



TYNDALL SCIENCE AT HOME

GREENHOUSE EFFECT: GREENHOUSE IN A JAR

AGES: 8 - 12

#Tyndall200

A national celebration to mark the bicentenary of John Tyndall, one of Ireland's most imaginative and influential scientists.

Take part by conducting this experiment at home. Take photos or make a video, and share it on social media using the hashtag **#Tyndall200**. You can also share photos or a 30-second video using our [online entry form](#). Either way you'll be entered to win a #Tyndall200 prize pack for science lovers!

BACKGROUND

The **Greenhouse Effect** is a process that happens when gases in Earth's atmosphere trap the Sun's heat. This process makes Earth much warmer than it would be without an atmosphere.

Some greenhouse gases are actually helpful and help keep the Earth's surface from getting too cold. The problem comes when pollution caused by human activities creates extra greenhouse gases. Burning fossil fuels like coal and oil puts more carbon dioxide into our atmosphere. The carbon dioxide released into the atmosphere during burning acts like an invisible blanket, trapping heat from the sun and warming the Earth.

The Greenhouse Effect was first proven in the 1800s by scientists including **John Tyndall** and **Eunice Foote**, an American scientist. Their experiments showed that different gases absorb different levels of heat. Greenhouse gases such as **carbon dioxide** stay in the atmosphere for a long time. Although plants and the ocean absorb carbon dioxide, they can't keep up with all the extra carbon dioxide that people have been releasing.

The amount of carbon dioxide in the atmosphere has been increasing over time, which has resulted in the warming of our climate.

THE EXPERIMENT

The below experiment shows you how a greenhouse works. In this outdoor experiment, we are going to test what happens to the temperature in a covered glass container on a sunny day.

YOU WILL NEED:

- A clear container (large jar or 2L plastic bottle)
 - A pencil
 - A sunny area outside
 - Stopwatch on phone or a clock
 - 2 thermometers (indoor/outdoor type)
- You can find **indoor/outdoor thermometers** in your local hardware or garden store or online:
- [Amazon](#)
 - [Lenehans](#)
 - [HandyHardware.ie](#)

WHAT TO DO:

- 1 On a sunny day put both thermometers in direct sunlight outside and leave them there for 3 minutes.
- 2 After the three minutes have passed, read and record the time and thermometer temperatures of each above the table below.
- 3 Put one of the thermometers into the jar or container and close the lid.
- 4 Make sure there is no shadow on either thermometer as this might affect the reading.
- 5 Record the temperature of the thermometers every minute for half an hour.
- 6 Discuss how the container affected the temperature of thermometers:

*How did the temperature inside the container change compared to outside the container? Did it **increase, remain the same, or decrease?***



NOTE:

Due to the Irish weather, it might take some time to notice a change in temperature between the two thermometers. Why not repeat the experiment for longer time periods and see if the difference increases?

OBSERVATIONS:



The thermometer outside of the container is being exposed to air that is constantly changing temperature. The air inside the container is trapped and can't mix with the cooler surrounding air so it just gets warmer as the sunlight heats it up which increases the temperature on the thermometer. This experiment shows you how a greenhouse works. A greenhouse is full of windows that let in sunlight. That sunlight creates warmth. The big trick of a greenhouse is that it doesn't let that warmth escape.

That's exactly how greenhouse gases act. They let sunlight pass through the atmosphere, but they prevent the heat that the sunlight brings from leaving the atmosphere which is what makes our planet warmer. Although some greenhouse gases are good and keep our planet from becoming too cold, too many of them can increase the temperature of the planet too much and upset the balance of the Earth.

EXPERIMENT NOTEBOOK

SCIENTIST NAME: _____ AGE: _____ DATE: _____

BEFORE EXPERIMENT: TEMPERATURE OF **THERMOMETER A** AFTER 3 MINS:

TEMPERATURE OF **THERMOMETER B** AFTER 3 MINS:

| TIME IN MINUTES | TEMPERATURE OF THERMOMETER A IN SEALED CONTAINER | TEMPERATURE OF THERMOMETER B OUTSIDE CONTAINER |
|-----------------|---|---|
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |
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| 7. | | |
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| 29. | | |
| 30. | | |

EXPERIMENT CONCLUSIONS

One thing I learned was:

If I was doing this experiment again, I would try/use....

ADDITIONAL EXPERIMENT



Try the same experiment indoors with the thermometers on the window.
Do you see the same differences in temperature?



DID YOU KNOW?

The instruments and techniques that John Tyndall invented have been crucial in creating new branches of climate science, including the areas of Energy Policy and Modelling, Atmospheric Chemistry, Environmental Engineering and Attribution of Extreme Weather events, all of which are the focus of research projects here in the Environmental Research Institute in UCC.

The instrumentation derived from John Tyndall's work includes sensors used to study invisible infra-red radiation and the transmission of light. One of the most direct connections that our research has with John Tyndall's early findings is in the area of modelling of Greenhouse gas fluxes from Grasslands and a Peatland in Ireland.

In Ireland, approximately 14% of our total national greenhouse gas emissions from human activities are accounted for by emissions from agriculture. As a result agricultural greenhouse gas emissions (CO₂, N₂O and CH₄) are a very important area of scientific investigation. If we can understand the mechanisms of generation in agricultural lands, we may be able to recommend measures to control these emissions and reduce national greenhouse gas emissions.



John Tyndall (1820 - 1893) was one of Ireland's most successful scientists and educators. Born in Leighlinbridge, County Carlow, he reached the pinnacle of 19th century science. His major scientific interest was the interaction of light with matter, and he is most widely known for the explanation of why the sky is blue. Tyndall National Institute, Ireland's leading ICT research institute, is named in recognition of his work.