

EXPERIMENT



Transpiration and evaporative cooling

Research question:

How does plant transpiration affect the composition of the air?

Your assumption (hypothesis):

Materials:

Experimental Approach 1:

- ☐ 1 plant (cut flower)
- ☐ Glass with water
- ☐ Ink
- ☐ Knife
- ☐ Chopping board
- ☐ Spoon

ATTENTION

You will carry out two experimental approaches:

- In experiment 1 (observation): Transpiration is observed indirectly via the water uptake of a plant (cut flower).
- Experimental approach 2 (measurement): The air humidity is determined using the air humidity sensor.

Experiment procedure:

Experimental Approach 1:

1. Put some ink in the glass.
Fill the glass with a little water.
Stir the ink with a spoon.
2. Cut a piece off the stem of the cut flower crosswise.
Cut off the leaves of the cut flower at the sides.
Place the cut flower in the glass.
Observe the cut flower over the next 60 minutes.

Describe your observations. It takes time for us to see changes.

Materials:

Experimental Approach 2:

- ☐ Humidity sensor (O₂ sensor)
- ☐ Ivy
- ☐ Scissors
- ☐ Lamp
- ☐ Sample container
- ☐ Clock (mobile phone or iPad)

Experiment procedure:

Experimental Approach 2:

1. Place the piece of ivy (plant) in the sample container.
2. Insert the O₂ sensor into the upper opening of the sample container.
3. Place the sample container at a distance in front of the lamp.
Switch on the lamp.

4. Record the measured value in the table:

- at the start
- after 1 minute
- after 3 minutes
- after 5 minutes

Measurement table

Humidity at the start of measurement in %	Humidity after 1 minute in %	Humidity after 3 minutes in %	Humidity after 5 minutes in %

Describe the test results. Summarise your results from the table.

Experiment evaluation:

Both Experimental Approaches:

Explains the results. Also describes the effect of transpiration on the ambient temperature. Read the text box "evaporative cooling" (next page) for more information.

Tip:

Try this experiment:

1. Moisten your hands and forearms.
2. Use a piece of cardboard to fan air over your wet skin or blow on your wet skin.

What effect does this have?

Text box: Evaporative cooling

Plants absorb water from the soil through their roots. This water reaches the leaves, where some of it evaporates into water vapour and leaves the leaf through small openings called **stomata**.

For water to evaporate, i.e. change from a liquid to a gaseous state, it needs heat (energy). You can imagine that the water vapour carries this heat outside through the stomata like an invisible 'backpack'. This cools the leaf.

Why is it cooler in the park than in the city in summer?

Many plants release a lot of water vapour at the same time. This water vapour carries a lot of heat into the air (atmosphere), for example through the wind. That is why it is often cooler in parks or under trees than on sealed surfaces.

This cooling effect is called **evaporative cooling**.

Conclusion:

Both Experimental Approaches:

Compare the results with your assumption (hypothesis).

Tick the box:

- ☐ The hypothesis is correct
- ☐ The hypothesis is incorrect
- ☐ The hypothesis is partly correct