A4 Evaporation heat – How to cool with heat

1 Why do you freeze in wet clothing?

1.1 Apparatus and materials

- Alcohol (optional)
- Cardboard, a spiral notebook, or something similar as a fan
- 1 – 2 towels or paper tissues
- Water

Attention: After you have completed the experiment, return the materials or dispose of them properly as instructed by your teacher.

1.2 Safety information

The materials may be used only as instructed by your teacher or as described in the experimentation instructions.
Remove all water-sensitive materials from your workspace.

1.3 Conducting the experiment

- Dip a towel in water and then moisten the back of your hand with the towel.
- Observe for a moment how the moisture feels.
- Repeat the test with your other hand and fan air over the back of your moist hand.
- Describe how the feeling on your wet skin changes when you fan your hand.
- Dry both hands thoroughly and fan air over your dry skin.
- If alcohol is available, dip the second towel in the alcohol and moisten the back of your hand.
- Investigate what changes in this case when you fan air over your moist hand.
- Describe the differences in your observations between water and alcohol.

1.4 Observation

Share your observations with a classmate.

1.5 Analysis

a) Describe the effect of fanning the moisture on your skin.
b) Establish a connection between the cooling effect and evaporation.
Which liquid dries up most quickly on your skin?
c) Create an experiment that makes what you feel on your hand visible.

1.6 Questions

a) Why do dogs pant when it is hot?
b) What other examples from everyday life can you think of in which cooling by evaporation also plays a role?

2 How does a wet cotton pad cool you?

2.1 Apparatus and materials

- Alcohol (optional)
- 1 clock
- 2 cotton pads
- 1 digital thermometer
- Water

Attention: After you have completed the experiment, return the materials or dispose of them properly as instructed by your teacher.

2.2 Safety information

The materials may be used only as instructed by your teacher or as described in the experimentation instructions.
The alcohol is not suitable for consumption.

2.3 Conducting the experiment

- Create a table for recording the temperature every 30 seconds over a 10-minute period. You are to enter three series of measurements in the table.
- Turn on the thermometer. Wait until the temperature stops changing; it then shows the ambient temperature.
  If the thermometer's display turns off (battery-saving feature), then simply push the "on" button again.
- Make sure that you touch only the black casing of the thermometer.
- Measurement 1: Moisten a cotton pad with water, squeeze out the excess water, and lay the cotton pad over the thermometer (see Fig. 1). Hold the thermometer horizontally so that the cotton pad does not fall off (Fig. 2).
  Enter the temperature value in the table every 30 seconds. Measure the temperature over a 10-minute period.
- Measurement 2: If alcohol is available: Repeat measurement 1 for a cotton pad soaked in alcohol.
- Measurement 3: Repeat measurement 1 for a cotton pad that you fan air across (Fig. 3).

Fig. 1: During the measurement it makes sense to place the thermometer on an object, for example, on a plastic cup, such that the cotton pad hangs freely in the air.

Fig. 2: The figure shows you how to lay the moist cotton pad over the thermometer.

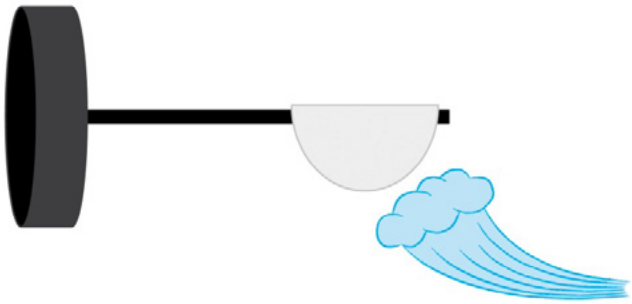

Fig. 3: In the last test, you fan air across the cotton pad.

2.4 Observation

Write down a summary of your observations.

2.5 Analysis

a) Enter the values you measured (temperature over time) for all three series of measurements on a single graph, preferably using a different color for each series.
b) Describe the difference in the cooling curves.
c) Explain the difference in the cooling curves.

2.6 Questions

a) In the experiment, did you expect a greater cooling effect with a soaking-wet cotton pad or a dampened cotton pad? Explain your reasons.
b) Imagine that you are in a very warm room that you would like to cool by evaporation. How would you do it?
c) How do you explain the cooling effects, or “evaporative cooling,” with the particle model?