Complete teaching ideas

Education in Chemistry
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rsc.li/EiC318-airpollution

These teaching ideas accompany the above article 'Taking care of the air'.

Air pollution is commonly included in exam specifications. Air pollution illustrates the impact of chemistry and shows how human activity can affect our planet. This article provides an up to date perspective on an old problem and the key concepts recur in a number of different core topics. The article itself is a useful stimulus for discussion of the chemical and geographical factors that affect the extent of urban air pollution. The classroom resources described here provide a range of activities to support the teaching of concepts linked to air pollution such as combustion experiments, equations for the generation of air pollutants and 'citizen science' type science club activities.

> Download the text of this article, and all the related teaching resources described on these pages – as pdfs or word documents – from the *Education in Chemistry* website: rsc.li/EiC318-airpollution

Incomplete combustion

Demonstration, all ages

The chip pan fire demonstration is popular with pupils of all ages. It shows students that heat, fuel and oxidant are required to keep a fire burning. It can also demonstrate that combustion can lead to particulate matter entering the air. The oil burns with an orange, smoky flame, indicating incomplete combustion. A test tube passed through the flame will blacken with soot (particulate carbon). Find a video, the instructions and the technician notes for this demonstration at rsc.li/2pnXUxl

Combustion equations

Differentiated worksheet, ages 14–16

The article provides context for revisiting the chemistry of combustion. Writing equations for combustion processes is a key skill and can be very challenging for pupils. It is a popular topic for examining constructing and balancing equations. Pupils need to be able to balance such equations and to construct them from descriptions, taking note of the clues within the questions such as 'poisonous gas' and 'solid pollutant'. The worksheets downloadable from the *Education in Chemistry* website (rsc.li/EiC318-airpollution) are differentiated to provide increasing challenge for pupils. Use the knowledge organiser provided alongside the combustion equations activity to support lower achieving pupils.

Which is the best fuel?

Differentiated experiment, ages 11–14, 14–16

Experiments that involve burning things are always popular with pupils. In this experiment downloadable from the *Education in Chemistry* website (rsc.li/EiC318-airpollution), pupils compare different fuels and consider factors that might be important in choosing the best fuel. It is differentiated for younger and older pupils. Younger pupils consider their observations, draw conclusions and begin to evaluate how the experiment can be improved. For older pupils the activity involves more measurement and touches on the foundations of calculating energy changes using the equation $q = mc\Delta T$.

How catalysts reduce emissions

Video resources, ages 11–14, 14–16, 16–18

These video resources cover the role of catalysts in reducing harmful emissions. There are three videos, one for each age range: rsc.li/LCcatalysis

Air quality project

Science club investigation, ages 11–14, 14–16

Measuring particulates in the air is an excellent 'citizen science' project that can be carried out over a number of weeks by a science club: bit.ly/2H60w9N. A cross-curricular approach involving maths and geography could involve making plans of the school grounds before deciding on suitable sites for testing. In this activity microscope slides are used to collect particulate air pollution. The activity could be extended beyond the school grounds with pupils taking home slides to put in their gardens. These can then be brought back to school to compare with the results gained on school sites.

Reading comprehension

DART lesson starter or settler exercise, ages 14–16

Reading comprehension is an important skill for pupils of all ages and DART (directed activities related to text) can help pupils build up stamina in dealing with introductory texts they will see in examination questions. The DART activity downloadable from the *Education in Chemistry* website (rsc.li/EiC318-airpollution) could provide a useful starter or settler activity.

How big is the nanoscale?

Maths in science, ages 14–16

The Canadian researchers featured in the article suggest nanometre-size particles in the air could be particularly problematic. Their large surface to volume ratio gives them greater potential to react in detrimental ways with our bodies when inhaled. Pupils really struggle to imagine just how small measurements in nanometres actually are. Exercises found on the *Education in Chemistry* website (rsc.li/EiC318-airpollution) immerse pupils in the mathematics of this measurement using familiar objects and a variety of pupil learning activities. They include a matching exercise, a reading exercise, a calculator conversion exercise and construction of a scale using toilet paper. The exercises are differentiated to give greater to support to pupils with lower prior achievement. These activities could be used as a single lesson focusing on maths in science.