SHAPING OUR FUTURE: THE CLIMATE CHALLENGE

KS2 LESSON 1 – TEACHER GUIDE

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WHAT IS CLIMATE CHANGE?

KS2 LESSON 1 - TEACHER GUIDE
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WHAT IS CLIMATE CHANGE?

Learning objective:
To understand the terms 'weather' and 'climate', and explore some of the factors which affect them.

Curriculum links:
Science and geography

This lesson will provide the opportunity for pupils to develop an understanding of key terms, such as weather and climate, and discuss the causes and impact of climate change.

You can then choose from four practical experiments and a research task to investigate the weather. Some of these involve making or setting up apparatus and measuring changes over time, so you may want to complete these over multiple sessions. Alternatively, you could split the class into five different groups and ask each group to complete a different experiment or task. Afterwards each group could present back to the rest of the class, encouraging discussion and observation.

SLIDES 1-2

PENGUINS AND POLAR BEARS

Climate change is almost certainly a term that your class will be familiar with, but do they really understand what climate change is? And more importantly, do they appreciate that climate change relates to them? Use this slide to launch the topic.

Is climate change just about melting ice caps, penguins and polar bears? Elicit and briefly discuss pupils' knowledge and understanding before playing the animation embedded on the slide.

https://vimeo.com/140200000

SLIDE 3

LET'S START FROM THE BEGINNING... WEATHER

Weather is the day to day localised conditions, which have great variability (especially here in the UK). The word climate is the collective term used to describe long-term weather patterns for a particular area.

Use the slide visuals to explore the different types of weather and what pupils already know about how they are formed.

SLIDE 4

CLIMATE

© FRITZ PÖLKING / WWF

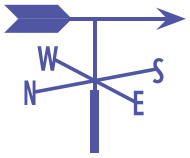
Use the slide visual to explore the climate areas, and together with a world map or globe identify countries from each of the areas featured. For example:

Polar	Norway, Sweden, Finland, Russia, Greenland, Antarctica, Iceland
Temperate	Parts of the United States of America, parts of Europe, the UK, Japan and New Zealand
Mediterranean	France, Greece, Italy, Spain, Turkey, parts of Australia and California
Desert	Afghanistan, parts of Africa, Saudi Arabia, Iraq, Egypt and Pakistan.
Tropical	Brazil, parts of India, parts of Australia, central Africa, the Caribbean Islands, Thailand and south east Asia.

NB: Move across the climate areas given at the bottom of the slide to display the different images.

SLIDES 5-6

WEATHER WATCHING



The slide presents the four main ways in which the weather changes. Each of these are linked to an experiment explained at the end of this guide which allows pupils to explore the weather in practical way. You could select one to set up during this session and then check it over the course of the week, and complete the others over multiple sessions, or split the class into groups for them to complete a different one each.

Movement
Winds blow from all directions. Knowing which way the wind is blowing can help predict the weather.

Weather watcher linked experiments:
- make and use a weathervane to determine wind direction
- make and use a simple anemometer to measure wind speed

Pressure
Pressure affects whether we have clear, cloudless days or thunder and lightning storms.

Weather watcher linked experiment:
- make and use a simple barometer

Moisture
The moisture content of the air causes mists and fogs and of course rain and frost if it's cold.

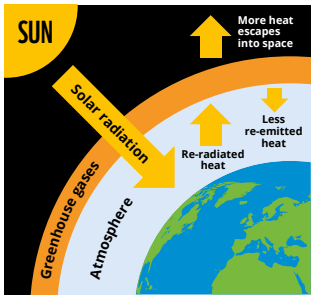
Weather watcher linked experiment:
- understanding evaporation and condensation in relation to the water cycle

Temperature
Temperature is influenced by all of the above, as well as how much sunshine reaches the Earth.

Weather watcher linked experiment:
- measuring temperature changes

SLIDES 7-8

CLIMATE CHANGE



Global temperatures have been rising for over a century, accelerating in the past 30 years, and are now the highest on record. Human activity is releasing greenhouse gases into the atmosphere. These gases are carbon dioxide, surface level ozone, water vapour, methane, nitrous gases, and CFCs. The biggest contributor to the warming effect is carbon dioxide, which is released by burning fossil fuels for energy, farming, and destroying forests. These emissions are causing the greenhouse effect – trapping heat and making the Earth warmer to an extent that can't be explained by natural factors alone. This is affecting weather patterns and habitats, plants and animals. People and wildlife often can't keep up with the changes that are happening to their homes.

Use the image on the slide to help pupils understand the greenhouse effect and discuss some of the reasons why this is happening.

SLIDE 9

WHY DOES IT MATTER?

© WIM VAN PASSEL / WWF

Use the images to explore some of the impacts of the greenhouse effect discussed in the previous slide.

Encourage pupils to think about the different places they suggested for each of Earth's climate zones on slide 4, and consider which of these weather extremes are likely to affect the animals and people who live in those places most. For example, they may have seen media coverage of flooding in the UK, tornadoes and hurricanes in the USA, or drought in Africa.

NB: Move across the black dots shown at the bottom of the slide to display the different images.

SLIDE 10

CLIMATE CHANGE AND US

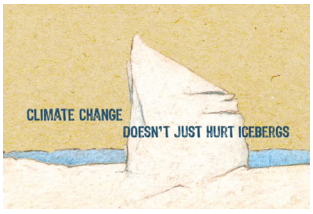
© GLOBAL WARMING IMAGES / WWF

This slide asks pupils to consider the impact of climate change on us, here in the UK. Reinforce the message from the start of the session, that climate change is not all about penguins and polar bears, it is about all of us and everything that shares our planet. Pupils may have experienced or witnessed flooding for example, or there's a risk of some countries where their favourite foods come from also being affected in this way.

If you are in an area that has already been affected by the weather extremes of climate change, e.g. flooding, then allow opportunity for pupils to share their experiences or concerns. Display the images on the slide to remind pupils of the impact of an imbalanced weather system. Are your pupils surprised to see chocolate on the slide? Explore their ideas and remind pupils that impacts in other parts of the world might impact things we use and enjoy every day here in the UK, because many of our products come from abroad.

SLIDE 11

CLIMATE CHANGE AFFECTS US ALL!



Summarise the session by showing the film embedded on the slide and discussing the class's responses: **www.youtube.com/watch?v=gEvmwNoMYEg**

GUIDANCE FOR WEATHER WATCHER LINKED EXPERIMENTS

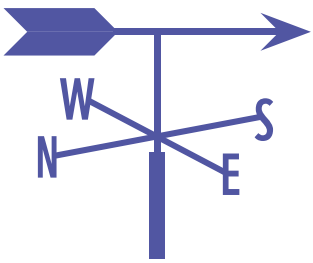
In this section there are four experiments and a research task. The experiments provided will support pupils in finding out more about the factors which affect our weather and climate. These experiments monitor day to day changes in the weather. However, they would need to be done over decades to see how the climate has changed.

Using the instructions provided in this guide, pupils are able to make their own weather monitoring equipment, and measure changes. Worksheets for pupils are provided to structure the process and enable recording of each task. The experiments can either be done as a whole class or in mixed ability groups. You could consider splitting the five tasks across different groups, with each group presenting back to the rest of the class. Encourage discussion and observation.

After undertaking the experiments, allow pupils time to reflect and share what they have learnt about the weather and climate change. Using the combined results and equipment, pupils should then be given the opportunity to monitor the weather over a period of time. Discuss ways in which you could extend your weather monitoring to measure climate change in your area e.g. monitor, record and compare over the academic year and keep findings for comparison with subsequent years, compare findings with Met Office information, look for other signs of climate change where you are. Consider creating a class diary to note instrument readings and weather. This process of monitoring, recording and reflecting will help pupils appreciate how climate change is measured and also how our weather is forecast.

You can search for YouTube demonstrations of each experiment online.

EXPERIMENT 1 EXPLORING MOVEMENT



(Supported by worksheet 1)

To give context, you could show this 4-minute clip in which Mark Thompson, Astronomer explores why the UK has always suffered from extremely windy conditions and whether this is liable to get worse. **https://uk.news.yahoo.com/video/weather-explained-wind-112018695.html**

The movement of the wind is measured in two ways:
- Using a weathervane to determine direction
- Using an anemometer to compare wind speed

Using the instructions, pupils make an anemometer and weathervane to measure wind speed and direction. Once made, the pupil worksheet provided gives an open task which challenges pupils to consider where they will measure wind speed and direction and when and how they will record their findings. Opportunity should be given to discuss and plan the project, with sufficient time for trial and error.

Pupils can record how many times per minute the anemometer spins, and multiply by 60 to find out how many spins an hour. They can then compare their results by taking measurements on different days or at different times.

INSTRUCTIONS FOR MAKING A WEATHERVANE

You will need:
- plasticine
- a recycled plastic pot with a lid
- scissors
- a bamboo (barbecue) skewer
- 2 recycled drinking straws
- clean and dry recycled drinks carton or cardboard
- marker pens
- pins
- sticky tape
- something to weigh the weathervane down and a compass to set it up

1. Stick a ball of plasticine in the middle of the inside of the lid of your pot.
2. Use the scissors to pierce a small hole in the middle of the bottom of your pot that's big enough for the drinking straw.
3. Place the lid on the table and fix the pot on top.
4. Cut the skewer to a length slightly shorter than the drinking straw, then slide it inside.
5. Push the straw and skewer through the hole in the bottom of your pot into the plasticine inside.
6. Cut out a square piece from the drinks carton and using a marker, mark each corner with the point of a compass. (N for North, E for East, S for South and W for West). Remember to make sure that N and S and E and W are opposite one another. Then add NE halfway between N and E, SE halfway between E and S, SW halfway between S and W and NW halfway between W and N.

7. Make a hole in the middle and carefully slip over and slide down the straw and skewer to sit on top of your pot.
8. Cut out two card triangles and stick them, using sticky tape, facing the same way on either end of the other straw to create an arrow. NB: your triangles need to be big enough to catch the wind.
9. Push a piece of plasticine into the top of the straw with the skewer inside.
10. Attach your arrow by pushing a pin through the middle of your arrow straw into the plasticine in the top of the straw on your pot.
11. If necessary carefully add sand or stones to your pot to weigh down your weathervane, then take it outside and place it somewhere open.
12. Using a compass make sure your N, E, S, W points are positioned correctly. Your weathervane arrow should now turn to point in the direction the wind is blowing.

Note: the wind changes direction often, so be sure to keep an eye on it!

INSTRUCTIONS FOR MAKING AN ANEMOMETER

You will need:
- red marker pens
- sticky tape
- plasticine
- 3 bamboo (barbecue) skewers
- 4 x small cardboard or compostable plant pots
- a small lidded bottle containing water and a stopwatch

1. Make two of the skewers into a cross and secure using sticky tape.
2. Using the red marker pen colour the base of one of the small cardboard or compostable plant pots red.
3. Using sticky tape attach each of the 4 small cardboard or compostable plant pots to each end of the cross.
4. Using a large blob of plasticine secure the cross with taped pots onto the top of the third skewer.
5. Carefully pierce a hole in the centre of the bottle lid big enough to insert your anemometer.
6. Push the anemometer through the cap and add a small blob of plasticine before immersing it in the water and securing the lid.
7. The weighted anemometer should now spin freely when you blow on it.
8. Place the anemometer in an unsheltered spot and observe how fast it spins. The faster the spin the stronger the wind.
9. You can use a stop watch to time how many times your anemometer spins in a minute by counting how many times the red pot reaches a certain point until a minute is up.
10. Experiment by holding your anemometer in different places and at different heights.

EXPERIMENT 2 EXPLORING THE WATER CYCLE

(Supported by worksheet 2)

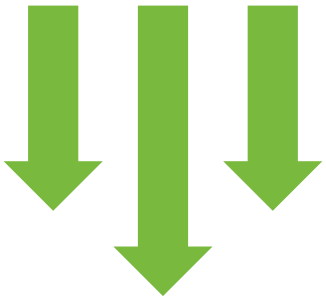
This experiment helps pupils understand that the Earth's water moves around the Earth and its atmosphere in a continuous cycle called the water cycle. Heat from the sun causes evaporation, where the water from our oceans, lakes and rivers becomes water vapour. Water is also released as water vapour into the atmosphere by plants and trees by transpiration. The water vapour rises into the atmosphere where it then cools down and changes back into droplets of water, which fall back to Earth as rain, or other types of precipitation such as sleet or snow, to replenish our oceans, lakes and rivers. This cycle repeats over and over again and can be demonstrated using the simple experiment below.

INSTRUCTIONS FOR EXPERIMENT TO EXPLORE THE WATER CYCLE

1. Place equal amounts of water in 5 or 6 identical re-sealable sandwich bags.
2. Carefully blow a small amount of air into each bag before resealing.
3. Using a marker pen, carefully mark the level of water on the side of each bag.
4. Position the bags in different areas around the class/school together with a thermometer to measure temperature.
5. Observe and record changes and temperatures.
6. Discuss findings.

Remember pupils can also monitor rainfall, simply by placing a measuring jug or jam jar with a measured and marked scale on the side, outside in an unsheltered spot, then checking and recording levels after each rainfall. NB: the narrower the measuring jug/jar, the easier the volume of rain will be to measure.

EXPERIMENT 3 EXPLORING PRESSURE



(Supported by worksheet 3)

This experiment will help pupils to relate changes in air pressure to changes in the weather. Worksheet 3 challenges pupils to consider the best location for their barometer and also the frequency of their monitoring and recording. Allow time for discussion, trial and error. It is important that the weather is recorded alongside any changes in pressure observed.

High pressure usually results in clear, cloudless skies which mean fine, dry weather in spring and summer and cold, dry weather in autumn and winter. This is known as an anticyclone – an area of high atmospheric pressure where the air is sinking.

Low pressure causes the air to rise, forming clouds which condense into precipitation, so usually indicates unsettled, wet and windy weather. This is known as a depression.

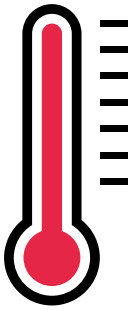
INSTRUCTIONS FOR MAKING A BAROMETER

You will need:

- an empty tin or jam jar
- a large balloon
- scissors
- elastic bands
- some tape
- a bamboo (barbeque) skewer
- a ruler
- a marker pen
- an empty cereal box

1. Cut the mouthpiece off the end of the balloon and stretch the balloon over the top of your empty jar or tin.
2. Using the elastic bands secure the balloon to form an air tight seal.
3. Carefully tape the blunt end of the skewer to the middle of the stretched balloon.
4. Tape the ruler to the wide side of your cereal box and stand it so that the pointed end of the skewer can be used to take a reading. Note the point at which the skewer rests on the ruler as your first reading. Use the marker pen to indicate this by drawing a line across the cereal box at this point.
5. Position your barometer where it can be left undisturbed and monitor regularly for any movement of the pointer.
6. As you record each change in pressure remember to observe and record the weather patterns that follow.

EXPERIMENT 4 EXPLORING TEMPERATURE



(Supported by worksheet 4)

The temperature of any place is dependent on how much heat energy it absorbs from the sun, which is partly influenced by the area's proximity to the sea. High ground tends to be colder than sea level and coastal areas will be cooler than inland, as the sea has a moderating effect on temperature. This can be explored using the following experiment, which helps pupils to understand that the sun's rays are absorbed differently by the land (in this case sand) and the sea (water). Although the water takes longer to heat up, it holds its heat for much longer, so coastal areas are cooler in summer and milder in winter, and snow is not usually seen at the seaside.

Ideally, this experiment needs a warm sunny day. Setting up the sand and water in step 1 can be done the day before to save time. Be sure to leave the sand and water to stand for at least one hour in order to ensure a similar starting temperature for both and therefore a fair test. Use the worksheet provided to support pupils to record their experiment and results.

INSTRUCTIONS FOR EXPLORING TEMPERATURE

1. Place two identical trays side by side in a cool place, ¾ fill one with water and one with sand and leave them to stand for about an hour.
2. Using a thermometer measure and note the temperature of both trays.
3. Now place the trays side by side in the sun or a warm place for an hour.
4. Predict what will happen to each tray.
5. Using the same thermometer measure and note the temperature of both trays.
6. Place both trays back in the cool place used in step 1. This time record the temperature of each tray every 15 minutes.
7. Use worksheet 4 to record your findings.

RESEARCH TASK

(Supported by worksheet 5)

EXPLORING CLIMATE CHANGE

This is a research task which supports pupils to consider the effects of climate change in relation to their local area. Depending on where you live, there may be obvious examples to be discussed with the class, e.g. flooding. According to climate scientists, extreme weather is more likely to happen more often in the future due to climate change. Pupils work in mixed ability pairs or small groups to consider the impact of heat waves, storms and flooding on their way of life and local area.

Worksheet 5 can be used to support pupils in recording their findings and ideas. Groups could use computers, or you could print some relevant information for them to use.

This Met Office link provides details of the UK's past extreme weather conditions and their impact, together with links to the original news articles where available.
http://www.metoffice.gov.uk/climate/uk/interesting/

Identify areas at risk of flooding in your local area using
http://www.checkmyfloodrisk.co.uk/

BACKGROUND INFORMATION AND RESOURCES

There is a wealth of accessible information about climate change and its impacts available on the WWF website
http://wwf.org.uk/climatechange

There is more background information on weather and climate on the Met Office website **http://www.metoffice.gov.uk/**

You can also find the latest on UK climate extremes from the Met Office
http://www.metoffice.gov.uk/public/weather/climate-extremes/#?tab=climateExtremes

You can compare your readings to the met office wind map for your local area at
http://ow.ly/8AzM303mCLX

The intensity of the wind is measured using the Beaufort Scale which relates wind speed to the effect on the sea
http://www.metoffice.gov.uk/guide/weather/marine/beaufort-scale

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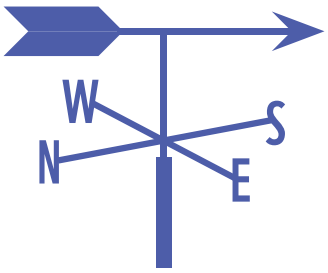
LESSON WORKSHEETS



EXPLORING MOVEMENT

You are going to measure the wind in two ways:

- Using a weathervane to look at wind direction
- Using an anemometer to compare wind speed

Follow the instructions to make your own wind monitoring equipment, then use this worksheet to help you plan and record your research.

CLIMATE FACTS

- The Earth is windy because the planet is warmer in some places than others. As the hotter air rises the cooler air is drawn underneath it. We feel this movement as wind.
- The Shetland Islands off the coast of Scotland are the windiest location in the UK.
- The fastest gust of wind ever at 253mph was recorded in 1996 by an unmanned instrument station in Barrow Island, Australia, during Typhoon Olivia.
- The UK has an average of 33 tornadoes a year, which due to our relatively small size means we have more tornadoes per km^2 each year than any other country!

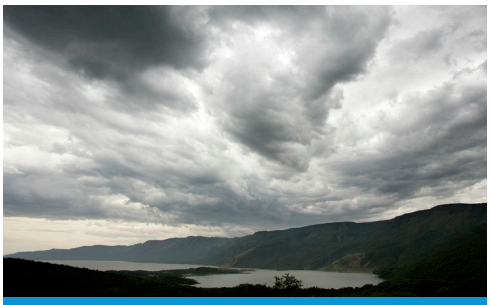
1 Think about the best place in your school to put your anemometer and weathervane. Use the space below to write why you have chosen this location.

2 When and how often will you record your readings? Who will do this?

3 How will you present your findings?

4 How could this equipment be used to monitor climate change?

EXPLORING THE WATER CYCLE



CLIMATE FACTS

- The biggest clouds are thunderclouds (cumulonimbus) which can hold as much as 500,000 tons of water.
- Natural materials such as untreated sheep's wool and seaweed (kelp) can be used to predict rain as they respond to changing levels of moisture in the air – swelling up when the air is damp and shrinking when the air is dry.
- Hygrometers use human hair to measure humidity, which tells us how much water vapour there is in the air and helps forecasters to predict rain.
- Two thirds of the world's rain falls in the tropical climate zone, which, unsurprisingly, also has the highest level of humidity.

1 **Follow the instructions to observe the water cycle. Explain how you would test the effect of temperature on the water cycle. What might happen?**

2 **Explain how you would make sure your experiment was a 'fair test.'**

3 **What do you think will happen as the temperature increases?**

4 **Using your test method carry out the experiment and record your findings.**

5 **Draw your own diagram of the water cycle in the box below.**

6 **Use the key words underlined to add labels to your drawing.**

The water cycle is a continuous process powered by the sun, which heats our oceans, lakes and rivers, turning the water into water vapour by the process of evaporation. As the water vapour rises into the atmosphere, it cools and forms clouds by the process of condensation. The water vapour stays in the atmosphere until the clouds can't hold any more moisture and the water falls back to the ground as precipitation (rain, sleet, hail or snow) to refill our oceans, lakes and rivers.

EXPLORING PRESSURE

Changes in atmospheric pressure lead to changes in the weather. When the air pressure drops then stormy weather is on its way! Follow the instructions to make your own barometer, then use this worksheet to help you plan and record your weather research.

Air pressure is all around us, so it is fine to keep your barometer indoors. The important thing is to position it carefully where the scale can be read without moving it.

1 Draw a diagram of your barometer and label it to show what will happen as

A. the air pressure increases
B. the air pressure decreases

CLIMATE FACTS

- Thunder and lightning happen at the same time but we see the lightning first because light travels faster than sound.
- The temperature of a typical lightning bolt is four times hotter than the surface of the sun.
- The sound of thunder is made by the air expanding at supersonic speed as it is heated by lightning. If the lightning travels a long way, then the thunder sound will rumble and roll as the sound carries from one end of the lightning flash to the other.
- Thunder can be heard up to 20km away. You can work out how far away you are from the storm by counting the number of seconds it takes to hear the thunder after each lightning flash, where 3 seconds equals 1km.

A.

B.

2 **Decide how often (frequency) you will check your barometer and for how long (duration) you will continue to monitor air pressure changes. Draw a graph on which to plot each reading.**

3 **Remember to record any weather patterns you noticed when the pressure changed.**

EXPLORING TEMPERATURE

The temperature of any place is dependent on how much heat energy it absorbs from the sun. Follow the instructions to explore temperature changes using sand and water.

1 What do you think will happen to each tray when you move them into the sun or a warm place?

2 Use the space below to create a table to record the temperature each time you use the thermometer.

CLIMATE FACTS

- Wind increases heat loss, so being by the seaside is pleasant on a hot summer's day, but on a winter's day, this additional heat loss known as 'wind chill factor' can make you feel much colder than the thermometer suggests.
- The coldest temperature on earth was recorded in August 2010 at -94.7°C by a NASA satellite in Antarctica.
- Deserts occur wherever there is very little moisture in the air. The hottest deserts, like the Sahara are found in the Tropics where the sun's power is at its greatest.
- Rising temperatures due to global warming are causing extreme weather, sea level rises and increasing the world's greatest challenges e.g. poverty, hunger and peace.

EXPLORING CLIMATE CHANGE

According to climate scientists extreme weather is more likely to happen more often in the future. Work with a partner or in a small group to research and reflect on the local impact of these changes in climate:

1. **As the temperature of the Earth rises we will see fewer frosts and more heat waves. Think about what effects this may have on our way of life e.g. travel, food supplies and your local environment.**

2. **Heatwaves are usually accompanied by thunder storms and torrential rain. Identify areas at risk of flooding in your local area using www.checkmyfloodrisk.co.uk. What do you think will be the impact on the people and animals that live in the worst affected areas close to you?**