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

Lower KS2 - Scheme of Work

Notes for teachers: ***In prep for this Module, please see:*** http://www.metoffice.gov.uk/climate-change/guide ***&*** https://royalsociety.org/~/media/Royal_Society_Content/policy/projects/climate-evidence-causes/climate-change-evidence-causes.pdf
(handy Met Office & Royal Society climate change guides for teachers' knowledge)

Overview: Children will examine and investigate the key scientific concepts and principles involved in climate change science in order to help them better understand the associated issues.

Most children will: understand the difference between the greenhouse effect and global warming; understand that Earth is warming up and that this is related to climate change; and that although climate change has happened before, it has not previously been linked to human activity.

Some children will not have made so much progress and will: understand that our climate is changing and that this is linked to human activity.

Some children will have progressed further and will also: be able to write about, make recommendations for, and discuss how we can all make changes to improve upon the climate change challenge.

<table>
<tr><th>Learning Objectives</th><th>Cross Curricular & Other</th><th>Key Resources:</th></tr>
<tr><td rowspan="3">To understand the difference between weather and climate, and how these vary around the world.

To understand what it means for living things to adapt to the places where they live.

To understand that climate change has happened before.

To understand the evidence that tells us climate has changed in the past.

To understand the greenhouse effect and why it is important.

To understand what global warming means and why it is important.

To understand that greenhouse gases are both natural and man-made.</td><td>Science - living things; microbes and bacteria; melting & freezing; changes in state; using evidence to form a conclusion

Geography - city vs countryside living

ICT - internet research

Literacy - points of view

PSHE - feelings and effect of actions on others; team work and discussions

Maths - data collecting

PE – laps; heart rate; heating bodies</td><td>Internet
Maps & pictures of plants/animals
Ice cubes
Clear tank, plastic cups or bottles
Water and access to freezer
Coats
Potted plant(s)
Plastic bags
Elastic bands or ties
Yeast
Bottle
Balloon
Warm water
Sugar
Warm room</td></tr>
<tr><td></td><td>Overall Outcome:

To be able to discuss the science behind climate change and to be able to suggest ways of helping the Earth to confront the challenges it brings.</td></tr>
<tr><td>Vocabulary:

Weather
Climate
Temperate
Atmosphere
Greenhouse effect
Global warming
Climate change
Ice cores</td><td>Assessment:

Can the children demonstrate an understanding of the key concepts of climate change science (e.g. weather vs climate; climate change; greenhouse effect; global warming) and describe how human activity plays a part in climate change?</td></tr>
<tr><td></td><td>Unit Extension:</td></tr>
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	Pollution Fossil fuels Adaptation Mitigation	See Module 1 Upper KS2 SoW re. ozone layer and associated activities.

Learning Objectives	I can statements	Suggested Activities	Extension	Outcomes	Resources and web links
(1) Weather vs Climate					
To understand the difference between weather and climate. To consider how different parts of the world have different climates. To understand what it means for living things to adapt to the places where they live.	I can understand a weather forecast. I can explain what weather is and tell you the difference between weather and climate. I can explain that the UK's climate is called temperate. I can explain how the UK's climate is different to other parts of the world. I can explain why certain plants and animals are found in certain parts of the world and how they are adapted to these place.	- Ask children as a class what 'weather' means (i.e. what is happening outside your window on a particular day in a particular place, like Newcastle). – Ask children to review different weather symbols and what they mean. Use: http://news.bbc.co.uk/weather/hi/about/newsid_8775000/8775922.stm Children will watch a weather forecast from this site and discuss features of it as a class. - Children can be spilt into 7 groups and asked to make flash cards (A4 size) that cover the following weather symbols: use http://www.naturalhistoryonthenet.com/Weather/weather_symbols.htm or http://www.metlink.org/other-weather/weather-crafts/weather-symbols/ or http://www.metoffice.gov.uk/weather/uk/guide/key.html to help chat through various weather symbols used on weather forecasts (don't forget to help them understand the symbols used for wind speed and direction – white symbols with numbers). - Assign each group a different day of the week for a pretend week in springtime (weather very variable during the week…think about the hot to cold weather week in late March/early April 2012!) and ask them to prepare a weather forecast for their particular day of the week. They can use their flash cards and stick onto a **giant map of the UK**. - Ask class to come together again and brainstorm what the word climate means and how it is DIFFERENT to the word weather (if weather	Children can become weather presenters, making, recording and presenting their weekly forecast. Children will compare and contrast different world climates with the UK's climate. Also, you could try using the Pod Climate change activities for 7-11 http://jointhepod.org/resources but you will need to register on the site first before you can access materials.	Understanding of the differences between weather and climate. Understanding the linkages between weather and climate. Understanding what the word temperate means. Understanding what adaptation is about and why it is important for living things.	Computer & internet (for teacher), projector and whiteboard World map & UK map Pictures of plants, animals and people from around the world A4 card/paper, crayons, markers, scissors, sticky tape/blue tack World map (A3 size) Video camera (optional)

		means what happens daily or in the short-term, then climate means the weather in a particular place over MANY MANY years). 'Weather = what you get Climate = what you expect' - Blow up a **world map** to A3 size and give to each of the 7 groups. Children will make symbols to stick onto the UK and other selected countries to illustrate different climates of various parts of the world, e.g. UK, Greenland, Australia, Sahara Desert, Amazon Rainforest. - Introduce terminology '**adaptation'**. Ask children what they think it might mean for plants and animals, and once understood, why it is important to living things. Children can put pictures of living things from around the world onto appropriate countries on their world map – ask them as they do so, to explain what adaptations about the plant or animal makes it possible for them to live where they do. - Ask as a class or in small groups for the children to explore what it means for **PEOPLE to adapt**. In terms of **climate change, it means protecting us from the climate**. Ask them to place pictures of people in different traditional dress on the map in the countries where they live (e.g. Inuit, Amazon Indian, Aborigine, cowboys etc.) and explain why their clothes are important to help them live where they do. - Explore the word 'temperate' with the class (mild, wet, windy) and ask children to individually sketch an image of what they might wear outside on a day in winter, spring, summer and autumn, bearing in mind what the word temperate means.			
(2) Ice detectives					
To understand that climate change has	I can explain how I know that climate	- Watch trailer for 'Ice Age' at http://www.imdb.com/title/tt0268380/trailers-	Children can produce an 'ice	Understanding what ice cores are.	Computer & internet (for teacher), projector and

happened before. To understand the evidence that tells us climate has changed in the past.	change has happened before.	screenplay-vi2125332761 - Ask children what the words 'climate change' might mean and discuss briefly as a class. So is climate change new or has it happened before? What are some of the climactic differences that the world has experienced in the past? e.g. desert, glaciers, tropical forests etc. - Ice core discussion – **'what do snowballs and time machines have in common?'** This can be quite tricky, so the key things to note are: (1) that in cold parts of the world, or like during an Ice Age, snow never melts, even in summer (2) layer upon layer of snow builds up and up http://www.whoi.edu/oceanus/viewImage.do?id=59759&aid=35746 **(Can print this out ahead of time and disseminate to children – ask them what they are looking at…a glacier).** (3) Eventually, the snow on top gets so heavy that it packs the snow underneath LIKE A SNOWBALL (have children pantomime making snowballs) and turns all the layers below into ice! (4) Ask children, whilst they are looking at the jpg mentioned above, are the layers they see on top OLDER or NEWER than the ones at the bottom? (They are NEWER), so if they dug a hole from the top to the bottom of the glacier, they'd be going back in time LIKE A TIME MACHINE. (5) Let children handle some pre-prepared ice cubes to look for air bubbles. Explain that as the snow starts to turn into ice, it also traps little ancient bubbles of air from when the snow fell thousands and thousands of years ago. (6) Ask children if they can figure out a way of piercing the ice cubes to let the air inside the bubbles escape? Scientists can by using a MASSIVE drill to dig down into the ice **(show video clip here)*** and pull out a giant cylinder ('kind of straw-shaped') of ice called an ICE CORE to look at these little ancient air bubbles. (7) The **ancient air bubbles can tell us about**	core' that they think could be extracted from Antarctica in the future if climate change continues. Children can write and illustrate a diary describing their memories of seasonal changes during their lifetime. ***See also RSC_climate_change_science SoW' in Module 1, 'Clues from the past' activities.***	Understanding what makes ice cores special. Children will produce an 'ice core' showing a climate different to their own and be able to explain how scientists know that climate change has happened before.	whiteboard Ice cubes to handle (and paper towels to dry hands) Pre-prepared 'ice core' tank with layers created by the seasons that are typical to our climate - **NOTE: will need to make one layer at a time for freezing (see further notes below)** Small fish/clear tank (small enough to put into freezer) -OR- they could make their own with clear plastic cups/bottles Water & access to freezer Objects denoting seasons (e.g. lambs wool, egg shells or green leaves for spring, flowers for summer, autumn leaves, twigs for winter – may need to make some of these items from felt before freezing)

		temperature thousands and thousands of years ago, like when we had our last Ice Age, and also about when the world started to warm up – show 'Ice Age 2' trailer http://www.imdb.com/title/tt0438097/trailers-screenplay-vi59834649 ***See also http://youtube.com/watch?v=Atp412HEHDY&feature=related for teacher reference (can show bits of the clip without sound – interesting imagery, narrate in your own simple text)** - Show children 'ice core' tank and ask children to describe the layers and what they can tell us about the UK's present-day temperate climate. - Children can then prepare a tank/cups/bottles for freezing that has unusual climate activity i.e. longer winters (very little vegetation later in the year due to shortened growing seasons, gravel due to less vegetation and soils in Ice Ages), hotter summers (lots of vegetation or even more tropical plants, lots of dust if droughts etc.) – they can also use items suggested in the resource column.			
(3) Feeling warm?					
To use physical activity to think about the greenhouse effect. To describe the greenhouse effect and global warming.*	I can describe the greenhouse effect and why it is important. I can describe global warming means to me and why it is important.	- Review the term 'climate change' with the children **(*see teacher's note below)**; Earth is warming up and human activity is responsible. Explain that they will discover how this is happening by playing a game. - Split the class into groups of 4-5 in the hall or out in the playground. Demonstrate how to take your own pulse, then ask children to take their own for 1 minute and write it down on a sheet. - Next, one person in each group must wear all of the coats or jumpers of other group members and then do 2-3 laps of hall or playground. Non-coat wearing members must also run the laps as 'control' group. **(NOTE: use selected children as class monitors to help ensure order when**		Children will use physical activity as a simple analogue to describe the greenhouse effect.	Children's coats/jumpers Stop watch Computer & internet (for teacher), projector and whiteboard Paper/pens/pencils ***For teacher:** http://www.guardian.co.uk/environment/blog/2010/jan/06/cold-snap-climate-sceptics

		others are running laps). - Ask all of the children to re-measure their own pulse for 1 minute and how they feel after running around, particularly the coat-wearers - Compare pulses of coats and non-coats to see if any difference. Ask them what would happen if we added more coats or jumpers to each child? - So what's the link between the lap running w/ coat & non-coat wearers, and the global warming animation? - Ask them to write their own short story about 'global warming' based on the lap activity, animation and storytelling –**OR**- ask the class to tell the story all together where **one child contributes one word each** and this carries around the room until the story is complete! (May take a few goes to get the story accurate!) ***Teacher's notes:** **(1) it is important to consider how you use the terminology 'climate change' vs 'global warming'.** **'Global warming' can mistakenly imply consistently warmer weather year on year, and that cold snowy winters are not possible w/ global warming. This is NOT correct – it is EXPECTED that weather will become more variable and unpredictable due to climate change (e.g. cold, snowy winter in 2010 is entirely 'normal', as increases in global temperatures continue to disrupt patterns in oceanic & atmospheric circulation, as does the melting of sea-ice and warming of the oceans, all which can lead to episodes of extreme weather in different seasons).** **Global temperatures are still TRENDING**			http://www.bbc.co.uk/news/science-environment-12119329

		upwards, hence 'global warming' DOES describe this process, but 'climate change' is sometimes better used as a holistic descriptor. **(2) If this activity generates a question about a hole in the ozone layer – refer to Module 1 Upper KS2 SoW lesson 4.**			
(4) Troubled by gas?					
To understand that greenhouse gases are both natural and man-made. To identify the link between an 'enhanced' greenhouse effect and global warming.	I can explain the difference between natural and man-made greenhouse gases. I can talk about the gases that are linked to global warming and suggest ways of reducing their emissions.	- Show http://tiki.oneworld.net/global_warming/climate3.html and read through the information onscreen (children can help to read each sentence) – recap greenhouse effect & global warming from previous lesson (can try to repeat the class story from previous lesson if done before, or if not, ask them to do as a test to see if they can remember).. - Explain to children that greenhouse gases are sometimes natural and that they are sometimes man made. Discuss the gas carbon dioxide (CO_2) and where they might have heard of it before (i.e. humans exhale it, while plants breathe it in). This is a 'greenhouse gas' because it is good at trapping heat from the sun. - Emphasise that water vapour, CO_2 and methane are the three main greenhouse gases. Explain where methane comes from - paddy fields, rotting things, cow's flatulence and ours! All of these gases act as a blanket around our planet – LINKAGE BACK TO THE GREENHOUSE EFFECT. NATURAL EMISSIONS/NATURAL GH EFFECT - We can see the natural emissions of water vapour. **(NOTE: use selected children as class monitors to help ensure order when running experiments).** Children to put plastic bags around leaves of plant(s) and see what happens to the bags. - Also all breathing organisms release CO_2. Activate yeast in a bottle by adding warm water	Write an action plan for the Prime Minister, to encourage lowering emissions. Make a video about climate change and show to lots of people!	Children will observe respiration of plants and bacteria, and the human impact of fuel consumption. They will be able to discuss the differences between natural and man-made GH gas emissions.	Computer & internet (for teacher), projector and whiteboard Potted plant(s) Plastic bags Elastic bands or ties Yeast Bottle Balloon Warm water Sugar Warm room

		and sugar then put the balloon over the top of the bottle and it should blow up the balloon over the space of 1-2 hours. MAN-MADE EMISSIONS/ENHANCED GH EFFECT - First discuss what pollution and fossil fuels mean. - Make a collage with images from children's research on the internet using Google images searching under 'air pollution', 'greenhouse gas' etc. (NOTE: emphasise that greenhouse gasses are NOT visible, so the smoke they see is pollution which contains the invisible greenhouse gases). - Children then discuss as a class which emissions (natural or man-made) are most responsible for climate change and global warming. - Introduce terminology '**mitigation'** – explain that it is an action taken to try and make a situation better. **In the case of climate change, it means finding ways to protect the climate from us** (e.g. reducing energy use, recycling, turning off the lights, carbon footprints etc). - Ask children as a class to produce a top 10 list of ways to reduce emissions.			