When heating icy water the temperature only rises if the ice has completely melted. The energy needed to melt ice is called heat of fusion.

Material

1	Demo physics board	02150.00
1	Clamping holder, *d* = 0 ... 13 mm, fixing magnet	02151.07
1	Holder for hand-held meters	02161.00
1	Burner-holder on fixing magnet	02162.00
1	Wire gauze holder on fix. magnet.	02163.00
1	Stop clock mechanical, 210 mm	03074 00
1	Wire gauze 160 mm x 160 mm, ceramic cen.	33287.01
1	Beaker, 250 ml, low plastic	36013.01
1	Glass beaker DURAN, short, 600 ml	36015.00
1	Glass rod, l=200mm, d=6mm	40485.04
1	Temp. meter 2xNiCr-Ni, hand-held	07140.00
1	Immersion probe NiCr-Ni, stainl. steel	13615.03
1	Large-scale display, digital, RS-232 port	07157.93
1	Data cable RS 232, SUB-D/USB	07157.01
1	Butane burner, Labogaz 206 type	32178.00
1	Butane cartridge without valve, 190 g	47535.00
	Ice cubes of approx. 300 ml water	
	Hammer	
	Towel	

Fig. 1

Setup

- Place the holder for burner at the bottom of the board
- If using the butane burner place the holder for the wire gauze on the board at the marked height of 240 and place the wire gauze on top of it
- Place the hand-held meter within the magnetically adhesive holder upon the board and connect it to the large-display unit
- Attach the temperature sensor with the aid of the clamping holder and connect it to the hand-held meter

Implementation

- Wrap ice cubes in a cloth and crush them with a hammer. This should result in ice fragments that are as small as possible.
- Fill the 600 ml beaker up to roughly the 300 ml mark with ice
- Add 200 ml of water
- Carefully stir ice and water with the glass rod
- Place the glass beaker upon the wire gauze
- Immerse the temperature sensor approx. 2 to 3cm into the icy water
- Stir until the temperature remains constant, measure the temperature (table 1)
- Light the burner and set it to a low flame
- Start the stop-watch
- Regularly stir the icy water
- Measure the temperature at 1 minute intervals and enter them in the table
- Monitor how much ice is present

Observation and measurement results

There are only a few ice fragments present after approx. 5 minutes
The ice has completely melted after approx. 8 minutes

Table 1

$\frac{t}{\text{min}}$	$\frac{\vartheta}{°C}$
0	0.0
1	0.0
2	-0.1
3	0.1
4	0.0
5	0.2
6	0.8
7	3.2
8	6.8
9	11.5
10	15.4

Evaluation

The temperature initially remains constant when heating the icy water, the ice is melted by the heat added. This heat is called heat of fusion. The constant temperature is the melting temperature of ice, 0°C (the fixed point of the Celsius scale at normal pressure).
Once the ice has completely melted the water heats up in the glass, the temperature increases. (Fig. 2)

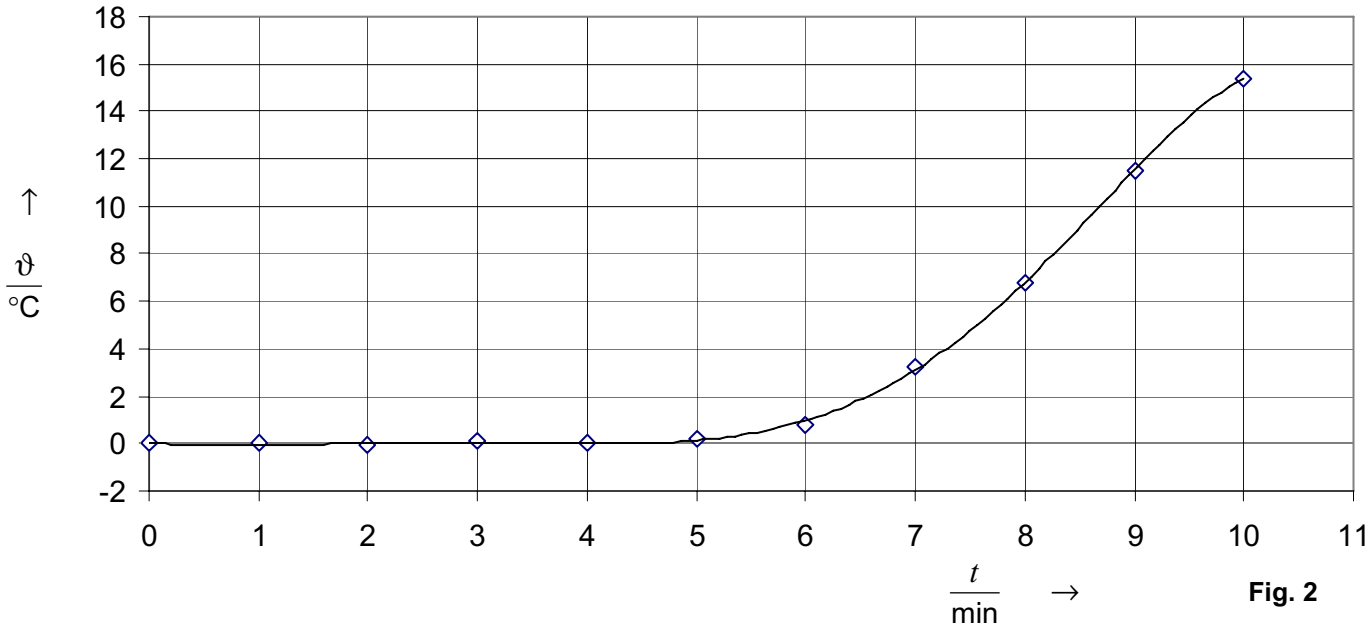

Fig. 2

Remarks

1. The measuring accuracy of the NiCr-Nr temperature sensor is +/- 1.5°C. The temperature meter and the sensor must therefore be calibrated to 0°C in the icy water (refer to the operating instructions of the temperature meter). We recommend that you calibrate it before the lesson.

2. Another option would be to show the students that the temperature sensor can be calibrated with a fixed point that defines the Celsius scale.

3. The last digit of a digital temp. meter can always vary by 1 digit. Hence negative values in the display such as - 0.1° C or even 0.2°C are possible instead of 0.0°C.