Evaporation (Item No.: P1045100)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 14-16
Topic: Thermal physics
Subtopic: States of matter: Melting, boiling, evaporation
Experiment: Evaporation

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

Additional Requirements:

- Spirit for burning, 1000 ml 31150-07
- Blotting paper (DIN A5)
- Scissors

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

The evaporation of water and spirit, and the temperature decrease during this process is observed.

Remarks

1. Methylated spirit is very inflammable! During the experiment there should not be an open flame near the experimental setup.
2. If necessary to save time, the temperature measurements can be started while the drying of the spots is being observed.
3. By sinking and raising the bosshead both thermometers can be moistened and then simultaneously pulled out of the liquid to begin the measurements. Beaker and Erlenmeyer flask should remain under the thermometers during the experiment to catch any liquid which might drip from them.
4. After the experiment the spirit should be collected for later use.

Psychrometers (wet-and-dry-bulb hygrometers) work according to this principle. From the temperature difference between a dry and a moist thermometer, the relative humidity of the air can be determined.

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Task and equipment

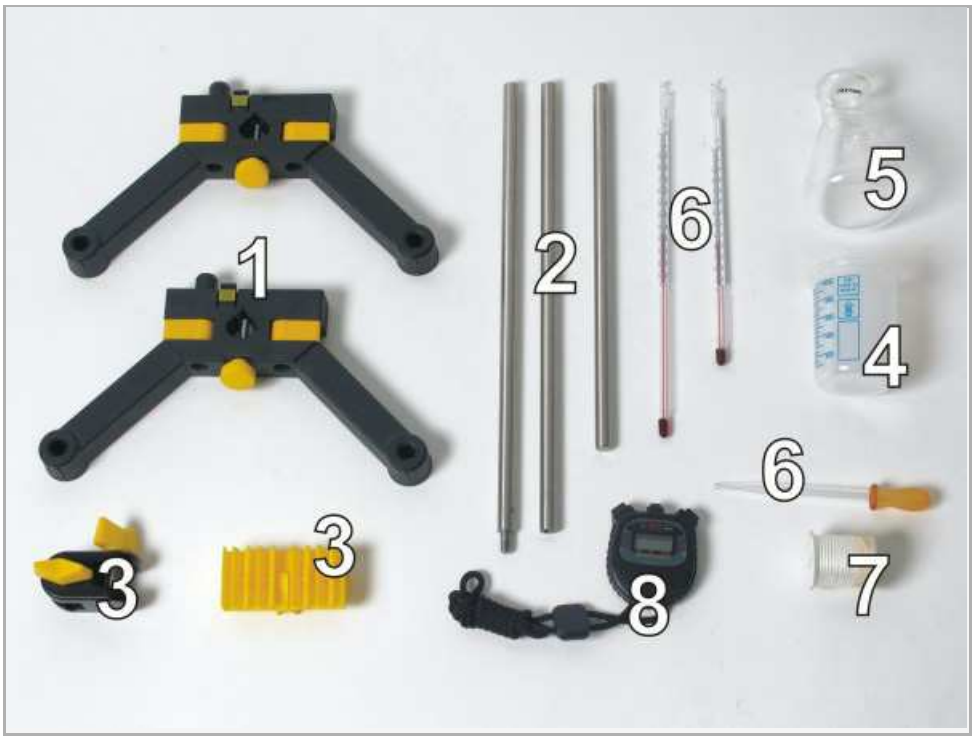
Task

What happens when laundry is dried?

Blotter paper is moistened in water and spirit.

1. Observe the wet spots.
2. Wrap moistened paper around the bulb of a thermometer and observe its scale.

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
2	Support rod, stainless steel, l = 600 mm, d = 10 mm	02037-00	1
3	Boss head	02043-00	1
3	Glass tube holder with tape measure clamp	05961-00	1
4	Beaker, low form, plastic, 100 ml	36011-01	1
5	Erlenmeyer flask 100 ml, wide-neck SB 29	36428-00	1
6	Pipette with rubber bulb	64701-00	1
6	Students thermometer,-10...+110°C, l = 180 mm	38005-02	1
6	Students thermometer, -10...+110°C, l = 230 mm	38005-10	1
7	Fishing line, l. 20m	02089-00	30 cm
8	Stop watch 4	03078-00	1
Additional material:			
	Spirit for burning (denatured alcohol), 1000 ml	31150-70	
	Blotting paper (approx. DIN A5)		1
	Scissors		1

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Set-up and procedure

Set-up

Attention!

Spirit is very inflammable. There should not be any open flame near the experimental setup.

Setup

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

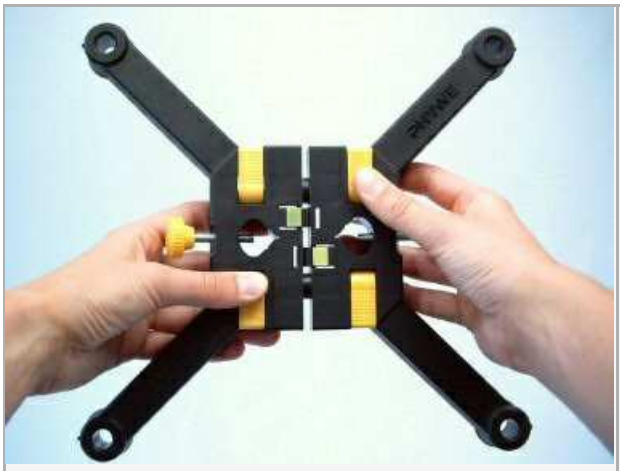

Fig. 1

Fig. 2

Fig. 3

Fig. 4

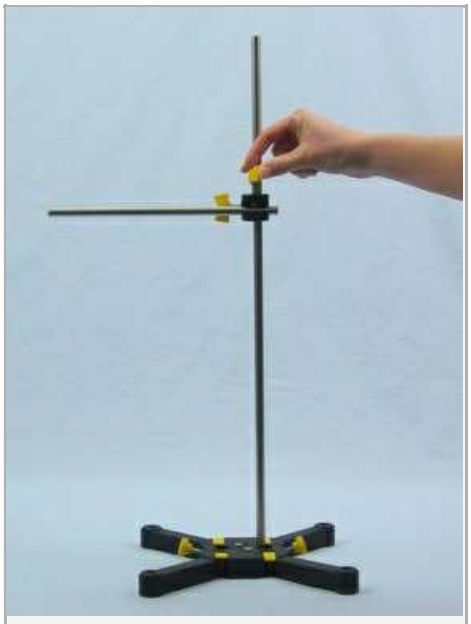

Fig. 5

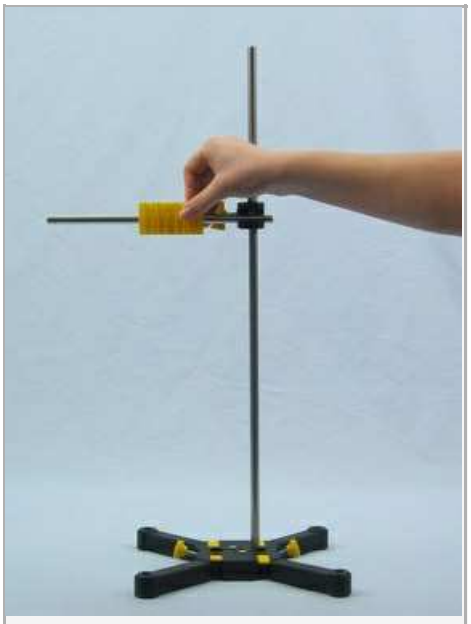

Fig. 6

- Cut strips of blotting paper in the following sizes: two 4 cm x 6 cm strips; two 5 cm x 10 cm strips.

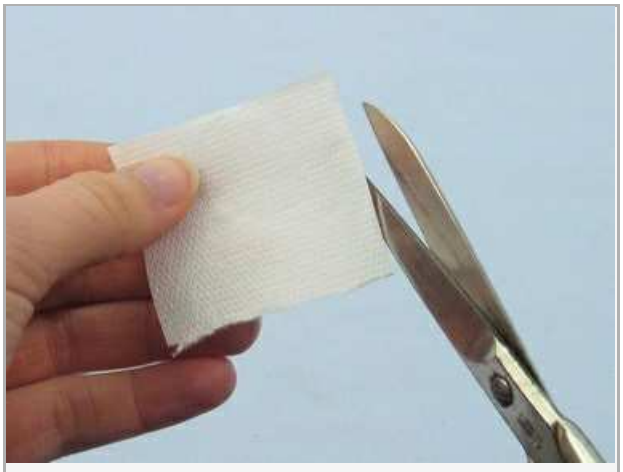

Fig. 7

- Poke a hole in each of the smaller strips (with your pencil) and thread a piece of fish line through it; knot the ends to form a loop.

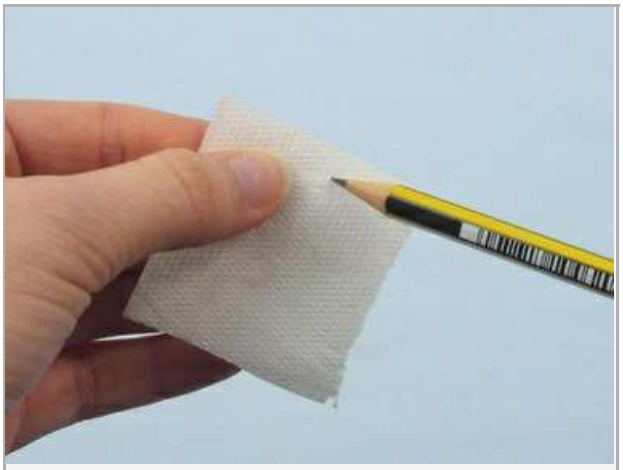
Fig. 8

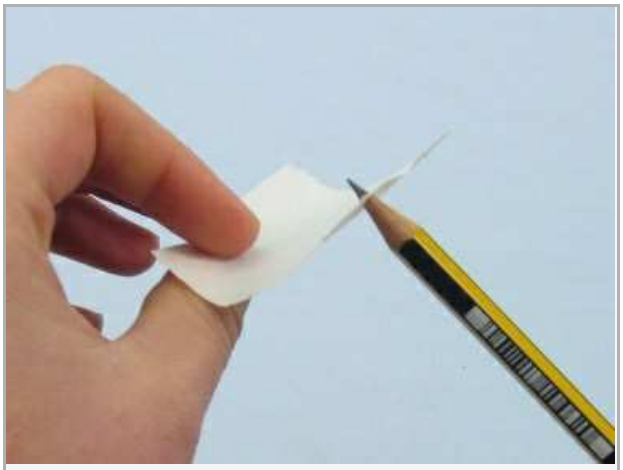
Fig. 9

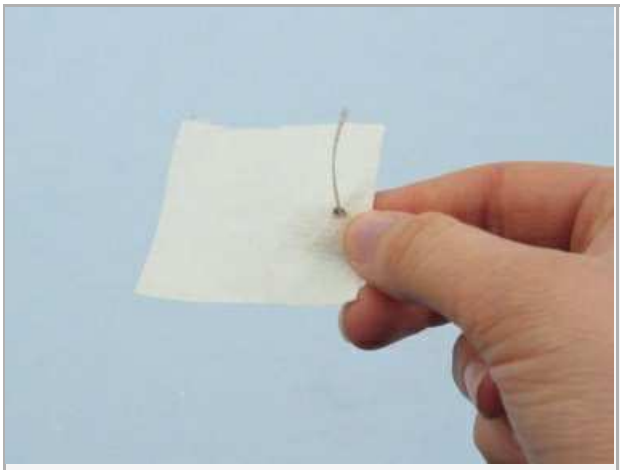
Fig. 10

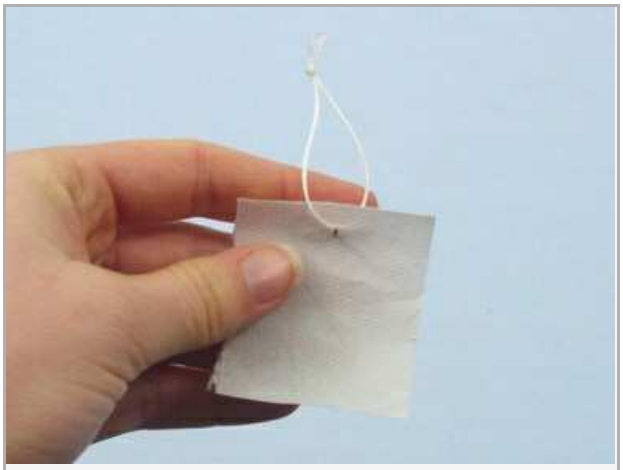
Fig. 11

- Roll the larger strips around the bulb of each thermometer and tie them in place with a piece of fish line. Be sure to cover the bulbs completely.

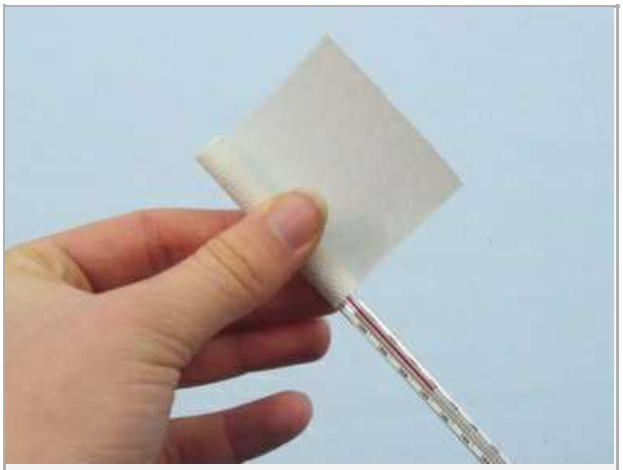
Fig. 12

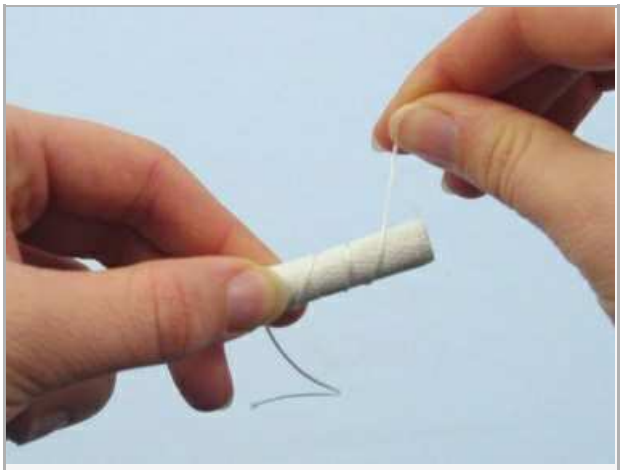
Fig. 13

- Pour 20 ml of water into the beaker.

Fig. 14

- Pour 20 ml of methylated spirit into the Erlenmeyer flask.

Procedure

1. Observation of the moistened spots

- Drip 5 drops of spirit onto one of the small strips and 5 drops of water onto the other.

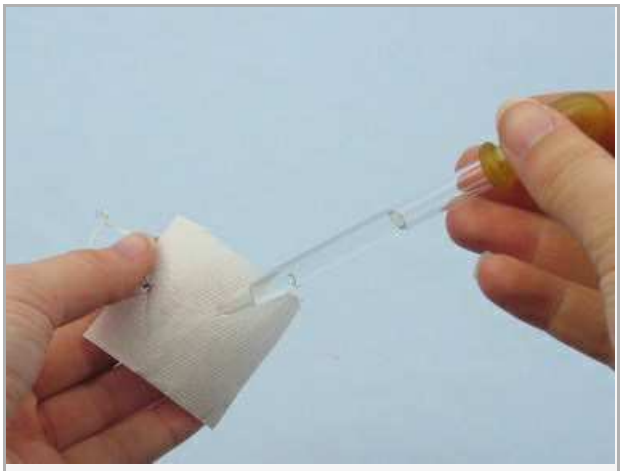

Fig. 15

- Hang the strips on the horizontal rod.
- Record your observations in the report.

2. Temperature measurement

- Measure the initial temperature ϑ_1 and ϑ_2; record them in the table under t = 0 min.
- Lower the bosshead so that the thermometers are immersed in spirit and water respectively.
- Return the thermometers to their original position when the paper is saturated; and start the stop watch.
- Measure and record the temperatures ϑ_1 and ϑ_2 at one-minute intervals.
- Stop measuring after 10 min.

Report: Evaporation

Result - Observation 1

When do the spirit and water spots dry?

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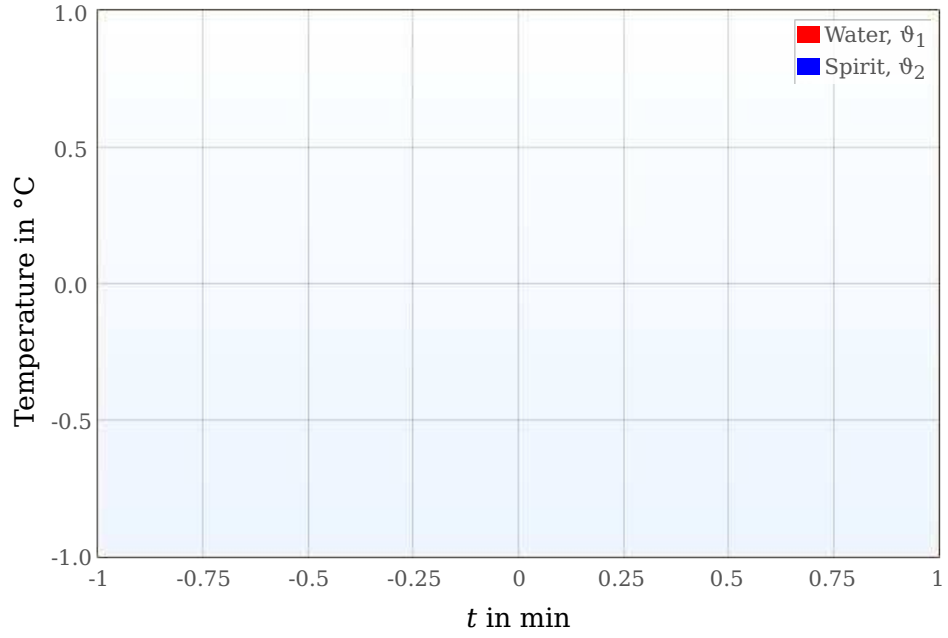
Result - Table 1

Record the measured values for water (ϑ_1) and spirit (ϑ_2) in the table.

t in min	ϑ_1 in °C	ϑ_2 in °C
0	1 ±0	1 ±0
1	1 ±0	1 ±0
2	1 ±0	1 ±0
3	1 ±0	1 ±0
4	1 ±0	1 ±0
5	1 ±0	1 ±0
6	1 ±0	1 ±0
7	1 ±0	1 ±0
8	1 ±0	1 ±0
9	1 ±0	1 ±0
10	1 ±0	1 ±0

Number1



Evaluation - Question 1

Which spot dries first?

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Evaluation - Question 2

What is this process of drying called?

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Evaluation - Question 3

From your experience can you state what the drying process would speed up?

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Evaluation - Question 4

Describe and compare the measured courses of temperature of water and spirit (look at the chart of Table 1).

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Evaluation - Question 5

Why does the indicated temperature sink?

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Evaluation - Question 6

The boiling points of the two liquids are:

Water: 100 °C

Spirit: 78 °C

Formulate a correlation between the respective boiling points and the final temperatures which were observed in the experiment.

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