OCR A Science – Particulate pollution – Hackney Marshes
Specification links

C1.1 What chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution?
Specification Objectives:
6. When using their own and given data relating to measured concentrations of atmospheric pollutants, or the composition of the atmosphere:
- uses data rather than opinion in justifying an explanation
- can suggest reasons why a measurement may be inaccurate
- can suggest reasons why several measurements of the same quantity may give different results
- when asked to evaluate data, makes reference to its reliability (i.e. is it repeatable?)
- can calculate the mean of a set of repeated measurements
- from a set of repeated measurements of a quantity, uses the mean as the best estimate of the true value
- can explain why repeating measurements leads to a better estimate of the quantity
- can make a sensible suggestion about the range within which the true value of a measured quantity probably lies
- can justify the claim that there is/is not a 'real difference' between two measurements of the same quantity
- can identify any outliers in a set of data, and give reasons for including or discarding them.

C1.2 What chemical reactions produce air pollutants? Where do these pollutants come from?
Specification Objectives:
13. understand that atmospheric pollutants cannot just disappear, they have to go somewhere:
- particulate carbon is deposited on surfaces, making them dirty
- sulphur dioxide and nitrogen dioxide react with water and oxygen to produce acid rain

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KS4 NC How Science Works link:
2. Practical and Enquiry Skills
a. Plan to test a scientific idea, answer a scientific question, or solve a scientific problem
b. Collect data from primary or secondary sources
c. Work accurately and safely, individually and with others, when collecting first hand data
d. Evaluate methods of collection of data and consider their validity and reliability as evidence
3. Communication skills
a. Recall, analyse, interpret, apply and question scientific information or ideas
b. Use both qualitative and quantitative approaches
c. Present information, develop an argument and draw conclusions using scientific, technical and mathematical language.

Key questions

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In London what are the main pollutants and what are the key sources?
Where do the pollutants go?
What affects do pollutants have on the environment?
What is a bio monitor?
Why do we sample areas studied?

How learning will be assessed

Oral participation in small groups and whole class discussion.
Individual skill development of reading and highlighting relevant information
Identifying variables – independent and dependent.

Misconceptions
The larger the sample the more accurate the results.
Ozone is in decline throughout the atmosphere.

Websites and resources

SKEES Project – http://www.kcl.ac.uk/depsta/education/skees.html
Contact Rod Watson at King's College, London

For up-to-date statistics
http://www.londonnoisemap.com/

http://www.londonair.org.uk/london/asp/home.asp

http://www.airquality.co.uk/archive/index.php

For news articles
http://www.research-tv.com/stories/health/airpollution/bb/

http://search.eurekalert.org/e3/query.html?col=ev3rel&ht=0&qp=&qs=&qc=ev3rel&pw=100%25&ws=0&la=&si=1&fs=&qt=air+pollution&ex=&rq=0&oq=&qm=0&ql=&st=1&nh=10&lk=1&rf=1

Upd8 ASE website –
http://www.upd8.org.uk/activity/160/Acid-rain-Britain-recovers.html

Session 1: Pre-fieldwork activities in the classroom
Aim: To understand the key sources of pollution and the distribution of pollutants within an urban setting. To be able to collect and analysis data and evaluate a method which studies local pollution; and to compare primary with secondary data.

Time	Teacher Activity	Student Activity / Differentiation	Resources
Starter (10 min)	Picture of London projected on board; Q - Describe this picture. Record adjectives on board. Smoggy / dirty? Picture of cyclist. Q - Why do they wear a mask? *Thus it is this smog / haze / pollution that you are going to be thinking about.* **Lesson title:** Pollution – where does it come from, can we measure it and who is affected?	Describe picture to partner Recall to teacher	London smog 1-picture Cyclist 2 picture
Activity One (20 min) Presenting new information	**Q:** In London what are the main pollutants and what are the key sources? Give out Sheet 1. Summarise and ask for key pollutants and sources. Use pictures to help Q&A. A second sheet is available to consolidate knowledge *(this is on the formation of acid rain),* and this can be modelled on the IWB Q - Where do the pollutants go? Why do we hear about them so much in the news? > give out/ show on projector news headlines involving pollution cases. List on board where pollutants go and differing affects they have. Be sure to mention lichens as air pollution bio-indicators here.	Read information sheet. Answer questions. Read headline and short articles and highlight answers using to different colours of where pollutants go and what affect they have on life. (Lots of other K&U standing sheets can be used here from the SKEES project – these would take up to an hour).	Sheet 1: Directed reading Sheet 2: Formation of acid rain Power station. and car exhaust (picture 3 & 4) Sheet 3: Newspaper headlines – Word and projector.
Activity Two (20min) Constructing problem and a method	Speaking couple putting problem forward… (use projector) Draw on board a plan diagram of the neighbours' locations What do pupils think in pairs; whom do they most likely agree with and how could they gain evidence to support their opinion? Using line diagram. **Prediction** – The amount of pollution will decrease further from the road, into the middle of the park. **Method** – Transect of trees away from the road into the middle of the park. Sample collection of black particles at each site (why will we sample?) NB*	Discuss with partner opinions and how it could be tested. Pupils could write in books Sampling is representative measurement.	PowerPoint - Air pollution argument
Activity 3 (5 min) Sense of place	PowerPoint to give an overview of the site that the method will be tested in. This should give pupils a sense of place, also some historic background to where they will visit. Health and safety discussed at this point also.	Listen and watch PowerPoint. Note down any physical evidence or data that is stated in the talk.	Sense of Place PowerPoint. Background information for teachers
Plenary (5 min) Pupil review	Set homework. Ask: Why will we **sample** the Hackney Marshes for pollution? What organisms can be used to monitor air pollution? Name 3 pollutants and there sources.	Record homework. Think and answer questions.	

Homework – *Using the internet find relevant sites that list pollution data for the borough. Note down for last year when the highest and lowest SOx , CO and NOx days were. Find out which is the most and least polluted parts of England. Record all this in your exercise books.*
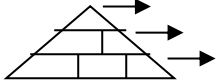This allows for differentiation by outcome.

NB* - The writing of methods could be developed into an individual lesson. If time permits, the class could be brought outside to a local site before designing the method to be shown how to identify a tree. Then Sellotape could be used on the tree and the particles could be looked at immediately after under the microscope. Discuss with the pupils how this method could then be used to sample all the way along a 'transect'.

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Session 2: Fieldwork
Aim: To be able to collect evidence of air pollution in a consistent fashion.

Time	Teacher Activity	Student Activity / Differentiation	Resources
Starter (10 min)	Q - What is the prediction? How are we going to measure it? Note on boards Students to get into small groups. Each group to collect equipment and to distribute roles. Review health and safety points again.	Read methods Pupils explain Pupils to form groups – key roles recorder, distance measurer, sampler, noise pollution monitor	Clipboard, recording sheet, long tape measure, selotape, slides, noise datalogger, tree id sheet, lichen key
Activity One Demo **(20 min)**	Model taking a sample on the bark using Sellotape. Use the data logger to measure sound and show what a transect is and how to measuring distances. Also discuss tree id and tree measurement (this might be too much for the groups to do?) Q; How are all these readings going to be kept consistent? Split the class groups into 3 smaller groups. Start one group at bottom of transect one at top and one at middle. Walk groups to the furthest sample distance.	Listen Think about keeping all readings consistent in the method	Teacher method sheet
Activity Two (20 min) Collecting data	Groups will the same tree more than once – why? Sample 12 sites, time permitting, in total along the transect. All groups will have some information along transect. The distances between the stations could either be measured prior to the lesson and the trees marked using site numbers or by the pupils during the activity.	Pupils sample 12 sites. Measure between the sites	Sheet 4: Individual results Long measuring tape, trundle wheel
Activity 3 (10 min)	Class to be brought together. Recording sheets need collecting and slides and particle sheets.	Return to school Give in recording sheets and equipment.	

Homework – *None set*

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Session 3: Post-fieldwork review in the classroom
Aim: To be able to analysis class data and evaluate the experiment

Time	Teacher Activity	Student Activity / Differentiation	Resources
Starter (5 min)	Lesson title: *Is the air cleaner further away from the road?* Q - On board Where did we go? What did we do? What did you predict? If you have digital photos from previous session use these as a reminder, or in a story board.	Pupils explain answering these questions.	Digital photos
Activity One Demo and collecting data **(15 min)**	Have microscopes and hand lens distributed around the class. Using an OHP place slide onto and lay acetate with squares on top of it. Explain that we are going to sample the slides for the amount of black particles that we found. See method sheet on how to do this. Again this is a sampling technique. 'Sampling the sample' - Pupils attempt to do this using random numbers and working out an average % for each site (see more information on methods of this on teacher sheet). Pull class together. Note down on board problems with method.	Listen Observe Go to apparatus and get a slide Note down on sheet problems with method.	Microscope, hand lens, Slide with site sample, grid paper acetate, random number table. Use worksheet
Activity Two (25 min) Analysing Evidence	Distribute class results. Discuss. They are to find the average for each site. Ask pupils to draw graph for distance and particle percentage. Can a distance/ sound graph also be drawn? Could this be drawn on acetate to overlap? Would tree type and sound need to be added as extra columns on table? To analyse the graphs answer the questions on the 'analysis sheet' Discuss answers as a whole class	For lower attaining students the axis titles will need to be defined Draw graphs Write answers on sheet	Sheet 5 - Class results and graph paper. Sheet 6 – Analysis and Evaluation
Activity Three Evaluation (10 min)	Distribute evaluation sheet. Highlight the questions that will involve getting secondary data to back up your results by discussing the pollution monitors on the internet sites that have this information. Explain the task, found on the sheet. Pupils to discuss in pairs. Record answers and complete for homework.	Read questions and discuss in pairs	Sheet 6 – Analysis and Evaluation
Plenary (5 Min)	1) Review the objectives and 2) Ask pupils to review learning using follow pyramid- What do I find difficult? What was new and okay? What did I already know? Look at pyramids of pupils to get a feel for future lessons.	Pupils to complete triangle and to check homework	

What might be taught next

This website has a 10 minute video clip on monitoring pollution and the effects of air pollution on human health.

 http://www.research-tv.com/stories/health/airpollution/bb/

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