

## Why does a dog pant?

Note: This task is designed so that it can be solved with the incremental hints.

The hints are available on the media portal for printing, or the students can use them online on a tablet or smartphone via the QR code included on the worksheet.

The worksheet for the students and the hints for printing are available as separate files on the media portal of the Siemens Stiftung. General information on using tasks with incremental hints in the classroom is provided in the “Tasks with incremental hints – an introduction” document, which is also available on the media portal.

### 1 Topical aspects

The task addresses the extraction of heat through evaporation. From a biological and physiological view, panting serves to regulate temperature in animals.

### 2 Learning prerequisites and level of difficulty

In order to complete the task, the students should know the states of aggregation of water and the transitions between them, as well as the fact that these transitions are linked to the energy balance. Regarding biological aspects, the students should have already worked with the topic of thermoregulation in living beings, especially regarding the significance of sweating in people. The level of difficulty of the task is rather low.

### 3 Background on the task

Compared with people, dogs have far fewer sweat glands. For this reason, the sweating we experience when the ambient temperature is higher or when we greatly exert ourselves, thereby raising the energy balance in our body, plays only a minor role in dogs. In order to regulate their body temperature, dogs pant.

In physical terms, panting is sweating via the tongue that is actively supported by air movement. When dogs pant, they let their tongues hang out and direct large volumes of air across their moist tongue surface by breathing in a particular way. The moisture evaporates, extracting the heat necessary for this process from the dog's tongue, the mucus membrane of its mouth, its upper airways, and – via the circulatory system – its body.

The higher the temperatures, the more intensively the dog will pant. The breathing rate may increase from 30 breaths per minute to ten times that number. So that the tidal volume does not increase arbitrarily during panting, the faster dogs pant, the shallower their breaths are. The air is inhaled through the nose and then circulated mainly in the dead space between the mucus membrane of the mouth, trachea, and bronchial tubes; this mechanism is therefore called dead space ventilation. Increased saliva production prevents the dog's mouth from drying out during panting, which is why slobbering is often observed in connection with panting.

### 4 The task

In the simplest form, the task can be formulated as follows:

Explain why dogs pant.

Because the context from which a task is developed fosters learning, depending on the teacher's assessment, a contextual scenario can be developed, such as the following:

Ronja's aunt is ill and cannot leave her house. So Ronja agrees to take her aunt's dog, Artus, for a walk. She returns very worried.

“Auntie, Auntie,” she calls as soon as she comes through the door. “Artus is definitely sick! His tongue was hanging way out and he was breathing really fast and so strangely!”

Her aunt merely smiles.

“It’s nice that you’re concerned, Ronja, but that’s perfectly normal in hot weather. Dogs simply pant or else they would get heatstroke!”

The objective of working through the task is to find a reason for panting and to clarify the connection with body temperature.

## 5 Variations

Depending on the learning group, the number of hints can be decreased or increased.

## 6 Overview of the hints

Note: The hints have been prepared as a separate file for printing or can be used online via the QR codes on the worksheet.

<b>Hint 1</b> Explain the task to each other again in your own words. State what you understood the task to be and what is still unclear to you.	<b>Answer 1</b> We’re supposed to find out why dogs pant and what exactly panting accomplishes.
<b>Hint 2</b> Carefully read through the text on the worksheet again. What information can you gather from it? Write down what you find out.	<b>Answer 2</b> <ul style="list-style-type: none"><li>▪ It is a hot day.</li><li>▪ When dogs breathe quickly with their tongues hanging out, this is called panting.</li><li>▪ Dogs often pant when it is hot.</li><li>▪ If dogs did not pant, they would get heatstroke.</li></ul>
<b>Hint 3</b> Think about how people feel on hot days.	<b>Answer 3</b> People sweat when it is hot or when they greatly exert themselves.
<b>Hint 4</b> Recall the purpose of sweating in people.	<b>Answer 4</b> Sweating ensures that a person’s body temperature does not get too high. When sweat evaporates from the skin, heat is extracted from the skin and the underlying tissue.
<b>Hint 5</b> Transfer what you know about sweating to panting in dogs.	<b>Answer 5</b> The purpose of panting is probably also to ensure that the dog’s body temperature does not get too high.

**Hint 6**

Now summarize all your thoughts and answer the question in the task in a short paragraph.

**Answer 6**

Dogs pant like we humans sweat. The purpose of panting is to regulate body temperature. Energy is necessary for moisture to evaporate. When air is breathed in and out quickly and flows across the moist tongue, a lot of moisture evaporates and heat is extracted from the dog's body.