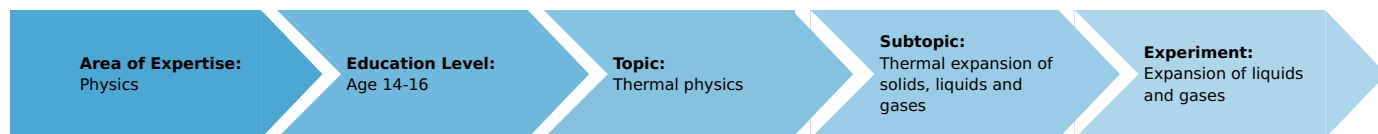


Expansion of liquids and gases (Item No.: P1042500)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- Butane burner, Labogaz 206 type 32178-00
- Butane cartridge C206, without valve 47535-00
- Glycerol, 250 ml 30084-25
- Matches
- Felt-tip pen

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

In this experiment the students should qualitatively observe the expansion of water and air during heating.

Remark

On insertion of the rubber stopper in the water-filled Erlenmeyer flask, the water level rises about 4 cm in the glass tube. No air bubbles should be under the stopper.

Expansion of liquids and gases (Item No.: P1042500)

Task and equipment

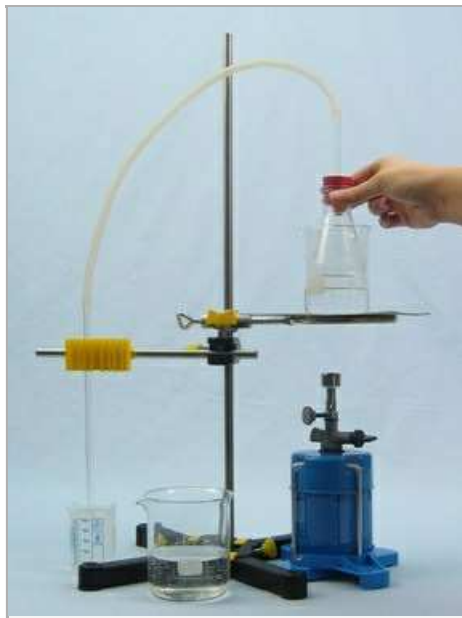
Task

Does the volume of liquids and gases change when heated?

1. Heat water and observe its volume.



2. Heat air and observe its volume.



Equipment



Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l = 250 mm, d = 10 mm	02031-00	1
3	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00	1
4	Boss head	02043-00	1
5	Glass tubes, l.250 mm, pkg.of 10	36701-68	1
6	Ring with boss head, i. d. = 10 cm	37701-01	1
7	Universal clamp	37715-00	1
8	Wire gauze with ceramic, 160 x 160 mm	33287-01	1
9	Beaker, low form, plastic, 100 ml	36011-01	1
10	Glass beaker DURAN®, short, 250 ml	36013-00	1
11	Glass beaker DURAN®, short, 400 ml	36014-00	1
12	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00	1
13	Glass tube, straight, l=80 mm, 10/pkg.	36701-65	1 piece
14	Glass tube holder with tape measure clamp	05961-00	1
15	Students thermometer, -10...+110°C, l = 230 mm	38005-10	1
16	Rubber stopper 26/32, 1 hole 7 mm	39258-01	1
17	Rubber stopper 26/32, 2 holes 7 mm	39258-02	1
18	Silicone tubing i.d. 7mm	39296-00	1
19	Measuring tape, l = 2 m	09936-00	1
Additional material:			
20	Butane burner, Labogaz 206 type	32178-00	1
21	Butane cartridge C206, without valve	47535-01	1
22	Glycerol, 250 ml	30084-25	15 ml
23	Matches		
24	Felt-tip pen		1

Set-up and procedure

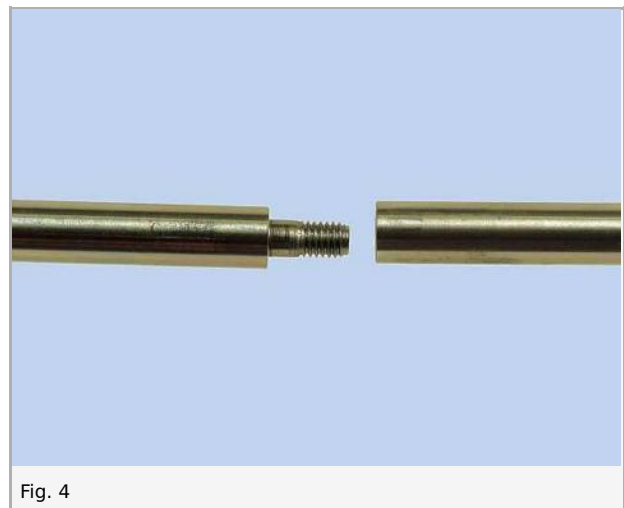
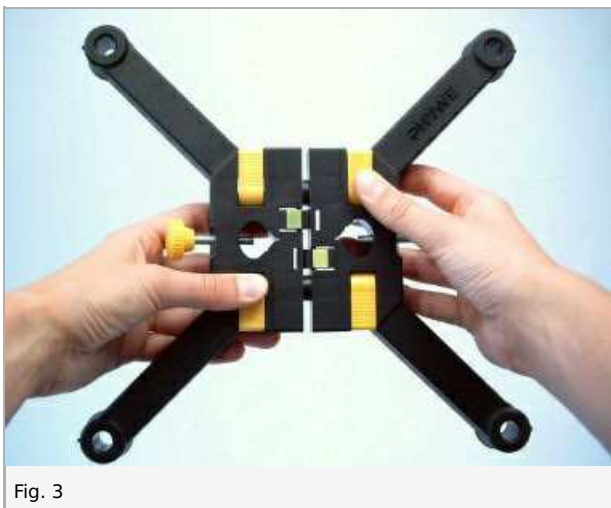
Set-up

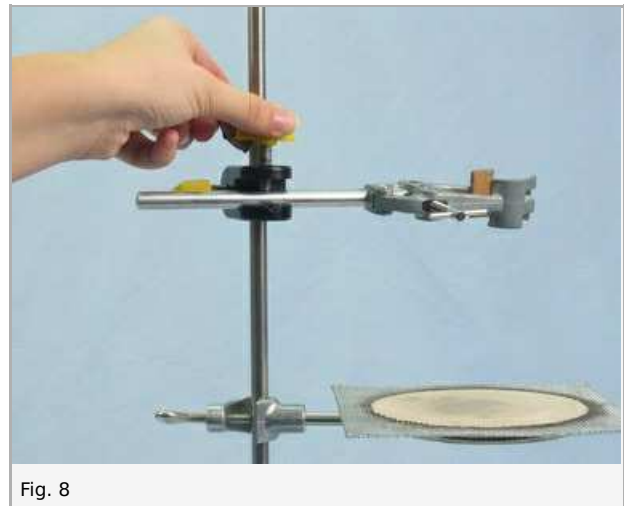
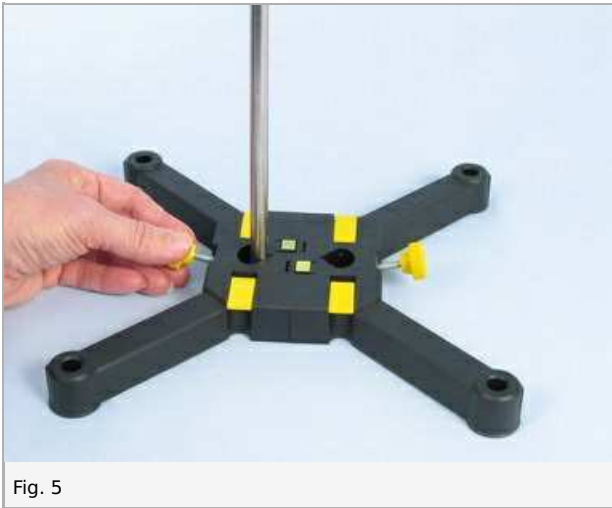
Warning!

1. Always insert the thermometer or glass tubes in the rubber stoppers using glycerol.
2. During the heating of the water the support ring and the wire gauze become extremely hot!

Setup

- Set up the support stand according to the following pictures.





- Pour 100 ml of water into the small and middle-sized beaker and 200 ml into the large one.



Fig. 9

- Place the 250 ml beaker onto the wire gauze.



Fig. 10

Procedure

Experiment 1: Heating of water

- Fill the Erlenmeyer flask nearly to its rim with cold water.



Fig. 11

- Insert the thermometer into the two-hole rubber stopper so that nearly all of its immersion stem is above the stopper.
- Insert the long glass tube into the other hole of the stopper so that its lower end is even with the bottom of the stopper.
- Insert the stopper into the Erlenmeyer flask. There must not be any air bubbles under the stopper!

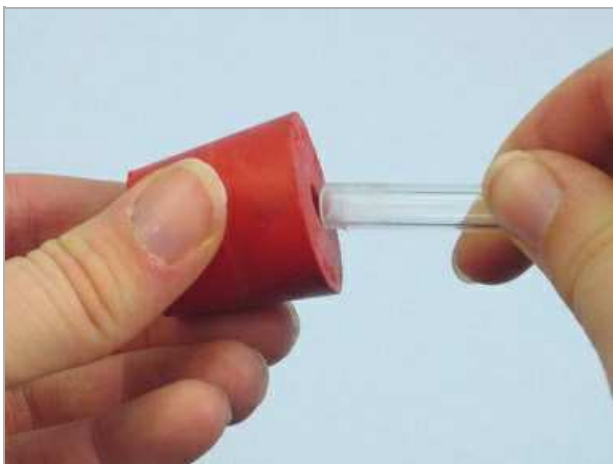


Fig. 12

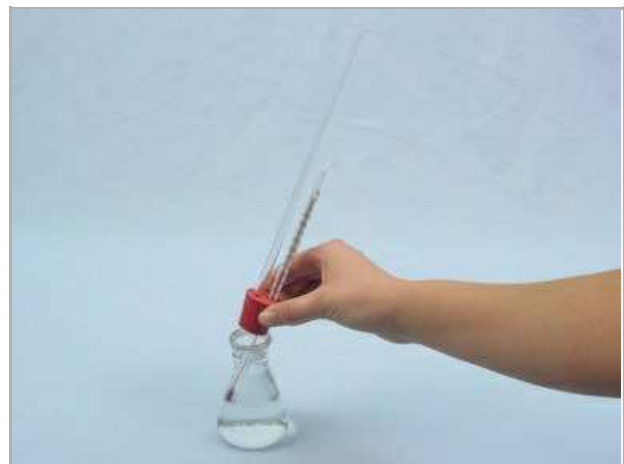


Fig. 13



Fig. 14

- Mark the water level in the glass tube.



Fig. 15

- Place the Erlenmeyer flask into the 250 ml beaker and clamp it into position with the universal clamp.

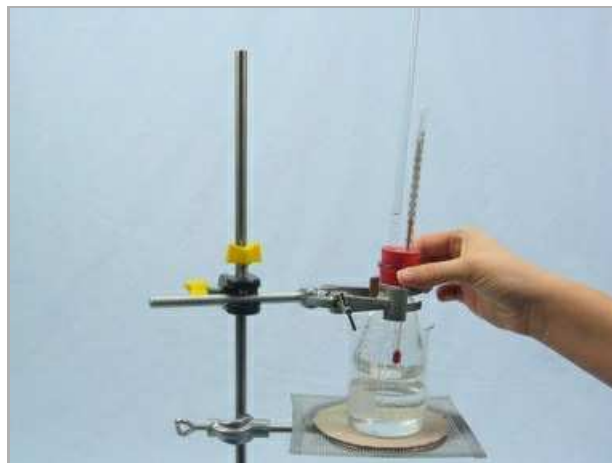


Fig. 16

- Heat the water to about 50 °C and note what you observe in the report.
- Measure the change in the water level.
- Immerse the warm Erlenmeyer flask into cold water (400 ml beaker) and note what you observe.



Fig. 17

Experiment 2: Heating of air

- Empty the Erlenmeyer flask and dry it carefully.
- Insert the short glass tube into the one-hole rubber stopper and insert the stopper in the flask.

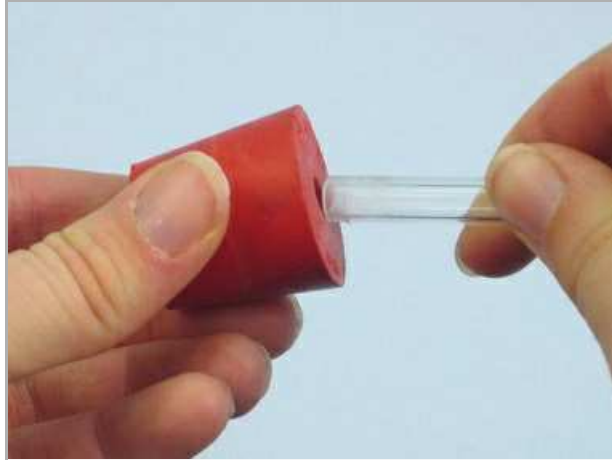


Fig. 18

- Clamp the long glass tube in the glass tube holder, so that its lower end is immersed in the water in the 100 ml beaker.



Fig. 19

- Connect the two tubes with a piece of tubing which is about 50 cm long.
- Immerse the flask into hot water (50 °C) and note your observations in the report.

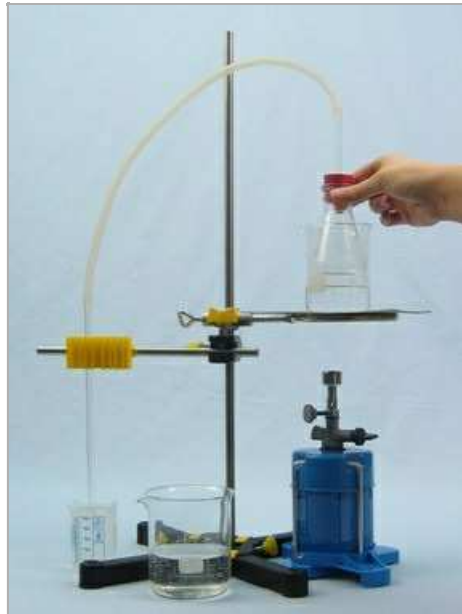


Fig. 20

- Now, immerse the warm flask into cold water and note your observations.

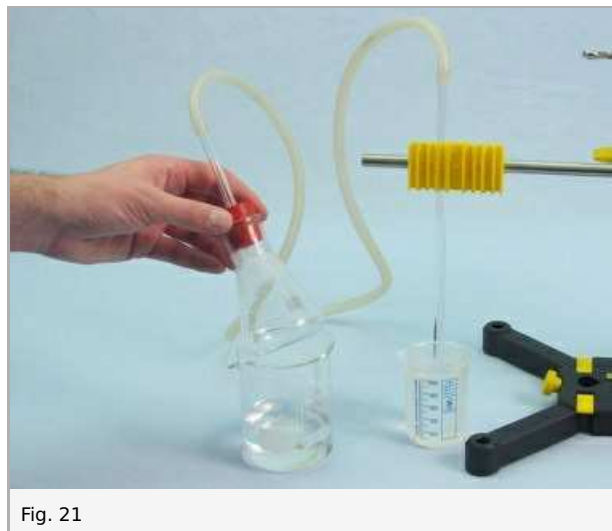


Fig. 21

- Wait until the water level in the tube or tubing no longer changes and then determine its height.

Report: Expansion of liquids and gases

Result - Observation 1

Note your observations when heating water.

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Result - Observation 2

Note the change in the water level.

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Result - Observation 3

Note your observations when cooling the water.

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Result - Observation 4

What happens on immersion in hot water in the 2. experiment?

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Result - Observation 5

What happens on immersion in cold water?

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Result - Observation 6

Note the water level.

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Evaluation - Question 1

How does the volume of water change with changing temperature?

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Evaluation - Question 2

How does the volume of the air change with changing temperature?

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Evaluation - Question 3

Compare the changes in volume of water and air.

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