

Can you Correctly Estimate Temperature Changes?

How does the temperature of a thermometer change if we blow on it? What happens if we fan the thermometer with a book instead of blowing on it? Does anything change if we dip the thermometer in water?

What you need:

- a cup of water of room temperature
(let the water sit in the room for a while)
- Vernier Go!Temp USB thermometer
- a book to fan the thermometer
- a cloth or a tissue to wipe the thermometer



Tasks:

1. Connect the thermometer to your computer and run the Vernier Logger Lite programme.
2. Set Duration to 30 seconds and Sampling Rate to 2 measurements per second.
3. Compare the air temperature in the room with the temperature of the water in the cup. If they differ, carefully add hot or cold water so that the temperatures are the same.
4. Before each measurement, put the thermometer into the water, so that the temperature quickly aligns with the room temperature.
5. Before the measurement, estimate the behaviour of the thermometer temperature in each case and sketch a graph. It is not about specific numbers, but about whether

the temperature rises, decreases or remains the same, eventually in what cases is the temperature change more distinctive. Justify your estimation.

6. Perform 6 successive measurements – three with a dry thermometer (when you take the thermometer out of the cup, wipe it dry with a cloth or tissue) and three with a wet thermometer (when you take the thermometer out, leave the thermometer wet):
 - a) do not blow on the thermometer nor fan it with a book
 - b) fan the thermometer with a book
 - c) blow on the thermometer from a distance of about 10 cm
7. Compare the measurement results with your estimation. If some measurements do not correspond to your estimation, look for an explanation

Notes for teacher

Typical results of the experiment are summarized in the graph below.

If the thermometer is dry and has reached the room temperature, it does not matter if we fan it or not. The temperature does not change (**red** and **dark green** curve). A small decrease in the temperature of the dry thermometer (with or without fanning) in the graph is due to the fact that the temperature of the thermometer was after all slightly higher than the room temperature. However, the change of temperature is so small that the temperature may be considered practically constant.

If the thermometer is dry and is not blown on nor fanned, there is an apparent decrease of temperature (**orange**) due to evaporation.

The effect of evaporation (and thus the temperature decrease) can be strengthened by air circulation. We achieve a higher temperature decrease by fanning the thermometer with a

book (blue) rather than blowing on it (green), because the air from our lungs is warm and thus acts against the cooling.

The biggest surprise (and for teachers an indicator of the students' incorrect beliefs) is the temperature increase when we blow on a dry thermometer (dark blue). Evaporation does not occur; on the contrary, the thermometer warms by the hot air from the lungs.

