Volume contraction of liquids

Task and equipment

Information for teachers

Learning objectives

- On mixing different liquids the volumes are not additive. A volume contraction occurs.
- Substances that differ from each other consist of diffferent-sized particles.

Notes on set-up and procedure

Preparation: Dried peas and mustard seeds are available at grocery stores. If necessary seeds can also be obtained from a gardener.

Remarks on the students' experiments: Ensure that the volumes are accurately measured and that as little as possible remains in the graduated cylinder.

Inform the students how to read the volume correctly (curved liquid surface).

Hazard and Precautionary statements

Methylated spirit:

H225:	Highly flammable liquid and vapour.
P210:	Keep away from heat/sparks/open flames/hot surfaces. - No Smoking.

Hazards

- Raw alcohol (denaturated) is extremely flammable. Extinguish all open flames!
- Wear protective glasses!

Remarks on the method

Discontinuity concepts are generally new to the students, even if they have already heard the word "atom". Therefore, judging from past experience, the transference of the implication of experiment 2 to the volume contraction and its interpretation is not easy and requires strong guidance in the course of instruction. Convey the historical development of the atom concept (Democritus to Dalton). State the properties which Dalton ascribes to the atoms (spherical particle model) as this is required for the next experiments to some degree.

Waste disposal

Pour the methylated spirit/water mixture into the collection container for flammable organic substances.

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Task

How can the structure of matter be visualised?

Investigate the volumes on mixing liquids; compare it with another mixture.

Student's Sheet

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Equipment

Position No.	Material	Order No.	Quantity
1	Protecting glasses, clear glass	39316-00	1
2	Wash bottle, 250 ml, plastic	33930-00	1
3	Graduated cylinder, 25 ml, transparent, PP	36635-00	1
4	Grad.cylinder,high,PP,50ml	46287-01	1
5	Denaturated alcohol (spirit for burning), 1000 ml	31150-70	1
Additional material			
	Dried peas		
	Mustard seeds		
	Water		

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Set-up and procedure

Set-up

Hazards

- Raw alcohol (denaturated) is extremely flammable. Extinguish all open flames!
- Wear protective glasses!

Procedure

Pour exactly 25 ml of water into the small graduated cylinder (Fig. 1) and pour it into the large one (Fig. 2). Then pour exactly 25 ml of methylated spirit into the cleaned and dried small graduated cylinder and pour it also into the larger one (Fig. 3), read the volume and record it under Result - Observations.

Fig. 1

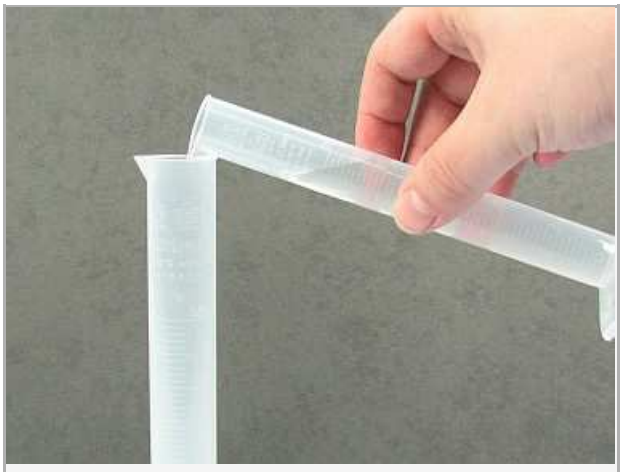

Fig. 2

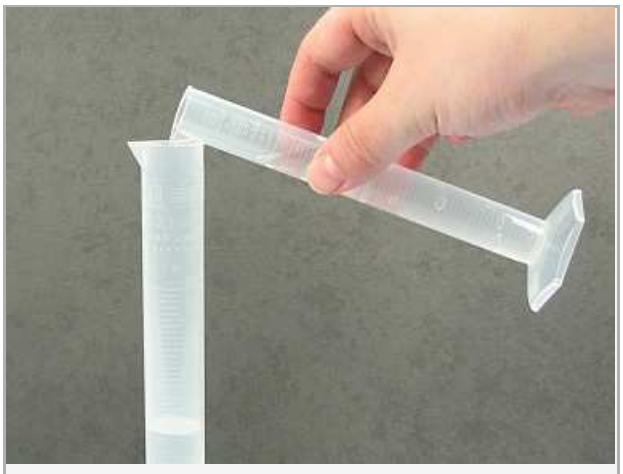

Fig. 3

Dry the small graduated cylinder (paper towels or something similar). Measure 25 ml of dried peas in it (Fig. 4) and pour them in the larger cylinder (Fig. 5) which you have previously cleaned and dried. Then measure 25 ml of mustard seeds in it (Fig. 6) and pour it also in the larger cylinder (Fig. 7). Close the graduated cylinder and shake it vigorously (Fig. 8). Read the result and record it also.

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Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Waste disposal

Pour the methylated spirit/water mixture into the collection container for flammable organic substances.

Report: Volume contraction of liquids

Result - Observations

Note the experimental result.

A) 25 ml water+ 25 ml methylated spirit result in ..... ml mixture.

B) 25 ml peas + 25 ml mustard seeds result in ..... ml mixture.

Evaluation - Question 1

Compare the two results and formulate them in a concise statement.

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Evaluation - Question 2

Attempt to find an interpretation for the result. In doing so, orient yourself on the visible process in the second experiment.

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Evaluation - Question 3

What model conception for the structure of substances results from this? Explain the term model; give an example.