

## Greenhouse Effect

### Purpose

Using “Borderless Lab 365” platform to study the Greenhouse effect by comparing the temperature changes inside gas domes with different CO<sub>2</sub> contents.

### Theory

- The atmosphere of Earth contains water vapour, carbon dioxide, methane, nitrous oxide, ozone and fluorinated gases that scientists refer to as greenhouse gases. Greenhouse gases absorb infrared radiation and trap the heat inside the atmosphere.
- General speaking, greenhouse effect is a natural process that maintains the earth’s temperature and supporting life. However, intensive human activities, including burning fossil fuels and clearcutting of forests, dramatically increase the greenhouse gases which trap additional Sun’s energy, causing excessive warm effect in our planet.
- In this experiment, we will demonstrate the ability of an intensified CO<sub>2</sub> atmosphere in absorbing additional heat as compared with a normal air atmosphere.
- A controlled experiment will be conducted using two glass domes. Additional CO<sub>2</sub> will be added into the normal air in the first glass dome as experimental setup, but in the second one only normal air will be used as a control. The 100W light bulb will be used as the heating source (similar to the Sun in nature) and the students will observe the temperature changes of the two glass domes. (Fig. 1)

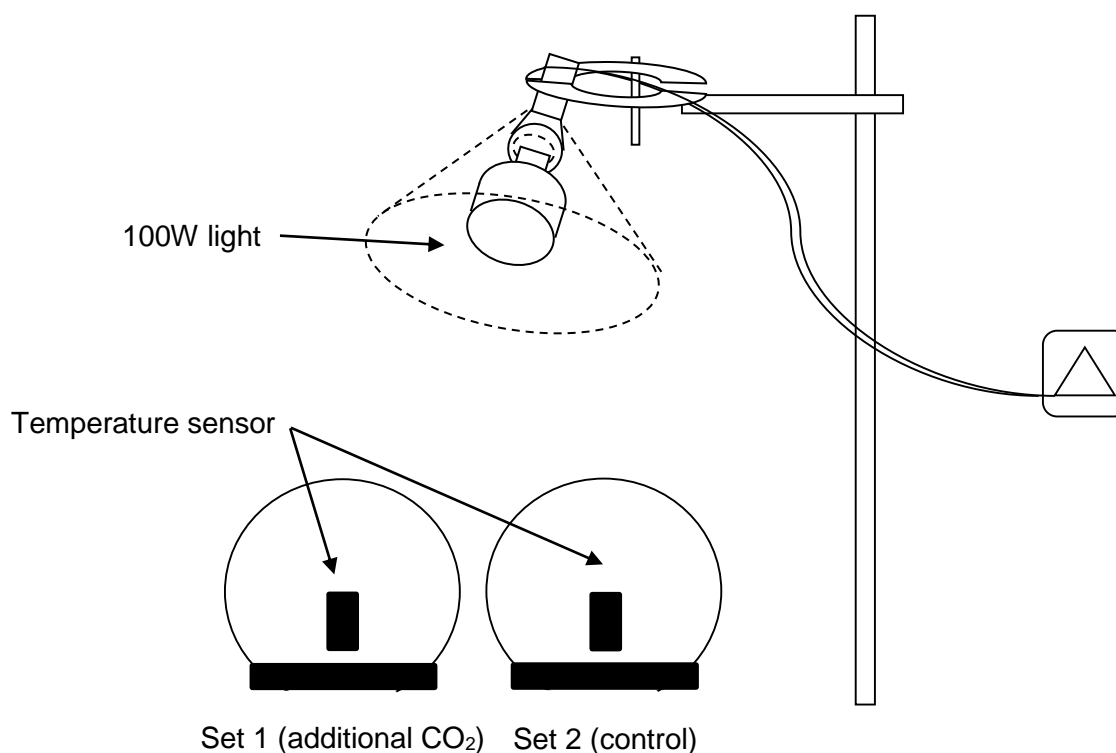


Fig. 1 Experimental setup to observe the greenhouse effect.

### Apparatus

- “Borderless Lab 365” Platform
- 2 glass domes inserted with temperature sensors
- 100W light bulb
- Air for Flushing out the gas domes (to reset the initial temperatures for the two domes)
- ADD CO<sub>2</sub> Pulse (to inject additional CO<sub>2</sub> gas into the first dome)

### Procedure

1. Log in the experiment module “Greenhouse” on the Borderless Lab 365 platform. <https://stem-ap.polyu.edu.hk/remotelab/>
2. Check the initial temperatures of the two glass domes. Press “On” under Flush on the right of the control panel to pump the fresh air to both sets and narrow the temperature difference between the two sets.
3. Press “Off” when temperatures of the two sets are nearly the same.
4. Press “ADD CO<sub>2</sub>” to pump a pulse of CO<sub>2</sub> into Set 1. Click once only and wait for couple seconds until CO<sub>2</sub> sensor responses. (Max. value 5000)
5. Press “On” under the Sun to turn on the light bulb and click “Start capture” to record the temperature change.
6. Measure the temperature rises for around 45 minutes.
7. Stop capture and Press “Export” to output the data.
8. Turn off the light bulb by pressing “Off” under Sun and Click “logout” to finish the experiment.

**Data:** From the graph, please obtain the temperatures for various intervals.

Time (mins)	Set 1 (Additional CO <sub>2</sub> ) Temperature / °C	Set 2 (Control setup) Temperature / °C	Temperature Difference / °C
Initial			
5			
10			
15			
20			
25			
30			
35			
40			
45			

### **Discussion**

1. Is the result of the experiment supporting the theory of greenhouse effect?
2. Why we need to narrow the temperature difference of the 2 sets before we start to measure?
3. What are the possible errors of the experiment?
4. Do you think greenhouse gases impacting you daily life? Why?