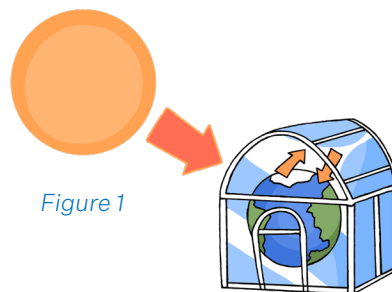


Objectives	Greenhouse Gases	Extra Information
<p><b>L.O:</b></p> <p>To Understand the Impact of Greenhouse Gases on the Climate.</p>	<p><b>GUIDANCE</b> – Some of the topics discussed in this lesson can bring up feelings of anxiety in children. We recommend that you give time for open and honest discussion of any such anxieties and reinforce that only by acknowledging an issue (such as climate change or unethical use of fossil fuels) can solutions be talked about and implemented.</p> <p><b>STARTING ACTIVITY – (5 minutes)</b></p> <p><b>GROUP DISCUSSION</b> – Begin the lesson by asking the class if they are familiar with the terms <b>global warming</b> and <b>climate change</b>. Allow time for open discussion on the subject.</p> <p>Explain that although it is referred to occasionally as <b>global warming</b> this doesn't mean that everywhere will be warmer all the time, rather, that the average global temperature (the average temperature of everywhere on the planet) is increasing by a few degrees. Further explain that to make things less confusing for those who have noticed extremes of cold weather in recent time, it is referred to more commonly as <b>climate change</b>.</p> <p><b>MAIN TEACHING – Not so Green, Greenhouse Gases (15 minutes)</b></p> <p><b>GROUP DISCUSSION</b> – Ask the class if they are familiar with one or more causes of <b>climate change</b>, again allowing time for discussion whilst leading the class to the concept of <b>CO2 emissions</b> and the <b>greenhouse effect</b>.</p> <p>Explain that greenhouses work by allowing warm sunlight in but when the heat tries to escape it's reflected back and trapped inside. Explain that <b>CO2</b> is what is called a '<b>greenhouse gas</b>', and that <b>greenhouse gases</b> sit in the atmosphere surrounding the planet in the same way that the glass of a greenhouse surrounds the plants inside. The light from the sun enters the atmosphere and normally the excess heat would reflect back into space, however <b>greenhouse gases</b> trap the heat, causing the planet to warm up.</p> <p><b>GUIDANCE</b> – It may help to display Figure 1 for the class to better illustrate the greenhouse effect:</p> <div data-bbox="1021 1134 1411 1426" data-label="Image">  <p>Figure 1</p> </div>	<p><b>Materials Required:</b></p> <ul style="list-style-type: none"> <li>▶ Fig 1</li> <li>▶ 2 sealable (jam) jars</li> <li>▶ Ice</li> <li>▶ Baking Soda</li> <li>▶ Vinegar</li> <li>▶ Lamp (with an incandescent bulb, required for heat)</li> </ul> <p><b>Key Words:</b></p> <ul style="list-style-type: none"> <li>▶ Greenhouse Gas</li> <li>▶ Greenhouse Effect</li> <li>▶ Emissions</li> <li>▶ Global Warming</li> <li>▶ Climate Change</li> <li>▶ Hypothesis</li> <li>▶ CO2</li> <li>▶ H2O</li> <li>▶ N2O</li> <li>▶ O3</li> <li>▶ CH4</li> </ul>

Objectives	Greenhouse Gases	Extra Information
	<p><b>MAIN TASK – Putting CO<sub>2</sub> Under the Spotlight (35 minutes)</b>            Explain to the class that they will now be doing their own experiment to demonstrate the effect of CO<sub>2</sub> as a greenhouse gas:</p> <ol style="list-style-type: none"> <li>1 Take one of the two jars and sprinkle a small amount of baking soda inside.</li> <li>2 Gently shake the jar to equally distribute the baking soda across the bottom.</li> <li>3 Add an equal amount of ice to each jar.</li> <li>4 Add a small amount of vinegar to a jam jar with the baking soda and seal both jars immediately.</li> <li>5 Put both jars under the light of a lamp, ensuring that they are equally lit (alternatively use two lamps).</li> </ol> <p>Put the experiment to one side and refer back to it throughout the remainder of the lesson. Explain that in this experiment the heat of the lamp simulated the heat from the sun and that by mixing vinegar and baking soda, a reaction occurs producing <b>CO<sub>2</sub></b>, our <b>greenhouse gas</b>.</p> <p>During the time immediately after the experiment ask the class to come up with <b>hypotheses</b> for the experiment, either as a class or individually, using the prompt “<b>I hypothesise</b> that:”. Ask them to specify if there will be any difference, and if so, the amount of difference. If this is done as a class, display this hypothesis on the board for the remainder of the lesson.</p> <p><b>Mini-Plenary:</b>  <b>GROUP DISCUSSION</b> – With hypothesis(es) noted, discuss with the class the impact the greenhouse effect has on our planet.</p> <p>Ask pupils to volunteer possible side effects of the planet warming up, noting each suggestion on the board and discussing them with the class. Possible prompts for this detailed below:</p> <ul style="list-style-type: none"> <li>▶ <b>Melting Ice Caps</b> - causing raised sea level and damage to ecosystems.</li> <li>▶ <b>Hotter environments</b> - damage to ecosystems, possibly dangerous environments in already hot climates.</li> <li>▶ <b>Forest Fires</b> - as a side effect of hotter environments, forests will be drier and forest fires will become more common.</li> <li>▶ <b>Warmer Oceans</b> - massive damage to many ecosystems, loss of major food source for humans (fishing industry).</li> </ul>	<p><b>Success Criteria:</b></p> <ul style="list-style-type: none"> <li>▶ I can perform a simple experiment to demonstrate the effects of CO<sub>2</sub> on the atmosphere.</li> <li>▶ I can perform a simple experiment to demonstrate the effects of CO<sub>2</sub> on the atmosphere and I can understand some of the immediate impacts CO<sub>2</sub> as a greenhouse gas has on the atmosphere.</li> <li>▶ I can perform a simple experiment to demonstrate the effects of CO<sub>2</sub> on the atmosphere, I can understand some of the short and long term impacts CO<sub>2</sub> and other greenhouse gases will have on the atmosphere.</li> </ul>

Objectives	Greenhouse Gases	Extra Information
	<p>After this discussion, return to the experiment to discuss its results. If the experiment has been successful, there should be significantly less ice in the jar with <b>CO2</b>. If this is not the case, explain that possible reasons for failure of significant results include a poor seal on the jar or a poor reaction between the vinegar and baking soda. However, reiterate that under stricter testing conditions <b>CO2</b> has been shown to be a <b>greenhouse gas</b>.</p> <p><b>MAIN TASK – (5 minutes)</b> Explain to the class that <b>CO2</b> is just one of several greenhouse gases, including <b>water vapor (H2O)</b>, <b>nitrous oxide (N2O)</b>, <b>ozone (O3)</b> and <b>methane (CH4)</b>. Explain that <b>CO2</b> and Methane are among the worst contributors to <b>global warming</b>.</p> <p>Ask the class to list any sources of <b>CO2</b> they can think of, leading them towards engine emissions and power stations. Explain that most major sources of <b>CO2</b> are human sources.</p> <p>Ask the class to think of any sources of Methane they can think of, reminding them that Methane is the primary gas in farts. After giving the class some time to laugh, explain that Methane is 83 times more potent as a <b>greenhouse gas</b> than <b>CO2</b> and is produced in large amounts by the food industry, for example, in cow farts.</p> <p><b>GUIDANCE</b> – If you haven't already, check out the ethics lessons that take a deeper look at the pros and cons of the meat industry as a whole.</p> <p><b>GROUP DISCUSSION</b> – If there's time, discuss with the class possible solutions to the excess <b>CO2</b> in the atmosphere. Remind the class that plants convert <b>CO2</b> into Oxygen. Also explain that the bark of trees is mostly carbon and by planting trees and other plants you can actually trap large amounts of carbon from <b>CO2</b> in the atmosphere inside the tree, although it is released upon the tree decaying or burning.</p>	

## Greenhouse Gases - Worksheet

Figure 1

