THE ROYAL SOCIETY

We need air

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Mark's research focuses on ways of measuring chemicals in the air. This has applications in measuring air quality, detecting air contaminants and could even be used in security applications. He has developed equipment that uses a technology called ultraviolet absorption spectroscopy. This detects molecules in the air by measuring how much ultraviolet light they absorb. It is fast and extremely sensitive.

In the UK, air quality is measured by a network called the Automated Urban and Rural Network (AURN).

The network uses a series of sites throughout the country that measure levels of air pollutants to make sure that standards in air quality are met. These stations measure levels of substances such as particulates (microscopic dust particles), sulfur dioxide, nitrogen oxides, lead and low-level ozone. Maintaining good air quality has a big impact on people's health.

Information on the air quality in your location can be obtained from the Department for Environment, Food and Rural Affairs (DEFRA) at **uk-air.defra.gov.uk**

Introduction to Inspiring Scientists

Inspiring Scientists is a series of resources to help develop your students' understanding and awareness of science and the diversity of scientists. This resource forms part of a collection of ten ethnic minority scientists in the UK who are leaders in their field of scientific research. The resources for each scientist are divided into three academic levels: primary, secondary and post-16.

Each resource is accompanied by an activity worksheet, scientist's timeline and a video profile.

Learning outcomes

- Describe the composition of air and why we need it to breathe.
- Understand that pollution affects air quality.
- Determine that fire needs oxygen to burn through observation of a burning candle.
- Perform simple measurements to learn their lung capacity.

We need air

Activity one

As Mark's research focuses on the air we breathe, this first activity is a simple demonstration to illustrate the need for oxygen. Place a lit night light candle on a suitable flat surface (such as a ceramic plate). Then place a clear glass container over the candle. Have students observe what happens.

Once the candle has used up all the oxygen in the air within the glass, the candle will go out. Use this as a way of talking about air containing a gas (or 'part') called oxygen. In a similar way to the candle needing oxygen to burn, humans need oxygen to survive.

Note: Practice before demonstrating in front of students. Take all necessary precautions with the lit candle, its placement, and the glass, which may become hot. The glass container should be much taller than the candle flame, so that the flame cannot touch the top of the glass.

Activity two

Students use a plastic container to measure their lung volume. This is the amount of air that they can exhale. Typically this will be in the region of three to five litres, depending on the age and size of the children.

Set the equipment up as shown in the activity sheet diagram.

Use a large plastic bottle, such as a five litre bottled water container or similar. It can be calibrated by adding one litre of water to the empty container and marking the level. Then adding a second litre and marking the level, and so on.

Fill the bottle with water and upturn it into a bowl of water as shown in the diagram.

Students use a plastic tube to blow into the bottle and displace the water. The volume of their breath can be measured. Record the volumes of children in the class and use the data to make comparisons such as:

- What is the average lung volume?

Safety notes:

Perform a risk assessment before carrying out the activity.

The risk assessment should relate to the class and children involved. Some points to consider may include:

- Ensure students do not have any underlying medical conditions and are able to perform the test safely.
- Assess the additional risks if students have conditions such as asthma.
- Allow students to only make one attempt, to avoid them becoming hyperventilated.
- Ensure the area where the test is performed is safe and uncluttered.
- Each student should wrap a small piece of cling film around the pipe before they do the activity, and then remove it after their turn and place it in the bin.
- The water may spill causing slip hazards. Have a mop available to clean up

Activity toolbox

To complete this activity you will need:

- Activity sheet;
- Empty plastic five litre bottle;
- Plastic tubing;
- Water trough;
- Rulers;
- Cling film
- Graph paper;
- Calculators;
- Candle and matches; and
- Glass jar which can fit the candle inside.

Suggested sequence of events

Timing: 45/60 minutes

- Lead a class discussion to recall prior learning of the topic.
- Play the video profile and encourage students to record their own notes (running time approximately 7 minutes).
- Lead a class discussion on how we need air and perform candle demonstration.
- Brief class on the activity.
- Activity.
- Share results.

Homework ideas

Lung laboratory
Design a poster to explain the experiment. You must include a diagram of equipment, step by step method and a short explanation of your findings. Could you improve the experiment to make it more accurate next time?

Extra reading?
Look out for primary science or fiction books on this subject to use during class time. Why not try *Utterly Amazing Science* by Robert Winston, winner of the Royal Society Young People's Book Prize?

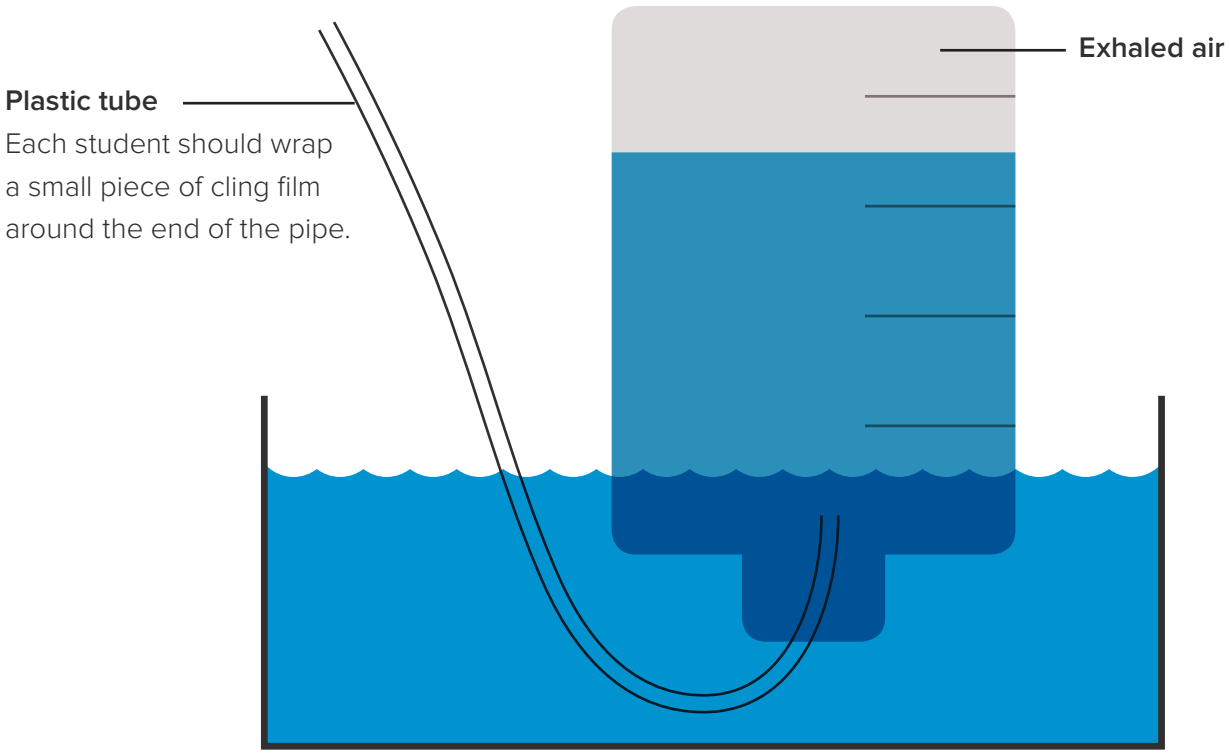
ACTIVITY

We need air

Use the equipment to see how much air you hold in your lungs.

Task

1. Fill the bottle with water.
2. Quickly turn it upside down in the bowl.
3. Put one end of the plastic tube inside the bottle.
4. Wrap a small piece of cling film around the pipe.
5. Take a breath.
6. Blow out all you can into the bottle.
7. Measure the volume of air you breathed out.
8. Remove your piece of cling film and place it in the bin.



Questions

- What volume of air did you breathe out?
- What is the average volume for the class?