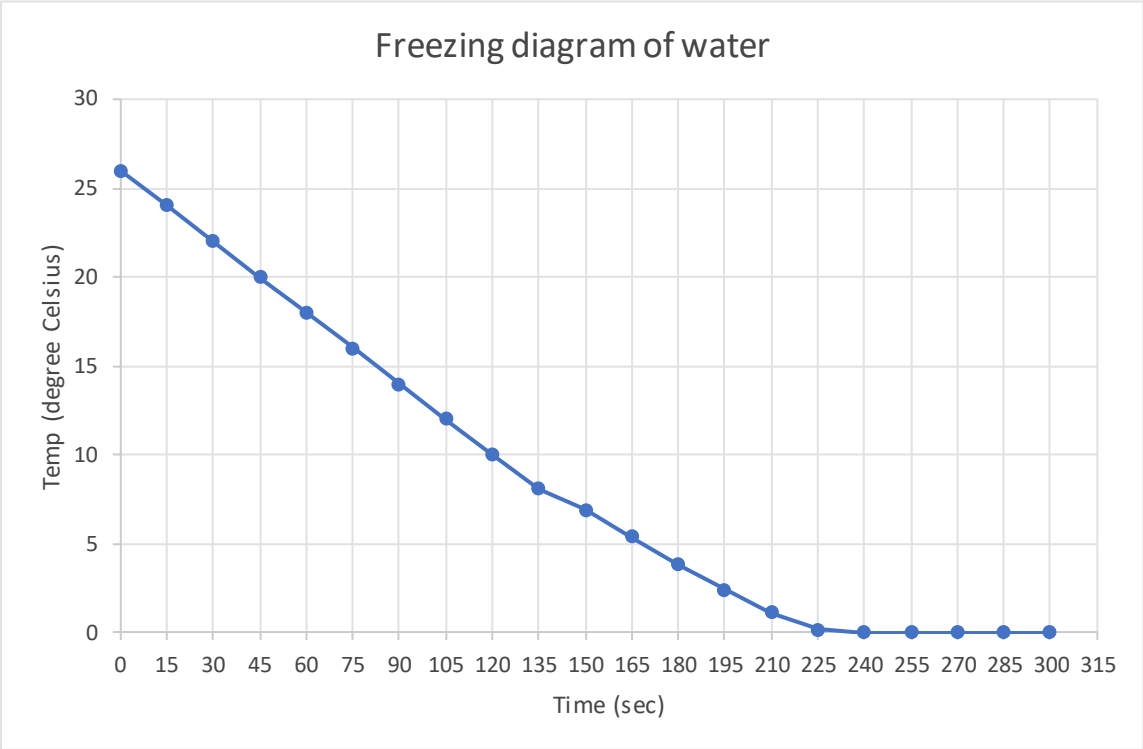
1.1 Melting point and freezing point of solids

Basic information and collecting ideas 	Students should be aware that substances can assume different states of matter at different temperatures. One possible teaching method for the introduction is “think-pair-share”: “Who knows a substance that is solid or liquid at different temperatures?” Depending on the age of the students, you can have the whole class play a game: Low temperatures → Students are firmly connected through their hands (solid state)/ Higher temperatures → Students are moving around, constantly forming new connections with each other.
Setting up and conducting experiments 	When students use a mixture of ice, table salt, and water (about 3:2:1 ratio), they should determine the temperature of the cooling bath first. The temperature of this mixture is well below 0°C. The reason: The strong bonding forces between the salt ions must be divided. This process needs energy. Energy is absorbed from the solution. This reduces the temperature. Advise the students that the tasks are distributed in the group: (1) set up the experiment, (2) keep time, (3) read the temperature, (4) make the entry in the table (page 2), and (5) present the results. The curve on the second page is provided as an example so that the students have an idea of how to create their own curve.
Observing and documenting 	From the diagram, the students should realize that the temperature at the melting point stays constantly at 0°C. If the temperature in the test tube goes below 0°C, it is due to the very cold cooling bath.
Analysing and reflecting 	1. Pure water and other pure substances have a constant temperature value at the freezing point. 2. Solutions have a lower freezing point because the dissolved particles interfere with the formation of a solid. More energy must be withdrawn and thus the temperature drops.
Doing further research 	1. To detect the similarity of the melting and freezing points, students should chop ice cubes and place them about 5 cm high in a test tube. At high outside temperatures, the students follow the melting of the ice and enter the temperature profile in a table as in the first experiment. In the beginning, the second curve has a constant temperature at 0°C, which rises to room temperature after the ice melts. 2. In the second experiment, students can see that metals melt even at comparatively low temperatures. The solder is placed about 1 cm high in the test tube (the tip of the thermometer must be in contact with the solder) and heated with a tea light. Solder is composed of lead, copper, silver, tin, and zinc. The melting point varies depending on the composition. A temperature range refers to a mixture.

Technical and vocational application	1. **Electrical engineering:** soldering, production of circuit boards 2. **Metalworking:** Most engineering metals are alloys (for example, steel is an alloy of iron and other metals such as manganese, chromium, tungsten, or nickel). There are about 2,500 different types of steel. This mixing improves the properties of iron: corrosion resistance, hardness, elasticity, etc.). 3. **Jewellery making:** Gold alloys with copper or silver have different melting points, colours, and hardness. **Electrical engineer, Metal worker, Jeweller, Material scientist**

Time (sec)	Temperature (°C)	Time (sec)	Temperature (°C)
0		165	
15		180	
30		195	
45		210	
60		225	
75		240	
90		255	
105		270	
120		285	
135		300	
150			



The illustrated curve serves only as a guide. Create your own curve with the results from your experiment.