Determination of the density of liquids (Item No.: P0998600)

Curricular Relevance

Area of Expertise:	Education Level:	Topic:	Subtopic:	Experiment:
Physik	Klasse 7-10	Mechanik	Stoff- und Materialeigenschaften	Dichtebestimmung flüssiger Körper

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

In the determination of the density of solids in Experiment ME 1.5, the density was determined as the quotient of mass and volume from a weighing to determine the mass and measurement of volume by different methods. As a prerequisite for this experiment, it was assumed that the mass and volume of water are numerically identical, i.e. that the quotient of both – the density – has a value of 1 g/cm3.
This should now be confirmed experimentally by the same method: weighing a quantity of a material and measuring its volume.

1. First the students are to determine the density of water from a volume measurement in a graduated cylinder, a weight determination and then a calculation.
2. The students should then determine the density of a table salt solution (approx. 10%) which they made themselves by the same method.

Suggestion

The small beaker (100 ml) must be well dried before each new measurement.
When pouring liquids from the graduated cylinder into the beaker, care should be taken that all of the liquid is transferred – even the drops!

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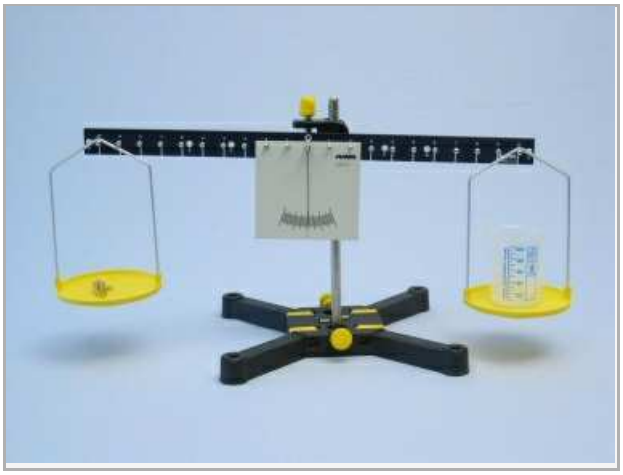
Task and equipment

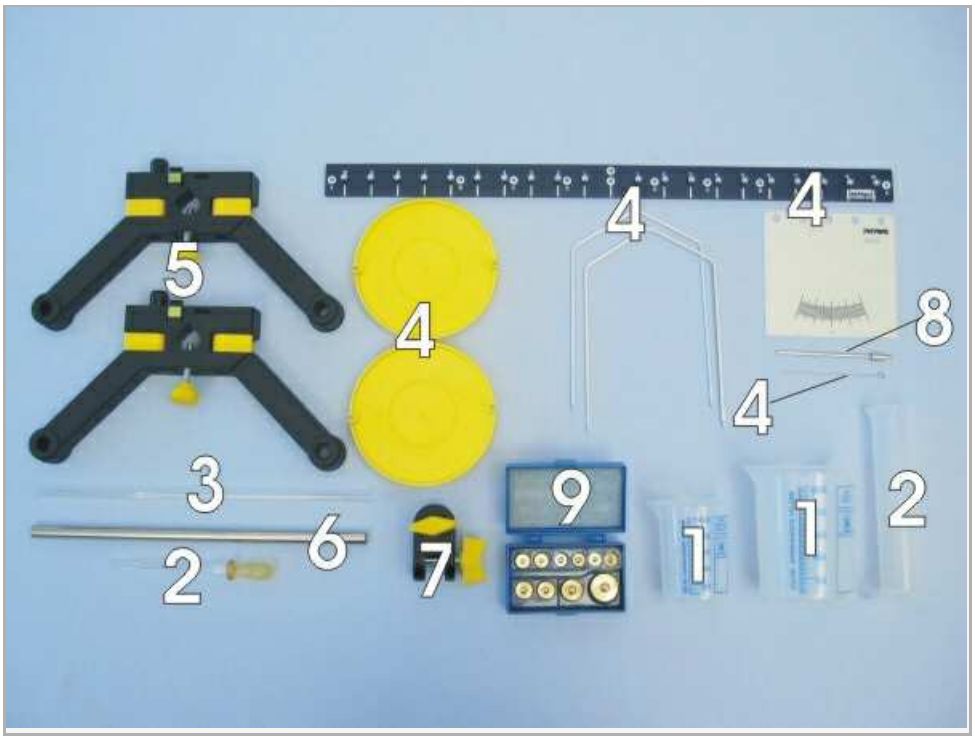
Task

Can liquids have different densities?

The density ρ can be determined from a mass and a volume measurement. The unit of density is kg/dm^3 or g/cm^3 or g/ml. In this experiment the density of water and of a salt solution are determined.



Equipment



Position No.	Material	Order No.	Quantity
1	Beaker, 250 ml, low form, plastic	36013-01	1
1	Beaker, low form, plastic, 100 ml	36011-01	1
2	Graduated cylinder, 50 ml, plastic	36628-01	1
2	Pipette with rubber bulb	64701-00	1
3	Glass tubes,l.250 mm, pkg.of 10	36701-68	1
4	Balance pan, plastic	03951-00	2
4	Plate with scale	03962-00	1
4	Lever	03960-00	1
4	Pointer for lever	03961-00	1
5	Support base, variable	02001-00	1
6	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00	1
7	Boss head	02043-00	1
8	Holding pin	03949-00	1
9	Set of precision weights,1g-50g	44017-00	1
	Sodium chloride 250 g	30155-25	1

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Set-up and procedure

Set-up

Set up a stand with the support base and the support rod as you can see in Fig. 1 and Fig. 2.

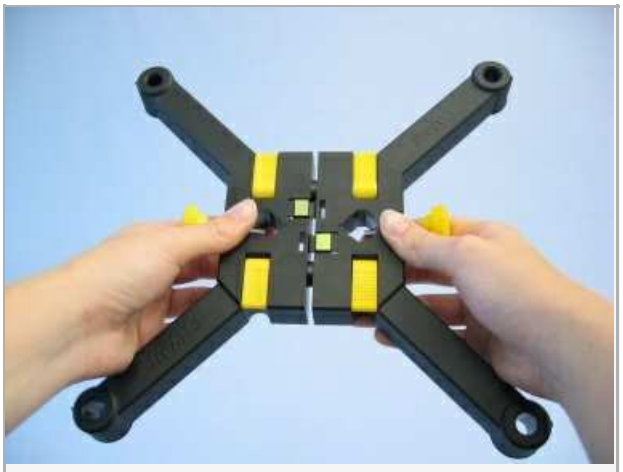

Fig. 1

Fig. 2

Put the plate with scale in the middle of the lever, then, put the holding pin in the hole of the pointer and in the hole of the lever (Fig. 3). Fix the holding pin in the bosshead (Fig. 4).

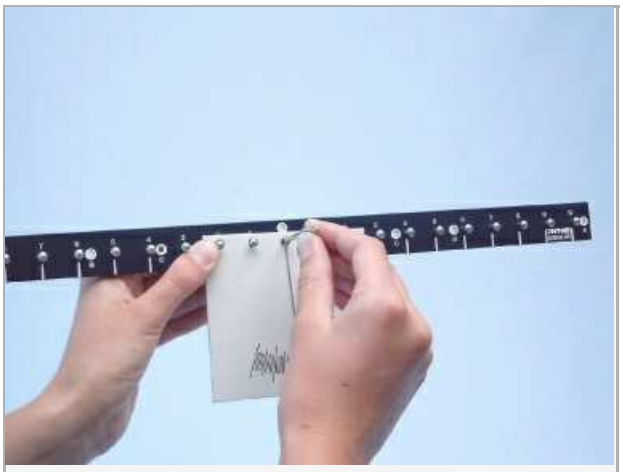

Fig. 3

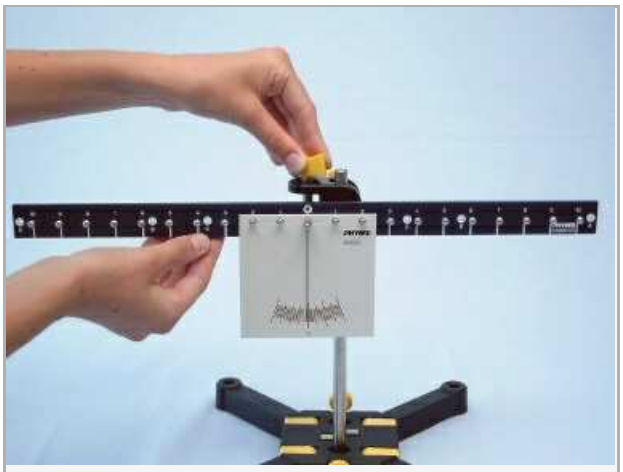

Fig. 4

Assemble the balance pan (Fig. 5) and hang each of them up at the end of the lever (Fig. 6).

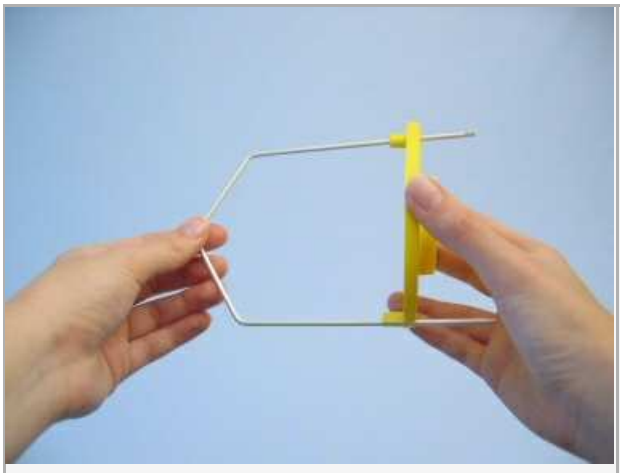

Fig. 5

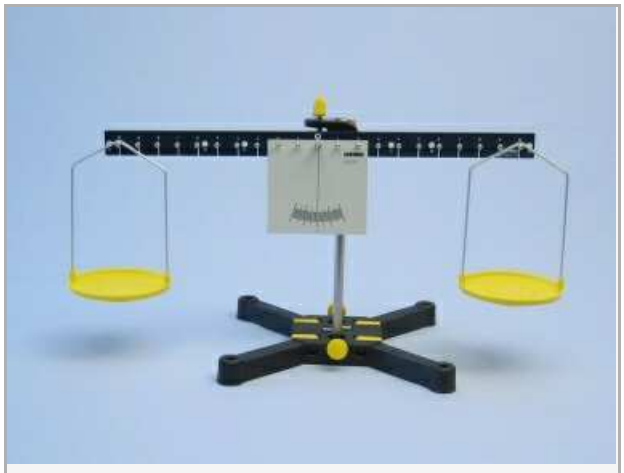

Fig. 6

Place the pointer in such a way, that it points exactly to the zero mark (Fig. 7).

Fig. 7

Procedure

- Fill exactly 50 ml of water into the graduated cylinder.
- Read the exact Volume V on the graduated cylinder; take the meniscus into consideration!
- Determine the mass m_0 of the small beaker with the beam balance (Fig. 8), note the result in Table 1 in the report and fill the contents of the graduated cylinder into the small beaker. Be sure to pour all of the water into it.
- Determine the mass m_1 of beaker and water, and note the new value in Table 1.
- Add 10 g of NaCl (table salt) to the graduated cylinder and fill it up with 40 ml of water.
- Stir the solution vigorously with the glass tube until all the table salt is dissolved; then fill the cylinder exactly to the 50 ml mark with the pipette.
- Pour the solution into the small beaker, determine the mass m_2 of the solution in the beaker and record the new value in Table 1.

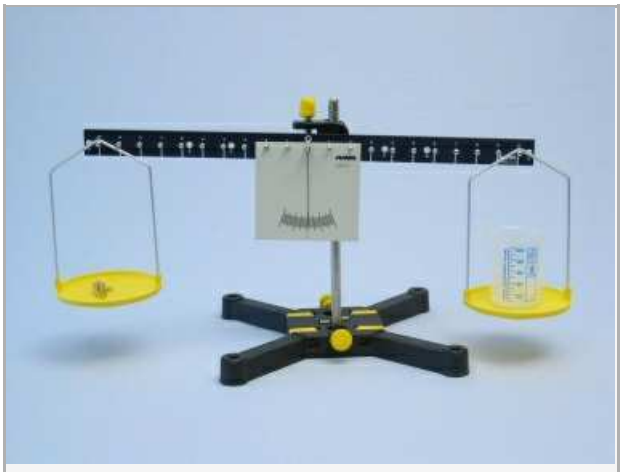

Fig. 8

In order to disassemble the support base you should press the yellow buttons (Fig. 9).

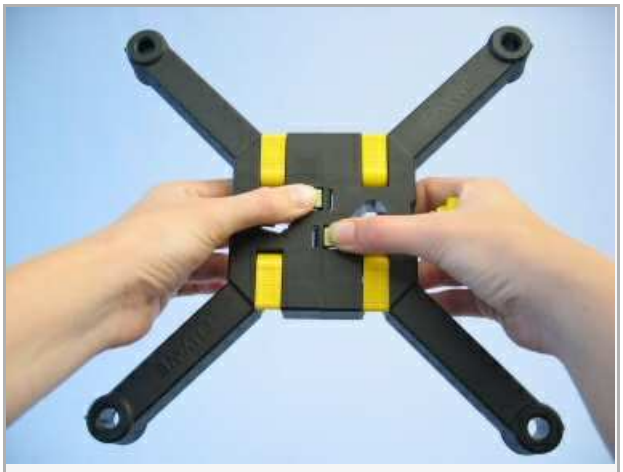

Fig. 9

Report: Determination of the density of liquids

Result - Table 1

Note down your values into the tabe.

Masse des kl. Bechers:		
empty	m_0 in g	1 ±0
with 50 m of water	m_1 in g	1 ±0
with 50 ml of solution (10% salt)	m_2 in g	1 ±0

Evaluation - Question 1

Using V = 50 ml and $m = m_1 - m_0$ and $m = m_2 - m_0$ respectively to calculate the density of the water and the salt solution according to the formula: $\rho = m/V$

material	m in g	V in cm^3	ρ in g/cm^3
water	1 ±0	1 ±0	1
salt solution	1 ±0	1 ±0	1

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Evaluation - Question 2

Which liquid has the higher density?

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Evaluation - Question 3

How would you explain this difference?

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Evaluation - Question 4

Do you know any liquids with a density less than water?

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Evaluation - Additional task

What happens when you carefully pour oil or alcohol onto water? Can you explain your answer?

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