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AIR POLLUTION

Fact Sheet Series for Key Stages 2 & 3

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Contents

1. What is Air Pollution?
2. What is Acid Rain?
3. Air Pollution & Transport
4. Air Pollution & Industry
5. Effects of Air Pollution & Acid Rain on: Vegetation
6. Effects of Air Pollution & Acid Rain on: Wildlife
7. Effects of Air Pollution & Acid Rain on: Health
8. Effects of Air Pollution & Acid Rain on: Buildings
9. What Can You do to Help Reduce Air Pollution?
10. How Can Technology Reduce Air Pollution?
11. What is the Government Doing?

Glossary

1. What is Air Pollution?

Introduction

Air pollution is the term used to describe any harmful gases in the air we breathe. Pollution can be emitted from natural sources such as volcanoes, but humans are responsible for much of the pollution in our *atmosphere*.

Air Pollution from Cars

The number of cars on Britain's roads is constantly increasing. Each car burns fuel, and fumes come out of the exhaust pipe and pollute the atmosphere.



Electricity and Air Pollution

We all rely on electricity to cook food, watch television and make our daily lives more comfortable. Electricity is made in power stations by the burning of *fossil fuels*



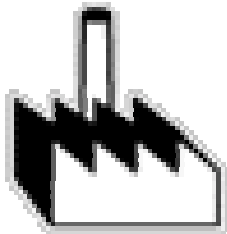
(coal, oil and gas). As they are burnt, gases are emitted from tall chimneys, called stacks, into the atmosphere.

Air Pollution from Homes

Today, most people have central heating in their homes, but in remote areas coal is still burnt to provide heat. Harmful gases are given off which can be damaging to the environment. In the past nearly all homes were heated in this way.



The History of Air Pollution



The problem of air pollution was first recognised about 500 years ago when the burning of coal in cities was increasing. About 200 years ago, a large growth was seen in the amount of coal burnt, as the Industrial Revolution took place in Britain. The Industrial Revolution was a fast growth in industry that was based around the use of fossil fuels.

During foggy weather, when little wind was present the smoke produced by the coal would mix with the fog and form smog.

Smoke + Fog = Smog

The smog made it difficult for people to see and breathe. In 1952 the Great London Smog occurred, killing 4000 or more people.

Cleaning Up the Air

The Great London Smog became a landmark in the history of air pollution in Britain, and it led to the declaration of the Clean Air Acts of 1956 and 1968.

The Acts aimed to cut air pollution by reducing the amount of coal burnt. They also introduced the idea of using tall chimneys to try and ***disperse*** pollutants high into the air.

The occurrence of smog slowly began to decrease and a higher standard of living was achieved.

2. What is Acid Rain?

Introduction

Acid rain is the term used to describe the deposition of **acidic** air pollution back to Earth. This includes acidic pollution falling as rain, snow, sleet, hail, mist or fog - **wet deposition** - and the **dry deposition** of gases and particles.

How is Acid Rain Measured?

Acidity is measured using the pH scale. It ranges from 1 - 14:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Acid				Neutral				Alkali					



Substances like vinegar and lemon juice are **acidic**, and have a low pH. Distilled water is **neutral** with a pH of 7.

Substances like blood and milk are ***alkaline*** and have a high pH.



All rain is slightly acidic as it contains dissolved carbon dioxide, a gas found in air. We therefore class unpolluted rain as having a pH of 5.6. Acid rain has been found to have a pH as low as 2.4.

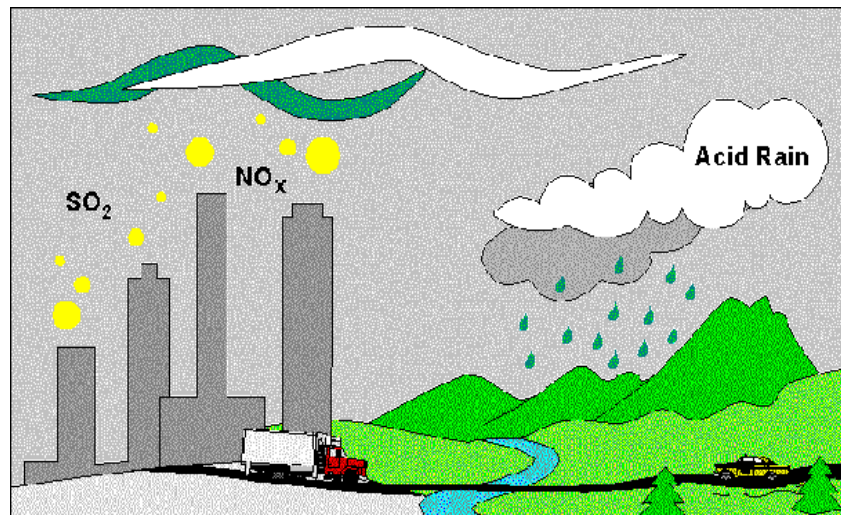
How is Acid Rain Made?

When power stations, factories, houses and cars ***emit*** pollution into the atmosphere, it contains chemicals known as ***sulphur dioxide*** and ***nitrogen oxides***. These chemicals may either fall directly back to the Earth due to ***gravity*** (dry deposition), or they may mix with water in the atmosphere (moisture) and form acids.

Once acids have formed, they can be transported long distances by the wind before being deposited with rain, snow or hail. This is known as wet deposition, and is commonly called Acid Rain

Acid Rain has become a world wide problem. In countries such as Britain and America, there are many power

stations and factories that produce a large amount of pollution. This pollution is transported by the wind and deposited in countries such as Norway, Sweden and Finland, which lie hundreds of miles away.



3. Air Pollution & Transport

Introduction

The largest source of air pollution in Britain is transport. The number of vehicles on Britain's roads is constantly increasing and pollution from them is now a major problem. Today there are about 29 million vehicles on the road in Britain, 24 million of which are cars.

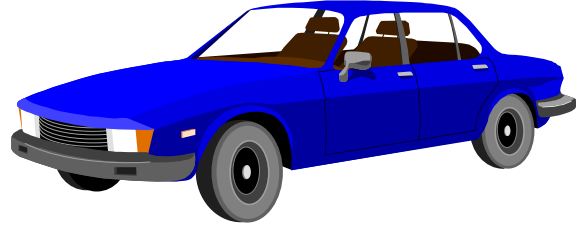
Lead Pollution

The majority of the UK's vehicles run on petrol or diesel. Unleaded petrol is now commonly available, and all cars made today can run on this. Lead pollution can be particularly harmful to children, and can be damaging to wildlife. This is why it was banned completely in 2000. Nevertheless, cars using unleaded petrol still emit other pollutants like nitrogen oxides.

Main Air Pollutants from Transport

The main pollutants associated with transport are:

- *carbon monoxide;*
- *nitrogen oxides;*
- *hydrocarbons;*
- *particulates.*



They are all emitted from car exhausts and create pollution close to the ground, where it contaminates the air we breathe.

Ozone is another major pollutant, but it does not come out of exhaust pipes. It is formed when nitrogen oxides, carbon monoxide and hydrocarbons react in the presence of sunlight to form **photochemical smog**. (This is a different type of smog to that formed in earlier years from a combination of smoke and fog).

Los Angeles is an example of a city that suffers badly from photochemical smog. The city lies in a basin surrounded by hills, and so pollution from transport becomes trapped over the city.

4. Air Pollution & Industry

Introduction

Pollution from industry was significantly reduced following the Clean Air Acts of 1956 and 1968, but still poses a problem in some areas.

The two major pollutants produced by industry are:

- Sulphur dioxide
- Nitrogen oxides

Sulphur dioxide

Sulphur dioxide is the main pollutant emitted from power stations. In Britain, 90% of sulphur dioxide pollution comes from power stations and other industry. Once in the air, sulphur dioxide mixes with moisture to form *sulphuric acid*, which will later fall as acid rain.



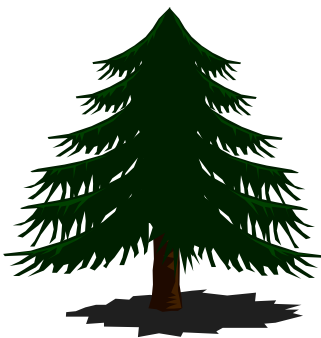
Nitrogen oxides

Nitrogen oxides are pollutants which are mainly associated with car exhausts, although some emissions come from industry. Again, they mix with moisture in the atmosphere and form ***nitric acid***, which then falls as acid rain.

Today, industries that emit air pollution must have stacks which release the waste gases into the atmosphere at higher levels, thereby reducing the risk of ground level pollution. Power stations are now also required to reduce their emissions of sulphur dioxide by using specialised emission reduction technology.

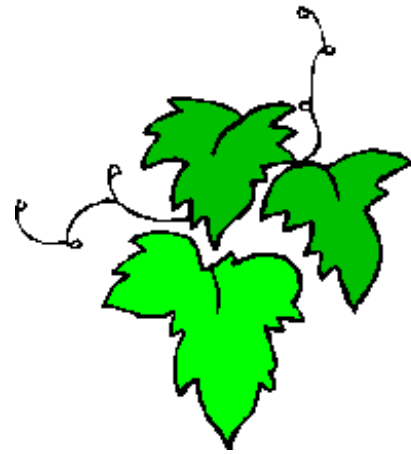
5. Effects of Air Pollution & Acid Rain on Vegetation

Acid rain and other *pollutants* can harm plants. Many forests are dying in different countries of the world. The acid in polluted snow, sleet and fog, as well as rain, takes important *minerals* away from the leaves and the soil. Without these minerals, trees and plants cannot grow properly.



Damaged trees lose their needles or leaves, have stunted growth and damaged bark. This makes it easier for *fungi* and insects to attack the tree, and the tree may die.

Acid rain not only damages soil but can also block or damage little *pores* on leaves. These take in carbon dioxide from the air, which the tree needs to *photosynthesise* and grow.



6. *Effects of Air Pollution & Acid Rain on Wildlife*

There are three ways in which animals can be affected by air pollution. They can:

1. breathe in gases or small particles;
2. eat particles in food or water;
3. **absorb** gases through the skin.

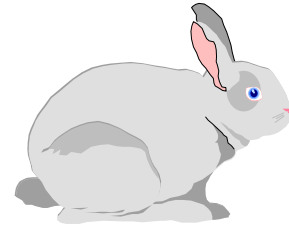


Mainly soft-bodied *invertebrates*, such as earthworms, or animals with thin, moist skin, are affected by absorbing pollution through skin.

Some gases from pollution change in the air, giving rise to *secondary pollutants*. One such secondary pollutant is ozone. Ozone is naturally found high in the atmosphere, and protects all living things by filtering out some of the Sun's harmful rays. When it is formed near the ground as a result of man-made pollution, it can be harmful to plants and animals. Ozone, as well as the

primary air pollutants such as sulphur dioxide and nitrogen dioxide, can effect the breathing of animals.

Particulates, another form of man-made pollution, can cause many problems for wildlife. When the particulates contain metal they are especially dangerous, as high levels can build up in the body tissues of animals.

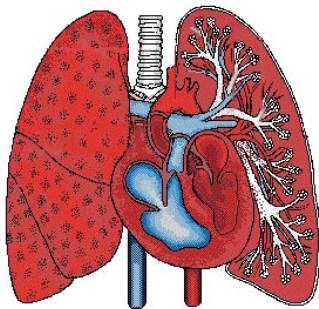
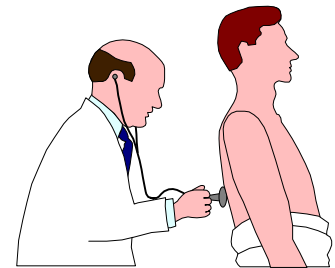


As well as these direct effects of pollution, wildlife is also affected by changes in the environment caused by pollution and acid rain. A change in the acidity of the water that animals live in, or a decrease in the amount of trees that provide shelter, may cause serious problems for wildlife.

7. Effects of Air Pollution & Acid Rain on Health

Particulate Pollution

Particulates in air pollution are one of the main causes of health problems. In towns and cities, these are released mainly from diesel engines in cars and trucks.



When we breathe in air pollution, the very fine particulates can easily enter our lungs, where they can cause breathing problems, and over time even lead to cancer.

Ozone

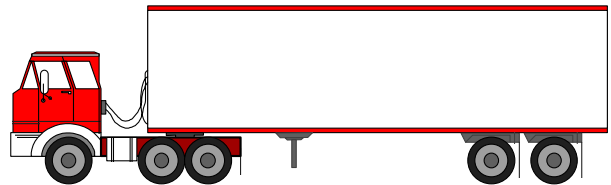
Ozone that forms near to the ground can also damage our lungs and throats. If you have **asthma** then the symptoms may be even more severe.

Carbon Monoxide

Other air pollutants also cause problems for our health. *Carbon monoxide*, from transport, cigarette smoke and faulty gas fires, affects the blood and is especially dangerous to pregnant women and their unborn babies. The babies may be born with brain damage.

Lead

Lead in petrol has now been banned.



Before 2000, lead from petrol fumes was a potential cause of damage to organs in the body such as the kidneys, heart and brain. Children were more sensitive to the effects of lead pollution than adults.

8. Effects of Air Pollution & Acid Rain on Buildings

Introduction

The effects of air pollution on buildings has been noticed since the beginning of the Industrial Revolution 200 hundred years ago. Buildings that had been standing in all types of weather for thousands of years suddenly began to ***decay*** rapidly.

Limestone & Marble

Air pollution can be especially damaging to ***limestone*** and ***marble***. When acid rain falls on the buildings it slowly dissolves away the stonework. Ancient monuments are affected by air pollution more than modern buildings because they are often made of limestone or marble. Consequently, these buildings may need constant up-keep.



Plastics

Acid rain also affects most other materials. Paint and some plastics may be damaged quite badly.

Lasting Damage



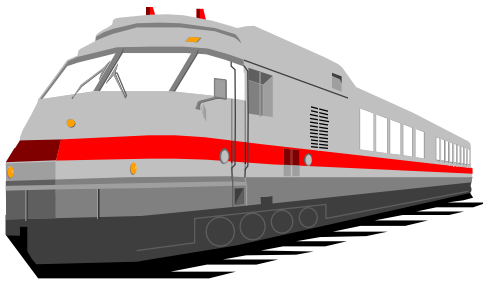
Even though air pollution has been reduced in recent years, buildings are still showing signs of damage. This is because the acid rain has permanently changed the stones from which the building is made.

9. What Can You Do To Help Reduce Air Pollution?

Introduction

There are many ways we can all help to reduce air pollution.

Public Transport



Use buses and trains instead of cars, as they can carry far more people in one journey. This cuts down the amount of pollution produced.

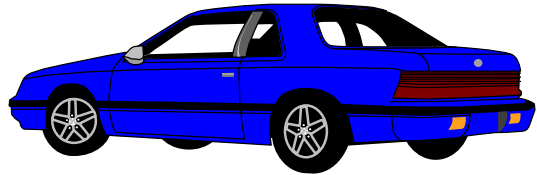
Walking & Cycling

Walking or cycling whenever you can will be even more beneficial, as it does not create any pollution. It will also benefit your body, as regular exercise will keep you fit and healthy.



Car Sharing

Avoid using cars for very short journeys as this creates unnecessary pollution. If a car journey must be made, then try to share it with other people, such as when you go shopping. Also encourage people to drive more slowly as this produces less pollution.



Saving Energy & Electricity



We can also help prevent pollution from our own homes. Turning off lights when they are not needed and not wasting electricity will reduce the demand. Less electricity will need to be produced and so less coal, oil and gas will have to be burnt, resulting in less air pollution.

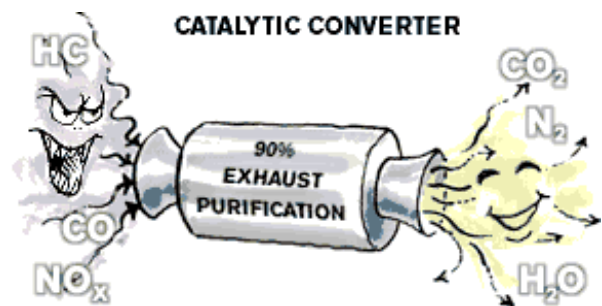
10. How Can Technology Reduce Air Pollution?

Introduction

Developments in technology can reduce acid rain and air pollution, but a lot of money is needed to make them work.

Reducing Pollution from Cars

Since 1993 all new cars sold in Europe have been fitted with a **catalytic converter**. A catalytic converter takes harmful pollutants and turns them into less harmful ones.



New fuels are being made that are cleaner than petrol and diesel. The ones that have been developed so far are:

- Natural Gas;
- Liquid Petroleum Gas;
- Hydrogen;
- Alcohol;
- Battery Power.

Reducing Pollution from Power Stations and Industry

Power stations can be fitted with special equipment that reduces the amount of pollution given off when fuel is burned.

Reducing the Effects of Acid Rain

Liming is a common method used to combat acid rain effects. It is sprayed onto lakes and forests. This reduces acidity and reduces the damage done to wildlife.

11. What is The Government Doing?

The Clean Air Acts

The development of air pollution control in the UK has been strongly determined by the early smog episodes in cities such as London. The Clean Air Acts of 1956 and 1968 were introduced to tackle the smog and improve air quality. The Acts were successful in reducing sulphur dioxide pollution from industry, but new pollution problems from transport have since increased.

The Environment Act

In 1995, the Environment Act was passed to address poor and declining air quality and reduce the risk of health problems due to air pollution.

The National Air Quality Strategy

In response to the Environment Act, the National Air Quality Strategy was published in 1997 and updated in

2000. This strategy made commitments to achieve new air quality objectives by 2005.

The main aim of the Government is to reduce the amount of polluting emissions to levels which are harmless to human health. The strategy set standards to reduce the 8 main air pollutants in the UK.

Summary

Government policies should reduce air pollution by a significant amount. However, the action of individuals is just as important; if everyone plays their part then we can aim for a pollution free future.

Glossary

Absorb:

Receive or take in.

Acid Rain:

Water in the air mixes with pollution, which comes from cars, factories and power stations to make acids. These acids then fall to the ground with rain.

Acid:

Any substance with a pH of less than 7.

Alkali:

Any substance with a pH greater than 7.

Asthma:

A disease that makes it difficult for a person to breathe, especially during exercise.

Atmosphere:

The layer of gases that surrounds the Earth.

Carbon Monoxide:

A highly poisonous gas produced when fuel is burnt. It is mainly emitted from car exhausts.

Catalytic Converter:

A filter fitted to car exhausts to help remove pollution.

Decay:

To slowly waste away.

Disperse:

To scatter and distribute pollutants in the atmosphere.

Dry Deposition:

The direct deposition of particles resulting from air pollution.

Emit:

To release into the air.

Fossil Fuels:

Sources of energy such as coal, oil and natural gas.

Fungi:

Neither plants nor animals, these organisms include moulds, mildews, yeasts and mushrooms.

Gravity:

The force of attraction that pulls things towards the Earth.

Hydrocarbons:

Organic substances containing carbon and hydrogen.

Invertebrates:

Any animals that do not have a skeleton or backbone.

Limestone:

A type of rock used as a building material.

Marble:

A hard rock that is formed when limestone is heated to very high temperatures within the Earth. It is also used as a building material.

Minerals:

Substances formed naturally in rocks and earth.

Neutral:

Neither acidic, nor alkaline, with a pH of 7.

Nitric Acid:

A component of acid rain formed when nitrogen oxide pollution mixes with moisture in the air.

Nitrogen Oxides:

Polluting gases produced when fuel is burnt.

Nutrients:

Substances that are nourishing and help a plant or animal to grow.

Ozone:

A pollutant that is formed when nitrogen oxides, carbon monoxide and hydrocarbons mix and react together in the presence of sunlight.

Particulates:

Pollution that is made up of very fine particles.

Photochemical Smog:

Describes the hazy conditions that occur when pollutants are trapped at ground level.

Photosynthesis:

The use of sunlight, carbon dioxide and water by plants to grow.

Pollutants:

Substances that can damage the air, water or land when released into it.

Pollution:

Harmful substances in the environment.

Pores:

A small opening in the skin or outer surface of a plant or animal.

Primary Air Pollutant:

Pollutants released directly into the air.

Secondary Air Pollutant:

Pollutants formed in the air by the mixing of primary air pollutants.

Sulphur Dioxide:

A polluting gas produced when fossil fuels are burned.

Sulphuric acid:

A component of acid rain formed when sulphur dioxide pollution mixes with moisture in the air.

Wet Deposition:

Any gas or particle that falls to the ground after it has mixed or reacted with water, forming acids.