# 1.2 Boiling point of water

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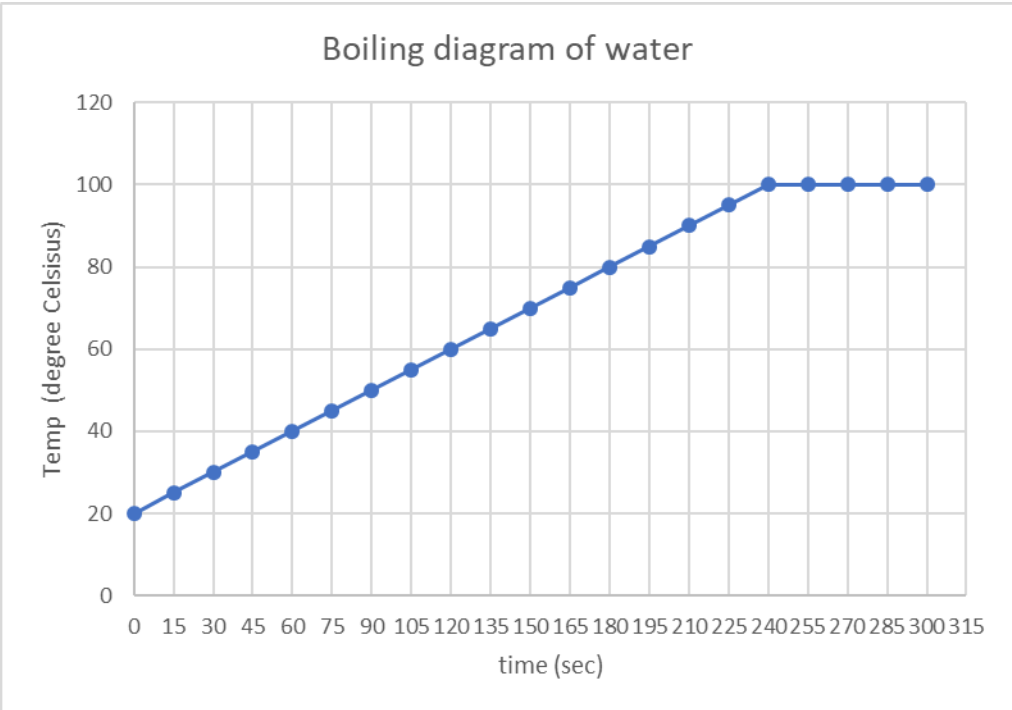
|---|---|
| **Basic information and collecting ideas** | The students should be aware of everyday examples in which liquid substances are transformed into gaseous substances (e.g., perfume, gasoline, or water). Use the method of “question for discussion” and ask the students why we should not keep perfume or gasoline in an open container.<br><br>Also work out the difference between the evaporation and the boiling of a liquid. If the particle model is known, students should understand that evaporation takes a long time because there is not enough energy for all the particles. At the boiling point, enough energy is supplied to the liquid so that the transition to the gaseous state can proceed spontaneously. |
| **Setting up and conducting experiments** | Show the students that they should use the clothespin to adjust the test tube height to about three fingers’ width over the tea light. If the flame is too close, the test tube will turn black. Timing does not start until the burning tea light is pushed under the test tube.<br>The tasks should be distributed among the members of the group: (1) set up the experiment, (2) keep the time, (3) read the temperature, (4) make the entry in the table (page 2), and (5) present the results.<br>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** | Advise the students to first note the temperature values in the table. Explain how to transfer the values to the diagram.<br>The students should recognize that the temperature rises until the water boils and then stays constant at about 100°C. This means that the boiling point of water is 100°C. |
| **Analysing and reflecting** | The boiling point of a pure substance always has a fixed value and is an important identifying feature. The lower the boiling point of a substance, the faster it will evaporate at room temperature. This can be dangerous, especially with flammable liquids. |
| **Doing further research** | 1. Ask the students to add a pinch of table salt to 3 ml of water and determine the boiling point of the salt solution as in the first experiment. The temperature will be above 100°C. The reason: A solution needs more energy/a higher temperature to release the particles to the gaseous state.<br>2. Give examples for flammable liquids (petrol, methylated spirits, solvents, etc.) and point out what can happen if the containers are not closed. |

<table>
<tr><td>Technical and vocational application<br></td><td>▪ Evaporation of solvents with a low boiling point (adhesives, varnish) – danger of explosion<br>▪ Cooling of body parts with alcohol<br>▪ Boiling points of odorous substances (perfumes)<br><br>▪ Painter: handling of paints with solvent<br>▪ Technician: use of adhesives with flammable/explosive solvents<br>▪ Beverage technician: distillation of wine to liquor<br>▪ Oil technician: separation of crude oil into petroleum, gasoline, diesel, etc.</td></tr>
</table>

| 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.