EDT

Industrial Cadets

CARBON FOOTPRINT CHALLENGE

IN PARTNERSHIP WITH

GFG FOUNDATION

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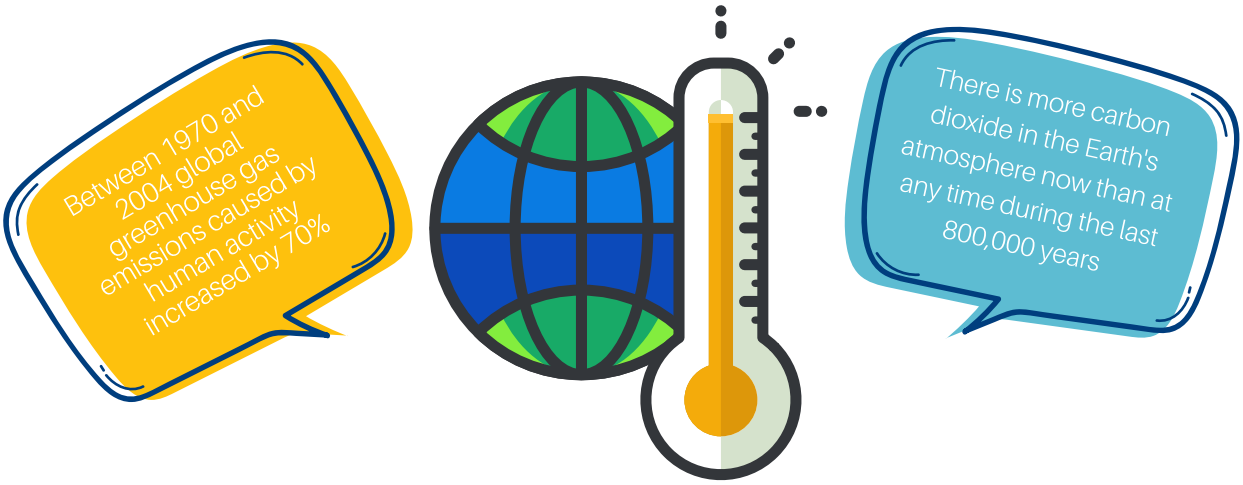
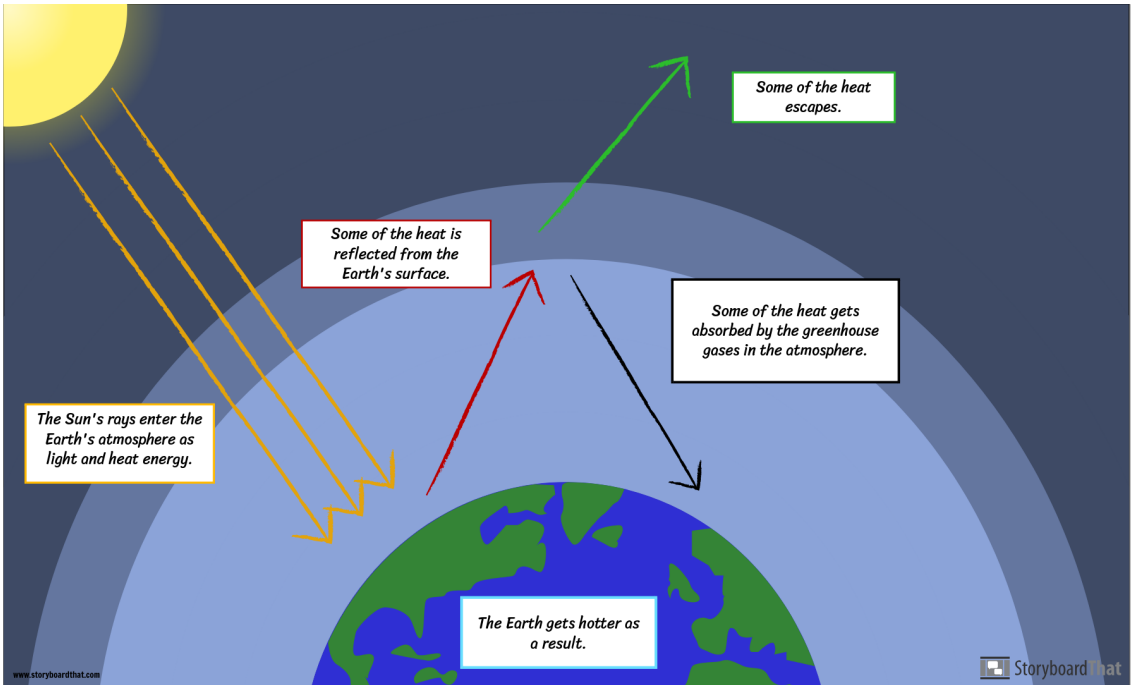
CARBON FOOTPRINT CHALLENGE

Glaciers are melting, sea levels are rising, forests are dying and wildlife is scrambling to survive. These are all effects of climate change, which is happening right now - and a large part of it is caused by human activity.



As we burn fossil fuels to help power our modern lives, we release heat-trapping greenhouse gases such as carbon dioxide into the Earth's atmosphere. These collect and build up, a bit like a blanket insulating the earth. Heat and light from the sun shines down onto the Earth's surface and is reflected back up into the atmosphere. Normally it would leave the atmosphere, but instead the thick blanket of greenhouse gases reflects the radiation back down to the Earth's surface. The heat is trapped, and over time our planet has become hotter and hotter.



CARBON FOOTPRINT CHALLENGE

INVESTIGATE – HOW BIG IS YOUR CARBON FOOTPRINT?

Before looking at the Carbon Footprint Challenge, it's important to think about the amount of greenhouse gases our own activities produce.

Spend a week looking at the ways that you use energy and how much you use. Use a table like the one below to help you keep track, and start to think about any possible ways to use less energy.

Day / Energy	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
TV (hours)							
Computer (hours)							
Mobile phone (number of charges)							
Microwave (number of uses)							
Lights (hours)							
Car journeys (hours and minutes)							
Showers (minutes)							
Hairdryer/straighteners (minutes)							
Games console (hours)							
Other (hours)							

All water that goes down our drains has to be processed at a water treatment works, even if that water is clean. Help save energy only by using the water you need.

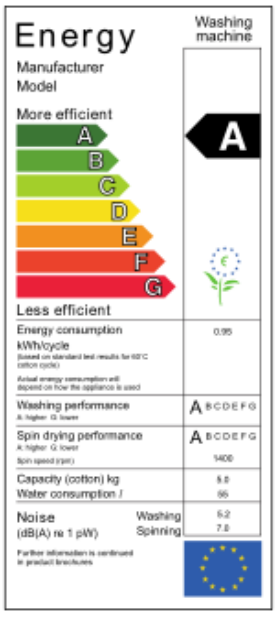
Energy-efficient lightbulbs consume less energy than conventional bulbs. Switch to these (and turn lights off when you're not using them) and you'll save money on your bills too.

Energy-efficient appliances use less energy - if you need a new oven, fridge, microwave and so on look for the energy efficiency label in your country.

All vehicles produce carbon dioxide emissions, and the bigger the car, the greater the emissions. Make sure the car is properly maintained and that tyres are fully inflated so you are not using more fuel than necessary.

Recycling is good for the environment because it keeps waste out of landfill and uses less energy and resources than producing new products.

See our activity pack on the 6Rs of Sustainability!



CARBON FOOTPRINT CHALLENGE

INVESTIGATE – HOW BIG IS YOUR CARBON FOOTPRINT?

It's not just the activities we do that end up contributing to our carbon footprint, our lifestyles can have a big impact too.

Housing, Home and Energy

1. If you live in a detached house, colour 4 rings red; if you live in a flat or any other type of home, colour 2 rings red.
2. If you DON'T use energy-efficient lightbulbs, colour 1 ring red
3. If your home DOESN'T have a programmable thermostat, colour 1 ring red
4. If you are NOT familiar with the energy-efficiency rating system for your home appliances, colour 1 more ring red.

Transport

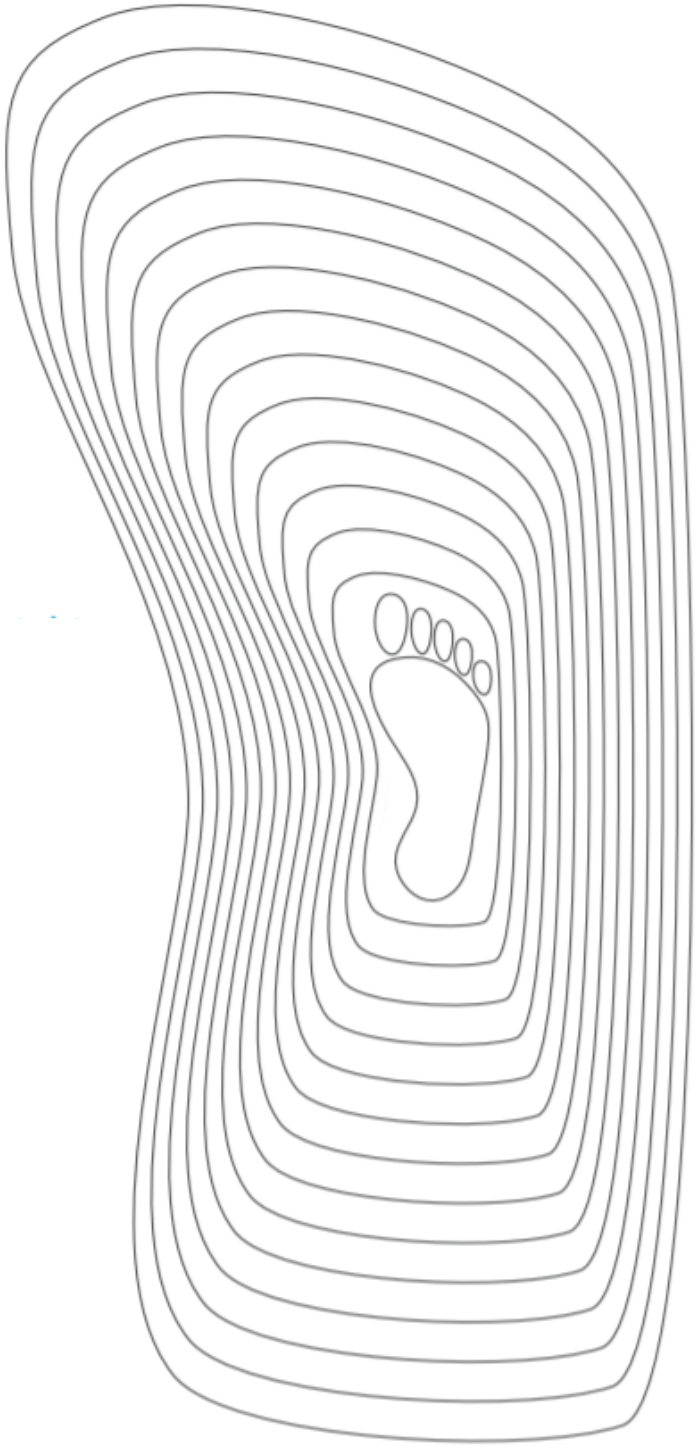
5. For every small car in your household, colour 1 ring blue
6. For every medium or large car in your household colour 2 rings blue
7. If the car's owners DON'T regularly maintain the car, and check tyre pressures, colour 1 ring blue
8. For every plane trip you have taken in the past year, colour 1 ring blue.

Personal Habits

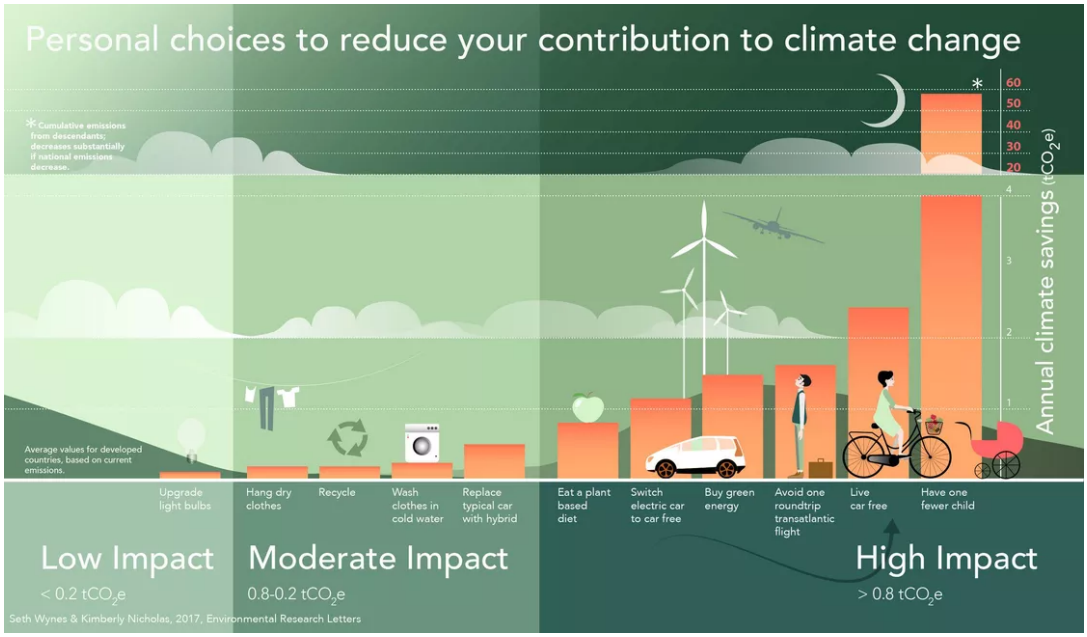
9. If you are vegetarian, colour 1 ring green; if you are NOT vegetarian, colour 2 rings green
10. If you NEVER eat organic food, colour 1 more ring green
11. If you have baths, leave the tap on while you brush your teeth, or water the plants several times a week, colour 1 ring green

Recycling and Waste

12. If you usually recycle your household rubbish, colour 1 ring brown; if you NEVER recycle colour 2 rings brown
13. If you NEVER compost food or garden waste, colour 1 more ring brown.



CARBON CAPTURE CHALLENGE



DIFFICULT QUESTIONS TO GET YOU THINKING!

Some changes we can make to reduce our carbon footprints will have a bigger impact than others. Spend some time answering the questions below, you could even put together an interview for adults to answer.

- Do you believe that as an individual the changes you could make will have an impact?
- Who's responsibility is it to try to reduce carbon emissions - big businesses, or people as individuals?
- What factors get in the way of you and your household reducing your carbon footprint?
- Would you be willing to pay more for more sustainable products, or products where carbon emissions had been offset?

SUSTAINABILITY CAREERS

Research some companies in your country which focus on sustainability and the environment.
What do these companies do? You could investigate specific roles within these companies, or look at the effect these companies have had either on a local level or even globally!

EXPLORE FURTHER

Check out these links and videos for information about sustainability and carbon footprints:

- The Best Ways to Reduce Your Carbon Footprint
- Can We Plant Enough Trees to Fix Climate Change?
- Why Peat Matters
- WWF Carbon Footprint Calculator
- Prospects: Environmental and Agriculture Jobs (UK only)

CARBON FOOTPRINT CHALLENGE

CARBON CAPTURE AND STORAGE

Picture the scene - an evil super-genius has come up with a way to suck all the oxygen out of the air, then buries it in the ground. It sounds like the stuff of comic books...

However, if we could do just that with the carbon dioxide in the atmosphere, we could go some way to combatting global warming. This is called carbon capture, and there is a lot of technology being developed to help with this. The good news is there are lots of natural ways of doing this too, which is often called carbon sequestration.

TREES AND PEATLANDS – TWO NATURAL CARBON SINKS

Despite what we might think about carbon dioxide, we need a certain amount in the atmosphere. Just like humans, trees and plants 'breathe' - but they take in the carbon dioxide, combine it with a little sunlight and some water, and create energy in the process. They then breathe out oxygen, and store the energy as carbon inside the tree - we call this process PHOTOSYNTHESIS.

Peatlands (also known as bogs, wetlands and marshes) are really important too. As well as helping to prevent flooding and providing a home to a huge variety of plants and animals, they are really effective at storing carbon dioxide. Because peatlands are so wet, there isn't enough oxygen in the soil for their layers of moss to fully rot down. More and more layers of plants build up, and these compress over time, trapping the carbon that the living plants have absorbed from the air.

Peat is often removed from bogs for gardeners to add to their compost, or to burn as fuel - but damaging the bogs means the carbon they store is released.

10 billion trees

175 countries

3%

46 million hectares

150,000 native trees

14,000 acres

8000 football pitches

What do the numbers on the right represent? Watch the GFG Foundation 'Did You Know' video to find out.

CARBON FOOTPRINT CHALLENGE

HOW MUCH CARBON IS STORED IN A TREE?

We know that through the process of photosynthesis, trees store energy in the form of carbon. But how much carbon do they store? Find a nearby tree or two, and find out.

STEP 1:

Measure 1.3m/chest height up from the ground up the trunk of the tree and mark the height with your finger. Have a friend measure the circumference of the tree at that height (the circumference is the size of the tree trunk.)

Swap roles and repeat - the two circumference measurements will help you be more accurate.

Circumference 1: _____cm

Circumference 2: _____cm

STEP 2:

Find the mean average of the two circumferences.

To do this, we add the two together, and divide that total by two (because we took two measurements.)

	+		÷2 =	
Circumference 1		Circumference 2		Average circumference

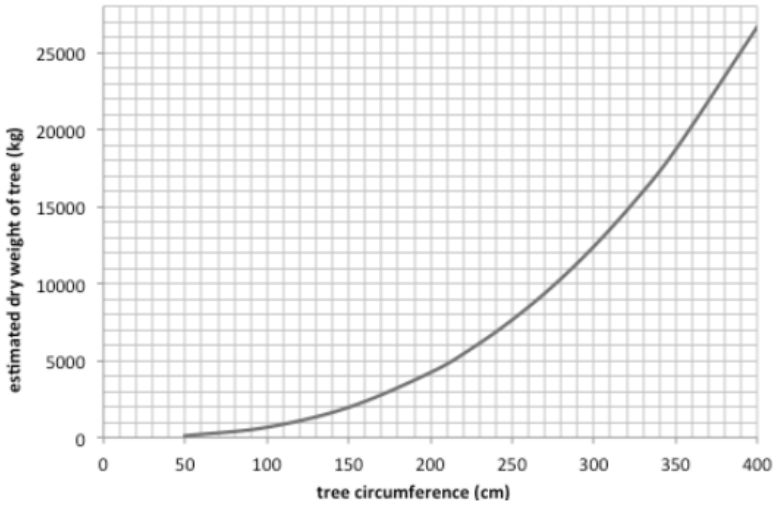
STEP 3:

Next, we need to calculate the amount of carbon in the tree.

Use the table or graph below to find the tree's dry weight, then divide the weight by 2 - because most living things are 50% carbon.

	÷ 2 =	
Estimated dry weight of tree		Estimated weight of carbon in the tree

Reference Graph: Dry Weight of a Tree



Reference Table: Dry Weight of a Tree

Circumference (cm)	Tree dry weight (kg)
50	106
100	668
150	1964
200	4221
225	5771
250	7641
275	9842
300	12410
325	15350
350	18700
400	26674

*These values, provided by **Forest Research**, are for an individual hardwood tree in Westonbirt Arboretum. They should be used as an **example**.*

Trees will grow at different rates across the UK depending on, for example, the species, soil, drainage, slope aspect and climate conditions.

CARBON FOOTPRINT CHALLENGE

STEP 4:

Now we want to find out how much carbon dioxide gas this is equivalent to.

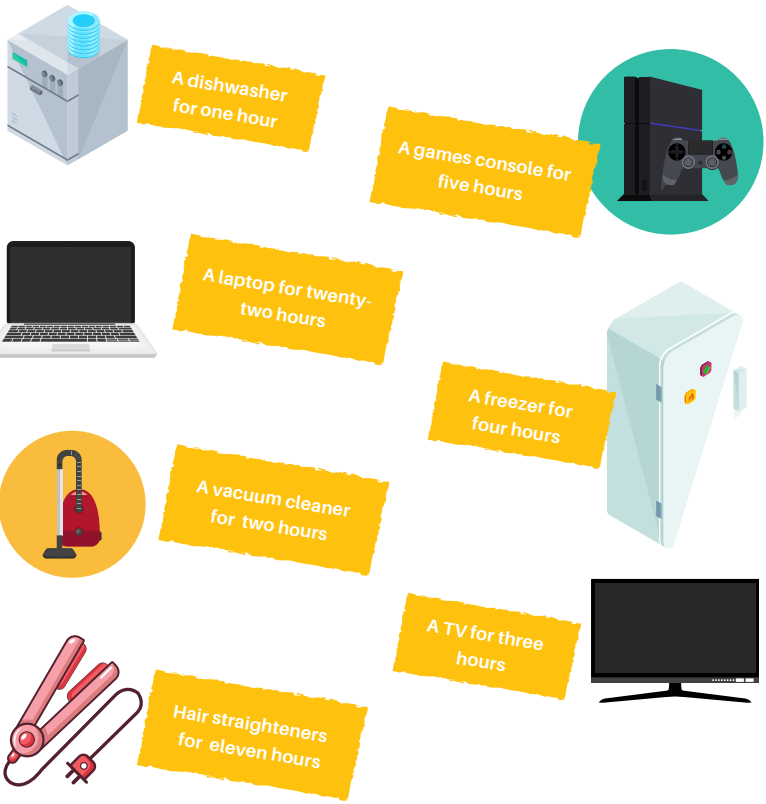
	×	3.67	=	
Weight of carbon in the tree		This number helps us switch from carbon, to carbon dioxide - which also contains oxygen		Estimated weight of carbon dioxide in the tree

SO YOU HAVE CALCULATED THAT THE TREE YOU MEASURED CONTAINS _____ KG OF CARBON AND _____ KG OF CARBON DIOXIDE.

SO WHAT?

Most coal-fired power stations produce 1kg of carbon dioxide per kWh of electricity they generate.

1 kWh of electricity will power...



Can you find any more examples?

CARBON CAPTURE CHALLENGE

YOUR CHALLENGE!

Now that we understand the importance of trees and peat when it comes to reducing the effects of our CO2 emissions, your challenge is to harness their power and design an eco garden that will benefit people in a variety of ways.

THINGS TO THINK ABOUT...

- A vegetable garden could be a good place to start - you can grow produce that is in season, and won't need processing or transporting elsewhere.
- Try to identify plants that are good for pollinators like butterflies and bees - the wildlife will prosper and help keep your garden looking lovely too!
- You could also investigate plants and flowers that are drought-resistant - you'll be able to save water that way.
- Can you re-use materials to save them going to landfill: you could make bird feeders from milk bottles, or take a look at these ideas for containers.
- Are there any other ideas you could include, such as composting, or water collection - why would they be important?

WHAT TO DO:

1. Brainstorm your ideas: where could your garden be and who would have access to it? Could you identify an actual plot of land near to you that could be used, such as somewhere in your school?
2. Identify the materials and - more importantly - plants needed to make this happen?
3. Plan, draw, and annotate your design - tell us all about it!
4. Take a photo and post your design and finished product on social media, using the hashtags #STEAMstars and #GFGFoundation

WHAT DID YOU LEARN?

1. Has your knowledge of sustainability and carbon footprints improved?
2. What did you learn through speaking to others? Did you always have the same opinions?
3. Do you think you will make any changes to some of your habits based on your carbon footprint?
4. Do you think environmental issues should be viewed separately or do you think they are interconnected?

HOW TO RECEIVE YOUR INDUSTRIAL CADETS AWARD

To obtain your Industrial Cadets award you need to complete all the work included in this pack. Please send your project together with the completed form below to stemchallenges@etrust.org.uk

Name: **Gender:**

School address: **Year group:**

What have you learnt by completing this project?

What was your favourite part of this project?

Have you discovered a career in sustainability, that you didn't know existed, and sounds interesting to you?

What does this job involve?

Top 5 skills needed to do this job:

1.
2.
3.
4.
5.

Will you be telling your friends about EDT's challenges and Industrial Cadets?

How would you rate the experience of completing this project?

Excellent ☐ Very Good ☐ Good ☐ Below Average ☐ Poor ☐

NB: We are always keen to publicise the great achievements of our young people. If you are happy for us to share content from your submission please tick the box ☐
Please find reference to our privacy and safeguarding notice.

IN PARTNERSHIP WITH GFG FOUNDATION

More about the "Did you know" series

The GFG Foundation is a registered charity and was launched in February 2017 by Sanjeev and Nicola Gupta. Sanjeev is an international businessman, industrialist and Executive Chairman of the GFG Alliance. Working with partner organisations, the Foundation in both the UK and Australia is delivering programmes that empower and enable young people seeking opportunity to reach their life and employment potential.

The 'Did you know' videos and activity packs, developed in partnership with EDT, are an exciting yet simple way of learning about a variety of topics linked to sustainability and the environment. These engaging on-line resources can be used in the classroom, as a home learning resource or as a fun family challenge. They are also a great way for everyone to learn more about the GFG Alliance.

For more information about the GFG Foundation and other resources, please visit: www.gfgfoundation.org

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For more information about EDT and Industrial Cadets, please visit: www.etrust.org.uk

If you have any questions about this particular challenge, please email: stemchallenges@etrust.org.uk

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