

SESSION 1: WHAT IS CLIMATE CHANGE?

Age range: 11–14 years

Outline Learners will first explore their existing ideas about climate change. They will then carry out a practical activity to reinforce their understanding of what the greenhouse effect is. Finally, learners will use secondary sources of information to develop their knowledge and understanding about climate change.	
Learning objectives <ul style="list-style-type: none">• To recognise the difference between climate and weather.• To know that the Earth's climate is changing and that human activities are contributing towards this change.• To understand how the greenhouse effect works and the role of carbon dioxide as a greenhouse gas.	Learning outcomes <ul style="list-style-type: none">• Learners will develop their knowledge and understanding about climate change.• Learners will be able to explain the results of an experiment that helps them to understand what the greenhouse effect is.• Learners will share their knowledge and understanding about climate change with others.
Key questions <ul style="list-style-type: none">• What do I know about climate change?• What is the difference between climate and weather?• What is climate change?• What is the greenhouse effect?• What is the role of carbon dioxide in the greenhouse effect?	Resources <ul style="list-style-type: none">• Climate challenge A slideshow: slides 2–8• Activity sheet 1: The greenhouse effect in a jar

Curriculum links		
<p>England KS3 Science Working scientifically Pupils should be taught to:</p> <ul style="list-style-type: none"> • make predictions using scientific knowledge and understanding. • interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions. <p>Biology: Interactions and interdependencies Relationships in an ecosystem</p> <ul style="list-style-type: none"> • Pupils should be taught about how organisms affect, and are affected by, their environment, including the accumulation of toxic materials. <p>Chemistry: Earth and atmosphere</p> <ul style="list-style-type: none"> • Pupils should be taught about the production of carbon dioxide by human activity and the impact on the climate. <p>KS3 Geography Human and physical geography</p> <ul style="list-style-type: none"> • Pupils should be taught to understand how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems. 	<p>Wales Science: Enquiry</p> <ul style="list-style-type: none"> • Pupils should be given opportunities to carry out different types of enquiry- planning, developing and reflecting. <p>Developing number</p> <ul style="list-style-type: none"> • Learners develop their number skills across the curriculum by using mathematical information, calculating, and interpreting and presenting findings. <p>ESDGC: Climate Change</p>	<p>Scotland Sciences</p> <ul style="list-style-type: none"> • I can explain some of the processes which contribute to climate change and discuss the possible impact of atmospheric change on the survival of living things. SCN 3-05b • Through exploring the carbon cycle, I can describe the processes involved in maintaining the balance of gases in the air, considering causes and implications of changes in the balance. SCN 4-05b <p>Social Studies</p> <ul style="list-style-type: none"> • I can investigate the relationship between climate and weather to be able to understand the causes of weather patterns within a selected climate zone. SOC 3-12a

Activity 1.1 (20 min)

Climate change board race

- Show slide 3 and explain briefly what a board race is. A board race is run like a relay with the person at the front of each team running up to the board or piece of paper and writing something related to the question or topic. As soon as they have written something they run back to their team and hand the pen to the next person in line and then head to the back of the queue. The next person then has a go but they must not repeat anything that is already written on their group's board or piece of paper. The process is repeated until the time is up.
- Tell learners that the topic for this race is 'Climate change' and that you will give them five minutes to get as many ideas on their paper or board as possible. Organise learners into equal groups of four to six and line them up in front of a piece of paper (or a section of whiteboard) for each group with the topic 'Climate change' written at the top. Give the first person in each group a pen or pencil.
- If there is insufficient space to run a board race you could carry out a similar activity with groups staying at their tables and learners passing around a pen or pencil to take turns to write on a piece of paper.
- At the end of the race, ask learners to sit down. Count the number of answers for each team.
- Feedback the range of ideas focusing on any themes which emerge.
- Congratulate learners on how much they already know and emphasise that they will be building on their knowledge and understanding about climate change during the session (and any subsequent sessions).

Differentiation

- Make it harder: Make the groups smaller.
- Make it easier: Buddy up learners, with one person writing and the other giving ideas.

Activity 1.2 (Up to two hours)

The greenhouse effect in a jar

Source: This activity is based on one in 'Climate Chaos' (WWF 2005), which can be downloaded from: assets.wwf.org.uk/downloads/climate_chaos_info_pack.pdf

You will need an outside space and a sunny day for the following activity.

- Use slides 4 to 6 to explain the difference between climate and weather, what the greenhouse effect is and why the climate is getting warmer.
- Explain that we can use a glass jar to show the principle of the greenhouse effect. Display slide 7 which shows two thermometers, one in a glass jar and one in the open air. Explain to learners that glass acts like carbon dioxide in the atmosphere by trapping infra-red radiation emitted by the sun. Please note that this is a simplified explanation of the process for a younger audience.
- Ask learners to use their existing knowledge, understanding and experiences to predict what will happen to the temperature on each thermometer shown in slide 7 over time.
 - Do you think the temperature will always be the same on both thermometers at any given time?

- What do you predict will happen to the temperature over time on each thermometer?
- Why do you think this?
- Explain that learners are going to try this experiment (alternatively you could do this as a whole-class demonstration). Ask learners to set up (or set up at the front) two thermometers close to a filament bulb. Do not use a fluorescent bulb as it emits less heat. One thermometer should be placed inside a glass jar and the other thermometer should be in the open air. A diagram of the experimental set-up is provided on slide 8.
- Safety note: Ensure learners take care when handling glass jars to minimise the risk of breakage and possible injury.
- Discuss with learners how they should set up the experiment:
 - What should be kept the same for both thermometers?
 - How will you measure the results?
 - What do you predict will happen to the temperatures of the thermometers?
- Check that learners position the bulb so that it is equidistant from each thermometer, and that they measure the temperature change on each thermometer for the same length of time.
- Learners should then turn on the bulb and measure the change in temperature at intervals, such as 30 seconds or one minute, for 10–15 minutes. Ask learners to record their results using a table and line graph.
- At the end of the time period, ask learners to compare the temperature change for each thermometer.
 - What did you find?
 - Why do you think this happened?
 - Were your predictions correct?
- Recap on what learners found out about climate change in slides 4 to 6. Explain that gases such as carbon dioxide have a similar effect on the Earth's temperature as the glass jar had on the thermometer. This is why the global warming caused by the emissions of gases such as carbon dioxide is called the 'greenhouse effect'. The greenhouse effect is important for us as it has made the Earth warm enough to support life. However, human activity is making the layer of 'greenhouse gases' thicker and the Earth is getting hotter. Scientists are predicting many negative impacts as a result of these changes in temperature and people around the world are already being affected.

Differentiation

- Make it easier: Learners could use the templates provided on The greenhouse effect in a jar (Activity sheet 1), to record their results.

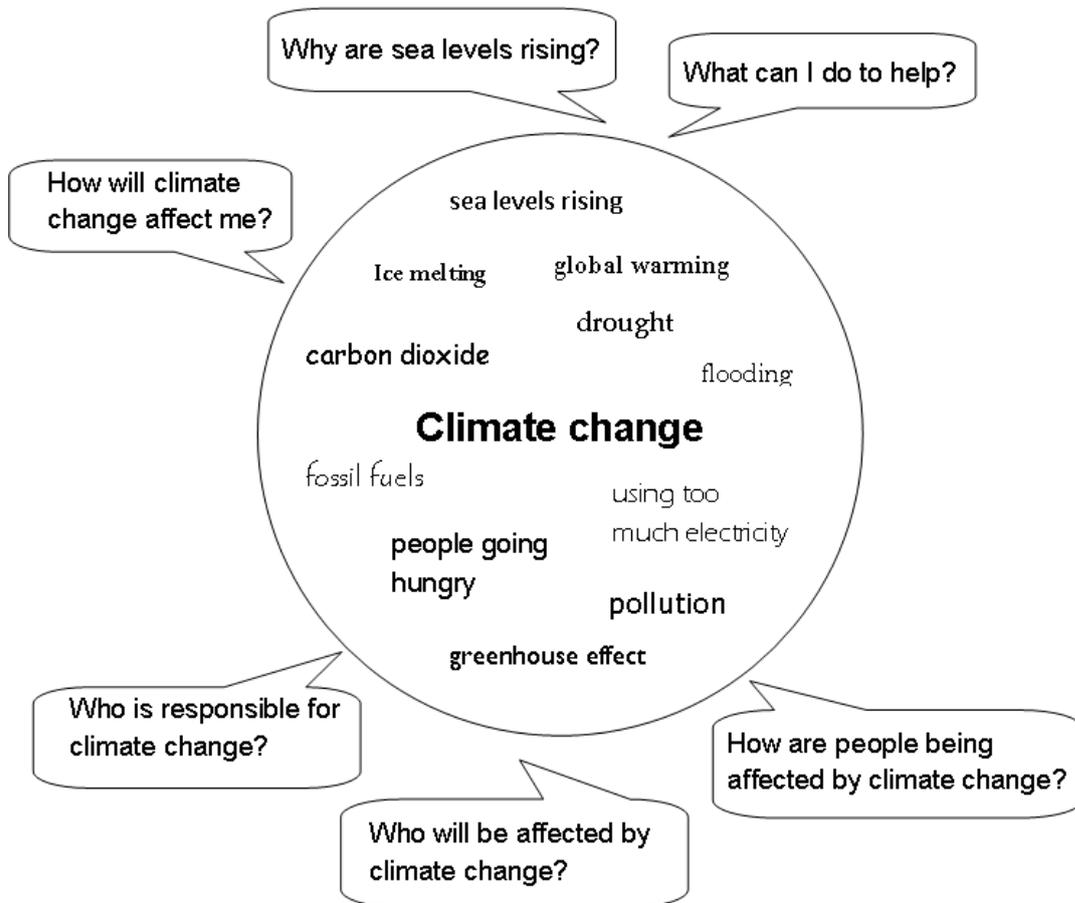
Activity 1.3 (30 min+)

What do you understand about climate change?

- Draw an outline of the Earth on a large piece of paper and write 'Climate change' in the middle. Learners could write anything they have found out about climate change or words related to climate change inside the Earth. Display the earth in a prominent place in the classroom and

encourage learners to add to it as they go through their climate change learning journey.

- Any questions that learners have about climate change could be written outside the Earth. Discuss how learners might find out the answers to these questions.
 - What information sources could you use?
 - What support might you need?
- Ask learners to use secondary sources of information to find out more about what climate change is. Explain that the learners should focus on the science around climate change. Tell them that they will be finding out more about the causes and impacts of climate change, as well as potential solutions, in subsequent sessions.
- The following web links might be useful:
 - www.metoffice.gov.uk/climate-guide
 - climatekids.nasa.gov
- Learners could add the findings from their research inside the Earth.



Further ideas

- Use Activity 1.2 as an opportunity to explore working scientifically in more detail by allowing additional time for learners to design and carry out the experiment themselves.
 - Discuss what factors or variables might affect the extent to which the glass jar influences the temperature. Possible factors include: the volume of the jar, the gases inside the jar, the thickness of the glass, or the colour or translucency of the glass.
 - Introduce a third jar into the experiment where learners vary one of these factors. Remind learners of the importance of changing only one variable and ask them what they will do to ensure that all the other variables are kept constant. Learners could pour a small, equal volume of water into each jar and add an effervescent tablet to the water in one of the jars. This will produce more carbon dioxide in one of the jars compared to the 'normal' air in the other jar (simulating the greenhouse effect).
 - Ask learners to decide how to record and present their results, for example using a line graph.
 - Learners could use digital thermometers to enable them to plot the results electronically.
- Learners could investigate microclimates within the school grounds. Ask learners to collect and compare weather data over a period of time from different parts of the school, such as near to and far away from a building or from areas with north and south facing aspects.

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The greenhouse effect in a jar

Activity sheet 1

Use the table and graph below to record your results.

Time	Temperature – No jar	Temperature – Glass jar

