# How clean is the air near me?

# Lesson 1 - Volunteer guidance (KS3)

## Key Stages

* Key Stage 3 comprises Years 7 – 9 , with pupils aged between 11 and 14

### Introduction

1. Hand out the name stickers and ask the pupils to write their first names on them. You can wear one too! Try to use the pupils’ names whenever you’re talking to them.
2. Introduce yourself and your team to the group. You can talk briefly about the university and what you all do there. You could choose to display the PowerPoint slide of the campus and ask if they know the link between the characters in the ‘Monster Inc’ movies and the University of Birmingham – it’s rumoured that the Monster University was based on UoB – note the clock tower! You could begin by asking the pupils what they know about universities. This would also be a useful way to break the ice. Based upon their responses, you could discuss the following:

* A university is a place where you can go to once you’ve finished normal school, to continue studying subjects they’re interested in.
* People normally go to university when they are 18 and have taken their A-levels.
* You can go to a university in Birmingham, but they’re all over the UK and the rest of the world.
* Pupils at KS3 may be aware that science can be broadly divided into the subjects of biology, chemistry and physics. Some schools do this at KS3, others wait until students have begun their GCSEs. Explain that within these three subjects, there are a huge number of other areas – like engineering, medicine, materials etc. This could be a good opportunity for the volunteer team to discuss what they studied at A-level and what they are doing now. It’s nice to involve the children, ask them what they’d like to learn about!

1. Introduce the project by saying that we are going to investigate how clean the air around us is. You should use the PowerPoint to assist you here.

At this point, volunteers can begin to get equipment ready:

* Clipboard
* Graph paper
* Garden twine – each clipboard will require about 25 cm

Start by asking the pupils about pollution – what is it and where does it come from? Tell them that we are going to be trapping pollution **particles** and ask them if they know what this word means. They may well have used the word as an alternative to ‘atoms’ – before they began to learn more about them. Tell them that the particles we are talking about are tiny bits of solid which are blowing around in the air

PowerPoint slides 5 - 8 feature some examples of particles which can be found in the air. There are some additional guidance notes with the slide.

You may want at this stage to ask pupils to look at their rulers, as the next slide shows the comparative approximate sizes of a strand of hair, a pollen grain and particles of soot. The width of the hair is given as 0.1 mm (this is an average, as some people have thicker or thinner hair). Students can be asked to convert this value into a fraction (they should be able to do this). You can mention here that we will be using special devices like microscopes to see some of the particles we’re going to study.

### Breathing

1. Tell the students that we are going to start by learning about breathing. This will help us understand why particles can cause health problems. KS3 students are likely to have some knowledge of the lungs and circulatory system from their work in junior school and may have begun to learn about gas exchange. You can assess their knowledge via some introductory questions:

A close-up of a medical device

Description automatically generated

* What happens when we breathe?
* Which parts of the body do we use?
* What is inside our lungs (they may not have studied this, especially if they are in year 7).

Demonstrate the diaphragm and lungs model. This consists of two small balloons, representing the lungs, and a rubber sheet, representing the diaphragm. When the sheet is pulled down then pushed up, the lungs inflate and deflate, simulating the action of the diaphragm.

There is also a short (1 minute 40) BBC Bitesize video which goes into a little more detail (link on slide 6).

1. Students could be asked to draw the position of various organs on an outline of the body (there are prompts on slide 7). Reveal the answers using one (or more) of the plastic human torso and/or lung models (shown below). The torso model is probably the best to use with KS3 students, as it shows the position of the lungs as well as other internal organs. They will have studied the digestive system in KS2 and this is also on the KS3 specification, so you could also ask them to identify the relevant body parts on the torso model.

A model of a human body

Description automatically generated

A model of human lungs

Description automatically generated

1. Describe what happens to large and small particles when you breathe in (see notes on slide 10). You could perhaps discuss large particles, then ask the pupils to think what might happen to particles which are too small to be trapped by mucus.

Depending on their knowledge of gas exchange and alveoli, you could limit your discussion to particles causing problems in the lungs (they may know people who suffer from asthma, so you can use this as an example). You can also talk about particles entering the blood from the lungs. These can lead to heart attacks and strokes.

### Introducing the experiment

1. Tell the pupils that we are going to set some traps for particles, so that we can see which areas of the school have the most pollution. You can ask them (in large or small groups) to think about where most pollution might be found. Depending on class size, each student can make their own trap, or there could be two traps per group.

### Variables and controls

* At KS3, students should have been introduced to the concept of independent, dependent and control variables (it’s worth checking with the member(s) of staff to see if the children have used these terms yet). If not, just use the descriptions shown below.

Ask the pupils to think about:

* Independent variable / what we are going to change (location of trap)
* Dependent variable / what we are going to measure (how many particles are ‘trapped’)
* Control variables / what we need keep the same (size of grid, size of squares)

This would be ideal for discussion in small groups with your help and prompting. Having the apparatus there in front of them is really helpful, otherwise they may find this too difficult.

Mention that you need to think about exactly the same things when you are planning and carrying out experiments at university! It’s a vital part of ‘working scientifically’.

### Predictions

Pupils can be asked to think about the different areas of their school and which ones are likely to have the most / least pollution. Again, you can talk to them about how this is part of working scientifically.

**Aim and method**

Discuss what these words mean. Pupils can begin to write about them on their worksheets.

**Carrying out the experiment**

1. Show / discuss the experimental set up, with a labelled piece of graph paper attached to a clipboard. There will be examples of these provided, so that you can show the pupils.

Pupils should fold a piece of graph paper in half (landscape orientation), then draw a grid on it (see slides 12 - 14).

If they start the grid about 4 cm squares from the left-hand side, and about 7 from the top, it should be fairly central.

Ask them how we can use this to trap particles – you could mention fly paper here!

1. Supervise the pupils as they apply a thin layer of petroleum jelly to their grid area. There’s no need to cover the entire piece of graph paper! This is best done by asking the pupils to bring their grids to a particular area of the room where a few pots of petroleum jelly and the spreaders will be located – you don’t want them wandering round with spreaders covered in Vaseline! Make sure that there’s plenty of room for the students; placing the pots and spreaders along the back bench of a lab is ideal.

Pupils can continue to write about their aim and method while they are waiting. There is a wordsearch at the end of the worksheet if required.

**Finishing off**

Congratulate the pupils on their attitude and tell them how much you’ve enjoyed working with them (hopefully you have!)

Give a brief description of what you will be doing next time – looking at the different particle traps and using magnifying glasses and microscopes to count how many particles were trapped in different places around the school.