Objects of the experiments

1. Detecting the effect of a buoyancy force when a body is immersed in a liquid step by step
2. Demonstrating the independence of the buoyancy force of a completely immersed body on the depth of immersion

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.
- In order to have well-defined depths of immersion, make marks on one side of the aluminium body with a spacing of 1.5 cm.

Stand setup:
- Slide the 400 mm 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.

Apparatus

1. Aluminium block.......................... 362 32
2. Plastic beaker............................ 590 06
3. Precision dynamometer, 1 N............ 314 141
4. Stand rod, V-shape, small................. 300 02
5. Stand tube, 450 mm, 10 mm diam., set of 2... 666 609ET2
6. Stand tube, 400 mm, 13 mm diam........... 666 607
7. Universal bosshead........................ 666 615
8. Clamp with hook.......................... 301 08
9. Fishing line, set of 2.................... 309 48ET2
10. Black felt-tip pens, medium size, set of 5...... 667 019ET5

Carrying out the experiment

1. Detecting the effect of a buoyancy force:
   - Determine the gravitational force of the aluminium body by means of the dynamometer.
   - Then immerse the body in the beaker, which is filled with water. Proceed step by step according to the marks on the body.
   - Each time read the force acting on the dynamometer.

2. Buoyancy force on a completely immersed body:
   - Slowly lower the completely immersed body in the water.
   - Observe the measured value at the dynamometer as the body is lowered.

Measuring example

1. Gravitational force of the aluminium body: \( G = 1.0 \text{ N} \)

<table>
<thead>
<tr>
<th>Depth of immersion ( s ) in cm</th>
<th>Force ( F' ) in N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>0.91</td>
</tr>
<tr>
<td>3.0</td>
<td>0.81</td>
</tr>
<tr>
<td>4.5</td>
<td>0.72</td>
</tr>
<tr>
<td>6.0</td>
<td>0.63</td>
</tr>
</tbody>
</table>

2. At any depth of immersion, a force \( F' \) of 0.63 N is read from the dynamometer.

Evaluation

1. When a body is immersed in a liquid, a force acts on it in the opposite direction of the gravitational force. This force is called buoyancy force \( F_B \). The magnitude of the buoyancy force is obtained from the difference of \( G \) and \( F' \): \( F_B = G - F' \).

2. The buoyancy force acting on a body which is completely immersed in a liquid is independent of the depth of immersion.