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| **Greenhouse Effect Experiment** | | |
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| Investigating how carbon dioxide affects temperature | | |
| **Subject(s):** Design & Technology, Science, Maths, Humanities  **Approx time:** 50-60 minutes |  | **Key words / Topics:**   * Atmosphere * Carbon dioxide * Gas * Greenhouse effect * Warming * Reaction |
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| Stay safe  Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for:    • ensuring that any equipment used for this activity is in good working condition  • behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others    Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠ | | |
| **Suggested Learning Outcomes** |  |  |
| * To understand that carbon dioxide is a greenhouse gas * To be able make a reaction between 2 materials/chemicals | | |
| **Introduction** |  |  |
| This is one of a set of resources designed to allow learners to use practical methods to support the delivery of key topics within Design & Technology, Science, Maths and Humanities. This resource, developed with the support of National Grid ESO, in a practical experiment that investigates how the greenhouse gas carbon dioxide affects the temperature is a closed environment. National Grid ESO ensure that Great Britain has the essential energy it needs by ensuring supply meets demand every second of every day. | | |
| **Purpose of this activity**  In this activity learners will discover the effects of mixing chemicals and the warming effects of the sun. They will undertake a controlled experiment to investigate how gases in the atmosphere affect the heat in an enclosed environment.  This activity could be used as a main lesson activity, to introduce the concept of the earth’s atmosphere, or as part of a series of lessons investigating environmental issues, the effect of global warming and greenhouse gasses. | | |
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| **Activity** |  | **Teacher notes** |
| **Introduction (10 minutes)**  Teacher to introduce the activity, explaining what the greenhouse effect is and the role of carbon dioxide.  **The experiment (30-40 mins)**  Teacher to demonstrate the steps shown in the presentation:   * Label four jars as Air, Vinegar, Bicarb and CO2 * Cut cling film big enough to cover the top of each jar, with a bit extra down the sides. ⚠ * Place plastic wrap on the air jar and secure it with an elastic band. * Add 1/4 cup (60ml) of vinegar to the vinegar jar. Cover with cling film and secure with an elastic band. * Add 1 tablespoon of Bicarb to the Bicarb jar. Cover as before. * In the CO2 jar, add 1 tablespoon of bicarb and 1/4 cup of vinegar. Allow the reaction to occur and cover as above. * Measure the temperature of all four jars. * Place the jars on the heat source.   Learners to repeat the steps above for themselves, then measure the temperature of the jars after 5, 10 and 15 minutes. Learners to complete the activity sheet.  **Plenary (10 minutes)**  Learners to discuss their findings. What are the implications of their results? |  | This activity could be carried out individually or in small groups, depending upon the available resources.  Large glass jars, such as jam jars, are the most suitable. Care must be taken when handling these and mounting them on the heat source to avoid breakages. If using a radiator for the heat source this must have a flat surface on which the jars are stable.  White vinegar is preferential to other varieties due to less additional ingredients.  The bubbles produced in the bicarb/vinegar reaction are CO2 gas. Cover with cling film as soon as the reaction starts to subside. CO2 is 1.5 times heavier than air, so should initially reside in the jar when it is created.  The thermometer can be either a non-contact infrared type (as shown in the presentation) or a traditional dual scale contact thermometer. If using a standard type, you will need 1 per jar; cut a small slit in clingfilm for this to pass through.  If using a sunny windowsill as the heat source the time may need to be extended, taking additional readings until a stable temperature is achieved. |
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| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Provide learners with pre-prepared jars and cling film. |  | * Plot graphs showing the changes of heating the jars. * Learners to use the internet to investigate what processes produce CO2 and how CO2 levels can be reduced. |

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| **Resources** |  | | **Required files** icon-docicon-pdficon-ppt |
| * 4 large empty jars * Cling film * Scissors * Masking tape * Permanent marker * Bicarbonate of soda * White vinegar * Measuring cups and spoons * Elastic bands * Thermometers (non-contact infra-red type preferred; if using a traditional contact type one thermometer will be needed for each jar) * Heat source (radiator with a flat top or a sunny window) |  | | icon-ppt Presentation - Greenhouse Effect experiment  icon-pdf Activity sheet - Greenhouse Effect experiment |
| **Additional websites** |  | |  |
| * The National Grid website <https://www.nationalgrid.com/> * Global warming <https://www.youtube.com/watch?v=PqxMzKLYrZ4> * What is the Greenhouse effect? <https://climatekids.nasa.gov/greenhouse-effect/> * Global warming facts for kids <https://www.youtube.com/watch?v=FuI8UOl9TrI> | | | |
| **Related activities (to build a full lesson)** |  | |  |
| **Starters** (Options)   * Discuss what learners understand by climate change. What examples of the effect of climate change have they heard of? * Watch one of the videos about climate change from the additional websites above. | | **Plenary**   * Learners to explain what has happened in the experiment and discuss the implications. | |

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| **The Engineering Context** |
| Many human activities result in emissions of greenhouse gases. These can have a significant effect changing the climate and weather conditions that we experience. There is a wide range of possible ways to reduce these emissions. Engineers play a huge role in such areas, developing and implementing processes and materials that produce lower levels of greenhouse gas emissions, such as sustainable methods of power generation. Engineers also have a significant social influence on our behaviours as a society when we consider the future implications of our actions and consumption. |

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| **Curriculum links** | |
| **England: National Curriculum**  Science KS2   * planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary | **Northern Ireland Curriculum**  Science The World Around Us KS2   * The effect of heating and cooling some everyday substances. |
| **Scotland: Curriculum for Excellence**  Technologies  I can talk about science stories to develop my understanding  of science and the world around me.  SCN 0-20a | **Wales: National Curriculum**  Humanities KS2   * I can collect and record information and data from given sources. I can then sort and group my findings using different criteria. |

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| **Assessment opportunities** |
| Informal summative assessment of the completed worksheet. |