Air quality

SATIS revisited
SUPPORTING HOW SCIENCE WORKS

Guidance for teachers

Air pollution

Downloads

- PowerPoint presentation
  - slide 1 – starter stimulus
  - slide 2 – gases in the atmosphere
  - slide 3 – pollutants in the air
  - slide 4 – table showing amounts of naturally produced pollutants
  - slide 5 – table showing amounts of pollutants produced by human activities
  - slide 6 – graph of pollutants
- Fact file blanks (make several copies and cut in half)
- Information sheet – Air pollution – where does it come from?
- Activity sheet A – Air pollution – where does it come from?
- Activity sheet B – Air pollution – where does it come from? (simplified version)

Running the activity

Start by showing PowerPoint presentation stimulus slide 1. The answers to the question 'What are you breathing in?' should include oxygen (21%), nitrogen (78%), carbon dioxide (less than 1%) and water vapour (variable). There are also minute amounts of argon, neon, helium, krypton and xenon, see PowerPoint presentation slide 2. The other substances in the air include emissions from cars and other processes, many of them naturally produced pollutants. The names of these pollutants are shown on PowerPoint presentation slide 3.

Students could find out for themselves which 'pollutants' are present in the atmosphere from the UK Air Quality Archive website. **www.airquality.co.uk/archive/index.php**

Clicking on 'What causes air pollution?' brings up a page with the list of pollutants and more information. The facts about each pollutant could be printed off to produce 'fact files'. These could be used where Internet access is not available. Students could also start filling in their own fact files using the Internet and books.

Students in Northern Ireland may choose to use the Northern Ireland Air Quality Website **www.airqualityni.co.uk**. Click on Air Quality on menu bar and then on Pollutants (or CNTRL Click on link below) **www.airqualityni.co.uk/about.php?n_action=pollutants&t=1**

The sources of different pollutants can be found at the Department for Environment Food and Rural Affairs website. Go to Homepage > Environmental Protection > Statistics > Air Quality **www.defra.gov.uk/environment/statistics/airqual/index.htm**

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Give students the' Information sheet Air pollution – where does it come from?' and 'Activity sheet A or B – Air pollution – where does it come from?' Students should use the data on the information sheet (also on PowerPoint presentation slides 4, 5) to produce a graph comparing natural sources of pollutants with those produced by human activities. A completed graph is shown on PowerPoint presentation slide 6. Note, the data is for the whole world and takes no account of daily, seasonal variations or local variations. If students are interested, you can see how carbon monoxide levels vary over the world and with the seasons by going to the NASA Earth Observatory website. Enter Seasonal Carbon Monoxide Measurements in the search facility.

earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=16550

Differentiation

Suggestions for students who may appreciate additional challenge

These students could see how the levels of carbon monoxide vary seasonally and at different places in the world, and then explain why these differences occur. See the NASA website reference above.

Suggestions for students who would benefit from additional support

A simplified version of the activity sheet is provided with the graph and an example plotted.

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Air pollution and health

Downloads

- PowerPoint presentation
  - slide 7 – AQI
  - slide 8 – AQI bands and values
- Information sheet – Air quality and health
- Activity sheet A – Air pollution and health
- Activity sheet B – Air pollution and health (simplified version)
- Fact file blanks (if not used in the first activity) (optional)

Background

Air Quality Index (AQI) is a numerical index for air pollution from 1 to 10. (see PowerPoint presentation slide 8). However, if you go to the EU and US websites, the values are from 0 to 100. The colours used are universal. The higher the AQI value, the greater the level of air pollution. Air quality monitors the levels of five pollutants: ground-level ozone, particles, PM_{10} (particles < than 10 µm), carbon monoxide, sulfur dioxide and nitrogen dioxide (see PowerPoint presentation slide 7).

The likely effects on health of different pollution levels are shown on the 'Information sheet – Air Quality and health' and at the websites listed below. Sensitive individuals are people who suffer from heart and lung diseases, including asthma, particularly if they are elderly.

Running the activity

Students complete 'Activity sheet A – Air pollution and health' using the 'Information sheet – Air quality and health' and PowerPoint presentation slides 7 and 8 or the websites or the booklet listed below. 'Activity sheet B – Air pollution and health' is available for students who would benefit from additional support.

UK Air Quality Archive website
www.airquality.co.uk/archive/standards.php - std
www.airquality.co.uk/archive/index.php

Northern Ireland Air Quality Website
www.airqualityni.co.uk/about.php?n_action=pollutants&t=1

AirNow website. Go to Air Quality Index (AQI) – A Guide to Air Quality and Your Health
www.airnow.gov/index.cfm?action=static.aqi

Booklet downloadable from Department for Environment Food and Rural Affairs website. Go to Homepage > Environmental protection > Air quality > Publications, click on the publication, Air pollution – what it means for your health.
www.defra.gov.uk/environment/airquality/publications/airpoll/pdf/airpollution_leaflet.pdf

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Differentiation

Suggestions for students who may appreciate additional challenge

Students could do further research into the health effects of individual pollutants and add this information to the fact files. See weblinks page on SATIS revisited website for a selection of useful websites.

www.airqualitynow.eu/pollution_health_effects.php

www.airquality.co.uk/archive/what_causes.php

www.airqualityni.co.uk/about.php?n_action=pollutants&t=1

www.deq.idaho.gov/air/prog_issues/pollutants/health.cfm

www.ace.mmu.ac.uk/Resources/Fact_Sheets/Key_Stage_4/Air_Pollution/18.html

Suggestions for students who would benefit from additional support

These students may need help to complete the worksheet tables. A simplified version of the activity sheet is provided.

Students, particularly those in Northern Ireland, may also click on the kid's corner of the Northern Ireland Air Quality website **www.airqualityni.co.uk/kids-corner.php?a=m**

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Forecasting air pollution

Downloads

- PowerPoint presentation
  - slide 9 – air quality stimulus
  - slide 10 – forecasting air quality instructions
  - slide 11 – blank table 1 from 'Activity sheet – Forecasting air pollution'
  - slide 12 – instructions for completing table 2 on 'Activity sheet – Forecasting air pollution'
  - slide 13 – blank table 2 from 'Activity sheet – Forecasting air pollution'
  - slide 14 – blank table to compare pollutants from different areas
- Activity sheet – Forecasting air pollution

Background

This activity looks at forecasting air pollution. Students are likely to be familiar with such forecasts from the television and newspapers. Forecasting is especially important to people such as asthmatics and those with heart conditions or lung diseases who may experience distress and other health effects, even at lower levels of pollution.

The air pollution level reported in the forecasts and summaries is the highest for any single pollutant. For example, if all but one of the pollutants in a region or city were 1–3 (low), with just a single pollutant registering 7 (high), the summary would describe air pollution as 7 (high).

Running the activity

This activity is best done by providing groups of students with access to a computer to gather the data. Each group can collect its own data for collation into a class set of results which can then be displayed and discussed.

Start by showing students PowerPoint presentation slide 9. After discussion show PowerPoint presentation slide 10 which gives details of the UK Air Quality Archive website at **www.airquality.co.uk/archive/index.php**

Look at the air pollution summary for your area by clicking on the map. Students should use the information to complete table 1 on 'Activity sheet – Forecasting air pollution'. Slide 11 of the PowerPoint presentation shows the blank table.

For details of the levels of individual pollutants on the UK Air Quality archive website: click on current levels. Then choose a site. These instructions are shown on PowerPoint presentation slide 12. For each pollutant information is given about the level (1–10) and band (Low, Moderate / Medium, High, Very high) as well as numerical values.

www.airqualityni.co.uk/index.php
Click on the map to show details of the air quality for the area closest to you.

Students should use the information to complete table 2 on 'Activity sheet – Forecasting air pollution'.

Slide 13 of the PowerPoint presentation shows the blank table to be completed.

You could ask students to find information about different areas and sites so that they obtain a mix of data for rural/country and urban sites. This information could be used to complete PowerPoint presentation slide 14.

The plenary discussion should investigate whether there are any differences between rural and urban areas (generally pollution is worse where there is more motor traffic and if there is any industry). Are there any differences? Would you expect any? Why?

You may also wish to collect data over the year, for example downloading forecasts from good days and bad days or summer and winter to compare.

Differentiation

Suggestions for students who may appreciate additional challenge

These students could compare data for EU cities using the Air Quality in Europe website. Go to the 'Comparing cities' page.
www.airqualitynow.eu/comparing_home.php

Data for Beijing, London, Athens, Los Angeles is available at the website Air Pollution – City Comparisons and could also be compared. Students could discuss the likely effect of the air quality on Olympic performance.
www.portfolio.mvm.ed.ac.uk/studentwebs/session4/27/citydiff.htm

Suggestions for students who would benefit from additional support

These students may need help interpreting the data on the web site and recording the information. Each student could be given one site to find out about.

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Analysing air pollution graphs

Downloads

- PowerPoint presentation
  - slide 15 – carbon monoxide graph
- Excel spreadsheet with carbon monoxide data (optional)
- Activity sheet A – Interpreting graphs
- Activity sheet B – Interpreting graphs (simplified version)

Running the activity

Show students PowerPoint presentation slide 15. The graph shows data for carbon monoxide levels, collected from an urban site beside a main road during September. Recording started on Friday morning and information was collected every two hours. Note data recording starts at 02.00 hours.

Ask students to look at the graph and see if there are any patterns. You could discuss any patterns and ask students to explain them by thinking about the likely levels of traffic at different times of day and week and possible weather conditions. The amount of traffic increases during the day with commuters and deliveries and in wet weather and decreases at night and at the weekend. Saturday night, Sunday morning shows less fall than other over night periods. Tuesday levels are higher than other days, this may because it was wet; more people use their cars when it rains.

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Suggestions for students who may appreciate additional challenge

You could collect other data about different pollutants for students to analyse from the UK Air Quality Archive.
www.airquality.co.uk/archive/data_and_statistics.php

- go to *measured data and simple statistics*
  - This brings you to the *data selector*
  - In data selector choose
- *pollutant name* e.g. nitrogen oxides and click on update selection
- *date range* e.g. this year and click on update selection
- *monitoring sites* e.g. country or site name and click on update selection
- *type of data* e.g. daily mean and click on update selection
- *output type* e.g. to screen or email and click on update selection
- *click go*

You can get Excel spreadsheets of the data which can be printed out or used to make graphs.

Or for students in Northern Ireland use the data at
www.airqualityni.co.uk/data.php

- go to *measured data*
  - This brings you to the *data selector*
  - In data selector choose 'get data'
  - Automatic Data
- On this screen go through the data selector, choosing the data that you are looking for from the following
  - Data type
  - monitoring site
  - Pollutants
  - Date range
  - Output type

Once the various options have been selected a table of data is produced either on the screen or emailed to you. This then can be transferred to Spreadsheet package such as Excel to allow the production of graphs.

Suggestions for students who would benefit from additional support

'Activity sheet B – Interpreting graphs' is a simplified version for students who would benefit from extra support.

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Analysing air pollution maps

Downloads

- PowerPoint presentation
  - slide 16 – instructions for getting the graphs
  - slide 17 – questions for the graphs

Running the activity

This activity is best done by providing groups of students with access to a computer to gather the data. Show students PowerPoint presentation slide 16. This gives the instructions for accessing maps showing a number of pollutants at the National Atmospheric Emissions Inventory website. **www.naei.org.uk/mapping/mapping_2005.php**

Sort the students into groups and allocate a pollutant to each group. The students should choose this pollutant to get a map. They should then answer the questions on PowerPoint presentation slide 17. PowerPoint presentation slide 7 could be available for students to help them answer the questions about pollution levels and air quality and AQI.

At the plenary session get each group to report back their findings. The students should find that all the pollutants are at higher levels in urban areas where there is more traffic.

Differentiation

Suggestions for students who may appreciate additional challenge

Students could look at and compare pollutants in the world's top 10 most polluted places in 2007. They could use the data to prepare a report. See Blacksmith Institute data at: **www.blacksmithinstitute.org**

Suggestions for students who would benefit from additional support

These students may need help in identifying rural and urban areas by reference to a map covering the same area with names of towns.