

## Module 1: 'Climate Change nuts & bolts' (Climate Change Science)

### KS3 - Scheme of Work

**Overview:** This Module is designed to use creative methods in providing a solid understanding of the core concepts of climate change science. Pupils will evaluate scientific fact and key climate change science concepts using different forms of media and experiments, and evaluate how to best communicate the sometimes complex principles of climate change science in a creative and engaging way.

**Most children will:** understand the key concepts of climate change science and be able to express their understanding in their own words; contribute to a team-developed production and presentation; and critically assess how a variety of communications methods portray the scientific facts accurately and in an engaging way.

**Some children will not have made so much progress and will:** understand most of the key concepts of climate change science and be able to express some of the scientific processes in their own words; contribute to a team presentation; identify different devices which may be used to communicate the science in an interesting way.

**Some children will have progressed further and will also:** begin to understand how misconceptions in the science of climate change may arise, and how these misconceptions may contribute to various attitudes and behaviours about climate change.

| Learning Objectives   | National Curriculum Links & Cross Curricula  | Key Resources:   |
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| <p>To decide whether evidence is good enough to answer a question.</p> <p>To evaluate a range of presentation styles or methods used to convey scientific principles.</p> <p>To understand the role of CO<sub>2</sub> in the atmosphere.</p> <p>To understand how the greenhouse works and that it is natural (and a requirement for life on Earth).</p> <p>To understand that adding CO<sub>2</sub> to the atmosphere through human activities leads to an enhanced greenhouse effect.</p> <p>To use secondary sources to answer scientific questions.</p> | <p>Geography - weather and climate, including the change in climate from the Ice Age to the present - understand how human and physical processes interact to influence the climate</p> <p>Science – Chemistry the production of carbon dioxide by human activity and the impact on climate</p> <p>English - Discussion of effectiveness of “video clips”; write a script for a documentary-style drama; write a critical review of the performances.</p> <p>Art &amp; Design - Create an advertising poster, create a 3-D craft model of the greenhouse effect and global warming.</p> <p>Drama – Produce and deliver a documentary-style drama regarding key climate change concepts.</p> <p>Music - Create a “theme” tune for the documentary.</p> <p>History - Has climate change happened before?</p> <p>Maths - Collect and use data of greenhouse effect experiment and online surveys.</p> | <p>Internet access<br/>Digital Projector<br/>Experiment resources<br/>Video Camera<br/>Camera</p> <p><b>ICT/Internet usage is encouraged in this Module, so it may be helpful to book access in advance; otherwise may print relevant website pages and disseminate to students.</b></p> <p><b>Overall Outcome:</b></p> <p>Students will use a variety of methods to obtain a firm grounding in understanding:<br/>(1) The difference between climate change and global warming.<br/>(2) That climate change has happened before.<br/>(3) That climate change is natural, but the rate of change at present is unprecedented, and that this rate of change is linked to human activity.<br/>(4) That the ozone layer does not cause global warming, and that environmental concerns over the hole in the ozone layer is a critical but separate issue.</p> |
| <p>To use creative methods to effectively communicate the complexity of climate change science.</p> <p>To evaluate the effectiveness of creativity to engage a wide audience on the principles of climate change science.</p>   | <p><b>Vocabulary:</b></p> <p>Words related to climate change:<br/>carbon dioxide (CO<sub>2</sub>)<br/>greenhouse gases<br/>greenhouse effect<br/>ozone layer<br/>global warming</p>  | <p><b>Assessment:</b></p> <p>Can students communicate an effective understanding of the key concepts of the nuts &amp; bolts of climate change science?</p> <p><b>Unit Extension:</b></p> <p>Use the online surveys to monitor and evaluate both pupil and school staff understanding, attitudes and behaviours on climate change.</p> <p><b>*For G&amp;T students:</b> see <a href="http://www.rsc.org/Education/Teachers/ClimateChange/index.asp">http://www.rsc.org/Education/Teachers/ClimateChange/index.asp</a> (Royal Society of Chemistry Climate Change resource for a wide variety of climate change science activities).</p>  |



| Learning Objectives   | Key resources   | Suggested Activities  | Cross-curricular & other           | Outcomes  | Extension(s)   |
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| <b>(1) Climate change science – the core principles</b>   |   |   |                                    |   |  |
| <p>To decide whether evidence is good enough to answer a question.</p> <p>To evaluate a range of presentation styles or methods used to convey scientific principles.</p> | <p>Computer/internet/projector (for teacher)</p> <p>Computers and internet<br/>Secondary sources</p> <p>Discovering Antarctica – excellent range of climate change resources e.g. polar regions, climate change, ice cores etc.<br/><a href="http://www.discoveringantarctica.org.uk/3a_climate.php">http://www.discoveringantarctica.org.uk/3a_climate.php</a></p> <p>The Pod 'Degrees of Change' activity (KS3) from <a href="http://jointhepod.org/resources/resource/31">http://jointhepod.org/resources/resource/31</a> but you will need to register on the site first to access the materials</p> <p>Information about the ozone layer (and how separate environmental issue) e.g.<br/><a href="http://www.bbc.co.uk/news/science-environment-12969167">http://www.bbc.co.uk/news/science-environment-12969167</a></p> <p>Documentaries:<br/><a href="http://www.imdb.com/title/tt0268380/trailers-">http://www.imdb.com/title/tt0268380/trailers-</a></p> | <p>- Play 'Global Warming' film<br/><a href="http://www.nationalarchives.gov.uk/films/1979to2006/filmpage_climate.htm">http://www.nationalarchives.gov.uk/films/1979to2006/filmpage_climate.htm</a></p> <p>And <a href="http://www.tes.co.uk/teaching-resource/Climate-Change-The-Causes-6046533">http://www.tes.co.uk/teaching-resource/Climate-Change-The-Causes-6046533</a> (very helpful Teacher's TV film clip – note: it is ~13 mins long, so may be worth breaking up into sections for discussion and/or note-taking/vocabulary etc.)</p> <p>Quick discussion about climate change and global warming – what are the main issues? What do they think are the scientific 'myths' or uncertainties surrounding the issues?<br/>- Collate these ideas for reference later (use in lesson 4).</p> <p>- Explain that in small groups, pupils will be looking at different documentaries (listed in resources column) to <b>decide if they answer the following 4 questions:</b></p> <ul style="list-style-type: none"> <li>• What are climate change and global warming?</li> <li>• Has climate change happened before?</li> <li>• Is climate change natural or man made?</li> <li>• What are the ozone layer and the greenhouse effect, and which gases are linked to global warming?</li> </ul> <p>- <b>They will also need to consider whether there is a difference in presentation styles between documentaries, and whether the evidence is reliable or not.</b></p> | <p>ICT<br/>English<br/>Science</p> | <p>Understand the key concepts and issues of climate change.</p> <p>Evaluate scientific facts and issues, and evaluate scientific reliability.</p> <p>Explain how they used the evidence to answer questions.</p> | <p>Debate some of the attitudes described about climate change misconceptions provided by<br/><a href="http://royalsociety.org/policy/projects/climate-evidence-causes/">http://royalsociety.org/policy/projects/climate-evidence-causes/</a></p> <p>And explore how these attitudes may be encouraged more positively to do something proactive about climate change.</p> |



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|  | <p><a href="http://www.imdb.com/title/tt0438097/trailers-screenplay-vi2125332761">screenplay-vi2125332761</a></p> <p><a href="http://www.imdb.com/title/tt0438097/trailers-screenplay-vi59834649">http://www.imdb.com/title/tt0438097/trailers-screenplay-vi59834649</a></p> <p><a href="http://www.bbc.co.uk/learningzone/clips/causes-of-climate-change/1491.html">http://www.bbc.co.uk/learningzone/clips/causes-of-climate-change/1491.html</a></p> <p><a href="http://www.youtube.com/watch?v=uvqU_L5PZtk">http://www.youtube.com/watch?v=uvqU_L5PZtk</a></p> <p><a href="http://www.youtube.com/watch?v=pK6KZE4gxa0">http://www.youtube.com/watch?v=pK6KZE4gxa0</a></p> <p><a href="http://www.epa.gov/climatechange/kids/">http://www.epa.gov/climatechange/kids/</a></p> | <p><b>-OR-</b> allow small groups (or pairs) of students to explore <a href="http://www.yourclimateyourlife.org.uk/">http://www.yourclimateyourlife.org.uk/</a></p> <p><b>-OR-</b> for More Able, see: <a href="http://www.metoffice.gov.uk/climate-change/guide/">http://www.metoffice.gov.uk/climate-change/guide/</a> .</p> <p>Groups or pairs could explore these websites in response to the 4 questions above (and then carry on with the activity outlined below).</p> <p>- 2, 4, 6 activity. In pairs, consider whether the research questions above were answered. Additionally, what are the differences in presentation styles?<br/>What makes an effective documentary?<br/>- Write down answers in two minutes.<br/>Share your answers with another pair and make a combined list in four minutes.<br/>- Share your lists with another pair and make a combined list of in six minutes.</p> <p>- Once this has been done ask each group of six to share their lists with the rest of the class and the reasons they say should be included on the board. (The rest of the groups should not repeat what has been said, they should tick on their own lists anything that appears so that they do not say it.)<br/>- Retain ideas as a reference (use in lesson 4).</p> |  |  |  |
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| <b>(2) Crazy carbon!</b>  |   |   |                                     |  |  |
| <p>To understand the role of CO<sub>2</sub> in the atmosphere.</p> <p>To understand how the greenhouse works and that it is</p> | <p>Computer/internet/projector (for teacher)</p> <p>2 glass beakers<br/>Measuring cylinder<br/>Cold water<br/>Ice cubes</p> | <p>Start by undertaking this simple clay modelling activity to look at the composition of greenhouse gases<br/><a href="http://www.sciencemuseum.org.uk/educators/classroom_and_homework_resources/resources/greenhouse_gases.aspx">http://www.sciencemuseum.org.uk/educators/classroom_and_homework_resources/resources/greenhouse_gases.aspx</a> <b>(Note: will help later if you also undertake the Extension activity</b></p> | <p>Science<br/>Art &amp; Design</p> | <p>To understand how CO<sub>2</sub> works in the atmosphere to keep Earth warm.</p> <p>To be able to explain the processes</p> | <p>Investigate the role of other greenhouse gases (e.g. methane, water vapour etc.) and their relative contribution to and impact on global warming. <b>Add these to</b></p> |



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| <p>natural (and a requirement for life on Earth).</p> <p>To understand that adding CO<sub>2</sub> to the atmosphere through human activities leads to an enhanced greenhouse effect.</p> | <p>Clear, colourless plastic bag<br/>         Thermometer (or Data Loggers if available),<br/>         Elastic band<br/>         Graph paper<br/>         Drawing paper<br/>         Pens/pencils<br/>         Assorted craft materials</p> | <p><b>suggestion for this session).</b></p> <ul style="list-style-type: none"> <li>- Show all 5 episodes from 'It's All About Carbon'<br/> <a href="http://www.npr.org/news/specials/climate/video/kulwich.html">http://www.npr.org/news/specials/climate/video/kulwich.html</a></li> <li>- In pairs, have children record key facts and figures per episode and list the top ten items as a class to keep for future reference.</li> <li>- Carry out the experiment below to illustrate the <b>greenhouse effect</b>:             <ul style="list-style-type: none"> <li>- Take the two glass beakers and fill them to exactly half way with cold water (use a measuring cylinder to ensure same amount of water in each).</li> <li>- Then add five ice cubes to each jar.</li> <li>- Wrap one jar in a plastic bag, add the thermometer or Data Logger and seal it at the top with an elastic band around the thermometer so it can be read (this one is the greenhouse).</li> <li>- Leave both jars on a sunny window ledge and measure the temperature of the water in each jar at regular intervals. Pupils should note that the temperature of the greenhouse jar's water has risen.</li> <li>- Plot data in graphical form and write a brief paragraph about what the experiment demonstrates.</li> </ul> </li> <li>- Class discussion: in bright sunshine, the air inside a greenhouse becomes warm. The greenhouse <b>glass</b> lets in the Sun's light energy and some of its heat energy – <b>does it let the heat out, too?</b> This heat builds up inside the greenhouse, just as it did in the jar.</li> <li>- How is this relevant to Earth, our atmosphere life on Earth and climate change? <b>Are there other gases besides CO<sub>2</sub> that are important</b></li> </ul> |  | <p>involved in the greenhouse effect.</p> <p>To describe the differences between Earth's natural greenhouse effect and the enhanced greenhouse effect linked to climate change.</p> | <p><b>the craft models.</b></p> <p>For More Able students, try using the 'simple climate model' to further investigate<br/> <a href="http://www.windows2universe.org/earth/climate/climate_model.html">http://www.windows2universe.org/earth/climate/climate_model.html</a></p> |
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|   |   | <p>(e.g. methane, water vapour)?</p> <p><a href="http://www.bbc.co.uk/news/science-environment-18120093">http://www.bbc.co.uk/news/science-environment-18120093</a></p> <p><b>What would Earth be like if there was no greenhouse effect?</b><br/> - What impact would increasing the concentration of CO<sub>2</sub> and other greenhouse gases in the atmosphere have on planet Earth?</p> <p>- OR-<br/> Ask children to create their own illustration of their understanding of how the greenhouse effect works (and what Earth would look/feel like if there was no greenhouse atmosphere).<br/> <b>Use an assortment of craft materials to allow students to make 3-D craft models which they can then explain to the class.</b></p> |   |  |   |
| <b>(3) Climate change science...communicating the science (A)</b>   |   |   |   |  |   |
| <p>To use secondary sources to answer scientific questions.</p> <p>To use creative methods to effectively communicate the complexity of climate change science.</p> | <p>Internet<br/>Secondary sources</p> <p>Computer</p> <p>Appropriate props &amp; costumes<br/>Art materials<br/>Musical instruments</p> | <p>- Explain the main task of the activity which is that they will be divided into 4 groups, each given a different topic to further research:</p> <p>Group 1: What are climate change and global warming?<br/> Group 2: Has climate change happened before?<br/> Group 3: Is climate change natural or man made?<br/> Group 4: What are the ozone layer and the greenhouse effect, and which gases are linked to global warming?</p> <p>- The research may take place over one or more lessons while pupils prepare a 10 minute documentary style drama whereby pupils share their expert knowledge with the rest of the class.<br/> - Ensure that within each of the 4 groups, specific roles are delegated to tasks such as</p>        | <p>Science<br/>ICT<br/>Music<br/>Drama<br/>English<br/>Art &amp; Design</p> | <p>To have prepared a documentary-style drama using information gathered during research.</p> <p>To use their creativity to disseminate scientific information in an engaging and dynamic manner.</p> <p>Finding novel ways of linking art, theatre and science.</p> | <p>Perform the dramas to a wider audience, e.g. assembly.</p> <p>-OR-<br/> Undertake 'Have I got climate science for you!' game show by the Science Museum<br/> <a href="http://www.sciencemuseum.org.uk/educators/classroom_and_homework_resources/resources/cli_quiz.aspx">http://www.sciencemuseum.org.uk/educators/classroom_and_homework_resources/resources/cli_quiz.aspx</a></p> |



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|  |  | producer/director, script-writer, actors, choreographer, orchestra etc.<br>- Pupils will need to prepare opening pictures for the documentary including appropriate music (written and presented by themselves).  |                         |  |  |
| <b>(4) Canny creativity – communicating the science (B)</b>  |  |   |                         |  |  |
| To evaluate the effectiveness of creativity to engage a wide audience on the principles of climate change science. | Video camera<br>Camera<br><br>Paper and pencils/pens | - If a video camera is available, the 4 documentaries could be filmed, and these could be used for assessment.<br>- Assessment will be <b>in the form of a review feature for a news article</b> including:<br>(1) Does the presentation content contain extensive knowledge and understanding of the topic?<br>(2) Is it easy to follow and does it captivate the audience?<br>(3) What is the journalist's view on whether using creative methods to engage the public on climate change science is a helpful method? | English<br>Maths<br>ICT | To produce a critical article reviewing the documentary-style dramas.<br><br>Students can collect and analyse data to evaluate impact. | Conduct a school-wide survey on attitudes and understanding of climate change before & after the dramas are performed. |

