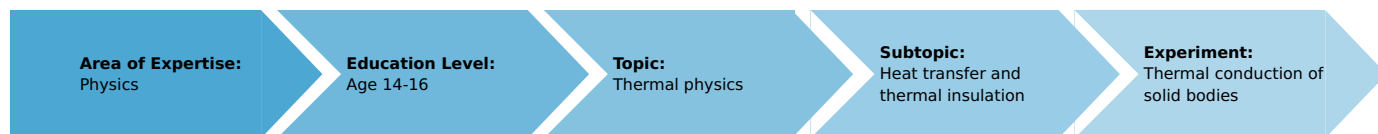


Thermal conduction of solid bodies (Item No.: P1043100)

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
- Scissors
- Matches

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

The thermal conductivity of different metals and glass should be qualitatively compared to each other.

Remarks

1. The support rod is insulated with tubing.
2. Ensure that both metal rods extend the same distance over the beaker and that the heat sensitive paper which is in the middle of both rods is located about 2 cm from the beaker. Otherwise, the radiation from the hot beaker and/or the steam could cause the heat sensitive paper to change colour and, thus, lead to a falsification of the observations.
3. The glass rod is slanted and due to its position across from the metal rods somewhat better oriented for thermal conduction. Nevertheless, its tip remains much colder than the metal rods so that the comparison of the rods' thermal conductivity is conclusive.
4. The heat sensitive paper attached to the glass rod (agitator rod) must be at the uppermost tip so that it does not change colour due to the steam.
5. Records should be made of when the red colour begins to appear on the heat sensitive paper in the rods and what end state is reached after 3 min.

Thermal conduction of solid bodies (Item No.: P1043100)

Task and equipment

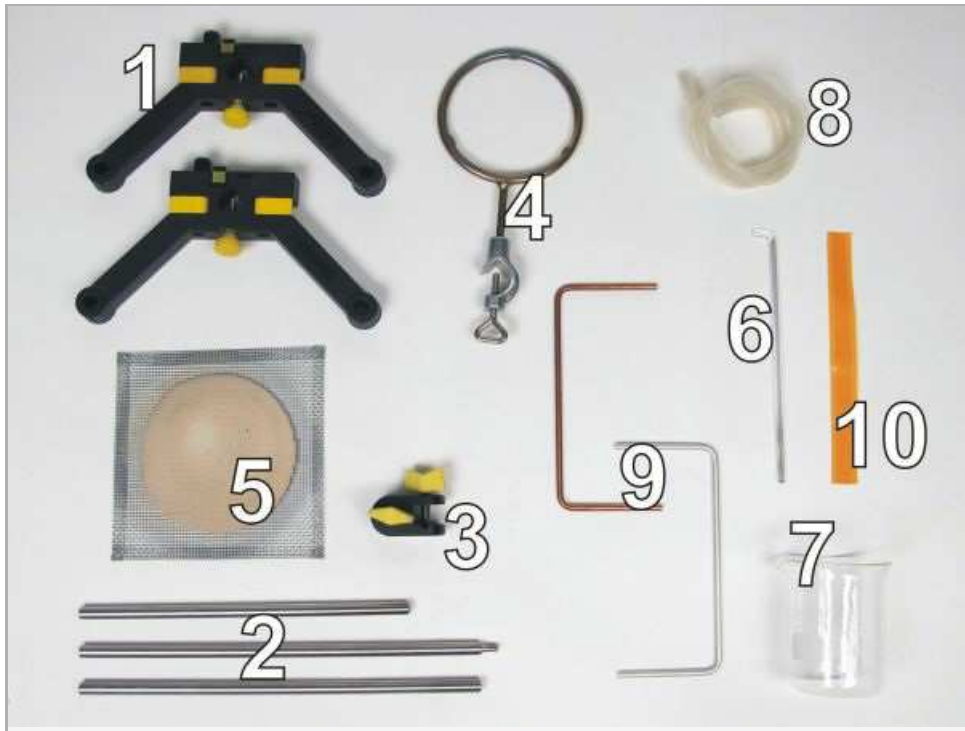
Task

How is heat transported in solid bodies?

Investigate the conduction of heat in metals and glass.



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	Agitator rod	04404-10	1
8	Glass beaker DURAN®, short, 250 ml	36013-00	1
9	Silicone tubing i.d. 7mm	39296-00	1
10	Copper rod, U-shaped	05910-01	1
11	Aluminium rod, U-shaped	05910-00	1
12	Heat sensitive paper	04260-00	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	Scissors		1
17	Matches		

Set-up and procedure

Set-up

Warning!

1. During the heating of the water the support ring and the wire gauze get extremely hot!

Setup

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

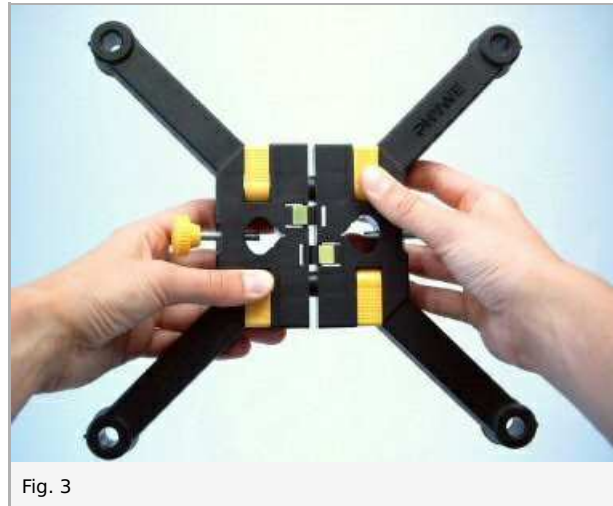




Fig. 4a



Fig. 4b



Fig. 5

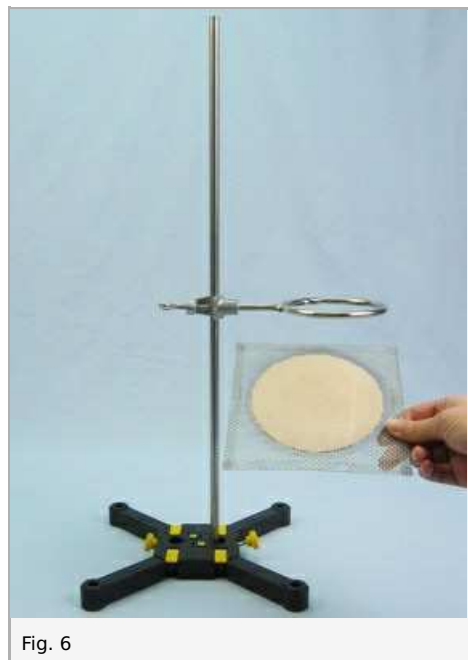


Fig. 6

- Slit off a piece of tubing (approx. 10 cm long) and slip it over the short support rod.



Fig. 7



Fig. 8

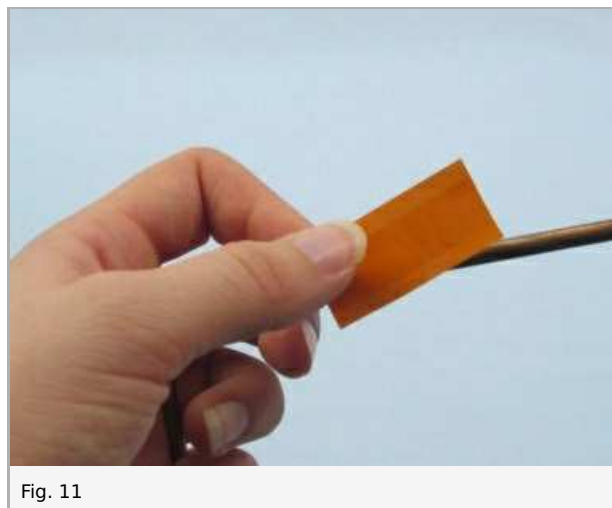
- Adjust the position of the support ring and the short support rod so that you can lay the U-shaped rod across the rod and the rim of the beaker.

- Pour about 200 ml of water into the beaker and drop a few beads into it.



Procedure

- The metal rods should not yet be laid across the beaker and the support rod.
- Heat the water in the beaker to a boil.
- Attach a piece of heat sensitive paper with its yellow side outwards in the middle of each U-shaped rod. The paper should be in close contact with the rods all the way around.



- A piece of heat sensitive paper should also be attached to the glass rod (agitator rod) at its upper end.

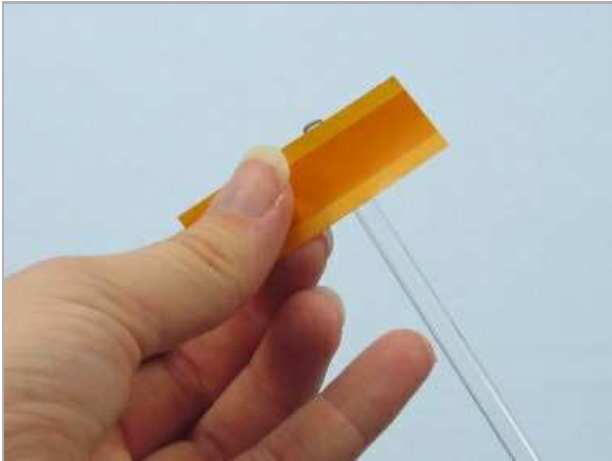


Fig. 12

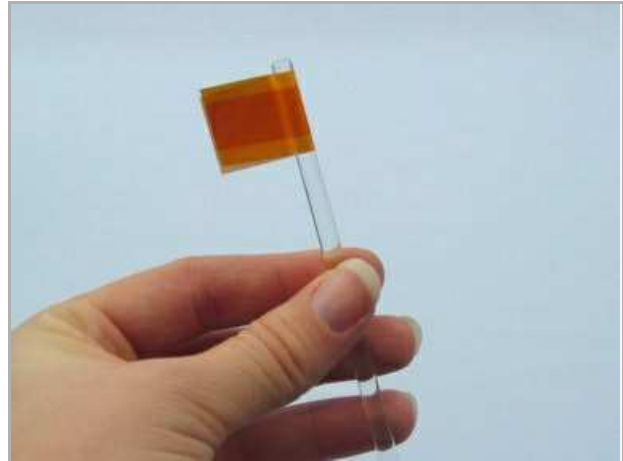


Fig. 13

- Hang both metal rods simultaneously so that one bent end of each is in the hot water and the other across the support rod.
- Be sure that the heat sensitive paper on both rods has the same distance (approx. 2 cm) to the beaker!



Fig. 14

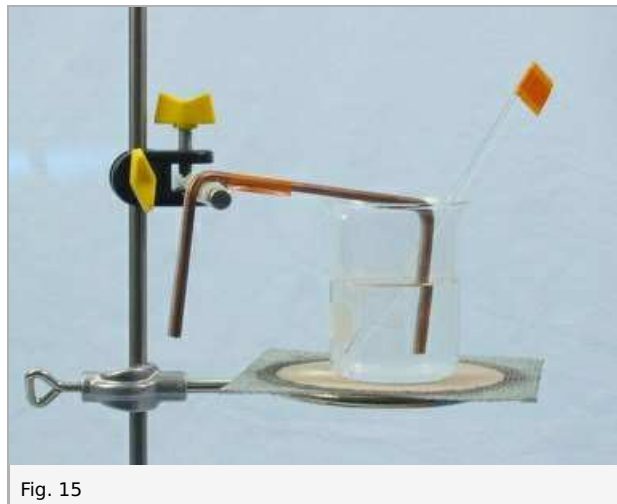


Fig. 15

- Slant the agitator rod as much as possible when placing it in the beaker so that the hot steam does not touch it.
- Observe the heat sensitive paper on the rods and record the time when the red colour appears and the appearance of the sheets after about 3 min in the report.
- Several minutes later touch the ends of the rods which are hanging over the support rod and record your observations.
- Touch the end of the glass rod and note your observations.

Report: Thermal conduction of solid bodies

Result - Observations 1

Aluminium:

What happens to the heat sensitive paper? When does the red colour first appear?

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Result - Observations 2

Copper:

What happens to the heat sensitive paper? When does the red colour first appear?

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Result - Observations 3

Glass:

What happens to the heat sensitive paper? When does the red colour first appear?

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Result - Observations 4

Aluminium:

How far has the colour spread after approx. 3 min?

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Result - Observations 5

Copper:

How far has the colour spread after approx. 3 min?

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Result - Observations 6

Glass:

How far has the colour spread after approx. 3 min?

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Result - Observations 7

Aluminium:

How warm are the ends of the rods?

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Result - Observations 8

Copper:

How warm are the ends of the rods?

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Result - Observations 9

Glass:

How warm are the ends of the rods?

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Evaluation - Question 1

The heat sensitive paper changes colour at about 45 °C. At lower temperatures it is yellow; at higher ones, red.

List the rods in the order of their thermal conductivity, i.e. good to poor.

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Evaluation - Question 2

Does a rod have the same temperature along its entire length? Give reasons for your answer:

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