

# CLIMATE CHANGE ALL CHANGE

## Climate Literacy topics and resources

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These learning resources are for teachers to use flexibly with their classes.

There are five powerpoint presentations, with interactive elements such as 'click and reveal' to prompt class discussions, and short videos by NASA and NOAA. Each presentation ends with a short quiz.

The following sections outline the learning aims of each presentation for children, additional information for teachers, suggested classroom activities, and additional resources for teaching and learning.

With thanks to Jan Kowal at the Open University, Sue Luke at the University of Winchester, and teachers and children at William Tyndale primary school in London.

## Climate Literacy Introduction

### Learning outcomes

- Identify starting points for climate science knowledge and understanding
- Develop curiosity about climate science and the atmospheric reasons for global heating

### Additional information

Climate change will also cause colder temperatures in some places sometimes. Technically, this is because the weaker Jetstream during the winter is less able to contain the polar vortex, and so events where cold air spills into lower latitudes become more common.

Additional effects of climate change include: the acidification of the oceans as a result of more CO<sub>2</sub> being dissolved. One effect of this is a reduction in the ability of shellfish to make strong shells, with the likely effect of reducing their ability to survive.

The warming of oceans and the increased rate of polar ice melts will be unpredictable changes to major ocean currents. These are already being noticed and could eventually result in whole regions flipping into a different climate type. For example, the north-eastern Atlantic seaboard (places such as the UK) could become much less mild in the winter as the Gulf Stream weakens or switches off. These changes can happen very abruptly and we don't yet know exactly how and when they will occur.

### Possible activities

Introduce the topic with a whole class discussion and scribing of children's ideas, or have children work in pairs or small groups to discuss and report back. What do children think climate change is? What do we know about climate change? How do we know? What do we want to find out about it?

### Additional resources

NASA Climate Kids <https://climatekids.nasa.gov/climate-change-meaning/>

Young People's Trust for the Environment lesson plans and presentations <https://ypte.org.uk/lesson-plans/climate-change>

Oxfam Climate Challenge for 7-11 year olds <https://www.oxfam.org.uk/education/classroom-resources/climate-challenge/>

Climate Generation <https://www.climategen.org/our-core-programs/climate-change-education/curriculum/>

Climate Change Educators' Toolkit <https://climatechangelive.org/index.php?pid=179>

Climate Basics for Kids <https://www.c2es.org/content/climate-basics-for-kids/>

National Geographic <https://kids.nationalgeographic.com/science/article/climate-change>

# The Spheres of the Earth

## Learning outcomes

- Identify and name Earth's spheres accurately
- Understand how the spheres are inter-connected
- Understand how a change in one sphere affects the other spheres

## Additional information

It is almost impossible to think of an example where one sphere does not touch or interact at least one other sphere; virtually any event on Earth is going to involve more than one sphere.

Scientists sometimes call water in solid form (snow, ice, glaciers, sea ice) the Cryosphere. The part of the Geosphere that is Earth's surface crust is called the Lithosphere. In the Geosphere, elements and compounds – in other words minerals – are essential to making the huge variety of molecules life needs to sustain itself. Volcanoes can provide fertile ground for plants to grow after an eruption. This is why many people choose to live near volcanoes despite the risk they present.

The atmosphere we see today is not how it always was. The high concentration of oxygen we currently observe was actually put there by early forms of life that evolved in an oxygen-free atmosphere. The life that's currently around us has evolved to exploit this gas, which was actually a waste product toxic to the life forms that excreted it.

Other examples of interacting spheres:

- Tree and plant roots stabilise the soil.
- An earthquake causes a tsunami. People are injured.
- Ocean waves carry sand that polishes rocks on the beach.
- Heavy rain and flooding cause a landslide. Trees are swept away.

## Possible activities

- Identify other words that use the pre-fixes 'geo', 'hydro', 'bio' and 'atmos' (e.g. geology, geography, hydrant, hydration, biology, biography, atmospheric)
- Draw an environment and label the spheres, or go outside and identify the spheres
- Give examples of how the spheres interact
- Create a practical experiment to illustrate spheres' interactions (e.g. how water force can change soil, how air current can change water direction)
- Make Geosphere, Hydrosphere, Atmosphere and Biosphere illustrated cards and work with 1, 2 or 3 partners to tell a story of how the spheres interact.
- Create the Earth's spheres in a terrarium.
- Ask grandparents or older people who have lived in the area for many years if the climate has changed since they were children (for instance, it used to snow every winter in London regularly).

## Additional resources

Ten Interesting Things about Air <https://climate.nasa.gov/news/2491/10-interesting-things-about-air/>

Earth Spheres games <https://www.wartgames.com/themes/science/earthspheres.html> (see Earth's Spheres Jeopardy for a fun whole class game)

# The Difference Between Weather and Climate

## Learning outcomes

- Know the difference between weather and climate
- Understand what scientists study to record climate changes

## Additional information

We can say that climate is the 'setting' in which weather occurs. Climate is determined by large-scale and (generally) slowly-varying parameters, such as concentrations of various gases, solar energy input, ocean temperature, position and size of land masses, air and ocean currents.

We have been able to detect changes in climate over short periods of time, fewer than 30 years. It all depends on using a time scale that will show a reasonable "norm" of seasonal weather patterns for a given region, and this depends on our ability to make measurements and apply statistical tests

## Possible activities

Record the temperature outside the classroom and make a descriptive weekly weather chart. Use scientific weather vocabulary (e.g. precipitation, wind speed, visibility) to write weather reports.

Research climate changes for your country or for another country and write climate reports.

## Additional resources

Video <https://climatekids.nasa.gov/weather-climate/> OR <https://www.youtube.com/watch?v=vH298zSCQzY&t=7s>

World Bank Climate Change Knowledge Portal <https://climateknowledgeportal.worldbank.org/>

From the main page, click on 'Country'. This will take you to a map of the world. For each country on the map of the world, there is information on the climate now, climate projections, vulnerability, and impacts of climate on agriculture, water and sea levels. Choose a country from the world map, like Brazil, or England. Children will need guidance to navigate the information. Questions you can ask about a country: What is the climate like? Has the climate changed? Have these climate changes caused any problems?

## Greenhouse Gases

### Learning outcomes

- Know the main greenhouse gases and some of their sources
- Understand how greenhouse gases protect Earth
- Understand how too much of greenhouse gases is harming Earth

### Additional information

Per molecule, methane is actually a much more potent greenhouse gas than CO<sub>2</sub>. It only traps less heat than CO<sub>2</sub> because there's much less of it in the atmosphere. Carbon Dioxide (CO<sub>2</sub>) is the greenhouse gas most responsible for global heating, but scientists are learning how water vapour plays a big part in climate change.

<https://climate.nasa.gov/news/25/tracking-earths-most-abundant-greenhouse-gas/>

<https://climatechangeconnection.org/science/what-about-water-vapour/>

<https://www.theguardian.com/environment/2011/jan/28/water-vapour-greenhouse-gas>

### Possible activities

Make a mini greenhouse, or make several with different light and heat sources, and different layers of covering. Observe what happens. Measure and record temperature changes.

Print out 'Meet the Greenhouse Gases' cards and create a game with them. Write in role as one of the Greenhouse Gases from the cards.

### Additional Resources

Practical science experiments <https://kidminds.org/how-to-explain-the-greenhouse-effect-to-kids-with-printables/>

NASA Climate Kids What is the Greenhouse Effect? <https://climatekids.nasa.gov/greenhouse-effect/>

Greenhouse effect experiment <https://schools.bchydro.com/activities/energy/greenhouse-effect-experiment>

Climate change practical activities <https://www.weareteachers.com/climate-change-activities/>

# Carbon and the Carbon Cycle

## Learning outcomes

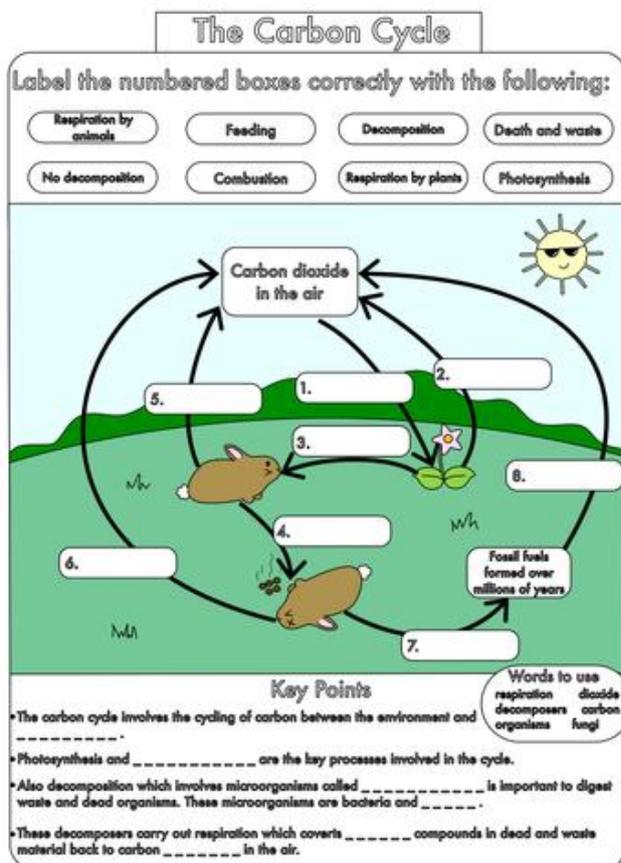
- Know that carbon is essential for life on earth
- Know that carbon easily combines with oxygen to make carbon dioxide
- Know the basic principles and sequence of the natural carbon cycle
- Differentiate the natural carbon cycle from the human activities that add more carbon to the carbon cycle

## Possible activities

Draw the natural carbon cycle and the human additions to it in different environments (rainforest, farm, city).

Move, act out or dance the carbon cycle, with children taking different roles.

Match carbon cycle terms to images, for example:



## Additional Resources

Carbon and the Carbon Cycle [https://youtu.be/xFE9o-c\\_pKg](https://youtu.be/xFE9o-c_pKg)

Carbon Cycle Explained <https://easyscienceforkids.com/carbon-cycle-diagram-video-for-kids/>

What is the Carbon Cycle and Why Does It Matter?

<https://www.youtube.com/watch?v=2Jp1D1dzxj8>

## People Have Changed the Earth's Climate

### Learning outcomes

- Understand the role of human activity in global heating
- Understand that the climate is changing too fast for life to adapt to the changes
- Think about actions to mitigate the climate crisis

### Additional information

Why is global heating a problem, given that the Earth did support life when it was much warmer and when CO<sub>2</sub> levels were last this high? The issue is the rate of change of temperature that we are causing is far too fast for life - at least complex life - to evolve to adapt to. Another big worry is that most of the effects of global heating seem to cause still further heating, and there could be a runaway effect where we find the temperature shoots up way beyond where most life can cope at all.

People can take individual actions. But to make the difference that is needed, governments and businesses across the world must make big changes to things that individuals can't change, like stopping extracting more oil and gas, massively increasing the use of renewable energy resources, changing the consumer/growth model of global economics, and instituting a carbon tax system that would make it economically impossible to release more CO<sub>2</sub> than absolutely unavoidable.

### Possible activities

The Carbon Map (listen to audio instructions first) <https://www.carbonmap.org/#Area>

Use NASA climate time machine <https://climatekids.nasa.gov/time-machine/> to see how the Earth's temperature, sea levels and CO<sub>2</sub> levels have all increased over time. Start with the children's birth years to the present.

Play Climate Trivia (there are lots of question variations, so children can play it several times) – this is also the quiz at the end of the presentation <https://climatekids.nasa.gov/trivia/>

Carbon footprint calculator <http://www.parkcitygreen.org/Calculators/Kids-Calculator.aspx>

How big is your environmental footprint? <https://footprint.wwf.org.uk/#/questionnaire>

Global Carbon Atlas <http://www.globalcarbonatlas.org/en/CO2-emissions>

Record your carbon footprint for a week. Record the school's carbon footprint for a week.

### Additional Resources

NASA Climate Kids <https://climatekids.nasa.gov/how-to-help/>

National Geographic <https://www.natgeokids.com/uk/discover/science/nature/how-to-save-the-planet/>

World Wildlife Fund <https://www.wwf.org.uk/thingsyoucando>

## BBC resources

These can be used in parts, depending on the prior experiences and levels of understanding of your class.

**David Attenborough's Climate Change: the facts** <https://www.bbc.co.uk/programmes/m00049b1>

### BBC Wales

**Weather reports of the future and impact on the coasts** <https://www.bbc.co.uk/news/uk-wales-59223819>

**Climate change impact on the rail network** <https://www.bbc.co.uk/news/av/uk-wales-59221584>

**Newsaround: your questions about climate change answered**

[https://www.youtube.com/watch?v=zl-7W\\_wB\\_fw](https://www.youtube.com/watch?v=zl-7W_wB_fw)

**Really simple guide to climate change** <https://www.bbc.co.uk/news/science-environment-24021772>

**Deforestation and palm oil impact** <https://www.youtube.com/watch?v=B5Fwl4P4EW8>

**Human impact and fossil fuels, species extinction**

<https://www.youtube.com/watch?v=dIsjcG7hTmo>

### BBC Bitesize (KS3 geography)

<https://www.bbc.co.uk/bitesize/topics/zx38q6f/articles/z773ydm#zgck96f13>

<https://www.bbc.co.uk/bitesize/topics/zx38q6f/articles/z773ydm#z6kjwnb10>

<https://www.bbc.co.uk/bitesize/guides/zx234i6/revision/1>