

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE**

**A214/02/RB**

**SCIENCE A**

Unit 4: Ideas in Context  
(Higher Tier)

**RESOURCE BOOKLET**

**JUNE 2009**

**To be opened on receipt**



**INSTRUCTIONS TO CANDIDATES**

- This booklet contains three articles.
- Take these articles away and read them through carefully.
- Spend some time looking up any technical terms or phrases you do not understand.
- For the examination on **Wednesday 10 June 2009** you will be given a fresh copy of these articles, together with a question paper.
- You will **not** be able to take your original copy into the examination with you.

**INFORMATION FOR CANDIDATES**

- This document consists of **8** pages. Any blank pages are indicated.

## Does homeopathy really work?

**Homeopathy** is a controversial form of alternative medicine. Homeopathic doctors believe in treating 'like with like'. This means an illness is treated with a substance that causes similar symptoms to the illness.

This could, of course, be dangerous so the substances are diluted using large quantities of water or alcohol. The substances are diluted so much that there is very little chance of any molecules of the substance being left in a dose of the medicine.

Homeopathic doctors say that a treatment may make the symptoms of the illness worse at first, but this is part of the healing process.



**Dilution Table**

	typical number of molecules of substance present in 1 cm <sup>3</sup>	
	1 000 000 000	original solution
diluted by 100	10 000 000	
diluted by 100	100 000	
diluted by 100	1000	
diluted by 100	10	
diluted by 100	0	1 cm <sup>3</sup> dose of medicine

Each time the substance is diluted, it is shaken. Homeopathic doctors believe that this shaking enables the solvent to retain a 'memory' of the substance.

**Homeopathic doctors** believe that homeopathy is safe for everyone, including the young and the old, and that it re-balances the 'vital forces' in the body. They say that the treatment restores health by stimulating the body's own healing powers. A survey of patients who have used homeopathic treatments reports that seven out of ten patients say that it has helped with their illness.

**Conventional doctors** say there is no scientific evidence to support homeopathy. There is no known mechanism for water or alcohol to keep the 'memory' of a substance that was once dissolved in it. These doctors believe that any benefit experienced by the patient is not due to homeopathy but is due to a placebo effect. Some experiments show that when patients are given a placebo (a dummy pill), they still think they are getting better. Another possibility is that patients simply recover due to natural processes (the patients' own immune systems). Conventional doctors say that patients who are seriously ill are just given false hope which possibly prevents them from receiving a scientifically proved conventional treatment. All conventional medicines are thoroughly tested before doctors can use them. The results of these tests are peer-reviewed and published, so that other scientists may attempt to replicate them.

Read the statements of these people.



**Jane**

When I took the homeopathic medicine I got better.



**Ranjit**

I took the homeopathic medicine but I did not get better.



**Peter**

I got better even though I did not take the homeopathic medicine.



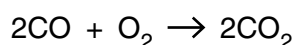
**Stella**

When I took the homeopathic medicine I got better.  
But I may have got better even if I had not taken it.

## Carbon monoxide – the invisible killer

Carbon monoxide is a colourless and odourless gas. It is also very toxic, so a concentration of 500 ppm (parts per million) in the air is enough to cause death. In smaller concentrations it is still harmful. Carbon monoxide joins to the haemoglobin contained in red blood cells 200 times more effectively than oxygen. It therefore reduces the ability of red blood cells to transport oxygen to the rest of the body. Continuous exposure to carbon monoxide can lead to blood clots, flu-like symptoms and long term illness.

The main source of carbon monoxide pollution is exhaust gas from motor vehicles. When the hydrocarbons in petrol and diesel fuels burn completely, the only products are carbon dioxide and water. But in car and lorry engines, incomplete combustion takes place, producing carbon monoxide. When carbon monoxide is released into the air, it reacts slowly with oxygen to form carbon dioxide.

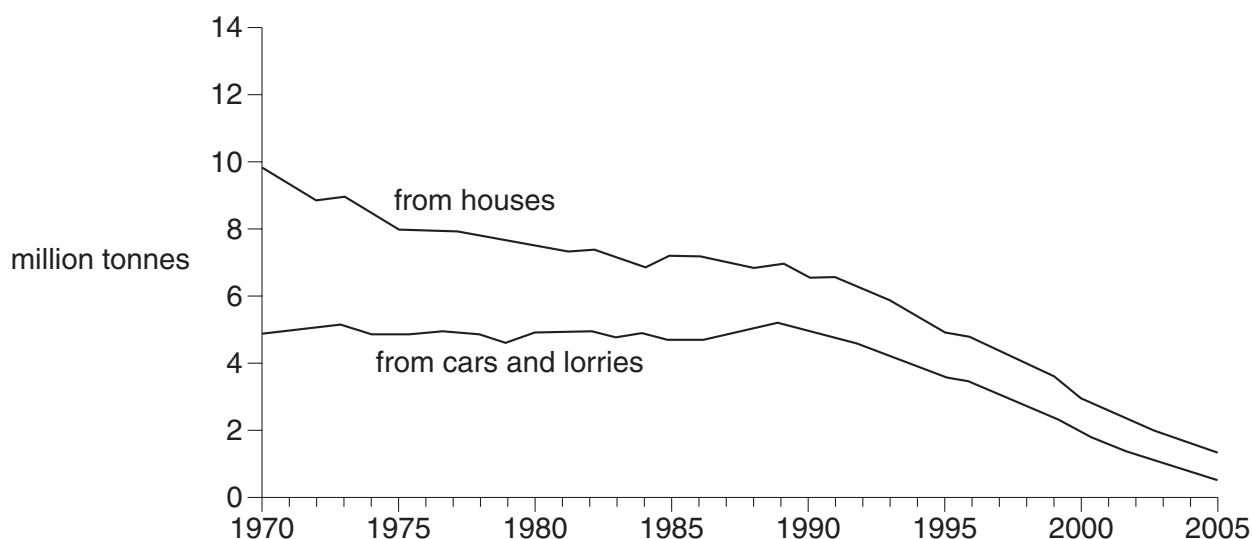


In cities, where high buildings reduce air movement, harmful levels of the gas can build up. To reduce this pollution, cars are banned from the centres of some cities. In other cities, drivers must pay to enter the city centre.

Another major source of carbon monoxide pollution is the burning of solid fuels such as coal. Solid fuels can be burned to heat homes. They can also be burned in power stations to generate electricity.

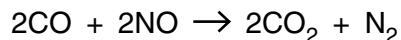
Annual emissions for carbon monoxide in the United Kingdom have been falling since the 1970s. But the number of cars on the road has been steadily increasing in this time.

**Carbon monoxide emissions by source: 1970 to 2005 – United Kingdom**



One way of removing carbon monoxide from car and lorry exhaust fumes is to use a **catalytic converter** (CAT). During the 1970s and 1980s only luxury cars were manufactured with catalytic converters. Since January 1993 all new petrol cars sold in the European Union (EU) are manufactured with CATs.

In a CAT, carbon monoxide reacts with nitrogen monoxide. The products of this reaction are carbon dioxide and nitrogen.



Each year, more new cars fitted with CATs are sold and old cars without CATs are scrapped. Therefore the proportion of cars fitted with CATs increases each year.

It has been suggested that the emission of carbon monoxide could be reduced much further if more people used electrically powered vehicles. The batteries used to run these vehicles can be charged up during the night when there is a low demand for the electricity produced by power stations.

When oil or gas is used as a fuel, much less carbon monoxide is produced than when a solid fuel such as coal is burned. During the past 40 years, the use of gas and oil for heating homes has increased, and the use of coal for heating has decreased. Many power stations have also switched from burning coal to burning oil or gas.

Even appliances that burn oil and gas can produce carbon monoxide if they are not serviced regularly. In an enclosed space, such as a kitchen or bedroom, the gas can build up to dangerous concentrations. Appliances that are serviced regularly are likely to produce little or no carbon monoxide. Appliances that are **not** serviced regularly can have a poor supply of oxygen and so release lethal levels of carbon monoxide into the air. These appliances can cause accidental deaths due to carbon monoxide poisoning. Even though many people do not have gas fires serviced, the number of deaths from carbon monoxide poisoning each year in the United Kingdom is very small.

## The risk from microwave radiation

Both mobile phones and wireless (WIFI) laptops use microwave radiation and people worry about their safety.

A mobile phone most transmits microwaves at a power of up to 100W at a frequency of 0.9 or 1.8 GHz, depending on the network. The mobile phones themselves transmit with a power of about 2W.

Wireless networks transmit microwaves of frequency 2.4GHz. The more powerful type of wireless network transmitters operate at a power of 0.2W.

Read these two newspaper extracts.

### Extract 1

#### **Health fears make schools switch off wireless networks**

Parents and teachers are forcing some schools to switch off wireless computer networks. This is due to fears that the networks could damage children's health. Wireless networks in schools allow pupils to use their laptops to connect to the school computer network and the internet without using cables.

Many parents and some scientists fear that low levels of microwave radiation emitted by the transmitters could be harmful. They worry that it might cause loss of concentration, headaches, fatigue, memory problems and possibly even cancer. Scientific evidence is not conclusive, but some researchers think that children may be more vulnerable than adults because of their thinner skulls and developing nervous systems.

One school switched off part of its wireless network after a teacher became ill. The teacher said, 'Whenever I was in the classroom I felt really sick. Over the weekend, away from the classroom, I felt completely normal.' The head teacher at the school now plans to put cabled networks in all new classrooms.

**Extract 2****Phone masts make you ill? It's all in the mind**

People who believe that mobile telephone masts are making them feel ill are mistaken. This is the conclusion of a study at Essex University.

The 3-year study was one of the largest of its kind. It found that some people do experience symptoms, such as headaches and sickness, when they know that they are exposed to radio waves. However, they cannot tell when the waves are turned on and off. This proves that they are not 'radiosensitive'.

In double-blind trials, in which neither participants nor experimenters knew whether the signals were on or off, no health effects were detected. This finding adds to earlier research suggesting that radiosensitivity does not really exist.

Volunteers who claimed to be radiosensitive were matched against volunteers who did not claim to be radiosensitive. Both groups were told when the signals were being switched on and off. The radiosensitive group reported headaches and sickness. The researchers then conducted double-blind trials. If radiosensitivity were real, alleged sufferers should have been able to detect changes and report symptoms. They did not. There was no correlation between illness and exposure to microwave radiation.

In the tests, 2 of the 44 sensitive individuals and 5 of the 114 control individuals judged correctly when the mast was on or off. The percentage judging correctly was very similar in each case.

The study was published in a scientific journal. It was funded by the Mobile Telecommunications and Health Research Programme. Half of the money was provided by the Government and half by the mobile phone industry.

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