

## SESSION 2: WHO IS RESPONSIBLE?

Age range: 11–14 years

<b>Outline</b> Learners will list some human causes of climate change. They will identify climate change contributors along a supply chain, from field to supermarket. Finally, learners will investigate the carbon footprints of people living in different countries around the world.		
<b>Learning objectives</b> <ul style="list-style-type: none"> <li>To identify some human activities contributing to climate change.</li> <li>To understand what a carbon footprint is.</li> <li>To recognise that everybody in the world has a carbon footprint but some people and countries are responsible for more CO<sub>2</sub> emissions than others.</li> </ul>	<b>Learning outcomes</b> <ul style="list-style-type: none"> <li>Learners will list some human activities which are contributing to climate change.</li> <li>Learners will identify and sort some of the processes involved in producing a loaf of bread and getting it to someone's home, and consider which of these processes use fossil fuels.</li> <li>Learners will investigate CO<sub>2</sub> emissions per person in different countries around the world.</li> </ul>	
<b>Key questions</b> <ul style="list-style-type: none"> <li>What human activities are contributing towards climate change?</li> <li>What processes are involved in producing a loaf of bread?</li> <li>What is a carbon footprint?</li> <li>Who is responsible for climate change?</li> <li>Who are the biggest contributors?</li> </ul>	<b>Resources</b> <ul style="list-style-type: none"> <li>Climate challenge A slideshow: slides 9–16</li> <li>Resource sheet 1: Life history of an aluminium can</li> <li>Activity sheets: <ol style="list-style-type: none"> <li>The journey of a loaf of bread</li> <li>Who is responsible for climate change?</li> </ol> </li> </ul>	
<b>Curriculum links</b>		
<b>England</b> <b>KS3 Science</b> <b>Biology: Interactions and interdependencies</b> <b>Relationships in an ecosystem</b> <ul style="list-style-type: none"> <li>Pupils should be taught about how organisms affect, and are affected by, their environment, including the accumulation of toxic materials.</li> </ul> <b>Chemistry: Earth and atmosphere</b> <ul style="list-style-type: none"> <li>Pupils should be taught about the production of carbon dioxide by human activity and the impact on the climate.</li> </ul> <b>KS3 Geography</b> <b>Human and physical geography</b> <ul style="list-style-type: none"> <li>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.</li> </ul>	<b>Wales</b> <b>KS3 Science</b> <b>Interdependence of organisms</b> <ul style="list-style-type: none"> <li>How human activity affects the global environment, e.g. acid rain, greenhouse effect, and the measures taken to minimise any negative effects and monitor them, e.g. by Earth observation satellites.</li> </ul> <b>KS3 Geography</b> <b>Understanding places, environments and processes</b> <ul style="list-style-type: none"> <li>Explain the causes and effects of physical and human processes and how the processes interrelate, e.g. causes and consequences of tectonic activity, impacts of migration in Europe.</li> <li>Explain how and why places and environments change and identify trends and future implications, e.g. population increase, climate change, globalisation.</li> </ul> <b>ESD6C: Climate Change, Choices and Decisions</b>	<b>Scotland</b> <b>Sciences</b> <ul style="list-style-type: none"> <li>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. <b>SCN 4-05b</b></li> <li>Through investigation, I can explain the formation and use of fossil fuels and contribute to discussions on the responsible use and conservation of finite resources. <b>SCN 4-04b</b></li> </ul> <b>Social Studies</b> <ul style="list-style-type: none"> <li>I can identify the possible consequences of an environmental issue and make informed suggestions about ways to manage the impact. <b>SOC 3-08a</b></li> </ul>

### Activity 2.1 (20 min)

What contributes to climate change?

- Show slide 10. Remind learners that the burning of fossil fuels such as coal, gas and oil has increased the amounts of greenhouse gases, such as carbon dioxide, in the Earth's atmosphere. Ask learners to think of human activities which involve burning these kinds of fuels (and therefore lead to increased carbon dioxide emissions).
  - Think: ask learners to think on their own for a couple of minutes and note down their ideas.
  - Pair: give learners a couple of minutes to compare their answers.
  - Share: spend a few minutes sharing some of the learners' answers as a whole group.
- Individually or in pairs, give learners a plain sheet of paper and ask them to fold it in half. On the left-hand side, they should write a list of everything they do on a normal day such as getting up, having a shower or eating breakfast. On the right-hand side, they should place a tick by any of these activities which they think might use energy from fossil fuels. Remind them that fossil fuels are used in many ways such as transport, heating and electricity. Plastics are also made from fossil fuels.
- After they have completed their lists, ask for volunteers to share them. Did the rest of the class notice any activities that use fossil fuels which they had missed? Alternatively, ask volunteers to read out their lists of activities and ask the rest of the class to put their hands up when they think an activity uses fossil fuels. Ask someone with their hand up to explain how the activity uses fossil fuels, for example a shower uses hot water which is heated by gas (a fossil fuel) or electricity (often generated from fossil fuels).
- Explain that approximately 80% of the UK's total energy consumption (for uses such as electricity, transport and heating) comes from fossil fuels (coal, oil, petroleum and natural gas products).<sup>1</sup> These are called non-renewable energy sources – supplies of them are limited. A growing amount of the UK's electricity now comes from renewable energy sources such as wind, solar and hydro energy – a third of the electricity we generated in 2018 was renewable.<sup>1</sup> Increasing the use of renewable energy sources is crucial if we are to reduce carbon emissions.

### Activity 2.2 (45 min)

Food, drink and climate change

- Show slide 11. Ask learners what they know about how an aluminium can is made.
  - Where does it come from?
  - What processes are involved in making it?
- Show learners the Life history of an aluminium can (Resource sheet 1). Talk through the process that it shows. Explain that bauxite is a rock from which aluminium is made. It has to be dug up from the ground using big, oil-powered machines. Point out that this is just about the can – for example, it does not include all the ingredients that go into the drink inside it, or the inks that are used to print the pictures on the outside.

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<sup>1</sup> Department for Business, Energy & Industrial Strategy (2019) Energy Trends March 2019.  
<https://www.gov.uk/government/statistics/energy-trends-march-2019>

- Organise learners into groups of three or four and show slide 12. If possible give each group the empty packaging from a loaf of bread.
- Ask learners to think about what processes were involved in getting that loaf of bread to someone's home.
  - What ingredients are used?
  - What processes are involved in making the loaf of bread and getting it to someone's home? Think about where the ingredients come from, how the loaf of bread is made and how it is transported.
  - What is the packaging made from and how is it made?
  - How might the supermarket use fossil fuels, for example for their lighting and heating?
- Ask each group to draw a flow chart showing all the processes they think went into making the loaf of bread and getting it to someone's home. They should consider all the stages necessary for gathering the ingredients, making the packaging, and combining and cooking the ingredients to make the bread. Learners might like to make a rough copy of their flow chart first to help them to think through and structure their ideas.
- Next, ask learners to choose two or three of the processes to illustrate, such as a combine harvester harvesting the wheat, machines packing the bread or the bread baking in an oven, and draw a picture of each of these processes on a small piece of paper.
- Ask learners to then cut out and sequence their pictures on a large piece of paper with a picture of a loaf of bread in the middle. They should stick down their pictures and add arrows to show how the different parts of the process connect.
- Finally, ask learners to use a bright coloured pen to mark all the stages which would have used fossil fuels and therefore contributed to climate change.
- Display all the flowcharts and allow time for learners to circulate and look at the flow charts of other groups. If time, ask each group to present and explain their flowchart to the rest of the class.

### **Differentiation**

- Make it easier: Provide groups with a copy of The journey of a loaf of bread (Activity sheet 1). Explain that the pictures and text show some of the processes involved in getting a loaf of bread to someone's home. Ask learners to cut out the boxes and arrange them into a flow chart to show the order in which these stages will happen. Learners should stick the boxes onto a blank piece of paper and add arrows to show how the different processes connect. Encourage learners to then add pictures and text to their flow chart to show the other processes involved. Finally, ask them to highlight the parts of the process which require fossil fuels and therefore contribute to carbon dioxide emissions and climate change.

### **Activity 2.3 (25 min)**

Who is responsible for climate change?

- Show slide 13. Explain that a carbon footprint is used to describe the amount of carbon dioxide released into the atmosphere as a result of activities by an individual person, an organisation, a community, a country or an event.

- Explain that every person on our planet has a carbon footprint. However, some people and some countries have larger carbon footprints than others. Ask learners why they think this is. Is this fair?
- Organise learners into groups of three or four. Give each group a copy of Who is responsible for climate change? (Activity sheet 2). Ask learners to cut out the boxes and order the countries according to what they think are their CO<sub>2</sub> emissions per person each year. The country with the biggest emissions should be at the top and the country with the smallest at the bottom.
- Allow time for groups to share their ideas. Encourage learners to give reasons for their decisions.
- Show slide 14 to share the correct country order (also provided below). Discuss learners' responses. Ask if they are surprised by any of the results. Note that Activity 2.4 gives learners the opportunity to discuss why they think CO<sub>2</sub> emissions per person are greater in some countries than in others.

Country	CO <sub>2</sub> emissions per person (tCO <sub>2</sub> ):	World ranking according to CO <sub>2</sub> emissions per person (tCO <sub>2</sub> ):
United Arab Emirates	27.1	3
USA	17.7	8
Australia	15.6	12
UK	8.5	35
South Africa	6.0	51
China	6.3	49
Brazil	2.5	70
India	1.7	79
Malawi	0.1	113

Please note that the above data relate to consumption-based CO<sub>2</sub> emissions. These include emissions both from those within the country and those caused by the production of the country's imports.

**Source:** The Global Carbon Atlas: [globalcarbonatlas.org](http://globalcarbonatlas.org)

## Activity 2.4 (30 min)

Investigating the Global Carbon Atlas

- Ask learners how they would investigate the following question:
  - Which countries have the worst CO<sub>2</sub> emissions?
- Discuss their ideas:
  - What does 'the worst' mean?
  - Which CO<sub>2</sub> emitting activities would you measure?
  - How would you measure it?
- Show slide 15. Explain that this world map shows the CO<sub>2</sub> emissions per person for each country in

2016. Data isn't available for some of the countries.

- Alternatively, you might like to use the interactive version of the map:

[globalcarbonatlas.org/?q=emissions](http://globalcarbonatlas.org/?q=emissions)

- Under Emissions – Type, you can select either Territorial or Consumption. Consumption includes those emissions both from within the country and those caused by the production of the country's imports. Territorial only includes the CO<sub>2</sub> emissions produced within the country. The maps shown on slides 15 and 16 are consumption-based.
- Under Emissions – Units, select tCO<sub>2</sub>/person.
- The default settings for Countries is All, however you may wish to change this to focus on particular regions or other groupings.
- If using the consumption-based map, you will need to click 2016 on the timeline (no data was available for 2017 at the time of resource publication).
- You can then use the cursor to explore the map. Move over a country to display its name, world ranking, CO<sub>2</sub> emissions per person and total population.
- Discuss with learners what they can see on the world map. Ask them which countries and continents they can identify. They may need to refer to a reference world map or atlas for help.
- Ask learners questions about the map:
  - Which continents emit the most carbon dioxide per person?
  - Which parts of the world produce the least carbon dioxide per person?
  - Why do you think some countries emit more (or less) carbon dioxide per person than others?
  - Is this fair?
- If using the interactive version of the map, ask learners to use it to find out the CO<sub>2</sub> emissions per person for specific countries.
- Learners could investigate the difference between territorial-based and consumption-based emissions for particular countries. For example:

Country	Territorial-based CO <sub>2</sub> emissions per person in 2016	Consumption-based CO <sub>2</sub> emissions per person in 2016
UK	6.1	8.5
China	6.9	6.3

- Ask learners why they think the UK's consumption-based figure for CO<sub>2</sub> emissions per person is greater than its territorial-based emissions, whereas China's consumption-based CO<sub>2</sub> emissions per person is less than its territorial-based emissions. Explain that many of the things we consume in the UK are imported from other countries. However, China exports many of the things it produces to other countries. Ask learners which measure they think is fairer and who they think should be responsible for the CO<sub>2</sub> emissions of these products – the country where the products were produced or the country where the products were consumed?
- Explain that people sometimes look at data for CO<sub>2</sub> emissions per country rather than per person.

Show slide 16 and say that this is a world map showing total CO<sub>2</sub> emissions for each country. Ask learners questions about this map and what differences they notice between this map and the world map showing CO<sub>2</sub> emissions per person.

- Which country has the highest total CO<sub>2</sub> emissions? Answer: China.
- India is ranked third in the world according to total CO<sub>2</sub> emissions however it is in 79<sup>th</sup> place for CO<sub>2</sub> emissions per person. Why do you think this is?
- Which map do you think is more useful and why?
- Finish by asking learners to consider how they think the ranking of countries according to their CO<sub>2</sub> emissions might change if the data took into account historical emissions, in other words, emissions that have built up in the atmosphere over centuries. For example, the industrial revolution started in the UK in the 18<sup>th</sup> century whereas rapid industrialisation and economic growth have taken place much more recently in other countries. Discuss whether learners think that countries should be responsible for these historical CO<sub>2</sub> emissions as well as their current emissions.

### **Further idea**

- Learners could write a story describing what their daily lives would be like if they tried to halve their use of fossil fuels. Ask for volunteers to read their stories aloud.
  - How did they feel about living in this way?
  - What were the good things about it?
  - What were the things they would find most difficult?

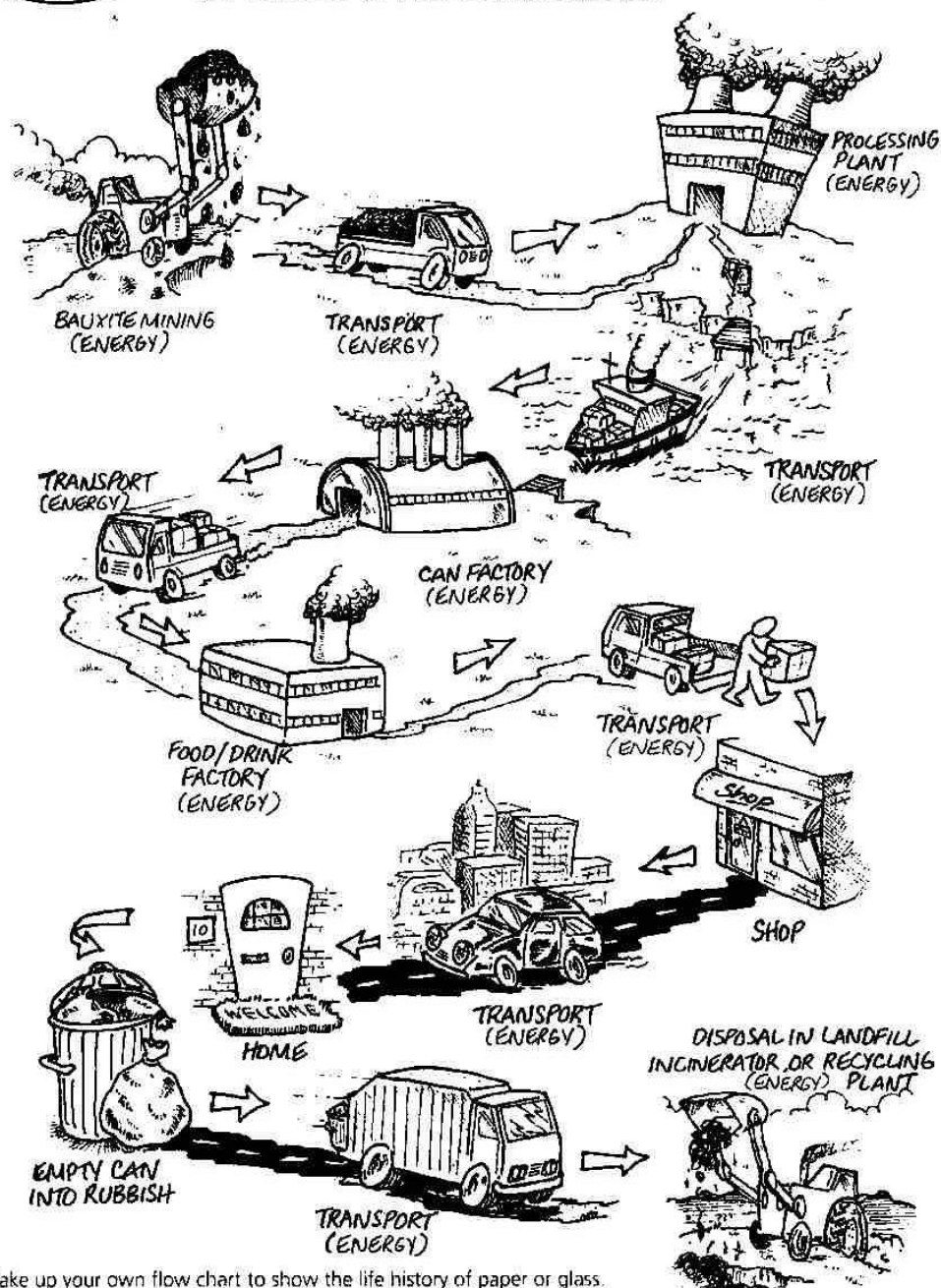
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## Life history of an aluminium can

## Resource sheet 1

**WORKSHEET 7****LIFE HISTORY OF AN ALUMINIUM CAN**

Make up your own flow chart to show the life history of paper or glass.





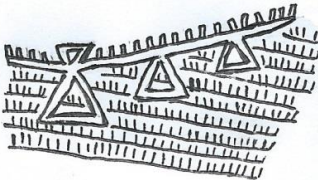
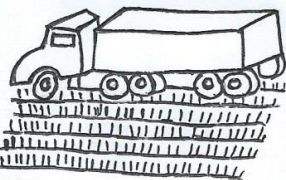

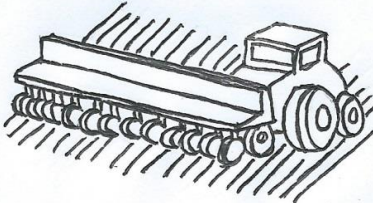

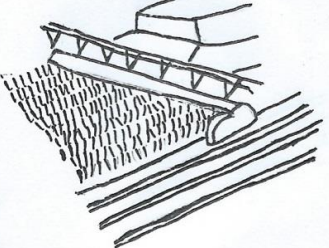
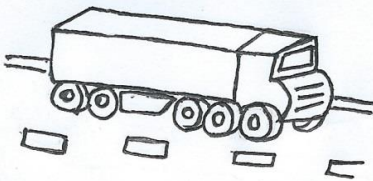
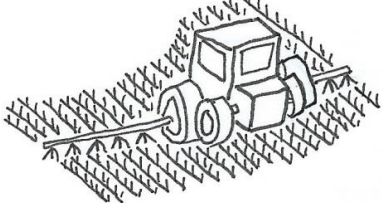
**Source:** The Aluminium Can worksheet, written by Gillian Symons and Prue Poulton and appearing in *Refuse, reuse and recycle* (1993). Reproduced with permission from EcoActive: [www.ecoactive.org.uk](http://www.ecoactive.org.uk)



## The journey of a loaf of bread

## Activity sheet 1

The boxes below show some of the processes involved in getting a loaf of bread to your home. Cut out the boxes and try to arrange them into a flow chart to show the order in which these stages will happen. Which of these processes do you think will use fossil fuels?

 <p>Customer driving to and from the shop.</p>	 <p>Milling the flour.</p>	 <p>Baking the loaf of bread.</p>
 <p>Packing the loaf of bread into its plastic packaging.</p>	 <p>Irrigating (watering) the wheat.</p>	 <p>Transporting the wheat to the mill.</p>
 <p>Mixing the ingredients together by machine.</p>	 <p>Planting the wheat.</p>	 <p>Transporting the flour to the bread factory.</p>
 <p>Harvesting the wheat.</p>	 <p>Transporting the loaf of bread to the supermarket.</p>	 <p>Spraying the wheat with pesticides.</p>



**Who is responsible for climate change?****Activity sheet 2**

Cut out the boxes below. Put the countries in order according to what you think are their CO<sub>2</sub> emissions per person each year. The country with the biggest emissions should be at the top and the country with the smallest at the bottom.

<b>USA</b>	<b>China</b>	<b>India</b>
<b>Malawi</b>	<b>South Africa</b>	<b>UK</b>
<b>Brazil</b>	<b>United Arab Emirates</b>	<b>Australia</b>

