

## **B2 Inclusion: Greenhouse effect in a drinking cup – A model for illustrating climate change**

Look at the following Web links and then work through the experiment.

- Video (YouTube) [https://www.youtube.com/results?search\\_query=climate+change](https://www.youtube.com/results?search_query=climate+change)
- Results from Paris  
[https://en.wikipedia.org/wiki/2015\\_United\\_Nations\\_Climate\\_Change\\_Conference](https://en.wikipedia.org/wiki/2015_United_Nations_Climate_Change_Conference)

### **Developing a question**

What influence do the following factors have on the temperature in the container (model of a greenhouse):

- open/closed container?
- the color of the paper?

### **Planning the experiment**

#### **Apparatus and materials (hint 1)**

- Glass or plastic cup
- Cover (coaster)
- White and black paper
- Thermometer (digital)
- Iron nail
- Test tube clamp
- Scissors
- Light source

### **Investigative task: Measure the temperature in the cup.**

#### **Conducting the experiment (general notes)**

Time per experiment: 10 min.

For all subsequent experiments, make sure that external conditions remain the same.

### Conducting experiment 1 (hint 2)



Measuring the temperature in an open cup

- Conduct experiment 1 according to the picture.
- Write down the change in temperature (inside the cup) after every minute.

1 min.	2 min.	3 min.	4 min.	5 min.	6 min.
°C	°C	°C	°C	°C	°C

### Conducting experiment 2 (hint 3)



Measuring the temperature in a closed cup

- Conduct experiment 2 in the same manner as experiment 1 was conducted.
- Write down the change in temperature (inside the cup) after every minute.

1 min.	2 min.	3 min.	4 min.	5 min.	6 min.
°C	°C	°C	°C	°C	°C

### Conducting experiment 3 (hint 4)



Measuring the temperature in a closed cup with black paper

- Conduct experiment 3 in the same manner as experiment 2 was conducted.
- Write down the change in temperature (inside the cup) after every minute.

1 min.	2 min.	3 min.	4 min.	5 min.	6 min.
°C	°C	°C	°C	°C	°C

### Conducting experiment 4 (hint 5)



Measuring the temperature in a closed cup with white paper or aluminum foil

- Conduct experiment 4 in the same manner as experiment 3 was conducted.
- Write down the change in temperature (inside the cup) after every minute.

1 min.	2 min.	3 min.	4 min.	5 min.	6 min.
°C	°C	°C	°C	°C	°C

## Analyzing the observations

Compare the temperature changes of the four conducted experiments with each other.

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Discuss the results of your observations with a classmate.

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In experiments 1 to 4, light transports energy into the cup.

Describe the processes that led to the temperature change in the cup. (hint 6)

### Questions

How would you transfer your results from the experiment to the greenhouse effect?

The open cup is the Earth without...

The closed cup is the Earth with...

The white paper is the Earth's surface at...

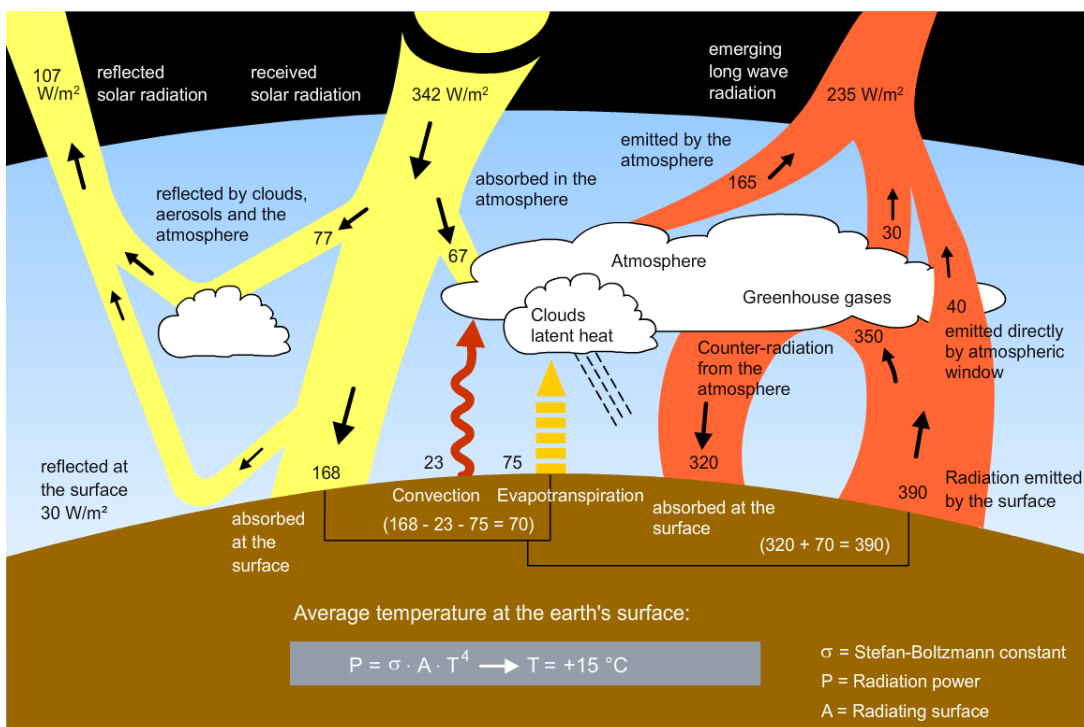
The black paper is the Earth's surface...

Describe the influence of greenhouse gases (hint 7) on the radiation of absorbed solar energy from the Earth back into space.

Compare the natural greenhouse effect and the greenhouse effect caused by people (hint 8).

You can use the following to answer the questions:

- the results of your measurements
- the following figure
- the explanation



The natural greenhouse effect

**Explanation:** The Earth's surface is warmed by solar radiation and emits the absorbed energy primarily as heat radiation. This is because air has very low thermal conductivity and the distance from the Earth's surface to the surface where the atmosphere meets space is very long (approx. 100 km). The stratification of the atmosphere also prevents heat dissipation beyond the cloud cover through convection.