

## WHY STREETS GET SALTED IN WINTER?

(VERSION FOR MIDDLE SCHOOLS)

In winter salt is used to help against snow and ice on roads, lanes, and streets. That is, because salt can support melting of snow and ice even below a temperature of zero degrees.



### **Why do ice and snow melt in contact with salt?**

Do you have an explanation for the question why ice and snow melt in contact with salt even at temperatures below zero?

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Plan an experiment helping you to find out the special features of a ice-water-salt mixture!

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### **A. Preparation**

*You will use a temperature sensor for this activity. A temperature sensor supports you in identifying the temperature and the temperature profile of a liquid or of air.*

#### **First, acquaint yourself with the temperature sensor**

Put approximately 20 ml warm water into a beaker and identify the water temperature with the help of a temperature sensor. Use a data collection time of two minutes and a sample rate of one sample per second. Add two times after approximately 30 seconds a teaspoon of salt to the water in the beaker and stir the liquid carefully until the salt has dissolved.

**What can you discover? How do you explain your observation?**

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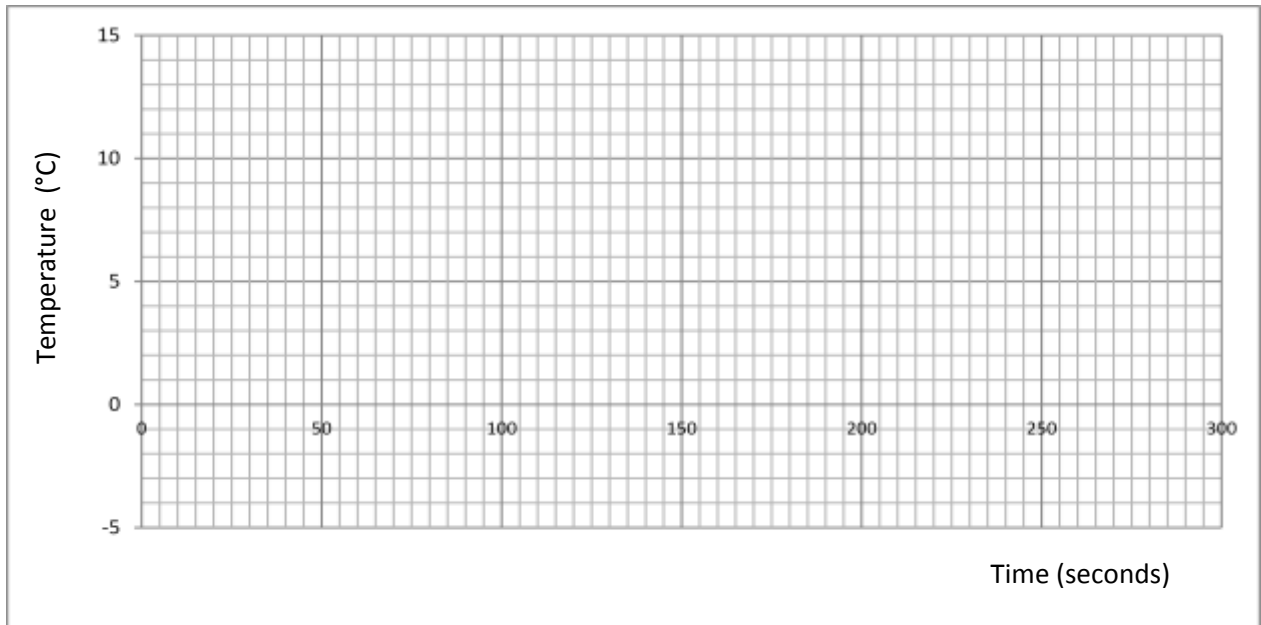
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### B. At what temperature does an ice-water mixture end up?

Put approximately 20 ml cold water into a beaker and identify the water temperature with the help of a temperature sensor. Use a data collection time of five minutes and a sample rate of one sample per five seconds. Then, add approximately six cubes of ice to the water in the beaker and observe the temperature of the water-ice mixture.

Plot your data by completing the diagram below.



F1) Describe the temperature profile in your own words.

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F2) Show your ideas in order to explain the temperature profile?

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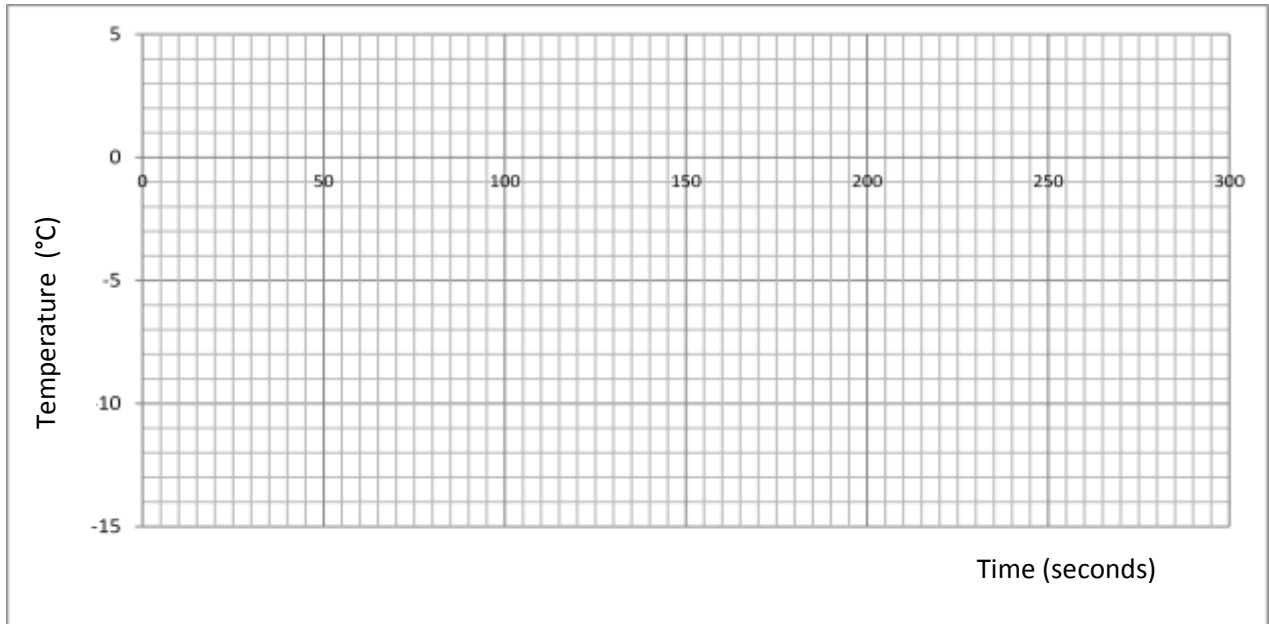
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### C. How does the addition of salt influence the temperature of the mixture?

Next, add approximately six teaspoons salt to your water-ice mixture and again measure the temperature within an time interval of five minutes and a sample rate of one sample per five seconds.

Plot your data by completing the diagram below.



**F3) Describe the temperature profile in your own words.**

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**F2) Show your ideas in order to explain the temperature profile?**

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## D. Show your results

1. Write a letter to a classmate who was not present at school and could not perform the learning activity. Specifically, explain her/him what you have learned by working on this particular activity.

2. **Imagine the following situation and explain the outcome of the particular thought experiment.**

You add clear water to an empty tea candle. Furthermore, you add the same amount of salt-water mixture to another empty tea candle. Then, you put the two tea candles out-of-doors. Outside, the temperature is  $-2^{\circ}\text{C}$ .

***What can you observe after a time period of two hours and how do explain your observation?***

### E. Challenge

Explore how low you can go by experimenting with a salt-ice-water mixture? Specifically, find out which mixing ratio is favorable for reaching a temperature as low as possible.

**Describe your considerations and show your results:**

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### F. What can you infer from your learning activities?

Let us look back at our initial question: Why do ice and snow melt in contact with salt?  
Why does salting don't any longer work at very low temperatures?

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**Further questions:**

a) It was easy for our group to design our own experiment and find an appropriate solution to the given task. Tick a number 1, 2, 3, 4 or 5 (1: strongly agree 5: strongly disagree).

Please explain your answer:

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b) The guidance in the worksheet helped us to perform the experiment and analyze the data in order to understand the physics behind and apply physics concepts to everyday life situations. Please, tick a number 1, 2, 3, 4 or 5 (1: strongly agree 5: strongly disagree).

Please explain your answer:

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