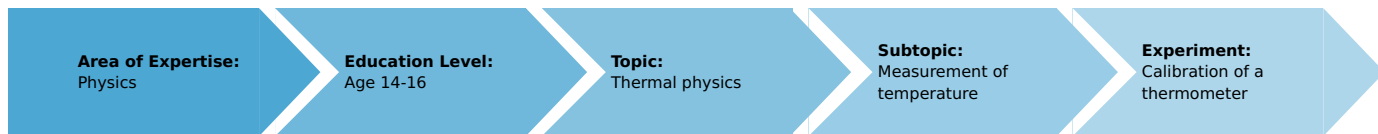


Calibration of a thermometer (Item No.: P1042300)

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
- Boiling beads, 200 g 36937-20
- Matches
- Felt-tip pen
- Ice, crushed (ice cubes, hammer and cloth)

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

The Celsius temperature scale is defined by the melting and boiling points of water. The students should calibrate a non-graduated thermometer and then make a few measurements with it.

Remarks

1. For the experiment a large number of small pieces of ice are required so that the temperature between them is as close to 0 °C as possible. The best way to crush ice is to wrap it in a piece of cloth so that all the resulting pieces can be used.
2. To show that the temperature of the ice water remains 0 °C until all the ice has melted the water must be carefully heated and painstakingly stirred.

In this experiment a more simple, non-graduated thermometer without the wide metal plate (Order No. 38003-00) can be used. However, the wide metal plate has the advantage that the scale can be more easily marked and more clearly labelled.

Calibration of a thermometer (Item No.: P1042300)

Task and equipment

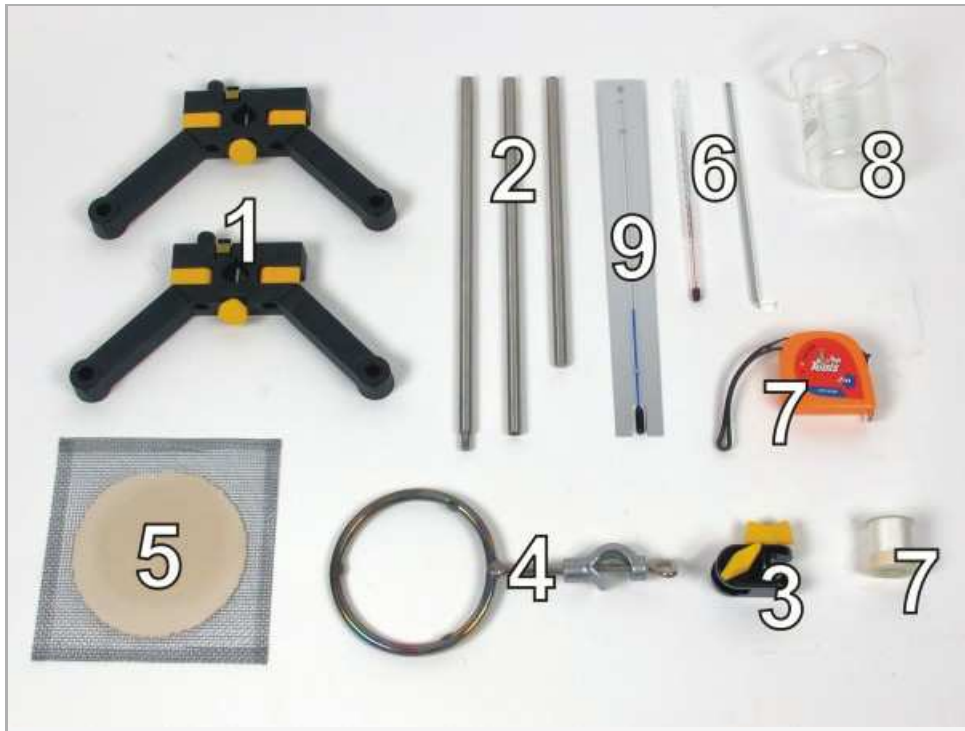
Task

How is the Celsius temperature scale determined?

Prepare a scale in degrees Celsius for a non graduated thermometer.



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	Ring with boss head, i. d. = 10 cm	37701-01	1
6	Wire gauze with ceramic, 160 x 160 mm	33287-01	1
7	Students thermometer, -10...+110°C, l = 180 mm	38005-02	1
8	Agitator rod	04404-10	1
9	Measuring tape, l = 2 m	09936-00	1
10	Fishing line, l. 20m	02089-00	1
11	Glass beaker DURAN®, short, 250 ml	36013-00	1
12	Thermometer, non-graduated	04256-00	1
Additional Material:			
13	Butane burner, Labogaz 206 type	32178-00	1
14	Butane cartridge C206, without valve	47535-01	1
15	Boiling beads, 200 g	36937-20	1
16	Matches		
17	Ice, crushed (ice cubes, hammer and cloth)		

Set-up and procedure

Set-up

Warning!

During heating of the water the support ring and the wire gauze become extremely hot! When the hot water is being transferred to another container, the beaker can only be held up by its upper flanged rim.

Setup

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



Fig. 1



Fig. 2

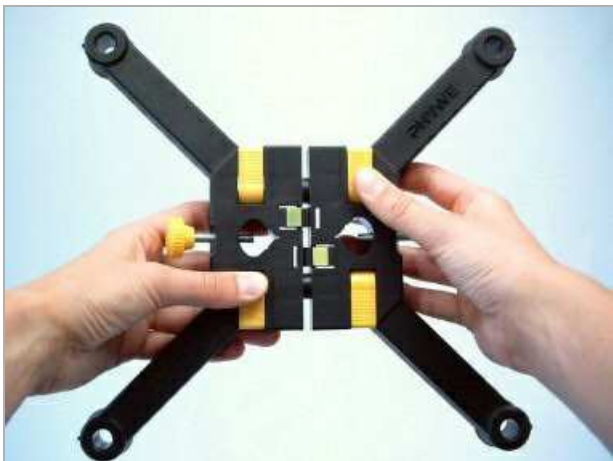
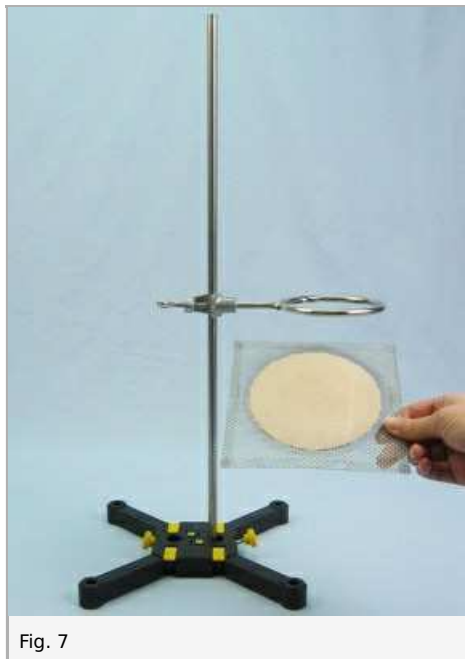
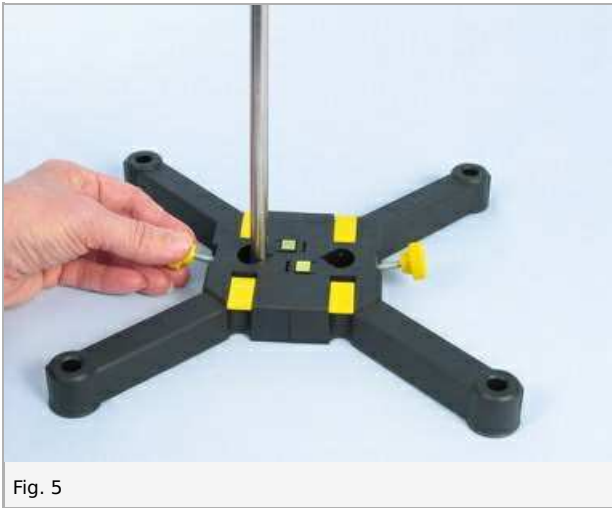


Fig. 3



Fig. 4



- Hang the non-graduated thermometer with a loop of fish line on the support rod.



- Using the hammer, break the ice cubes into very small pieces; to do so wrap them in a piece of cloth so that the pieces do not scatter.



- Fill the beaker half-full with ice.

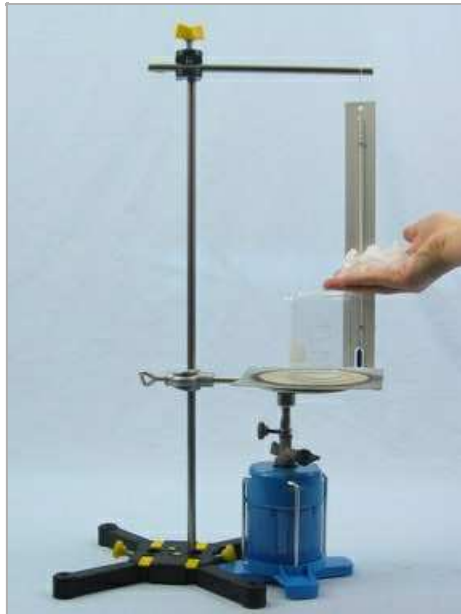


Fig. 12

- Place 2 beads into the beaker.



Fig. 13

- Add just enough water to cover the ice.



Fig. 14

- Immerse the non-graduated thermometer about 2 cm into the ice water, i.e. so that its bulb is completely immersed.



Fig. 15

Procedure

- Stir the ice water with the glass rod and then wait until the column level of the thermometer has stopped moving.



Fig. 16

- Mark this level on the thermometer.



Fig. 17

- Heat the ice water, stirring constantly until all the ice has melted.
- Observe the thermometer's column level and record its behaviour in the report.
- Continue to heat the water until it boils.
- Observe the thermometer's liquid column during heating and boiling, record its behaviour in the report.
- Turn off the butane burner.

Report: Calibration of a thermometer

Result - Observation 1

How does the thermometer's liquid column behave as long as there are pieces of ice in the water?

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Result - Observation 2

How does the thermometer's liquid column behave between melting and boiling?

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Result - Observation 3

How does the thermometer's liquid column behave when the water boils?

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Evaluation - Question 1

How large is the temperature difference between any 2 marks?

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Evaluation - Question 2

Immerse another thermometer beside your self-calibrated one. Compare the indicated temperatures while cooling the hot water and on immersion in cold water and record several measured values in the table.

	self-calibrated thermometer [ϑ in	control thermometer [ϑ in $^{\circ}\text{C}$]
hot water	1	1
warm water	1	1
cold water	1	1