Title: Ellie learns about global warming

Children explore how greenhouse gases warm our planet through practical models inspired by Ellie the Climate Champion.

Objectives

By the end of the activity, children will be able to:

- know that global warming is when the Earth's temperature increases slowly over many years.
- recognise that we need some greenhouse gases surrounding Earth to make sure that the temperature stays warm enough for living things to survive.
- carry out a practical enquiry to model the effect of greenhouse gases on Earth.
- take accurate measurements using standard units using a range of equipment, including thermometers and data loggers.
- recognise that human actions can increase greenhouse gases and suggest ways we can all help to reduce global warming.

Science vocabulary

- global warming - when the Earth's temperature increases slowly over time.
- climate - the usual pattern of weather in a certain place over many years.
- greenhouse gases - gases in the air that trap heat from the Sun and make Earth warmer than it would be without them.
- temperature - a measure of how hot or cold something is.

Resources

per class

- *Ellie the Climate Champion* (ABPI) story book or website.
- *globe (if available)*

per group of 4 children working together (or for teacher demonstration)

Option 1

- x1 recycled transparent jam jar (or similar made from hard plastic, e.g. Perspex)
- x1 ruler or tape measure
- x1 thermometer or data logger with an external temperature sensor
- x1 pair oven gloves
- x1 timer or stopwatch
- approximately 70 cm x 10 cm piece of recycled bubble wrap from used packaging
- x1 elastic band
- Activity Sheet 1a – Data recording

Option 2

- X2 small identical transparent plastic drinks bottles (recycled) with lids
- x1 1000ml jug of warm water (no hotter than 50 °C)
- enough bubble wrap from used packaging (pre-cut) to wrap around one bottle 5 times
- x2 thermometers
- x1 timer or stopwatch
- cotton wool or kitchen roll (enough to seal the opening of one plastic bottle)
- x1 small tray if available
- Activity Sheet 1a – Data recording

Note: It might take a while to collect enough jars/bottles for whole class participation so begin collecting early and involve your class/school. Ensure that all objects and materials can be re-used or recycled again at the end of the practical activities.

Safety guidance

- Water must be no hotter than 50 °C and handled carefully to avoid spills.
- Children holding jars in place during the hair dryer demonstration must do so at a safe distance (at least 30 cm) and wear oven gloves.
- Only use hair dryers on a low setting.
- Supervise all use of electrical equipment such as hair dryers.
- Electrical equipment must be PAT tested and kept away from water at all times.
- Do not drink water that has been heated.
- Supervise children closely when handling thermometers.

Prior knowledge / experience

Children should:

- understand that the Sun gives Earth light and warmth.
- be familiar with how to measure temperature with a thermometer and temperature sensor.
- have experience of making and recording simple observations and measurements using different types of science enquiries.

Top tip

Encourage children to work in teams with clear roles. You could use these role badges from CIEC. Giving each child a specific responsibility keeps everyone involved and helps practical enquiries run smoothly and safely in a busy classroom environment.

Activity notes

Introduction (10 mins)
Read or watch *Ellie the Climate Champion*. Focus children's attention on the **text on page 1**

(0:07 video): "Before bedtime she saw on the television that **global warming** is harming the planet." Ask children if they have heard of the phrase *global warming* and to share any ideas they may have about what this means.

Explain that scientists take regular measurements of the **temperature** in different places on Earth. These measurements show that there has been an unusual increase in the temperature of Earth's surface over the last hundred years. Explain that this warming of our planet has become known as global warming. Note: You could introduce 'globe' as another word for Earth and show the children a globe if one is available.

Reference to **page 2 of the story (0:23 video)** when Ellie says, "the **climates** are changing," and explain that this means that the usual patterns of weather, including Earth's average temperature, are changing over many years to gradually become warmer.

Ask children to suggest their own ideas for why they think the temperature on Earth is increasing. They should consider whether human actions might be causing this. Children should record their initial ideas informally for later reference.

Practical enquiry (up to 50 min)

Explain that Earth is the only planet we know of that is the right temperature for plants and animals, including humans, to live. For this reason, it is often called the Goldilocks planet – not too hot and not too cold. This is because Earth has a layer of invisible gases around it. Some of these gases trap heat from the Sun, which helps keep Earth warm.

Explain that this layer of gases works in a similar way to a greenhouse, trapping warm air from the Sun, so the temperature on the inside of a greenhouse is warmer than outside to help sensitive plants grow and stay healthy. Explain that some of the gases that surround Earth are called **greenhouse gases** because they help to keep Earth warmer than it would be without them, like a greenhouse.

Tell children that they are going to use a model to help them understand the effect of greenhouse gases on the temperature of Earth. They can do this in a number of ways, for example:

Option 1: could be done by groups of children or as a teacher demonstration.

Use a recycled transparent jar with no lid to represent Earth. Explain that the material of the jar represents a suitable layer of greenhouse gases surrounding Earth. Place the jar horizontally on a work surface and carefully blow warm air from a hair dryer, on a low setting, into the jar. This must be done from a safe distance at least 30 cm. The warm air represents heat from the Sun. The person keeping the jar in place should wear oven gloves to protect their hands from the warm air. As an alternative, you may prefer to shine a desk lamp onto the jar for a longer observation over time enquiry.

Measure and record the change in temperature of the air inside the jar over 30 seconds using a temperature sensor attached to a data logger inserted into the jar (or a thermometer can also be used).

Example set up for global warming model option 1 (part 1)

Repeat this activity using a jar wrapped in three layers of recycled bubble wrap (secured with an elastic band) to represent additional greenhouse gases surrounding Earth. Activity sheet 1a has been provided as an example of how children may decide to record the data collected.

Example set up for global warming model option 1 (part 2)

Option 2

Each group will use two identical recycled transparent bottles filled with water at 50 °C:

Bottle 1: to represent Earth with greenhouse gases surrounding it.

Bottle 2: five layers of recycled bubble wrap around the bottle to represent additional greenhouse gases surrounding Earth.

Children will measure and record the change in temperature of the water in both bottles over 30 minutes. They could do this using a small thermometer inserted into each bottle. Children

could seal the opening to bottle 2 using kitchen roll or cotton wool so that the top of the thermometer can pass through as required. Ensure that children fill both bottles with enough water, so they do not need to lift the thermometer out of the water to read the scale.

Example set up for global warming model option 2

Children should measure and record the same starting temperature of the water in both bottles, and then again, every five minutes for at least thirty minutes.

Activity sheet 1a has been provided as an example of how children may decide to record the data they collect.

Children measuring the temperature of water in both bottles over time

The practical aspects of this lesson provide opportunities for children to practise skills such as accurate measurement using a thermometer, setting up simple practical enquiries, recording and interpreting results. Discuss why some children may have discrepancies in their results, and how these could be due to inaccurate thermometer reading. Children should discuss how they might improve their investigation, for example: a child may have placed their hands around one bottle, and this may have affected the temperature reading. Similarly, a child may have spilt water from one bottle, and this could be why the results were different to what they predicted.

Knowledge development (30 min)

Children should review the data they have collected and discuss how the model they used illustrates that as the number of layers representing greenhouse gases around Earth increases, more heat becomes trapped, causing the planet's temperature to rise gradually. It is important

to talk with children about the limitations of using models. In the activity suggested for option 2, they will have observed the water cooling down over time, whereas in reality global warming refers to the Earth's overall temperature increasing. This discussion helps children understand that models are simplified representations used to explain scientific ideas and do not always mirror real-world processes exactly.

Return to children's initial suggestions for why global warming might be happening. Explain that scientists suggest this is because there are now more greenhouse gases surrounding Earth due to some ways in which humans are living today.

Discuss how one of the things humans are doing more than ever is using devices powered by electricity. This can be a problem because most electricity comes from power plants that burn coal, oil or gas. Explain that the more electricity we use, the more of these fuels we need to burn. This is a problem because when these fuels burn, they make greenhouse gases which go up into the air.

Ask children to look again at the results of their practical enquiries. Discuss how more greenhouse gases surrounding Earth means that more heat from the Sun becomes trapped and, over many years, the temperature of the whole planet increases.

Children could decide for themselves how to record what they have learned about global warming, greenhouse gases and human action. They should consider what small changes they could make at school and at home, such as turning off lights when they leave a room, unplugging chargers and electronic devices when not in use and turning off televisions and computers instead of leaving them on standby. Discuss how even small actions make a big difference when everyone works together.

Questions for thinking

Use these questions to encourage discussion and check understanding:

- What does *global warming* mean to you?
- How are greenhouse gases around Earth similar to how a greenhouse works?
- What happens if too much heat from the Sun is trapped by greenhouse gases?
- Just like Ellie, what can you do to make a difference to help reduce global warming?

Taking it further (at home or school)

Challenge yourself to switch off unused lights and electrical devices every day. Explain to your friends and family what small difference this will make to helping to reduce global warming.

Talk to a partner and try to explain these extracts from Ellie's story:

- "Electricity adds harmful gases to the Earth, and this causes global warming, so electricity shouldn't be wasted." (**page 5, 1:33 video**)
- "Trees take in the same gas that is making the Earth hotter so we must look after all the trees around the world." (**page 10, 3:23 video**)
- "Cars also add greenhouse gases to the atmosphere so we should walk to school tomorrow." (**page 12, 4:28 video**)

Background information for teachers

Information to increase teachers' knowledge about climate change and global warming can be found here on the ABPI website. This information is not suitable for sharing with primary-aged children.

Industry links and ambassadors

- Find out about the work of certain types of scientists who study how Earth's climate is changing and how to protect the planet. You could start by researching the role of an environmental scientist.
- Contact a local energy company to find out how they might encourage people to turn off lights, use energy-saving bulbs and fit smart meters so families and schools can monitor how much electricity they use and try to use less.
- Try to find out what laws, rules or targets have been set by the Prime Minister of England or MPs in your local area to aim to reduce electricity use, greenhouse gases and global warming.

ACTIVITY SHEET 1a: Data recording

You can record the data you collect using one of the tables provided below. However, you may have your own ideas.

OPTION 1

	START temperature of air inside the jar (°C)	END temperature of air inside the jar (°C)	Difference in temperature of air inside the jar (°C)
jar without bubble wrap			
jar with bubble wrap			

OPTION 2

	Temperature of water in °C taken every five minutes						
	start	5	10	15	20	25	30
bottle 1 (no bubble wrap)							
bottle 2 (five layers of bubble wrap)							