



# Air Quality Lesson 1 What is Air Pollution?



## OVERVIEW OF THE WOKINGHAM AIR QUALITY PROJECT LESSON 1

- These resources have been developed by The My Journey Team Air Quality Officer for KS2 pupils
- Teachers can use these resources however fits in best with their pupils learning.

### Main Science curriculum links:

#### Yr 4 Science

*Recognise that environments can change and that this can sometimes pose dangers to living things*

*Compare and group materials together, according to whether they are solids, liquids or gases*

#### Yr 6 Science

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

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

### Further curriculum links

Maths Geography & PSHE.



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## **Introduction – further information for teachers**

- Please pass on your comments and feedback on **Lesson 1 – What is Air Pollution?** To [kathryn.horsepool@wokingham.gov.uk](mailto:kathryn.horsepool@wokingham.gov.uk)
- Further information on my Journey Wokingham please visit <https://www.myjourneywokingham.com/>
- For further information on Wokingham Town Centre AQMA [https://uk-air.defra.gov.uk/aqma/details?aqma\\_ref=1602](https://uk-air.defra.gov.uk/aqma/details?aqma_ref=1602)
- For further information on Twyford AQMA [https://uk-air.defra.gov.uk/aqma/details?aqma\\_ref=1601](https://uk-air.defra.gov.uk/aqma/details?aqma_ref=1601)
- There are lots of resources for teachers on the My Journey Air Quality pages <https://myjourneywokingham.com/schools/air-quality/>
- For further education resources please visit <https://www.cleanairday.org.uk/schools>



## Why is clean air important?



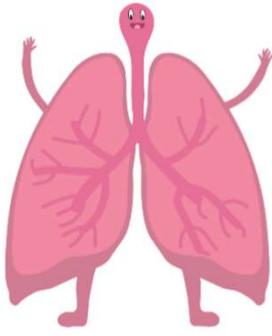
### Further Information

#### Tell them

- Air pollution is a major environmental risk to health.
- Breathing clean air can lessen the possibility of disease from stroke, heart disease, lung cancer as well as chronic and acute respiratory illnesses such as asthma.
- Lower levels of air pollution are better for heart and respiratory health both long and short-term.



**Air pollution can affect your lungs and impact your breathing.**



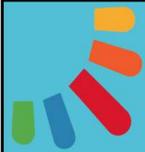
## **Tell them**

### **Air pollution is harmful to the lungs**

- Babies and children are especially vulnerable to air pollution as their lungs are still growing and developing.

### **Further information**

- Exposure to air pollution can harm normal growth of lung function in the womb, during childhood and right up to the late teens.
- In children with asthma, high levels of air pollution are linked to increased asthma attacks.
- Air pollution can affect the quality of the air we breathe when we are indoors, outdoors and in the car.



**Breathing in air pollution can cause asthma, or make symptoms of asthma worse.**

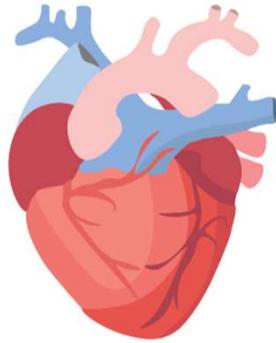


### **Additional Information to share with the class**

- Pollutants in the air have the same affect on children with asthma as other triggers.
- They irritate the airways, making them swell and tighten up, and cause breathing problems.
- Pollutants can also make children more likely to catch upper respiratory infections (like colds), which can bring on asthma symptoms.

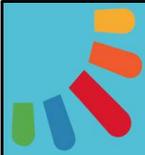


**Breathing in air pollution can affect your heart and cause future heart problems.**



### **Additional Information to share with the class**

- Air pollution can be harmful to the heart.
- Research has shown that air pollution can affect your heart and circulation by damaging the inside walls of your blood vessels, causing them to become narrower and harder.
- Restricting the movement of your blood vessels, can increase your blood pressure and add to the strain on your heart.

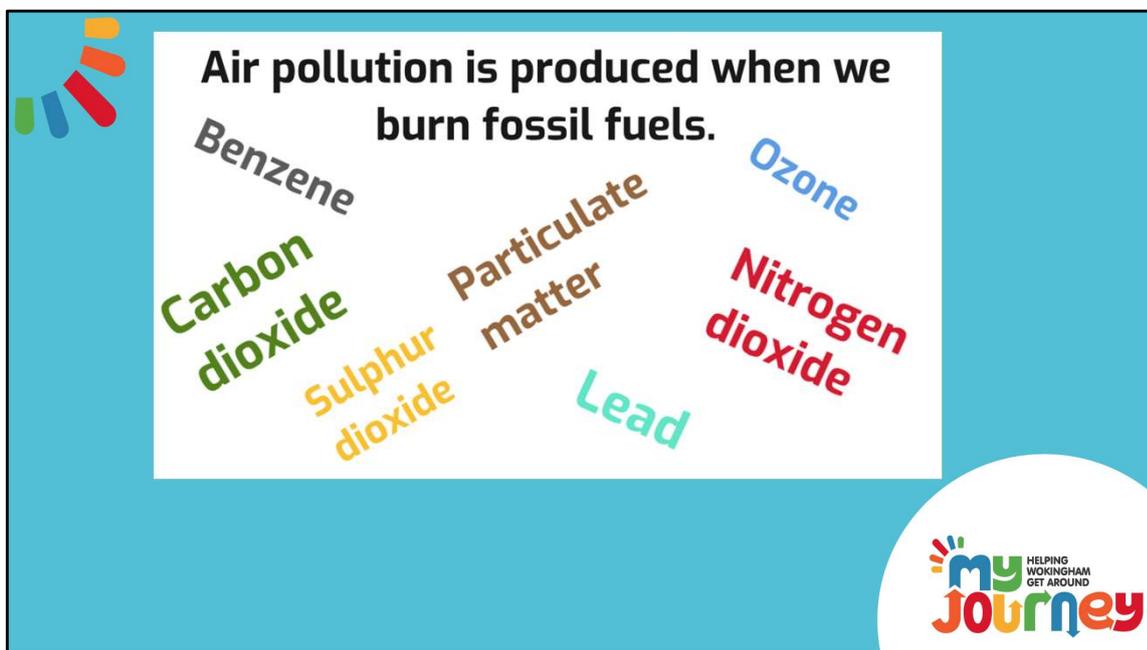


## ACTIVITY

- **Opportunity to stop the video**
- You may want to stop and ask the whole class what about affect of poor air quality on their body before continuing.
- **Extension Question** – have you ever lived outside of Wokingham Borough in another urban area which suffers from traffic congestion e.g. local town centre or a London borough?

## For further information tell them

- Air Pollution comes from different sources such as
- **Transport**– such as cars, buses, planes, trucks, and trains.
- **Industry** – such as power plants, oil refineries, industrial facilities, and factories and wood burning fireplaces.
- **Natural sources** – such as wind-blown dust, wildfires, and volcanoes.



### More info on main pollutants (particulate matter is also covered on Slide 10)

1. **Nitrogen oxides (NO<sub>x</sub>)** – produced in any combustion process, NO<sub>x</sub> emissions are oxidised in the atmosphere and contribute to acid rain. They can cause inflammation of the airways, reduced lung function and trigger asthma.
2. **Carbon dioxide (CO<sub>2</sub>)** – non-toxic but contributes towards climate change and one of the most important greenhouse gases, it also causes acidification of our oceans.
3. **Particulate matter (PM)** is a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye.
4. **Ozone** - When inhaled, ozone can damage , shortness of breath and, throat irritation. It may also worsen chronic respiratory diseases such as asthma as well as compromise the ability of the body to fight respiratory infections.
5. **Benzene (C<sub>6</sub>H<sub>6</sub>)** – occurs naturally in small quantities (less than 2%) in petrol and diesel, Benzene is emitted from vehicle exhausts as unburnt fuel and also through evaporation from the fuel system although modern fuel systems are sealed and have carbon canisters to hold the vapours. Benzene is toxic and carcinogenic and long-term exposure has been linked with leukaemia.
6. **Sulphur dioxide (SO<sub>2</sub>)** – sulphur occurs naturally in the crude oil from which petrol and diesel are refined. It forms acids on combustion leading to acid rain and engine corrosion. It also contributes to the formation of ozone and of particulate matter.
7. **Lead** – This is added to some fuels to improve vehicle performance. Depending on the level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system.



# Air Pollution comes from industrial processes



## Sources of air pollution

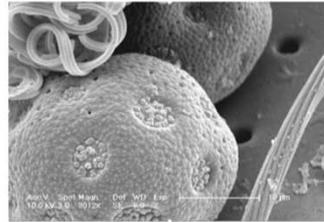




**Tiny particles in the air, called particulates, cause air pollution.**

**These are very small, equivalent to 2.5-10 millionths of a metre.**

**This is 10 times smaller than the width of a human hair.**



## **Tell them**

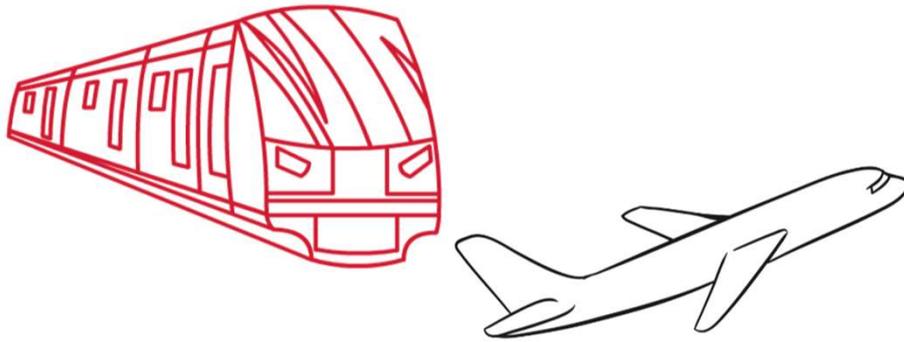
- Many particulates are very small and you need a microscope to see them properly like in the photo from the video.
- You can see some particles in the air for example from woodsmoke from a fire.

## **Further information**

- Based on size, particulate matter is often divided into two main groups:
- The coarse fraction contains the larger particles with a size ranging from 2.5 to 10  $\mu\text{m}$  ( **$\mu\text{m}$  = micrometre or micron**) (PM10 - PM2.5).
- The fine fraction contains the smaller ones with a size up to 2.5  $\mu\text{m}$  (PM2.5).
- Particulate matter contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems.
- Some particles less than 10 micrometers in diameter can get deep into your lungs and some may even get into your bloodstream.



## Air pollution also comes from transport



### ASK

Where does air pollution come from in petrol & diesel cars ?

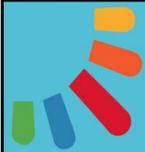
**ANSWER** – air pollution comes from the car exhaust

**Further question** – what about electric cars do they have any emissions? Are they better for the planet?



**ANSWER** – electric cars have no direct emissions from the exhaust but they are powered by a battery that needs to be charged up using electricity from the grid.

Using grid electricity has associated carbon dioxide emissions which contribute to climate change. However the grid is slowly decarbonising and more renewables are being used for electricity generation, which is making electric powered vehicles a cleaner option from an air quality and climate change perspective.



**Air pollution builds up when there is traffic congestion.**

**Gases, such as nitrogen dioxide, come from car exhausts.**



### **Question**

What is idling an engine?

### **Answer**

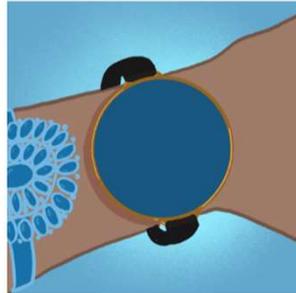
Running a car engine while it is stationary.

### **Fun Fact**

- Running your car engine while your vehicle is stationary is known as idling.
- An idling engine can produce up to twice as many exhaust emissions as an engine in motion.
- Exhaust emissions contain a range of air pollutants such as carbon monoxide, nitrogen dioxide, and particulate matter. These can affect the air quality of the surrounding environment and the air we breathe.



**Ann says "Let's stretch our legs and take a two minute break".**



**The timer is set for 2 minutes – make sure you stretch your legs!**

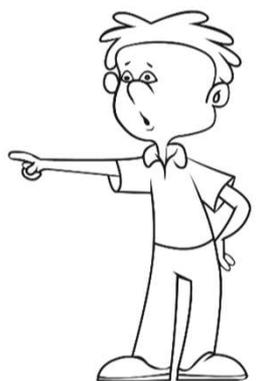
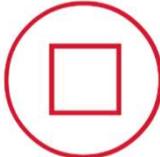


**Now it's your turn to  
answer some questions  
to see how much you  
know about what  
causes air pollution.**





This is Ehan. He says "Remember to stop the video when you see the question (before the answers appear)."



## Advise for Teachers

- The question will come up first.
- You then need to pause the video **each time** before the answers come up in **red** coloured text.
- The maximum you can score is 6 points.
- Advisory time 15 minutes to answer questions and discuss answers.
- Take as long as you need for the class to answer the questions.



## Question 1

### Why is clean air important?

Clean air is vital for all living things as we breathe oxygen, into our lungs, from the air. When the air is polluted we are breathing in the pollution, that enters into our bodies, through the lungs. (2 points)



### Advise for Teachers

- The question will come up first.
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- The maximum you can score is 6 points.
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## Question 2

Name two parts of the body that air pollution affects?

1. **Lungs**
2. **Heart**

(2 points)



### Advise for Teachers

- The question will come up first.
- You then need to pause the video **each time** before the answers come up in **red** coloured text.
- The maximum you can score is 6 points.
- Advisory time 15 minutes to answer questions and discuss answers.
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## Question 3

Name two sources of air pollution in Wokingham Borough?

1. **Petrol and diesel powered cars (not electric)**
2. **Lorries (HGVs)**

(2 points)



### Advise for Teachers

- The question will come up first.
- You then need to pause the video **each time** before the answers come up in **red** coloured text.
- The maximum you can score is 6 points.
- Advisory time 15 minutes to answer questions and discuss answers.
- Take as long as you need for the class to answer the questions.



**Ann and Ehan say "Well done!"**



**What was your score?  
(max 6 points)**





# Part 2



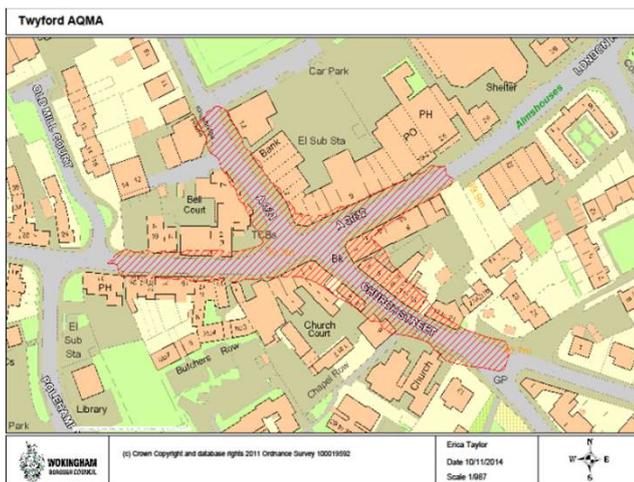
**Ann says "Is air pollution a problem in Wokingham?"**



## Which parts of Wokingham Borough is air pollution a problem?

### ANSWER

- Three areas of the borough experience higher levels of air pollution, in these areas and an Air Quality Management Area (AQMA) has been declared to DEFRA (Government Dept for Environment, Food and Rural Affairs)
- There are three Air Quality Management Areas (AQMA's), they are in Wokingham Town Centre, Twyford cross-roads and along the M4 corridor.
- The M4 AQMA is not covered by the project, this is managed by Highways England <https://nationalhighways.co.uk/>
- **Air Quality Lesson 1 – What is Air Pollution?** Focuses on Wokingham Town Centre and Twyford Air Quality Management Areas.





## **ASK**

Why do you think the transport is the main source of emissions in Wokingham?

- In the Air Quality Action Plan (AQAP) which covers the Air Quality Management Areas one of the most significant source on Nitrogen Dioxide in both Twyford and Wokingham was emissions from passenger cars.
- The Wokingham Air Quality Project (WAQ) is working with schools near to both the Wokingham town centre and Twyford AQMA.

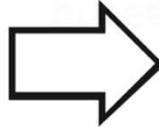
## **Further information**

- If you are looking for education resources regarding travelling by train please contact Maddy Mills, Community Rail Education Officer GWR.
- <https://www.southeastcrp.org/education/education-resources/>



Two areas which have the highest levels of air pollution are Wokingham town centre and Twyford crossroads.

Air pollution is monitored 24 hours a day.



## **ASK**

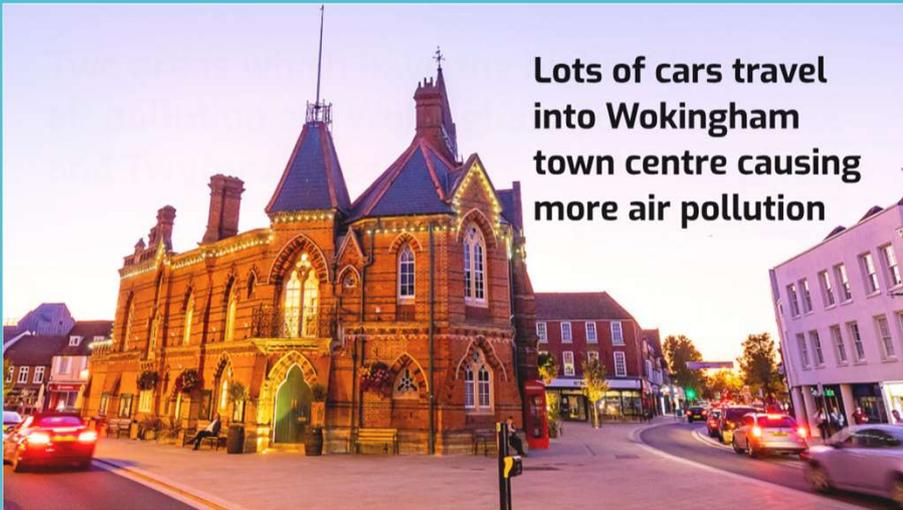
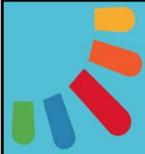
Why do you think Twyford Crossroad and Wokingham Town Centre have the highest levels of emissions?

## **Answer**

These two areas of the borough experience high levels of congestion and are Air Quality Management Areas (AQMA'S).

## **Further information**

Please consult the Public Protection Partnership (PPP) website for the latest official Air Quality Annual Status Report (ASR)  
<https://publicprotectionpartnership.org.uk/media/2439/wokingham-air-quality-annual-status-report-2021.pdf>.



**Lots of cars travel into Wokingham town centre causing more air pollution**



## **ASK**

Why do you think the transport is the main source of emissions in Wokingham?

## **ANSWER**

- Congestion has been a large cause for concern in Wokingham Borough for a number of years.
- A characteristic of Wokingham Borough is the semi-rural nature of the area.
- Public transport in the borough is not easily accessible to those situated away from the main towns.
- This means private transport is heavily relied upon which increases air pollution.
- Secondly, the affluence in the borough leads to high numbers of cars per household and also cars with larger engine sizes which are bigger polluters.



**At Twyford crossroads, cars and lorries must stop at the traffic lights, which increases levels of air pollution.**



## **ASK**

Why do you think Twyford crossroads experiences poor air quality?

## **Answer**

It is a crossroads and there are four set of traffic lights to control the flow of traffic.

Traffic is stationary while it is queuing which causes an increase in air pollution. There are banners up on the lampposts at the crossroads asking drivers to switch off their engines while stationary.

They look like this.





**Ann says "What is an  
air quality school?"**



## **Question**

**What is an Air Quality School?**

## **ANSWER**

- An air quality school has three diffusion tubes, which measure nitrogen dioxide gas, installed on the school site.
- They are located at the front gate, at the main entrance to the school and in the playground.
- The diffusion tubes are changed over every month and sent off to the laboratory for analysis.



**There are ten air quality schools in Wokingham Borough. Each of these schools have three diffusion tubes measuring nitrogen dioxide gas.**



## **Question**

**How is air quality monitored across Wokingham borough?**

## **Answer**

- The Public Protection Partnership monitors air quality across Wokingham, Bracknell Forest and West Berkshire.
- They undertake air quality monitoring within these three local authority areas to measure the main source of pollution which is derived from exhaust emissions from road traffic and report the levels to DEFRA in an annual status report (ASR).
- <https://publicprotectionpartnership.org.uk/environmental-health/air-quality/air-quality-monitoring/>
- Please contact them directly on [ehadvice@westberks.gov.uk](mailto:ehadvice@westberks.gov.uk) if you have any questions about the monitoring across the whole Wokingham Borough.



**Diffusion tubes are small plastic tubes with a cap at each end, one is coloured.**

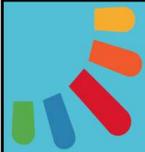
**Under the coloured cap is a steel mesh disc which is coated with Triethanolamine (TEA).**

**When gases pass over the mesh a chemical changes which tells us how much nitrogen dioxide was in the air.**

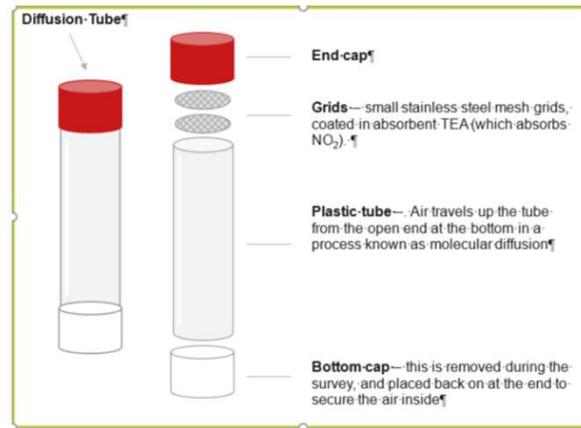


## **Further information on how to diffusion tubes work**

- Diffusion tubes are small plastic tubes with a cap at each end one of which is coloured. Under the coloured cap is a steel mesh disc which is coated with triethanolamine (TEA) a chemical that absorbs nitrogen dioxide.
- When gases pass over this mesh the chemical changes.
- This chemical change tells us how much nitrogen dioxide was in the air during the monitoring period.
- Tubes are attached in a vertical position with the coloured cap at the top to a stationary object such as a lamppost, road sign, railings or a drainpipe.
- The bottom white cap is removed so that the air can get into the tube in a process known as molecular diffusion.
- Nitrogen dioxide in the air reacts with the chemical on the mesh at the top of the tube and changes into nitrite.



## How do diffusion tubes work?



### Further information on how diffusion tubes work

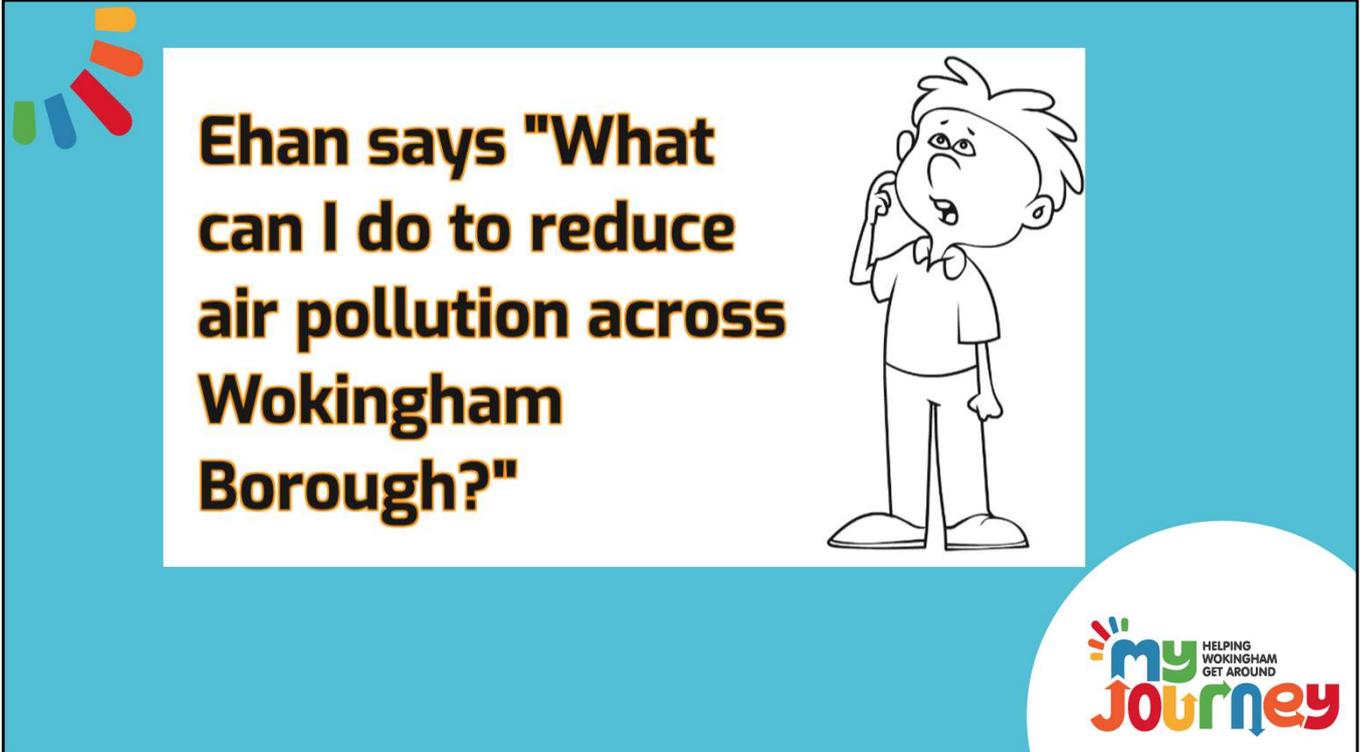
- Diffusion tubes are a cheap and easy way to measure nitrogen dioxide ( $\text{NO}_2$ ).
- They are supplied and analysed by laboratories.
- Local authorities use them measure the concentration of nitrogen dioxide gas across their borough by putting up tubes in lots of different locations, near to roads.



## Further information on the ten Air Quality Schools

We have ten air quality schools in Wokingham Borough.

1. Evendons Primary School
  2. The Colleton Primary School
  3. All Saints Primary School
  4. Floreat Montague Primary School
  5. St Paul's CoE Junior School
  6. The Hawthorns Primary School
  7. Wescott Infant School
  8. Nine Mile Ride Primary School
  9. Windmill Primary School
  10. Westende Junior School
- Many of the schools have been selected as they are near to the Wokingham Town Centre AQMA, Twyford Crossroads AQMA and the Finchampstead Rd urban air agglomeration zones (UAAZs) in Wokingham Borough.
  - The Wokingham Air Quality Project is funded by DEFRA and runs up until October 2023.



**Ehan says "What can I do to reduce air pollution across Wokingham Borough?"**

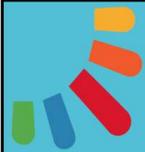


## **TELL**

- Did you know that children who walk, cycle or scoot to school show higher performance, better concentration, increased well being and self-esteem, and are exposed to less pollution than travelling by car?
- They are also more likely to choose sustainable travel options when they become independent.

## **Further information**

- My Journey Wokingham works with schools to encourage safe, active and sustainable travel for children (and parents) to school, including walking, scooting, cycling, park and striding (parking at least a five minute walk away from your final destination) and public transport.
- <https://www.myjourneywokingham.com/schools/>



# He can walk, scoot



# or cycle to school

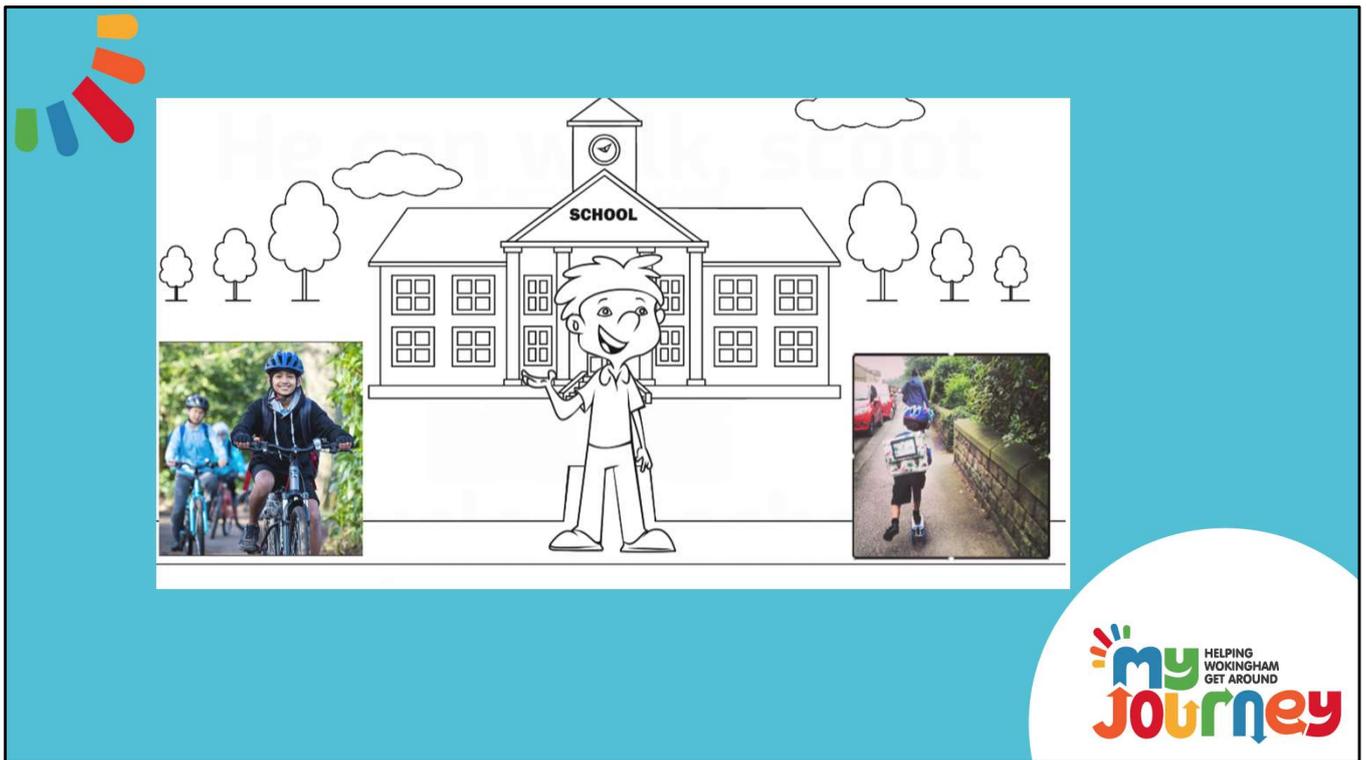


## **ASK**

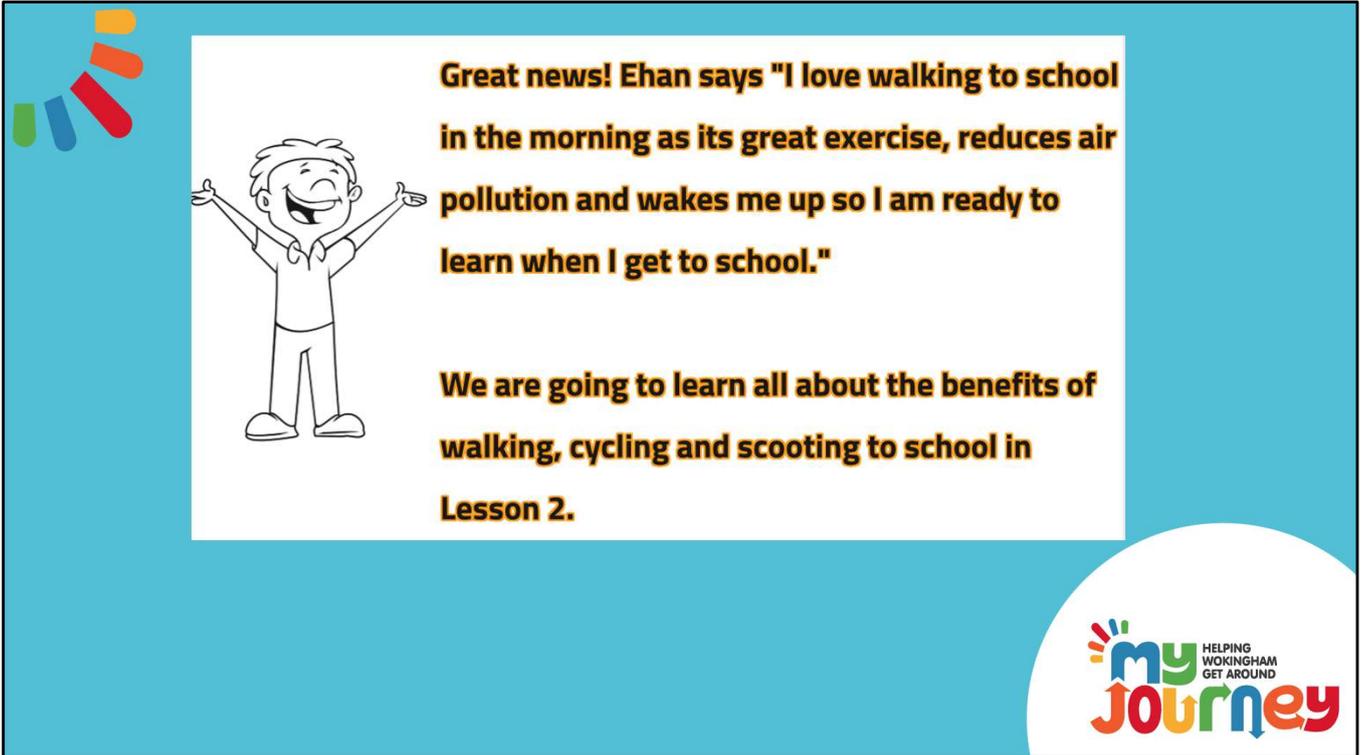
What are the benefits of walking scooting and cycling to school?

### **Further information**

- The benefits of active and sustainable travel extend far beyond the school gate. Research shows that active travel to school makes children more alert, improves concentration for up to four hours afterwards, improves academic performance, and encourages a better mood.
- <https://www.myjourneywokingham.com/schools/>



- **ASK** – how do you travel to school?
- You could do a hands up survey around the room.
- A basic travel survey can be used to form the basis of your school travel plan.
- The My Journey Team uses Modeshift STARS accreditation platform for school travel plans.
- <https://www.modeshiftstars.org/>
- Please get in touch with [myjourney@wokingham.gov.uk](mailto:myjourney@wokingham.gov.uk) for more information.
- <https://www.myjourneywokingham.com/schools/primary-schools/>



**Great news! Ehan says "I love walking to school in the morning as its great exercise, reduces air pollution and wakes me up so I am ready to learn when I get to school."**

**We are going to learn all about the benefits of walking, cycling and scooting to school in Lesson 2.**

**my Journey**  
HELPING WOKINGHAM GET AROUND

## **Tell**

Walking, cycling or scooting to school has many benefits:

- It helps children lead an active and healthy lifestyle; it can provide benefits to mental health.
- It helps reduce congestion and pollution, and help to tackle climate change.
- It helps children learn to make positive lifestyle choices as they grow up;
- It teaches them independence.

My Journey aims to encourage walking, cycling or scooting to school wherever possible.

For further information visit 

<https://www.myjourneywokingham.com/schools/primary-schools/>



**Now it's your turn to answer some questions, to see how much you know about air quality.**

**STOP**

**my Journey** HELPING WOKINGHAM GET AROUND

## **Advise for Teachers .**

- You may want to stop and pause the video as you go before you get to the questions at the end.
- There are six questions to answer – one question per slide
- The question will come up 1<sup>st</sup>.
- You then need to pause the video each time before the answers come up in **red** coloured text.



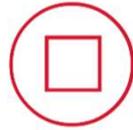
**Ready?**

**Good Luck**





**Remember to stop the video when you see the question (before the answers appear)**





## Question 1

What is the name of the gas diffusion tubes measure?

**Nitrogen dioxide**

2 points



### Advice for Teachers

- The question will come up 1<sup>st</sup>
- You then need to pause the video **each time** before the answers come up in **red** coloured text
- The max you can score is 6 points.
- Advisory time 15 minutes to answer questions and discuss answers
- Take as long as you need for the class to answer the questions



## Question 2

**How can you help to reduce air pollution?**

**Walk, scoot or cycle to school.**

**If you have to drive, then park and stride!**

2 points



### Advice for Teachers

- The question will come up 1<sup>st</sup>
- You then need to pause the video **each time** before the answers come up in **red** coloured text
- The max you can score is 6 points
- Advisory time 15 minutes to answer questions and discuss answers
- Take as long as you need for the class to answer the questions



## Question 3

**How many air quality schools are there in Wokingham Borough?**

**There are ten air quality schools.**

2 points



### **Further information on the ten Air Quality Schools**

We have ten air quality schools in Wokingham Borough.

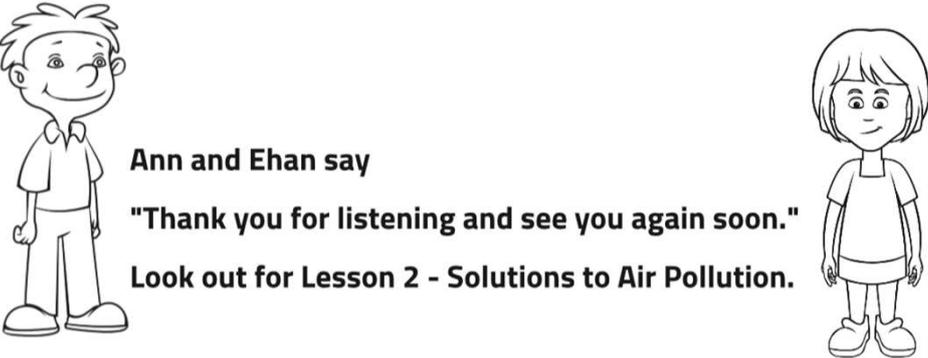
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8. Nine Mile Ride Primary School
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**GOOD  
JOB!**

**What was your score?  
(max 6 points)**

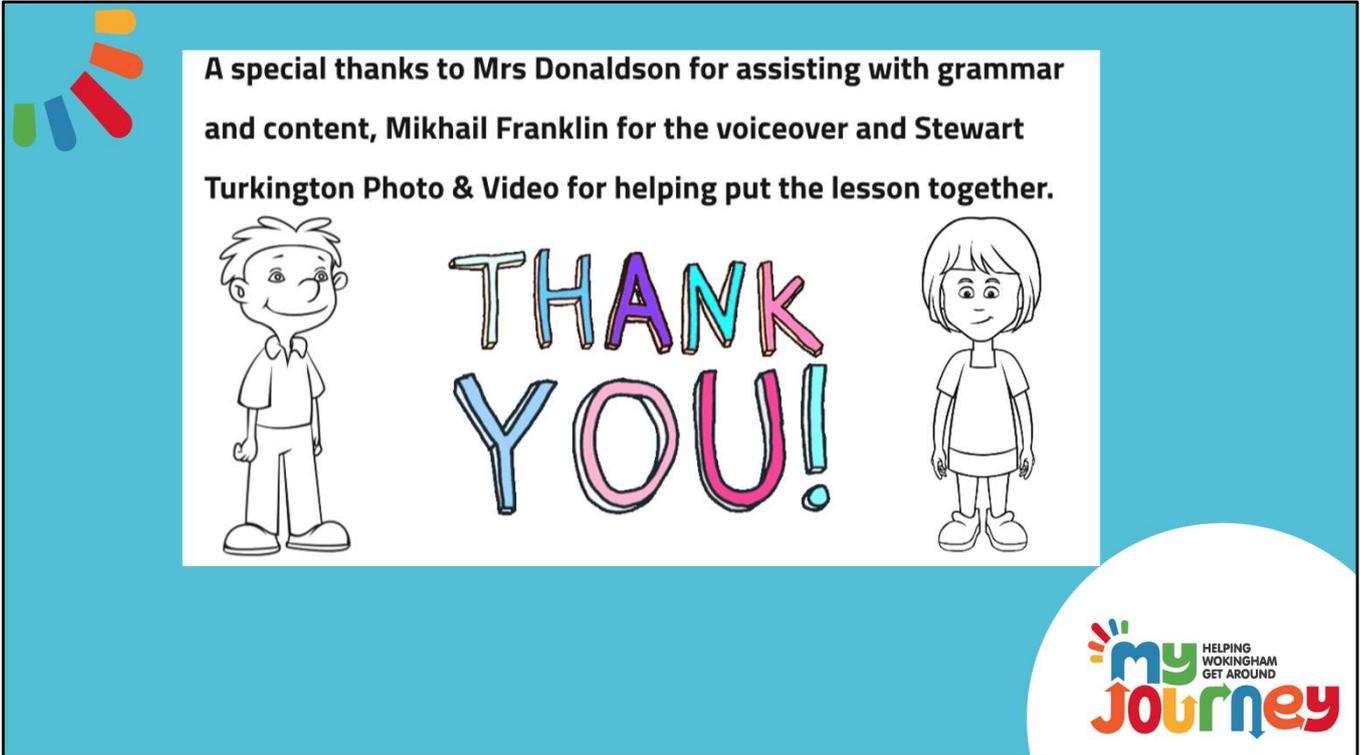




**Ann and Ehan say**  
**"Thank you for listening and see you again soon."**  
**Look out for Lesson 2 - Solutions to Air Pollution.**



Lesson 2 - Solutions to Air Quality will also be available at <https://www.myjourneywokingham.com/schools/air-quality/>



Thanks to Mrs Donaldson Year 6 teacher at Westende Junior School for assisting with grammar and content.

Thanks to Mikhail Franklin who is the narrator.

The video was edited by:  
Stewart Turkington  
Photography & Video  
stewart@stphotos.co.uk  
[www.stphotos.co.uk](http://www.stphotos.co.uk)

Please send any feedback you have on the education pack to  
myjourney@wokingham.gov.uk