# Global Warming

1. Compare and explain the degree to which regular air and carbon dioxide-rich air absorb heat.

2. Understand the causes and impacts of global warming and explain possible solutions.

## Fundamental Concept

1. Global Warming

The main cause of global warming is the greenhouse effect. The greenhouse effect refers to the phenomenon where radiant energy from the surface of a celestial body (e.g., Earth) is absorbed by its atmosphere before escaping into space, causing the temperature to rise. The Earth's atmosphere acts like a greenhouse made of plastic, hence the name. When solar energy enters a greenhouse, most of it escapes, but some remains. The retained energy warms the greenhouse, allowing plants to grow.
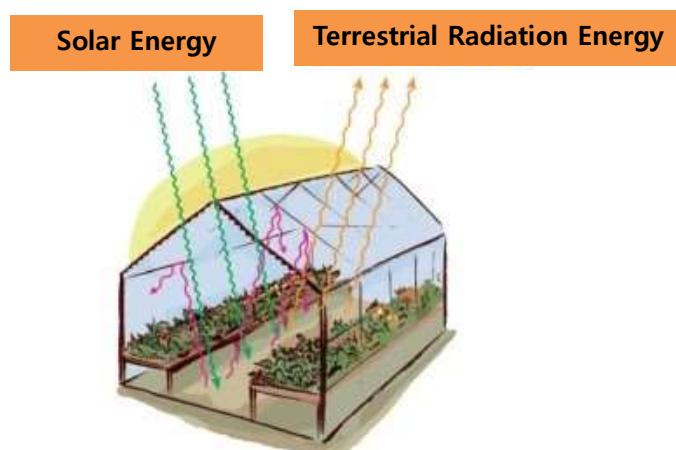
2. Causes of the Greenhouse Effect

Gases that cause the greenhouse effect are called greenhouse gases. These include carbon dioxide, water vapor, methane, chlorofluorocarbons (CFCs), and ozone. Carbon dioxide has the most significant impact on the greenhouse effect. As the use of fossil fuels like coal and oil increases, carbon dioxide emissions have surged, exacerbating global warming.

Greenhouse Effect
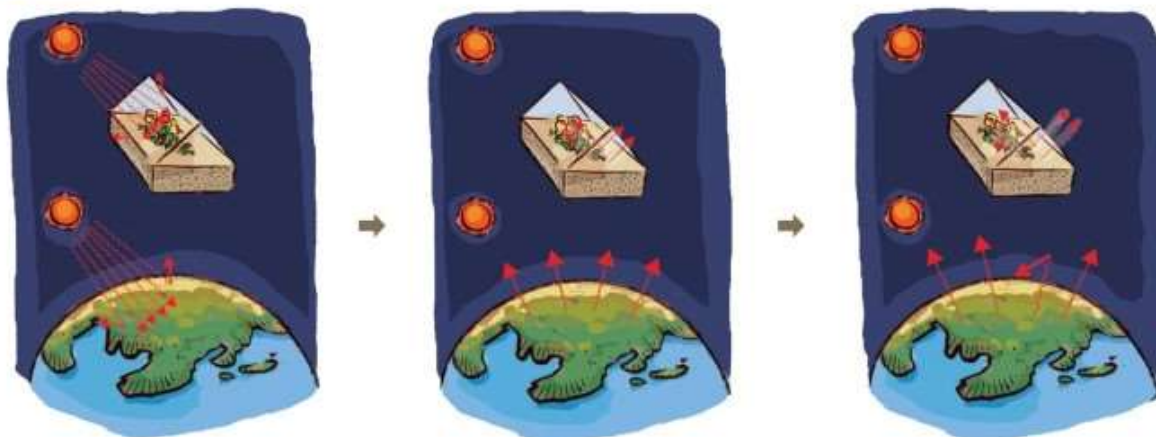
1. Some of the energy from the sun is reflected out by the atmosphere, but about 70% is absorbed by the atmosphere and the Earth's surface.

2. The energy that was absorbed by the Earth's surface is re-emitted from the Earth's surface.

3. Most of the energy emitted from the Earth's surface goes out into space, but some are absorbed or re-emitted by greenhouse gases, raising the temperature of the surface and the atmosphere.

Experiment

Materials Needed

Smart Sensor Box, Science# Program, Smart Device, Vacuum Chamber, Infrared Lamp (100W or more), Stand for Infrared Lamp, Calcium Carbonate (Limestone) 100 mg, 1M Dilute Hydrochloric Acid 100 mL, Paper Cup, Measuring Spoon

Preparation of Experimental Setup

1. Place the Smart Sensor Box inside the vacuum chamber..

2. Mount the infrared lamp on the stand and position it about 10 cm away from the vacuum chamber..

Interface Setup

1. Launch the Science# program.

2. Select 'Air Temperature' by pressing .

3. Set up the experimental environment as shown below, or use the automatic setting option.

Data Collection

1. Press to start data collection.
2. Turn on the infrared lamp to shine on the vacuum chamber while collecting data.

3. After 5 minutes of data collection, turn off the infrared lamp and open the vacuum chamber to cool the internal air.

4. Place 100 mg of calcium carbonate and 100 mL of dilute hydrochloric acid into a paper cup and place it inside the vacuum chamber.

5. Pump out the air from the vacuum chamber to increase the proportion of carbon dioxide inside.

6. After 10 minutes, quickly remove the paper cup and close the chamber..

7. - 현재 차트에 그래프 추가 Press to start data collection and simultaneously turn on the infrared lamp.

8. Turn off the infrared lamp after data collection to complete the experiment.

Data Analysis

Recording Data

1. Using an infrared lamp, heat regular air and carbon dioxide-rich air for the same duration. Compare the temperature changes inside the vacuum chamber and plot a time-temperature graph.

2. Complete the table below based on the data.

Condition	Initial Temperature	Final Temperature	Temperature Change

	(°C)	(°C)	(°C)
Regular Air			
Carbon Dioxide-Rich Air			

3. How does the increase in carbon dioxide in the Earth's atmosphere relate to global warming? Explain using the data.

Data Application and Extension Activities

1. What are the methods to confirm the production of carbon dioxide when calcium carbonate (limestone) reacts with dilute hydrochloric acid? Explain.

2. Having confirmed that carbon dioxide impacts the greenhouse effect, list methods to reduce carbon dioxide emissions in daily life.

Report
(For Teachers)

Report
(For Students)