



The greenhouse effect

Climate

time

60 minutes
and 15 minutes
waiting

learning outcomes

- To:
- know what the greenhouse effect is
 - know what the atmosphere is
 - discover that the atmosphere is very thin compared with the Earth
 - know some positive as well as negative consequences of the greenhouse effect
 - know that without the green house effect and the atmosphere there would not be any life on Earth

materials needed

- 12 thermometers that fit into the mouth of a bottle
- 12 1.5 litre bottles
- 6 drawing compasses
- 6 spoons
- 6 funnels
- A4 paper
- chalk
- rulers
- colouring pencils
- thread
- scissors
- soil
- water
- sticky tape
- sunlight

end product

- a bottle representing the Earth with its atmosphere and a bottle representing a planet without an atmosphere

Preparation

For this lesson you need to know something about the function of the atmosphere, the greenhouse effect and greenhouse gases.



The greenhouse effect 10 min.

Ask if any children know what the greenhouse effect is. What is it caused by? Come to the conclusion that it is caused in part by an increase in car exhaust gases being released into the atmosphere (CO₂) and because people are using more and more energy. There are other reasons for global warming. Greenhouse gases, such as carbon dioxide, trap the heat from the Sun.

Explain that the Earth has an atmosphere and that the greenhouse gases hang like a blanket in the atmosphere, which is why the Earth is getting steadily warmer. Explain that the greenhouse effect has positive as well as negative consequences. Without the greenhouse effect people would not be able to live on Earth!

The average temperature would be -15° Celsius.

The children complete Task 1 on the worksheet.



The children investigate the consequences of the greenhouse effect on the temperature on Earth.

Tip.

You can find a lot of films on the internet about the greenhouse effect.



Drawing of the atmosphere

40 min. (includes 15 min. waiting time)

Give each child a sheet of A4 paper and a colouring pencil. They are going to draw the Earth and its atmosphere. Explain briefly what an atmosphere is. Explain that the atmosphere is a layer of air surrounding the Earth. The children discover that this layer is very thin.

Hand out the compasses and rulers. The children use the ruler to adjust the compass so that they can draw a circle with a diameter of 13 centimetres. This circle represents the Earth. They draw a very thin line around this circle using a colouring pencil. This line represents the atmosphere. To be in scale, it must not be more than 1 millimetre thick. Ask the children what they especially notice about the size of the line. Come to the conclusion that compared with the Earth, the atmosphere is very thin. The children complete [Task 2](#) on the worksheet.

The atmosphere

Explain that the atmosphere keeps the greenhouse gases from escaping into space. Not all planets have an atmosphere; Saturn for example consists of gas and does not have a separate atmosphere. The children are going to carry out an experiment to see what effect an atmosphere has on a planet. Organise the children into groups of four. Give each group a number. Divide each group into pairs. Each pair will make a planet. Give the children the items they need and a marker pen to write their group number on the bottles and what each bottle represents. The children complete steps 1 to 6 on [Task 3](#) of the worksheet. They place their bottles on a sunny windowsill. After 15 minutes they complete [Task 3](#) on the worksheet.



Discuss the tasks. Come to the conclusion that the thermometer in the bottle 'Earth' shows a higher temperature. This is because the air in this bottle cannot escape, so it keeps getting warmer. The warm air in the bottle without an 'atmosphere' keeps coming into contact with cooler air, so it cools down again. This is why there is such a big difference between the minimum and maximum temperatures on a planet without an atmosphere. The heat is retained for longer on a planet with an atmosphere.



No atmosphere and no greenhouse effect 10 min.

The children answer the research question in [Task 4](#) on the worksheet. Discuss the tasks and come to the conclusion that we would not be able to live on Earth if there was no atmosphere and no greenhouse effect. Without an atmosphere the temperature differences on Earth would be too great. With an atmosphere but no greenhouse effect it would be too cold to live on Earth.



The greenhouse effect



In this experiment you will be answering the research question:

What are the consequences of the greenhouse effect on the temperature on Earth?

1 *The greenhouse effect*

a What is the greenhouse effect?



b What are the consequences of the greenhouse effect?

2 *Drawing of the atmosphere*



What do you particularly notice about your drawing of Earth with its atmosphere?

3 The atmosphere

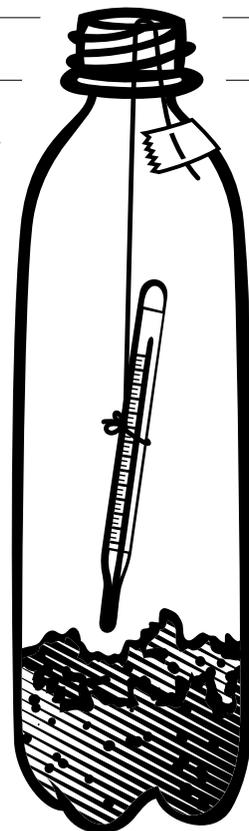
What do you need?

- 2 empty 1.5 litre bottles
- 2 thermometers
- thread
- soil
- water
- spoon
- funnel
- sticky tape

What do you need to do?

With your partner, make one planet Earth with an atmosphere and one planet without an atmosphere. Make both planets identical. For each planet:

- 1 Put the funnel in the mouth of the bottle.
- 2 Pour soil through the funnel until you have a layer a few centimetres thick in the base of the bottle.
- 3 Make the soil wet by adding 2 or 3 spoonfuls of water.
- 4 Now attach the string to the thermometer using sticky tape. Hang the thermometer in the bottle as shown in the drawing.
- 5 Tape the other end of the thread to the outside of the bottle, ensuring that the thermometer is hanging just above the soil.
- 6 Screw the lid onto the bottle that represents the



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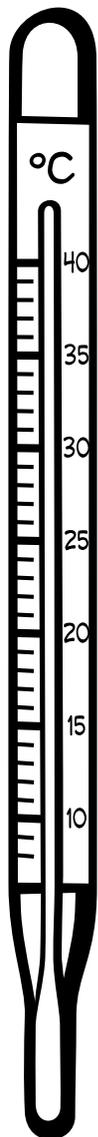
an atmosphere and the other planet does not. Write on each bottle which planet it represents and the number of your group.

7 After 15 minutes, read the temperatures shown on the thermometers.

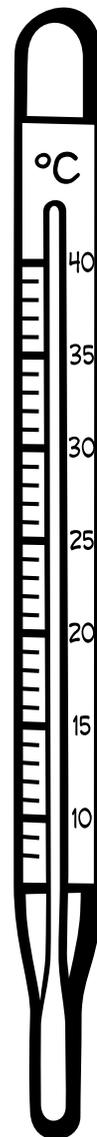
a Show the temperatures on the thermometers below.



**thermometer
Earth**



**thermometer
other planet**



→ **COLOUR**
the thermo-
meters to
the correct
temperature

b Why does one thermometer show a higher temperature?

4 No atmosphere and no greenhouse effect

a Answer your research question:

What are the consequences of the greenhouse effect on the temperature on Earth?



b Complete the following sentence: If the Earth did not have an atmosphere, then...

b What is the negative consequence of the greenhouse effect?