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SIEMENS AIR QUALITY MANAGEMENT

Weather and climate

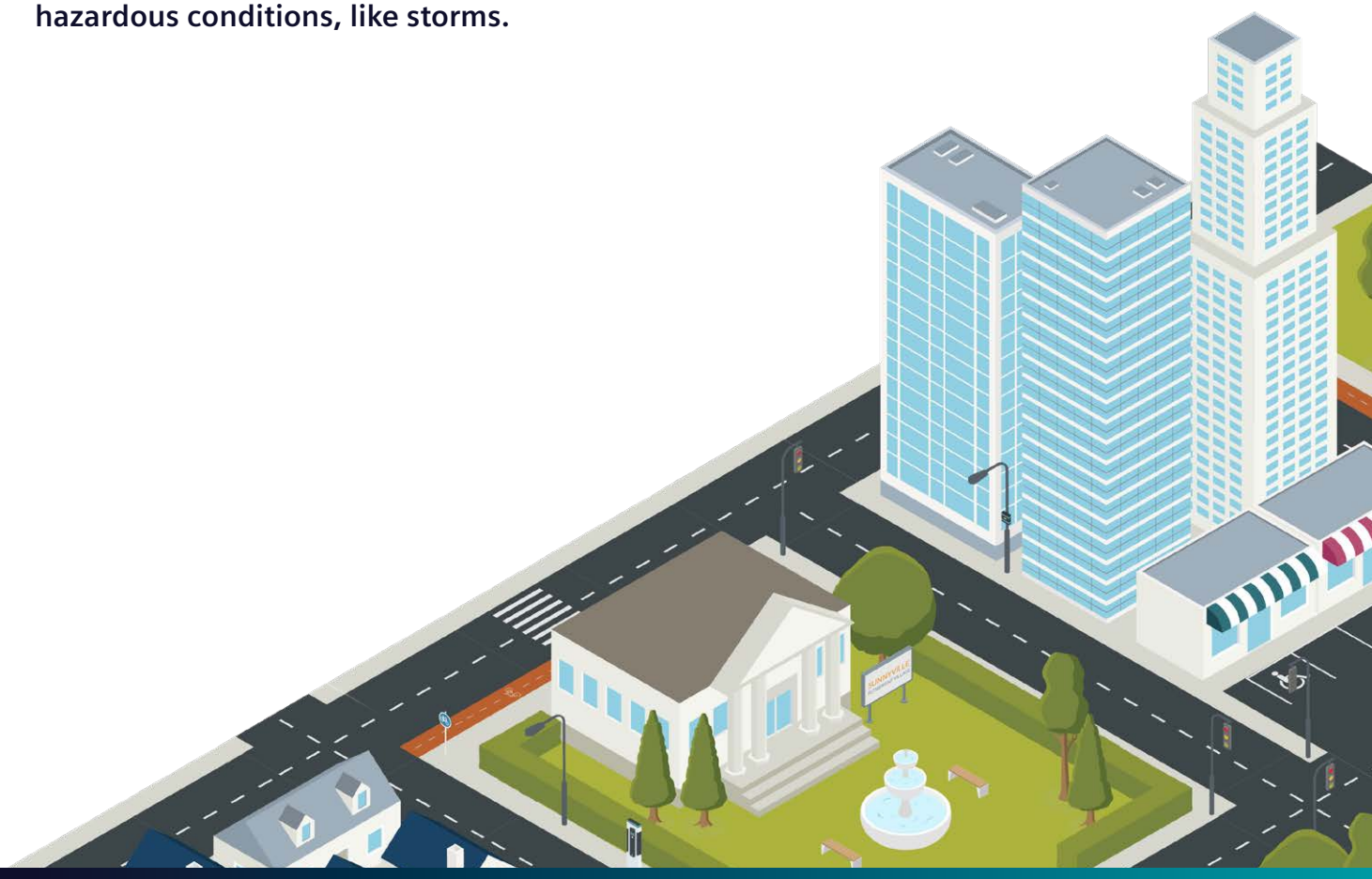
What's the difference?

The world's weather is always changing and it can influence our lives in many ways. We often make choices about what to wear depending on the weather, and it can even affect our moods. Weather describes the day to day conditions of the earth's atmosphere; like sunshine, cloud or rain.

Climates refer to the average weather conditions over longer periods, so what we can expect for specific areas. For example, tropical areas like South and Central American can expect monsoons at certain times of the year.

Did you know?

Meteorology is the study of weather and meteorologists are the specialist scientists who study weather patterns around the world. This allows us to forecast upcoming weather changes and even predict and prepare for hazardous conditions, like storms.



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Measuring the weather activity

Below are different weather aspects that are commonly measured. Can you match the correct equipment to the weather type?

Precipitation i.e. rainfall	Speed can be measured using an anemometer and strength is measured on the Beaufort scale.
Sunshine	Measured in Celsius (°C) using a thermometer.
Humidity i.e. amount of water vapour in the air	Measured using a specific device called a Campbell-Stokes recorder, which uses a spherical glass lens to focus sun rays on a specially designed tape. When the heat exceeds a certain level, the tape burns.
Air pressure	Measured by a barometer and the units used are millibars. The greater the reading, the higher the pressure.
Temperature	Measured using a rain gauge.
Cloud cover and visibility	A device called a hygrometer is used, which consists of two thermometers mounted together with a handle attached to a chain. One is ordinary, the other has a cloth wick over its bulb and is called a wet bulb thermometer.
Wind speed and direction	Measured in units called oktas. Each okta represents one eighth of sky covered by this weather type.

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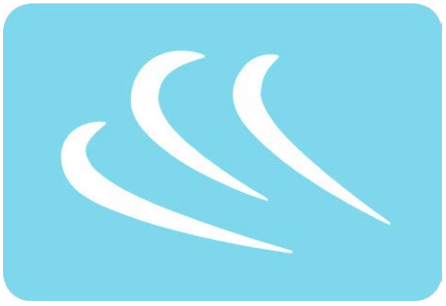
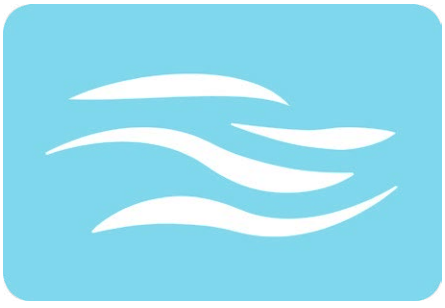
Cloud types activity

Have you ever looked up at the sky and spotted different shapes in the clouds? Clouds are actually categorised according to their height and shape and have been given names based on Latin words.

Using the cloud names and their Latin meanings below, can you match them to the correct cloud diagrams?

Nimbus – meaning rain bearing in Latin
Stratus – meaning lock of curly hair in Latin
Cumulus – meaning pile or heap in Latin
Cirrus – meaning lack of curly hair in Latin





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Population

Growing populations

The world's population is growing all the time and it never stays the same. It is growing at a rapidly increasing rate and has been over the last few hundred years. By 2050, it's predicted that our global population will increase by another 2 billion people.

There are 195 countries across the world and the number of people living in each isn't evenly balanced. The way we're spread out across the world is referred to as world population distribution.

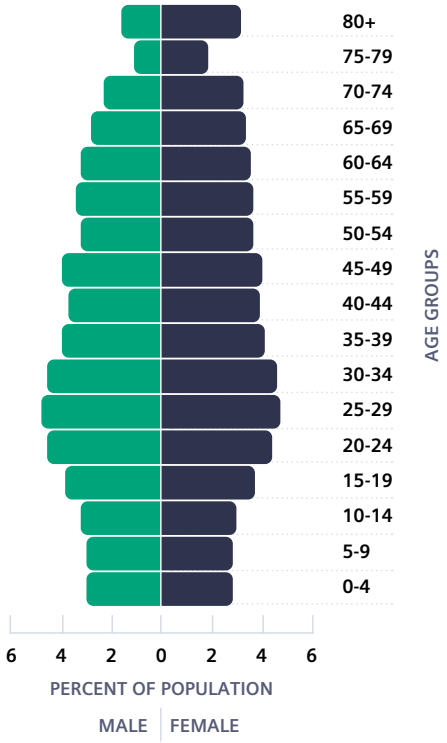
Did you know?

Nearly 2,000 years ago, the world population was about 300,000 people. Nowadays the world population is over 7 billion, and most of the growth has taken place within the last 100 years!

Population structure

Population pyramids (also called age-gender pyramids) are special graphs that are used to show population structures i.e. how many males and females of different age groups are in the population in each place. A population pyramid will use age, gender and population percentage as the variables.

Using a population pyramid, you will be able to identify if a place has an ageing or a young population. Currently China has the highest ageing population in the world whereas Niger, in Western Africa, currently has the youngest population.



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Draw a population pyramid activity

Imagine you are working for the city council of **Green City**. Using the population information below, **draw a population pyramid for the city** and see what observations you can make.

Have a think about what this might mean for your city i.e. an ageing population can bring benefits, such as more experience and knowledge. It also increases the cost of healthcare and adds to the government spending, as they have to pay everyone a pension (retirement income).

Green City's projected population 2051

Age	Females %	Males %
85+	2.92	1.63
80-84	2.15	1.71
75-79	2.52	2.24
70-74	2.65	2.53
65-69	2.92	2.89
60-64	3.05	3.07
55-59	3.12	3.16
50-54	3.07	3.13
45-49	3.05	3.11
40-44	3.02	3.08
35-39	3.00	3.07
30-34	2.98	3.07
25-29	2.92	3.04
20-24	2.83	2.98
15-19	2.66	2.81
10-14	2.57	2.72
5-9	2.53	2.67
0-4	2.50	2.64
Total	**50.5**	**49.5**

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People choose to live in certain villages, towns and cities depending on a variety of different environmental and economic factors. When few people live in a location, we describe it as sparsely populated and densely populated places are inhabited by lots of people.

Living environments activity

Cut out the below flashcards and partner with another student in your class. Study them first and then get ready to test each other. Take it in turns to read out the environment description and get your partner to guess what living environment you're referring to.

Talk about whether you think these environments might be densely or sparsely populated, and why that might be. Think about where you live too - which description suits you best?

Urban

Having characteristics of a town or city.

Having characteristics of the countryside.

Rural

Village

An association of houses, smaller than a town and usually in a rural area.

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Suburban

Having characteristics of a town bordering, or just outside, a city.

The capital or chief city of a country or region.

Metropolis

Borough

A town or district that has an administrative unit (the power to make government decisions locally)

A large town

City

Town

Smaller than a city but larger than a village, usually with its own local government

Did you know?

Some countries are divided up into boroughs (smaller areas) to make managing their land and the affairs of their people easier.

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SIEMENS SMART BUILDINGS

Urban environments and pollution

What are urban environments?

Urban areas, like towns and cities, are densely populated built-up areas and generally have extensive housing options and transportation links; as well as sophisticated systems for sanitation, utilities, land use and communication.

As urban areas continue to grow and develop across the world, a higher percentage of the population are making the shift from rural to urban living. In fact, the global urban population grows by 1.5 million people every single week! This shift from rural to urban living is referred to as urbanisation.

Did you know?

Back in 1950, cities made up a third of the world population but by 2050, they will account for more than two thirds.

Air quality and pollution

One of the most significant issues caused by large numbers of people living in densely populated areas, like cities, is the sheer volume of waste and pollution that they continue to create. As urban populations continue to soar around the world, air pollution has reached dangerous levels. The World Health Organisation (WHO) claims almost 90 percent of the world's urban population breathe air with pollutant levels that far exceed the recommended thresholds.

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Did you know?

According to the WHO (World Health Organisation), approximately 7 million people die each year from the effects of air pollution, which makes it one of the biggest global health threats.

When unwanted chemicals, gases and particles enter the air and the atmosphere; they cause harm to animals and damage the natural cycles of the earth - like long-term weather patterns. Air pollution can be a result of natural causes; like volcanic eruptions, forest fires and other natural phenomena.

Humans don't just create air pollution in cities either, it happens all over the world. Traditionally we have burnt fossil fuels, like coal and natural gas, to generate energy to power all of the different needs of our societies. This has resulted in the release of harmful elements, like carbon dioxide, into our planet's atmosphere.

Cities do, however, tend to be hot spots of environmental pollution due to all of the activity that happens within them.

Air quality news reporter activity

Imagine you're a local reporter for the city newspaper. You've just received a warning from the environmental agency to let you know the city's air pollution is approaching dangerous levels. Your newspaper editor has asked you to research and prepare an urgent newspaper article for the front page, urging local citizens to take immediate precautionary measures to reduce pollution.

Work with a partner to research and identify the main causes of human pollution in cities, and how people can reduce their carbon footprint (the amount of pollution they're contributing towards the environment).

You might want to start with aspects like transport methods that people use in and around the cities, as well as certain industries and businesses that might generate harmful toxins. **Once you've gathered enough information, design and write a front page article with your partner.**

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Monitoring air quality

Governments use something called the Air Quality Index as a way to alert people to the quality of the air and how bad the air pollution might be in an area or city. This index is colour coded to help people determine if it's safe to go outside.

AIR QUALITY INDEX
Hazardous
Very unhealthy
Unhealthy
Unhealthy for sensitive groups
Moderate
Good

We use the term pollutant to refer to the harmful gases and substances that cause air pollution. Here are some of the major air pollutants:

- **Sulphur dioxide (SO2)** - This is generated by burning fossil fuels, like coal or oil. It is one of the more dangerous pollutants and can cause acid rain, as well as respiratory illnesses like asthma.
- **Carbon dioxide (CO2)** - Through respiration, humans and animals naturally breathe out carbon dioxide. It is also released when fossil fuels are burned. Carbon dioxide is a greenhouse gas.
- **Carbon monoxide (CO)** - This gas is odourless and as such very dangerous, as we can't smell or see it. It is produced by cars and other motor vehicles and is so toxic, it can cause death if you breathe too much of it. This is one reason why you should never leave your car running in the garage.
- **Chlorofluorocarbons** - Often referred to as CFCs, these chemicals are not used as much today, but can still be found in spray can products. They cause significant damage to the ozone layer - the protective layer in the earth's atmosphere, that acts like a sunscreen to protect us from the sun's harmful rays.
- **Particulate matter** - These are tiny particles, like dust, that get into the atmosphere and make the air we breathe dirty and dangerous. They are linked to diseases like lung cancer and other respiratory illnesses.

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Air pollution debate activity

Your teacher will split your class into groups and ask you to think about your local area. Knowing what you do now about air pollution, and the different types of pollutants that can affect us, what do you think the biggest air pollution risk is in your nearest town or city?

Think about who this might affect the most and what local measures you could put in place to contribute to better air quality. Once you've debated this in your groups and agreed on an approach, start a class discussion and compare your thoughts.

Did you all identify the same issues or did your fellow students have other opinions? Would it be possible to do a number of different things to combat air pollution in your local area?

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SIEMENS SMART BUILDINGS

Sustainable growth and technology

As our world and the people in it continue to grow and evolve, developing sustainable resources and a plan for sustainable growth is more critical than ever to ensure we protect the environment for future generations.

Resources are the things that are useful to people. Natural resources can be divided into renewable and non-renewable resources and energy sources are a great example of this. Coal and oil energy are non-renewable resources, as eventually they will run out.

While technically the earth will produce more coal and oil over time, this takes millions of years and at the rate we're currently using fossil fuels it means we'll exhaust the supply before it regenerates in our lifetime. On the other hand; wind, solar (from the sun) and hydro (water) are all renewable resources as we can continuously harness them with the right technology and equipment.

Did you know?

Sustainability is the ability to maintain at a steady rate or level. In terms of the environment and our resources, sustainable choices mean that we carefully manage our resources and ensure we don't use more than what's available to us.

To help plan for the future, world leaders have agreed to put strategies into place that aim to help make the way they use resources in their country more sustainable. These agreements are referred to as 'Agenda 21' and 'Local Agenda 21' and you might hear about these when listening to or watching the news.

Through careful management of our resources, we can use them in different ways or recycle existing materials to help reduce the amount of waste or pollution generated. For example, we can re-use old vehicle tyres in road building materials rather than generating new ones.

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City leaders are also under pressure to think of new initiatives for sustainable, clean and smart growth. However, they often lack the sufficient data or digital tools necessary to make the best decisions.

Luckily for them, there is a wealth of new knowledge and technology that can be applied to sustainable city development. In fact, there is already existing technology that can be used to help manage city air levels through virtual or 'cloud-based' systems. It's called CyAM or City Air Quality Management software.

This tool helps city leaders visualise air quality data recovered from physical measuring stations that are installed around cities and towns. It can actually even predict, or forecast, air pollution levels for the next three to five days with up to 90% accuracy.

The most exciting thing about this technology is that city leaders can test ideas and emergency measures in the virtual environment first, to see if they work and improve air quality. It's a little bit like a simulation game, which you might have played before, and allows city leaders to choose from a list of 17 short-term measures such as implementing low emission zones, traffic speed limits and free public transport to reduce pollution.

There are two key benefits to using technology like this:

1. **Data helps to make better decisions** -
   For city leaders, having access to reliable information and data can form the basis of key decisions about their city's air pollution levels. Being able to predict the next five days using technology is like being able to look into the future. As well as giving city leaders a tool to help put emergency measures into place, it can also be used to help plan for long-term air quality improvements.

2. **Artificial intelligence improves air quality** -
   City Air Quality Management (CyAM) software allows city leaders to test measures using computer systems - or artificial intelligence. This means they can make and correct any mistakes in a virtual environment first, which helps protect the population and ensures that any measures will be safe and tested before they are rolled out in real-life. It also allows city leaders to find real solutions that positively improve air quality and public health.

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Future technology activity

With all of the exciting new technology that already exists, do you ever wonder what might be possible in 100 years' time? What might we have created or designed by then that will help improve our environment and reduce the amount of pollution we generate as humans?

Choose one of the following themes below and draw or design your own future technology. You could do this in a poster format, make a model using craft materials or sketch or draw your design on a smart tablet or pad.

1. **Transport** - cars, buses and trains are commonplace in our current world but how might we travel by the year 2120, to reduce the amount of pollution on our roads?
2. **Energy Resource** - wind, solar and hydro power already exist but what else might we develop technology for by 2120, to help us draw energy from more unusual, renewable sources?
3. **Environment** - what technology might we have developed to help protect our natural environments, like forests and oceans, and the animals that live within them by 2120?