I ♥ CLEAN AIR

Clean Air Schools Pack

Educating a generation on air pollution

Promoted by Anne Schiffer on behalf of Friends of the Earth Trust, registered charity no. 281681, company no. 1533942, of The Printworks, 1st Floor, 139 Clapham Road, SW9 0HP

friends of the earth

Muslim Aid® Serving Humanity

Important – read before using this Pack

Safeguarding

Friends of the Earth are committed to protecting children and young people and vulnerable adults from harm or abuse. We recognise the legal responsibilities and the duty of care that we have towards children, young people and vulnerable adults in particular. We aim to be a respected, trusted organisation where everyone involved in our work feels safe to participate in any of our activities.

Before undertaking any work with schools – be sure to obtain express written permission from the headteacher or staff member nominated by the head for safeguarding. Any work with children should be directed by schools or other children's services.

This includes, but is not limited to, seeking permission to put up air quality monitoring tubes on school premises.

In addition, if you are a Friends of the Earth local group member, please refer to the safeguarding guidance issued to local groups and notify your coordinator about the schools you have permission from.

If you have any questions about the Clean Air Schools Pack and safeguarding, please email: info@foe.co.uk

Welcome to your Clean Air Schools Pack

Hello!

Firstly, a huge thank you for signing up for this Clean Air Schools Pack created by Friends of the Earth and Muslim Aid.

We've teamed up because we want to help educate a generation of young people about the significant threat air pollution poses to our health and our environment, and to empower them to be part of the solution.

Here's what you'll find in this Clean Air Schools pack:

- 3 exciting lesson plans on air pollution, health impacts and campaigning.
- Colourful materials for your school walls on air-cleaning plants and reducing air pollution – and stickers for the children.
- A fun and active school assembly on air pollution.

For the first 200 teachers who request a Clean Air Schools Pack, Friends of the Earth will provide 5 free air monitoring tubes that monitor the toxic gas nitrogen dioxide (NO_2).

The lesson plans and materials have been developed for upper Key Stage 2 pupils, all in collaboration with teachers, and are brought to life with a fun and engaging story. In addition, we've made an effort to relate all lessons to the KS2 curriculum. Please do adapt these to the needs of your class.

We hope you find this Clean Air Schools Pack a useful resource. We are especially keen for feedback on your experience with it. What worked well? What could be improved? Would your school like to take more action with us to clean up the UK's air?

We hope your lessons are enjoyable!

In unity,

Aaron Kiely and **Lailah Nesbitt-Ahmed**
cleanair@foe.co.uk

On behalf of

friends of the earth

Muslim Aid Serving Humanity

"As a school we feel that it is extremely important that children gain an understanding about the environment in which they live.

Friends of the Earth provided us with a series of practical and enjoyable lessons that helped the children to understand the causes of air pollution, effects pollution could have on their health and how they could help to reduce air pollution and persuade others to do the same.

The children thoroughly enjoyed the lessons in which they were encouraged to act as scientists investigating a problem. They learnt about NO_2 and also helped to set up air monitoring tubes around the school to measure NO_2 in our area."

– Melanie Moore, Assistant Head, English Martyrs Catholic Primary School, Tower Hamlets, London

About Friends of the Earth

Friends of the Earth has worked for over 40 years to improve the wellbeing of people and the planet. We're famous for winning the first climate change law, for putting recycling bins on doorsteps, and championing green energy.
www.foe.co.uk

About Muslim Aid

Muslim Aid is an international charity that works in over 70 countries around the world to alleviate poverty regardless of race, religion or gender.
www.muslimaid.org

Clean Air Schools

Clean Air Schools is an initiative of Friends of the Earth's wider Clean Air campaign which is aiming to clean up the air we breathe.

With thanks to the many supportive colleagues at both Friends of the Earth and Muslim Aid who helped make these resources available; English Martyrs Catholic Primary School in Tower Hamlets, London who kindly trialled the materials; Loop Labs who created the teaching content; MADE in Europe for their advice; and the London National Union of Teachers Climate Change Network for their support. These materials were fabulously designed by Mulberry Design.

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Air pollution: Introductory briefing for teachers

Why teach about air pollution?

Air pollution is a killer. Outdoor air pollution is responsible for 40,000 premature deaths a year in the UK (more than alcohol or obesity), according to a 2016 report by the Royal College of Physicians (RCP) and Royal College of Paediatrics and Child Health. The report also says that high levels of air pollution have been "linked to cancer, asthma, stroke and heart disease, diabetes, obesity, and changes linked to dementia".

The government says that emissions from road transport are the biggest problem, and diesel is the worst of all. Even the most recent diesel cars emit more than **five times** as much nitrogen dioxide (NO_2) as the most recent petrol cars, according to the think-tank Policy Exchange.

How does air pollution impact children?

It has long been known that asthma symptoms can be worsened by air pollution.

Recent academic research supports the view that childhood exposure to air pollution can lead to the development of asthma. The World Health Organisation (WHO) has declared outdoor air pollution, including fine particles of air pollution (PM), and also diesel exhaust as cancer-causing in humans – in the strongest class (Group 1).

Pollution can damage children's lung development, and research by King's College London's Dr Ian Mudway suggests that children growing up in highly polluted areas are at risk of developing smaller lung capacity.

Although air pollution is an important health issue for people across much of the UK, the reality is that children and older people are the most vulnerable.

Imperial College London research has also shown that black and ethnic minority communities suffer disproportionately from high levels of pollution. The same is true for the most deprived in our society as

they tend to live near main roads where air pollution is worst. In London, the Greater London Authority found that four-fifths of schools in areas breaching EU limits for nitrogen dioxide (NO_2) are in deprived areas. Air pollution is a problem for people across the country, with 37 of 43 of the UK's Air Quality Zones failing to meet legal limits.

How do we solve it?

Tackling UK air pollution will require a range of concerted, joined up action at local, city Mayoral, national and EU levels. But one thing is clear: **diesel fuel must be phased out from road transport by 2025 at the latest**. And while this is an essential step it is not entirely sufficient – as well as cleaner vehicles we also need fewer of them, not least because pollution is caused by brake and tyre wear as well as exhaust fumes.

As teachers, you have a critical role in educating a generation about air pollution, raising awareness in the school community and supporting real action to reduce air pollution emissions.

Some forms of air pollution

- **Nitrogen dioxide (NO_2)** – can irritate the lining of the lungs and is worse close to road traffic.
- **Particulate matter (PM)** – tiny solid particles or liquid droplets in the air, the smallest of which can pass in to the bloodstream and are very hazardous to health.
- **Ozone (O_3)** – A gas formed when other pollutants – like nitrogen oxides – react in the atmosphere.

Fumes from diesel vehicles are a major source of NO_2 and particulates.

For more detailed information on air pollution – we've included a fully-referenced copy of a briefing.

Lesson 1

Understanding Air Quality

Learning outcomes:

By the end of this lesson, pupils should:

- Understand that air can be dirty, even if this cannot be seen.
- Know some of the key terms associated with air pollution.
- Be aware of some methods which can be used to measure air quality.

Curriculum links

Science: Upper KS2 Working Scientifically: using simple models to describe scientific ideas; identifying scientific evidence that has been used to support or refute ideas or arguments

Design and Technology: KS2 Design: generate, develop, model and communicate their ideas through discussion, annotated sketches

Introduction

Explain to the children that you have received a mysterious letter (letter 1). Invite one of them to read it aloud to the rest of the class. Discuss the professor's mission, the 'sensitive issue' and the riddle he has posed – *how is a human similar to a car*? Take pupils' ideas, and help them draw parallels between our bodies needing food which gives us energy, but which when digested produces waste (including gas), and cars using petrol or diesel for energy and giving off waste products from their exhaust pipes.

Notes

Although the letter mentions equipment that the Professor will send, do not show pupils the diffusion tubes at this point – wait until after the design task.

The 'P.S.' activity (designing a better diet for the professor) is an optional extra task linked to the topic of healthy eating, and doesn't need to be completed.

Whole class teaching

Concept cartoon – Invisible Dirt

Read letter 2 and look at the cartoon. Ask children which scientist they think is right (discuss this in pairs). Do they know for sure, or are they guessing? Let pupils share what they know about air pollution, what it is and how it is caused. Remind them that scientists rely on data (information) – sometimes this is data they collect, sometimes it comes from a secondary source – and that they will need to be able to back up their opinions with facts if they want to convince the professor.

Independent task 1

Give pupils the fact sheet on the great smog and ask them to work in pairs to use it to form their opinion about which scientist is right. Ask several pairs to report back and have them justify their answer with information from the text. (You may like to extend this activity by asking pupils to write a letter to the professor explaining their decision, or simply have a class discussion.)

Mini-plenary

Ensure that pupils understand that, while there are many types of pollutants which affect air quality, the two which cause the most concern are particulate matter (small particles which are too small to see) and nitrogen dioxide (NO_2 – a toxic gas which is invisible and odourless). Ask pupils how clean they think the air around us is now, compared to the time of the great smog.

Recent research suggests between 8,000 and 12,000 people died because of The Great Smog in London. Pupils may be surprised to learn that approximately 40,000 early deaths each year in the UK are linked to the long-term effects of today's air pollution.

Independent task 2

Ask pupils to consider how we might measure levels of air pollution (as per the 'P.S.' in the letter) and have them work in pairs or small groups to come up with an invention which will measure air pollution – whether particulate levels, NO_2 levels, or both. Ask them to draw an annotated diagram to explain their design. Encourage them to think creatively about this, and explain that they don't need to limit their thinking to devices they already know about – this is their chance to become inventors!

Let each pair in turn share their idea with the rest of the class, and invite comments about these. Look for similarities between pupils' ideas, and also ideas which are similar to technologies which already exist, and are used to measure air quality, e.g.:

- Hand-held monitors which use a light beam to detect the presence of particulates.
- Ozone patches which contain chemicals that change colour if ozone is present.
- Diffusion tubes that capture nitrogen dioxide.
- Lichen – some species only survive where nitrogen dioxide levels are high; some the opposite.

(Once this activity has taken place, diffusion tubes can be shown to pupils – see separate notes about these.)

Extended plenary

Play a game of Clean Air Bingo. Children should make their own bingo sheets by folding a sheet of paper into a 4x4 grid and writing one term (from the list provided) in each square. Give them the opportunity to ask the meaning of any terms they are not familiar with before the game begins. The teacher then reads a definition from the list, and pupils cross out the words on their sheet – first to make a row of 4 (across, down, or diagonal) wins.

Notes on diffusion tubes

The diffusion tubes come with full instructions for their correct use. Please do follow them otherwise the results may be invalid.

Have you thought about engaging the pupils in where to put them up? Could the pupils help the teacher put them up? Where are they worried about pollution? Where do they think there might be loads of pollution? The school playground? Outside the school gates? At a nearby bus stop? It may be good to contrast.

Consider placing the tubes at face-height and in places they won't be damaged or stolen e.g. on the inside of school railings near a main road.

THE INSTITUTE

Dear Citizens,

I am writing to seek your help with an urgent matter. For some time now, I have had a team of scientists working for me, on a problem which is of serious importance in your local area.

For reasons I won't bore you with, I suddenly find myself with no staff. To be quite honest, I'm glad to be rid of most of them as their work was not very good. But regardless of that, the fact remains that I still have work to do, and no-one to help me.

It has been brought to my attention that you may be able to help me. Personally, I am not convinced. It is bad enough to expect ordinary citizens to do the work of scientists. But *children* working as scientists? Is that really a good idea?

I am, however, desperate. Since I have been assured that yours are the sorts of scientific minds I need, I have arranged for some equipment to be delivered to you shortly. I do hope I have not been misinformed.

Meanwhile, I need your help with a slightly delicate matter, to do with my diet. Here is what I ate yesterday:

Breakfast: scrambled eggs (6) on toast.
Mid-morning snack: 3 pickled eggs.
Lunch: egg fried rice with a side dish of egg salad.
Dinner: cheese omelette (made with 4 eggs).
Dessert: 1 Cadbury Creme egg.

What can I say? I like eggs. The problem is, they make me... well, digesting all of those eggs makes a lot of gas, and that gas has to go somewhere. I am sure you can imagine the rest. Let's just say my office doesn't smell too good most of the time. Which brings me to the problem I'd like your help with...

But before I tell you about that, I have a riddle for you:

How is a car like a human body?

Read my next letter once you have worked out the answer. If you're smart enough to work it out, perhaps you'll be smart enough to solve my problem.

Yours sincerely, and with great eggs-pectations,

The Professor

P.S. Perhaps if you have enough time, you could also find out how healthy it is for me to be eating so many eggs. I've been eating nothing but eggs for so long now, I've almost forgotten what else I like to eat. Could you suggest a healthy meal plan for the week?

THE INSTITUTE

Dear Citizen Scientists,

Did you solve my riddle? Egg-cellent! Yes, just like human bodies need food for energy, cars need fuel to keep them going. And just like humans, once they've converted all of that fuel, there is some waste to get rid of. That's why cars have exhaust pipes.

Have you ever noticed the nasty stuff which comes out of cars? After all, you're exactly the right height to spot it. It looks a bit like smoke, especially if the car isn't working well or is getting a bit old.

So sometimes we can smell that the air isn't clean, and sometimes we can see that it isn't clean. Which brings me to my problem. INVISIBLE DIRT. Does it exist?

Let me explain. Not all of my old scientists were rubbish. Some of them were quite brilliant. I heard two of them talking last week, but I couldn't see their faces, so I couldn't work out if they were the clever scientists or the rubbish ones.

Anyway, I'm enclosing a cartoon I drew of them. Have a look and see what you think. Who do you think I should believe, and why?

Yours sincerely,

The Professor

P.S. If it turns out that there ARE things which make the air dirty, but which we can't see, how on earth are we going to observe or measure them? Please send me your thoughts.

THE INSTITUTE

What is air pollution?

What makes the air dirty?

There are many activities in our day to day lives which contribute to air pollution. Air pollution can be caused when we burn fossil fuels, such as coal, natural gas, petrol or diesel. We use these energy supplies for all sorts of things, from cooking and washing, to lighting and heating our homes and schools, and travelling by car.

The most concerning pollutants in the air are nitrogen dioxide (NO_2) and particulate matter (PM), or particulates. Other pollutants can include ozone (O_3) and sulphur dioxide (SO_2).

Nitrogen dioxide (NO_2): Breathing this in can irritate and damage the lining of the lungs. You can't see or smell NO_2 in the air, except in very warm weather when it sometimes combines with other chemicals in the air and makes the sky look hazy and brown.

Particulate matter (PM): Particulates are tiny particles of dust, soot or liquid which are too small to see. When you breathe these in they can sometimes go deep in to your lungs and the smallest can even pass into the bloodstream.

Air pollution and cars

One of the biggest causes of air pollution today is transport, especially cars. Today there are about 25 million cars on the road, and most of these use petrol or diesel as fuel. These cause gases and particles to be ejected from the exhaust, which contribute to air pollution. This pollution can be particularly dangerous for children.

Fact sheet

Air pollution in the past – the Great Smog in London

Even before there were so many cars on the roads, London suffered from the effects of air pollution. Since the Industrial Revolution, in the 18th century, factories sprang up, producing pollution in the form of smoke. When smoke and fog mixed together, they made 'smog', which made the air hard to breathe, and also makes it difficult to see. Smog was very bad in 1952, a period of time which became known as the Great Smog. During the Great Smog in London, around 8,000 to 12,000 people died from causes related to the levels of pollution in the air.

How does air pollution affect your health?

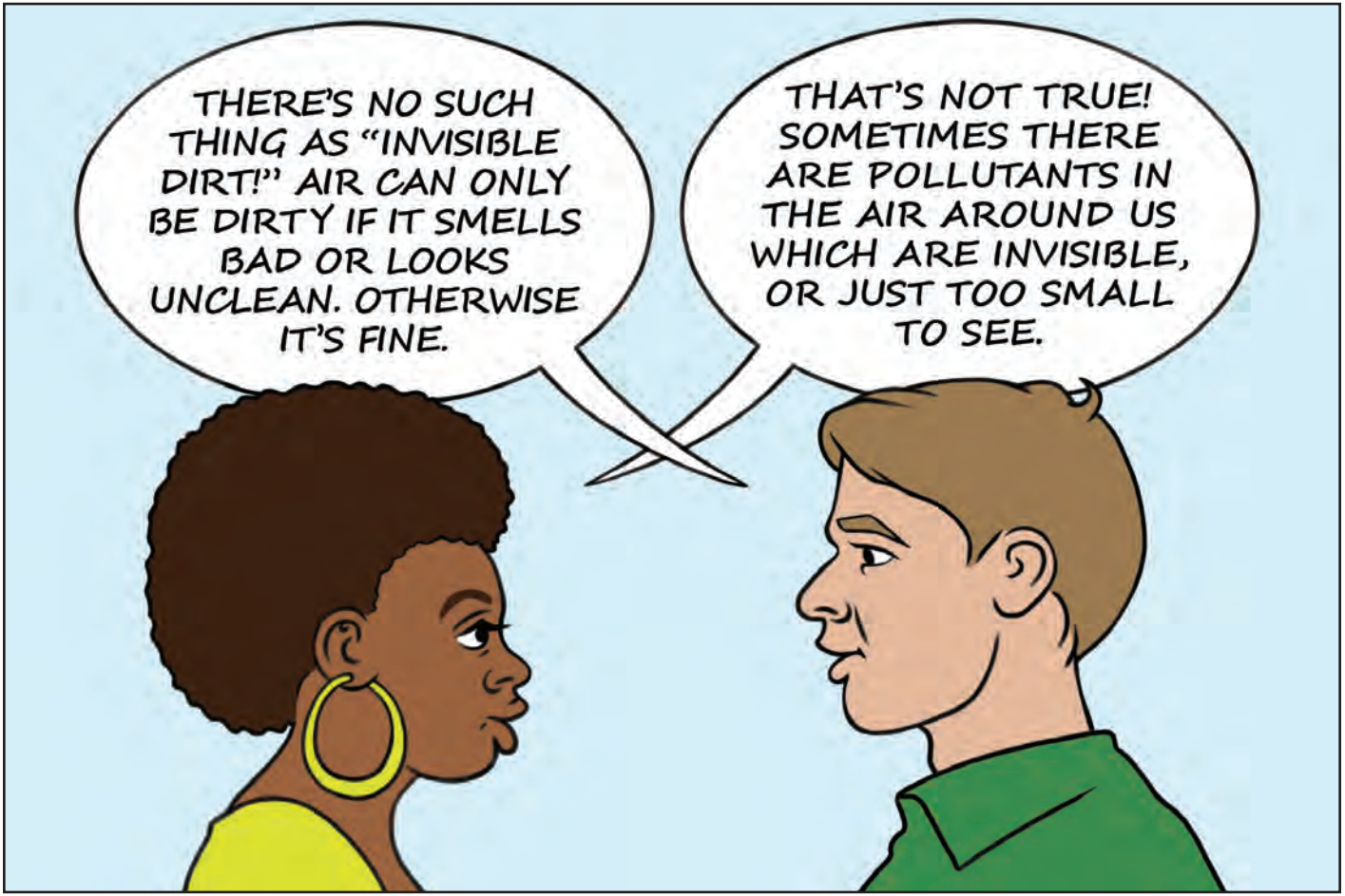
Air pollution can contribute to breathing problems, the development of asthma, and lung and heart diseases. The risks are greater for children, as your bodies are less resilient and still developing. Because of your height, you are also closer to the exhaust fumes from cars. Studies have also shown that living in very polluted areas can stop your lungs developing properly, which could cause health problems later in life.

Things you should know!

According to Asthma UK:

- Children and young adults with asthma are more at risk from the effects of pollution because they have faster breathing rates and their lungs are still developing.
- Children living in areas with high pollution are more likely to have reduced lung function than adults.
- Long-term exposure to high concentrations of air pollution may cause asthma in children.
- Breathing in outdoor air pollution and diesel exhaust are linked to causing lung cancer.
- It is estimated that exposure to air pollution contributes to 40,000 premature deaths every year in the UK.

Fact sheet


THERE'S NO SUCH THING AS "INVISIBLE DIRT!" AIR CAN ONLY BE DIRTY IF IT SMELLS BAD OR LOOKS UNCLEAN. OTHERWISE IT'S FINE.
THAT'S NOT TRUE! SOMETIMES THERE ARE POLLUTANTS IN THE AIR AROUND US WHICH ARE INVISIBLE, OR JUST TOO SMALL TO SEE.

Clean Air Bingo

How to play

Decide who is going to be the caller. Everyone else (the players) will need to make a bingo card by drawing a grid which is 4 squares by 4 squares, and write one of the terms in the list below in each square.

- **Petrol** – an example of a fossil fuel which, when burned, causes air pollution
- **The Great Smog** – happened in 1952 and caused the early deaths of around 8,000 to 12,000 people
- **Nitrogen dioxide (NO_2)** – a harmful pollutant of air in the UK
- **Asthma** – a condition which affects some people, making it harder for them to breathe
- **Immune system** – helps your body fight off infections, and can be affected by air pollution
- **Cars** – there are about 25 million of these on the roads in Britain
- **Lungs** – a part of your body which helps you to breathe
- **Particulates** – tiny particles of dust, soot, and liquid in the air, which are too small to see
- **Pollutants** – particulates and nitrogen oxides are both examples of these
- **Atmosphere** – another name for the air around you
- **Air quality** – a measure of how clean or dirty the air in a particular area is
- **Exhaust** – the part of a car which ejects dirty waste
- **Acid rain** – damages trees and plants; nitrogen oxides contribute to this
- **Contaminated** – how air which contains pollutants could be described
- **Diesel** – these cars are some of the most polluting
- **Breathe** – what we all do every few seconds

The caller should read one of the definitions – next to the words – and then put a tick next to it so that they know it has been called. Players cross the matching term off on their bingo sheet. Keep playing until one player has crossed off four squares in a straight line (across, down, or diagonally) – they are the winner! They should read back the words they have crossed off, so the caller can check they had the right definitions.

Lesson 2

The Effects of Air Pollution

Learning Outcomes

By the end of this lesson pupils will be able to:

- Explain how their lungs work and the function they play in the circulatory system.
- Understand what lung capacity is and how this can be affected by air pollution.

Curriculum Objectives

Science – Upper KS2:

Identify and name the main parts of the human circulatory system, and explain the functions of the heart, blood vessels and blood.

Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.

Use simple models to describe scientific ideas.

Online resource: Respiration – how is oxygen transported round the body? – BBC Bitesize, http://www.bbc.co.uk/education/clips/zy8sj6f

Starter Activity/Hook

Read the Professor's next letter. Show pupils a note left behind by the scientists who have gone on strike because their offices are located in an area of high air pollution. Pose the question asked by the Professor – *"So what if the air is dirty?! Does it even affect you?"*

Ask pupils to share what they already know about the effects of air pollution on health.

Display a set of statements (Truths and Lies) on the board, or give these to pupils on cards. Have them sort into two groups – which do they think are true and which do they think are lies? Ask them to consider which was the most surprising and rank these in order.

What are our lungs and why are they important?

Show pupils a model of how their lungs work – or, if time allows, have them make models themselves. The websites below offer simple instructions:

http://www.physicscentral.com/experiment/physicsathome/balloonlung.cfm
http://www.sciencekids.co.nz/experiments/lungvolume.html

You might find it useful to ask pupils about oxygen e.g. *What is oxygen? / Where do we find it? / What colour is it? / What smell does it have? / Is it important to us? / Why?*

What job do the lungs have? Discuss this as a class. Show them a diagram of the circulatory system and ask them how this is related to their lungs. Ensure that they understand that lungs take in oxygen, which is carried around or 'delivered' to the body via the blood stream.

Simulations – what happens when we breathe in dirty air?

Simulation 1 – Outdoors

This activity involves pupils in a physical simulation of particulates impacting our lungs when we breathe in polluted air. You will need to be in a large open space, such as a playground or a hall.

Mark an area with chalk or cones which is approximately 2m x 2m square. This represents the lungs.

Choose six pupils and have them stand in a circle, a metre or so away from each other, a few metres away from the lung area. This represents the rest of the body.

Divide the rest of the class into two groups – oxygen molecules and particulates.

Pupils may need a reminder of what "particulates" means before doing this simulation.

Demonstrate the following activity by doing it first yourself. To simulate breathing clean air, have each oxygen molecule in turn run through the 'lung' area, weave their way around the 'body', passing in front and behind of each classmate in turn, run back through the lung area and return to the start area to tag the next runner. Time how long it takes the entire team to complete this route once.

To simulate breathing polluted air, pair each oxygen molecule up with a particulate of air pollution. The pairs should run together to the lung area, where the particulate should stay, while the oxygen molecule completes the route and returns to the start area alone, to tag the next pair. As the activity progresses, and more 'particulates' are left in the lung area, it will become more affected, and harder for the oxygen to pass through, resulting in a slower time.

After running the simulation:

Ask pupils how accurate they think it is, and how it could be improved.

Get pupils to write about what they did, or draw a labelled diagram showing parts of the simulation and what they represent. Alternatively, you could take photographs of the activity and have them write captions for these.

Simulation 2 – Indoors

Discuss the effect that damage to our lungs can have on our ability to breathe. If any pupils in the class have asthma, encourage them to share their experience of what this is like, and the methods they use to help them manage their condition.

Explain to pupils that you are going to let them experience what it feels like to try and breathe with reduced lung capacity.

Before they start, remind them that they should stop the activity if breathing becomes very difficult, or if they feel dizzy.

Give each pupil a straw, and ask them to put the straw in their mouth and breathe through their mouth only. (They may find it easier to do this if they hold their nose.) Time them for an appropriate time, and then stop. Have pupils write or talk about how it felt.

Ask them to bite down on the end of the straw to flatten it, and then repeat the activity, this time only breathing for less time. This will be more difficult, so remind them again that they should stop if they feel dizzy or uncomfortable.

Plenary/Summary Activity

Ask pupils to write a letter to the Professor, in response to his question ('So what if the air is dirty?') explaining what they have learned about the effects of air pollution on the body. *(See Starter activity/hook)*

THE INSTITUTE

Dear Citizen Scientists,

I am enclosing a note that was left behind by my scientists, shortly before they disappeared. Please examine it carefully as perhaps it will give you some clue as to why they left.

Personally, I feel that their demands are more than a little unreasonable. Moving to an entirely new location? That seems most unnecessary. After all, even if what they say is true about the local air quality (and I'm not convinced that it is)... so what if the air outside their offices is dirty? Surely some tiny little pollutants can't be causing them too much harm.

I am, as I am sure you can understand, far too busy and important to deal with such trivial matters. However, if you do feel that they could have genuine cause for complaint, I might be willing to consider their suggestion.

Perhaps you could let me know your thoughts?

Yours in haste,

The Professor

THE INSTITUTE

Right, Professor Egghead...

ENOUGH IS ENOUGH! We are going on STRIKE until you can sort out a few things.

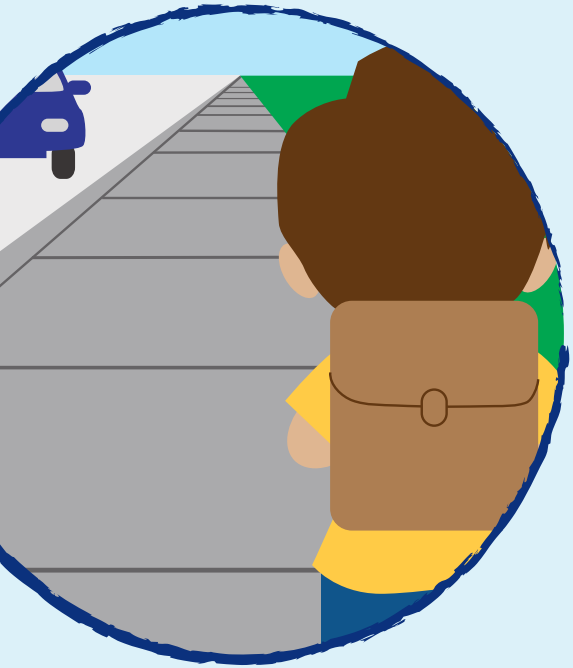
Let's start with our building. Why are you making us work in a place where the air quality is at its worst? (And no, we don't just mean inside your office. Outside it's pretty bad too.) We want you to move us to an area where the air is cleaner. Moving takes ages though, so can you also tell us some ways we can improve the air quality around us?

Tell us when you have some answers. We heard you have found some replacement scientists. Maybe they can help...

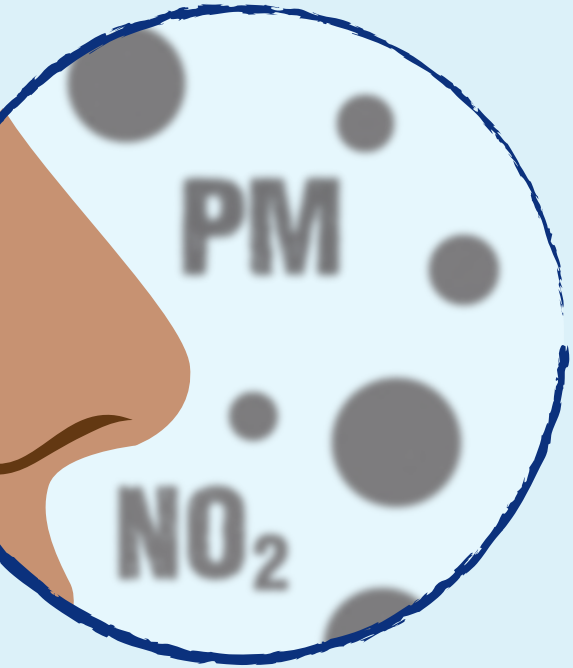
From the Scientists

A. Diesel vehicles are often the most polluting vehicles on the roads

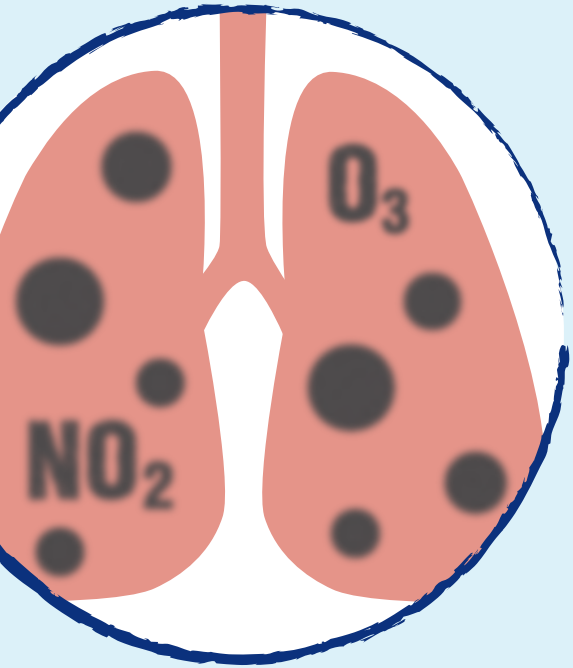
B. You can always see air pollution



C. Walking on the inside of the pavement and away from the road can help you breathe in fewer car fumes



D. You can always smell air pollution



E. The surface area for gases to diffuse through in human lungs is roughly the same size as a tennis court

F. It's always better to be inside a car to protect you from air pollution

TRUE: A, C, E
FALSE: B, D, F

More information:

B) Lots of pollution is invisible.

C) Lots of it is odourless.

F) Often, walking, cycling or scooting, especially in backstreets and less busy roads, can lessen exposure. In contrast, cars can trap pollution inside.

Lesson 3

Communicating and campaigning about air pollution

Learning Outcomes

By the end of the lesson pupils will be able to:

- Identify the main causes of air pollution in their local area.
- Suggest practical steps for reducing the effects of air pollution.
- Communicate key information about air pollution in a concise and persuasive way.

Curriculum Objectives

Computing:

- Key Stage 2 – select, use and combine a variety of software to design and create a range of programs and content that accomplish given goals.

English:

- Lower KS2:

– Plan their writing by discussing and recording ideas
– Evaluate and edit by assessing the effectiveness of their own and others' writing and suggesting improvements

- Upper KS2

– Plan their writing by identifying the audience for and purpose of the writing, and selecting the appropriate form
– Draft and write by selecting appropriate grammar and vocabulary, understanding how such choices can change and enhance meaning
– Evaluate and edit by assessing the effectiveness of their own and others' writing
– Proposing changes to vocabulary, grammar and punctuation to enhance effects and clarify meaning.

Introduction/Hook – Brainstorming Task

Remind pupils that the aim of brainstorming is to generate as many ideas as possible, without worrying too much at this stage about the quality.

Have them work in groups to brainstorm for 2–3 minutes on each of three topics:

- Causes of air pollution.
- Problems caused by air pollution.
- What can be done to reduce air pollution.

Ask groups to share back their top two or three answers and collate these. Make links between the causes of air pollution and what can be done to reduce this, as well as the problems air pollution can cause, and how the effects can be reduced.

Messages and audiences

Share the Professor's third letter with pupils, and discuss the task the Professor has set. Use the headings 'Who, What and How' to generate a list of key messages and audiences around air pollution.

Depending on the age and ability of your pupils you could simply give them the three headings to work with, or you may like to use the 'key messages' hand-out to support them. Give them the 'Who' list, for instance, and ask them to think about what sorts of messages they should focus on for these audiences, and how best to communicate with them. Or cut up and shuffle the elements of the table, and see if pupils can sort and match these. Can they think of other audiences, messages, or methods of communication to add to the list?

After they have come up with a list of key messages, ask pupils to rank these in order of importance. Challenge them to come up with a phrase or sentence to capture each message in exactly seven words. It might be useful to remind pupils to think about how they want people to feel.

Communication Tools

The rest of the session should be used for pupils to design and create their campaign tools. Below are some suggested activities; depending on the resources and time you have available, you could allow pupils to:

- Choose from a selection of these.
- Vote to decide which one the whole class will work on.
- Or have different groups focused on different activities.

Poster Campaign

Create a poster or series of posters to convey key air quality messages, and recommend appropriate locations to display them, e.g.:

- A poster warning of the dangers of idling engines, to display in the school car park or office.
- A poster asking 'Do you really need to drive?' to put near the front door at home, to remind parents to think twice about making short car journeys.
- A "We're a Clean Air School" banner to be put up at the school gates.

Internet Meme

Use digital tools (photo editing software, apps such as PicCollage or websites such as https://imgflip.com/memegenerator) to create an internet 'meme' which could be shared via email or social media. This is essentially an image (often a photo) with a small amount of text, which is designed to be published and shared via social media. This could be a good opportunity to reinforce key e-safety messages with pupils – how will they share their meme safely? How quickly and widely can they get it to spread?

Jingle all the way

Write, perform and record a short song, rap or radio jingle to convey a key message about air pollution in an entertaining way. Encourage the use of repeated choruses or catchy rhymes and rhythms to make these easy to remember. You could also try changing the words of a popular or well-known song.

Bumper Stickers

Create a set of bumper stickers, using catchy slogans and simple symbols or images, conveying key messages about air pollution.

Persuasive letter writing

There are many opportunities here to link with persuasive writing in literacy. For example, pupils could write a letter to:

- The mayor, prime minister, or local member of parliament, asking what action they are taking on dirty diesel.
- The local council, about traffic pollution hot-spots in the local area.
- Car manufacturers asking why they aren't making more electric cars.
- Their head teacher, asking for more plants around the school, changes to parking / drop-off arrangements, support for a 'walk to school' campaign.
- Their parents, asking them to consider driving less.
- Local businesses, asking for their help – e.g. to help plant shrubs and hedges.

Plenary/Conclusion

Give pupils an opportunity to share their finished products with each other and give feedback. Is the core message clear? Does the chosen communication method suit the intended audience and how will the audience feel? Where possible, produce and distribute the communication tools, and reflect on how successful they have been.

Truth or Lie?

A) Diesel vehicles are often the most polluting vehicles on the roads

B) You can always see air pollution

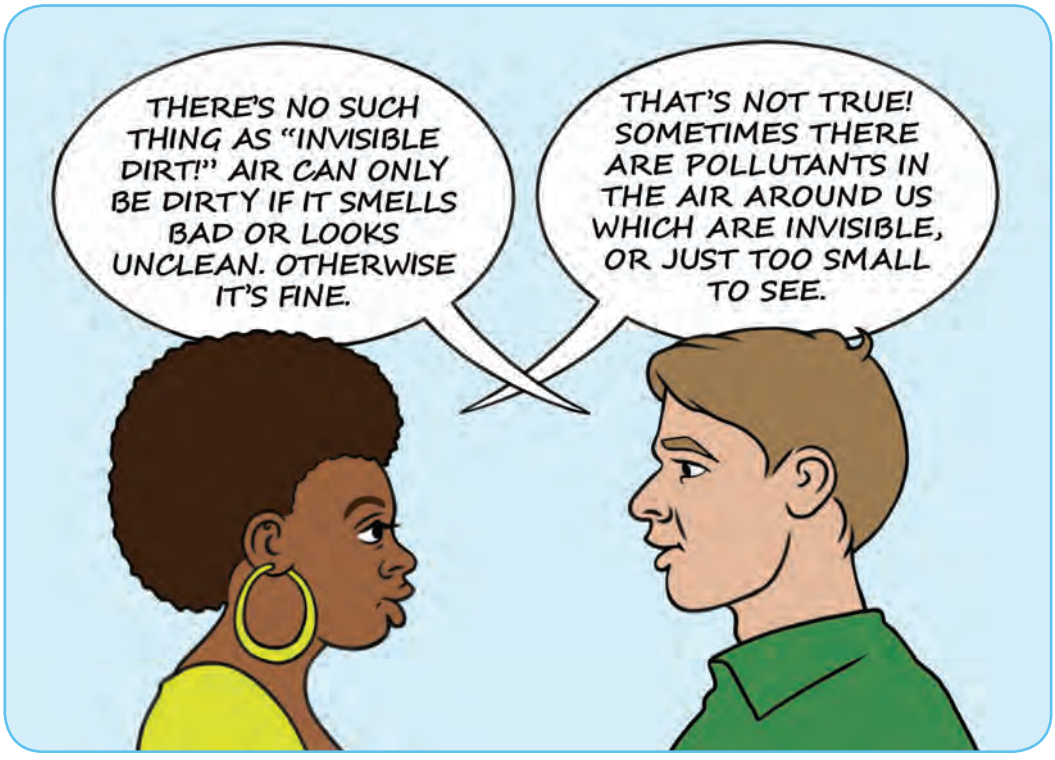
C) Walking on the inside of the pavement and away from the road can help you breathe in fewer car fumes

D) You can always smell air pollution

E) The surface area for gases to diffuse through in human lungs is roughly the same size as a tennis court

F) It's always better to be inside a car to protect you from air pollution

Concept cartoon



THE INSTITUTE

Dear Citizen Scientists,

When I received your package of letters I must admit my first inclination was to throw them in the bin. I am, as you know, very busy and important, and my time is far too precious to waste on children.

However, curiosity got the better of me and I read a few of them.

My word!

You have made some powerful arguments. I have to admit I am impressed.

I am also more than a little alarmed. If air pollution really can cause so many problems, we need to do something about it! And we can't do it alone – it's time to get the message out to a wider audience. As one last favour, perhaps you could have a think about the best way to do this.

Why the last favour, you might ask? Well, I am pleased to tell you that because of your hard work I have agreed to my scientists' demands and I am exploring options for moving their offices to somewhere with cleaner air. They've agreed to come back to work for me, so your services are no longer required.

I may not need you any more, but it sounds like there is plenty of work still to be done if we are going to sort out this air pollution business. So what are you waiting for?

Yours with thanks,

The Professor

Air pollution

Examples of key messages

Who	What	How
Parents	Air pollution can impact your child's health	Posters, radio jingles, memes, communications from school e.g. letters, newsletters, websites
Car manufacturers	Lots of air pollution is caused by dirty diesel cars – so move to electric	Letters and social media
Politicians	Get the most polluting vehicles off the roads, like diesel; and help there be clean air everywhere	Letters, protests, social media, local newspapers
Drivers	Only drive when it's essential; try walking shorter journeys and use public transport; switch off your engine when outside the school gates	Bumper stickers, radio jingles, reminder posters for homes, memes, social media
Schools	More pupils should walk to school; stop drivers leaving their engine on outside the school gates	Posters, leaflets, badges, letters to parents, school website, social media

What we're doing to **reduce** air pollution

I ♥ CLEAN AIR

We teach about air pollution and why reducing it is important for our health

We are monitoring air quality around the school

We have a 'switch it off' anti-idling policy

We encourage walking, cycling and scooting to school to reduce car use

We are planting green screens to help filter out air pollution

We have written to our MP to take action to phase out diesel

..... is a Clean Air School

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Indoor Plants for Healthy Air

When it comes to outdoor air pollution, emissions from road transport are the biggest problem, and diesel the worst of all. But poor air quality indoors can also affect our health. Here are some plants that can help clean the air in our homes and workplaces and filter out some pollution.

Bamboo Palm
(Chamaedorea seifrizii)

Very easy to look after. Has a consistently high rating for the removal of benzene, trichloroethylene and formaldehyde. Needs plenty of water in summer and must be kept moist in winter. Wash the leaves periodically to prevent spider mites. Safe for pets.

Chinese Evergreen
(Aglaonema modestum)

Very easy to care for and only needs low light. It emits more oxygen than most other plants.

Dracaena (Dragon Tree)
(Dracaena sp.)

Will tolerate dimly-lit areas and fairly cool temperatures. Dracaena glauca 'Janet Craig' is a popular variety, and is one of the best at removing chemical toxins. If well looked after, it will live for decades.

English Ivy
(Hedera helix)

A great air scrubber and humidifier. Very easy to care for, just water regularly. You can use ivy in hanging baskets, as ground cover for indoor planting beds or it can be trained to stand upright around a frame. Keep its growth in check, though!

Peace Lily
(Spathiphyllum sp.)

Strong dark green leaves and tall elegant white flowers. Easy to care for and good for air moisture, toxin removal and insect resistance.

Gerbera Daisy
(Gerbera jamesonii)

For rooms with long periods of direct sunlight. Its long-lasting flowers will bloom throughout winter. In early NASA trials, it proved to be extremely effective at removing chemical vapours in the air. The one thing it doesn't like is to be over-watered. Safe for pets.

Golden Pothos
(Epipiremnum aureum)

For rooms that don't get much direct light. Heart-shaped leaves with splashes of gold or cream. It has a good rate of chemical removal and is a wise choice for newcomers to houseplants, as it is very hard to kill.

Ficus sp.
e.g. Rubber plant, above, or Weeping Fig (Ficus benjamina), below

The Rubber plant is bred for toughness and is the plant to choose if the room doesn't have a lot of natural light. Its architectural form makes it a designer's favourite and its simple, large leaves look good in most places. Good at removing formaldehyde.

The Weeping fig helps remove formaldehyde, benzene and tichloroethylene. It is best when grown in bright, indirect light away from draughts. May drop its leaves if it is moved around.

Boston Fern
(Nephrolepis exaltata 'Bostoniensis')

Prefers indirect light or darker rooms. Keep this plant in the bathroom, or spray it daily, and it will thank you by getting rid of formaldehyde in the air. Safe for pets.

Mother-in-law's tongue (Snake plant)
(Sansevieria trifasciata 'Laurentii')

Great for filtering out formaldehyde. Bright light with some sun is preferable, though it can withstand dark areas. It needs humidity so is good for bathrooms.

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Other plants to consider

Aloe
(Aloe Vera)

Everyone can grow an aloe vera, just place it in a sunny spot and watch it thrive. It will help to filter out toxins such as formaldehyde and benzene.

Azalea
(Rhododendron simsii)

Another good plant in order to keep formaldehyde at bay is azalea. It has beautiful blooms that do best in cooler areas.

Chrysanthemum
(Chrysantheium morifolium)

The flowers from this plant help reduce harmful poisons like benzene. This plant likes direct sun and a draught, so place near a sunny, open window.

Spider Plant
(Chlorophytum comosum)

This resilient plant is a good remover of benzene, formaldehyde, carbon monoxide and xylene. Safe for pets.

To be effective you should have at least two to three plants per 100 sq ft (10m^2). Plants should ideally be situated within your personal breathing zone, so put them near where you sit and next to the computer or bed.

! Be aware that some houseplants can be toxic to pets.


I ♥ CLEAN AIR


CLEAN AIR
EVERY
WHERE

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