes' principle states that a body immersed in a fluid experiences an upward force (updraft 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 updraft 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.

BASIC PRINCIPLES

Archimedes' principle states that a body immersed in a fluid experiences an upward force (updraft or force of buoyancy) F_1. 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) $F(h) = F_0 - F_G(h)$

EVALUATION

The values measured for the updraft 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.

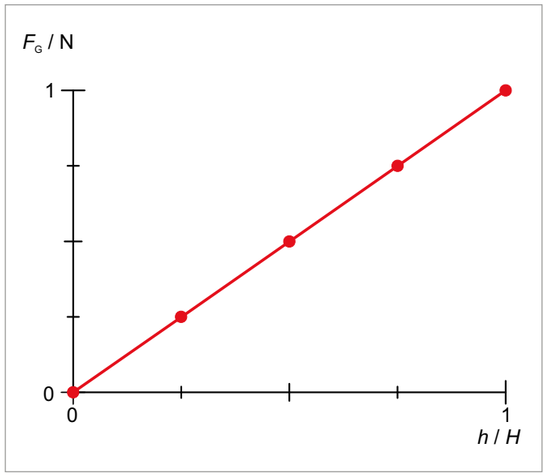

Fig. 1: Updraft F_G as a function of relative immersion depth h/H

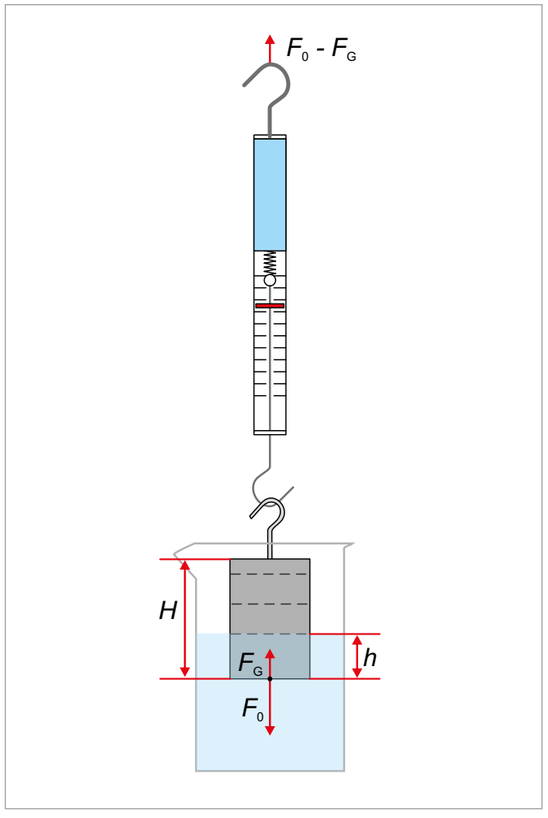

Fig. 2: Schematic representation

› EXPERIMENT PROCEDURE

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

REQUIRED APPARATUS

Quantity	Description	Item Number
1	Immersion Block Al 100 cm^3	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