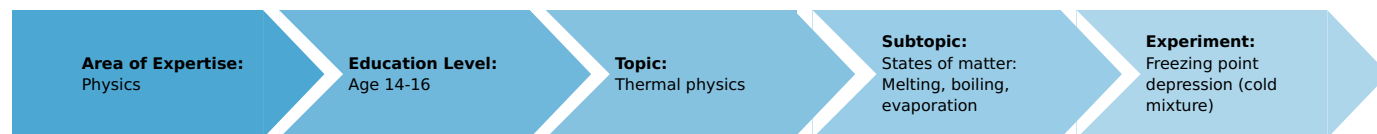


Freezing point depression (cold mixture) (Item No.: P1045300)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- Sodium chloride, 250 g 30155-25
- Ice, crushed (ice cubes, hammer and cloth)

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Additional Information

1. The ice is best crushed in a cloth so that individual pieces do not scatter.
2. In the first experiment the temperature of the ice water θ_1 is generally between 2 and 3 °C. A temperature of 0 °C is achieved only after waiting a very long time.
3. In the second experiment a temperature of under -10 °C is reached. Estimation of the temperature by extending the scale is sufficient for this qualitative experiment.
If an exact temperature reading is desired, a thermometer with a scale which extends to at least -20 °C should be used.

Freezing point depression (cold mixture) (Item No.: P1045300)

Task and equipment

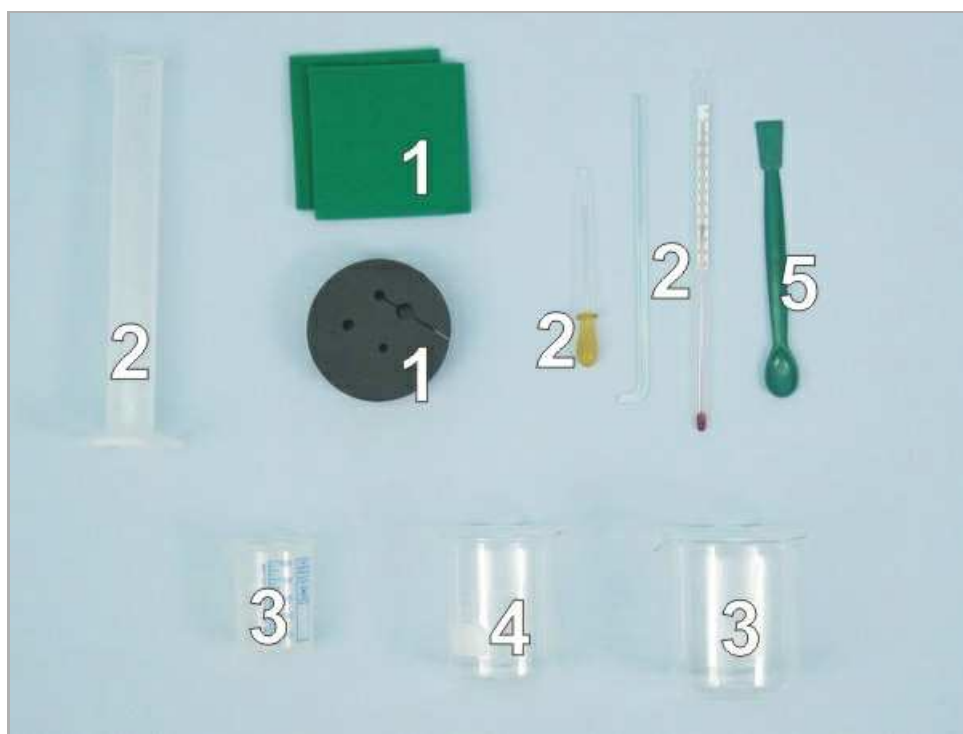
Task

Why is salt scattered on icy surfaces in the winter?

1. Add salt to ice water and measure the temperature.
2. Place salt between pieces of ice and measure the temperature.



Equipment



Position No.	Material	Order No.	Quantity
1	Lid for student calorimeter	04404-01	1
2	Felt sheet, 100 x 100 mm	04404-20	2
3	Agitator rod	04404-10	1
4	Students thermometer, -10...+110°C, l = 230 mm	38005-10	1
5	Graduated cylinder 100 ml, PP transparent	36629-01	1
6	Pipette with rubber bulb	64701-00	1
7	Beaker, low form, plastic, 100 ml	36011-01	1
8	Glass beaker DURAN®, short, 250 ml	36013-00	1
9	Glass beaker DURAN®, short, 400 ml	36014-00	1
10	Spoon, w. spatula end, 18 cm, plastic	38833-00	1
Additional material:			
11	Sodium chloride 250 g	30155-25	1
12	Ice, crushed (ice cubes, hammer and cloth)		

Set-up and procedure

Set-up

- Assemble a thermally insulated vessel (calorimeter) using the two glass beakers (250 ml and 400 ml) and two felt sheets.



Fig. 1



Fig. 2

- Insert the thermometer ($d = 8 \text{ mm}$) and the agitator rod ($d = 5 \text{ mm}$) through the respective holes in the lid.



Fig. 3



Fig. 4

- Crush the ice with a hammer. To do so wrap it first in a cloth so that no small pieces scatter.

Procedure

1. Salt in ice water

- Add about 100 ml of ice to the calorimeter.
- Add 20 ml of cold water and stir with care.



- Measure and record the temperature θ_1 in the report.
- Add 3 spoonfuls of salt and stir carefully.
- Measure and record the temperature θ_2 .
- Add 3 more spoonfuls of salt and stir carefully.
- Measure and record the temperature θ_3 .
- What happens to the pieces of ice when you add salt to the ice water? Record your observations (report).

2. Salt with crushed ice

- Fill the calorimeter with alternating layers of crushed ice (thick layer) and salt (thin layer).
- Stir this mixture.
- Observe the thermometer's scale and record your observations in the report.

Report: Freezing point depression (cold mixture)

Result - Observation 1

Temperature of the ice water $\theta_1 = \dots\dots\dots$ °C

with 3 spoonfuls of salt $\theta_2 = \dots\dots\dots$ °C

with 6 spoonfuls of salt $\theta_3 = \dots\dots\dots$ °C

Result - Observation 2

What happens to the pieces of ice in the ice water?

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Result - Observation 3

What does the thermometer show when salt is mixed with the pieces of ice?

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Result - Observation 4

What happens to the crushed ice?

Evaluation - Question 1

What can you say about the freezing point (melting point) of water which contains salt?

Evaluation - Question 2

Why is salt scattered over icy surfaces?

Evaluation - Question 3

Why is a mixture of salt and ice called a "cold mixture"?

Evaluation - Supplementary problem 1

Explain your observations with the aid of the energy concept. In doing this consider that two processes take place:

Dissolution of the salt and melting of the ice!

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