STUDENT SUPPLEMENT

InfoChem

ISSUE 115 MARCH 2009

PERIODIC REVIEWS

Loughborough Grammar School students review fun chemistry resources

Dr Hal's chemistry trumps – the Periodic Table
Hal Sosabowski
Surrey: Staxo-o-Facts 2008
£4.99; www.drhal.co.uk

This is a very enjoyable game based on the familiar Top Trumps, the only difference being this set of cards presents elements of the Periodic Table. The game can be played with as many people as you want but it is recommended between three and five players play at one time.

There are 33 cards in the pack, 32 playing cards and an information card. Each playing card presents information on a particular element, what it is called, its symbol, when it was discovered, its usefulness, a danger rating, its melting point (in ºC) and the atomic mass of the element. At the bottom of the card there are some additional facts about the element and its uses. The information is clearly explained and the cards are very colourful with a photo of the element. The cards are strong and don't crumple easily.

This game will not only appeal to younger kids but also to older ones because it is an excellent source of revision. When you are playing the game you realise it helps you learn about the elements – only this time it's fun.

Priced at £4.99, the cards are only available to buy over the Internet. Overall, this pack is a must for the Top Trumps collector, the chemistry enthusiast, students with an interest in science or anyone who wants to play an unusual and novel card game.
Vishal Maini

Periodic puzzle
C. Egbe Agbor
London: Periodicpuzzle 2008
£9.99; www.periodicpuzzle.co.uk

This resource comes in very colourful packaging, which displays an image of the game on the front and on the back gives instructions for playing the game. The puzzle is aimed at children aged eight and older who are interested in learning some chemistry in a fun and simple way.

The game is easy to play. You first mix up the display of the Periodic Table by moving the individual element, Group number and blank tiles within the puzzle frame. Then, you try to re-create the correct layout of the Periodic Table shown on the box. The puzzle is made from strong plastic and therefore will last a long time.

Included with the puzzle is a leaflet which provides information on what element each symbol stands for and the element's uses. The vocabulary used in the leaflet is simple to understand.

This game will be useful to teenagers if they are finding it hard to learn the position of elements in the Periodic Table, their names and properties. The puzzle costs £9.99 and is worth every penny.
Anvir Cheema

IN THIS ISSUE

Editor
Kathryn Roberts
Assistant editor
James Berressem
Design and layout
Dale Dawson

Infochem is a supplement to *Education in Chemistry* and is published bi-monthly by the Royal Society of Chemistry, Burlington House, Piccadilly, London W1J 0BA, UK. 020-7437 8656, e-mail: eic@rsc.org
www.rsc.org/Education/EiC/index.asp

Published in January and alternate months. ISSN: 1752-0533

Obesity – at wi

ISSUE 115 MARCH 2009

Obesity is fast becoming endemic in the developed nations, where fat-rich foods are plentiful and computer games are among today's most popular pastimes. Does the solution lie in better diets and exercise or do anti-obesity drugs have a part to play in its control?

By 2050 scientists predict that a third of all men and half of the women in the UK will be 'obese.' Equally alarmingly, by this date, 25 per cent of under 20s and 50 per cent of all 6–10-year olds in the UK are expected to fall into this rotund state. Similar data are found in the rest of Europe, and in the US the problem is worse.

How do we classify obesity?

People with a BMI (body mass index) of 30–40 are classified as obese. The BMI is calculated from the following equation:

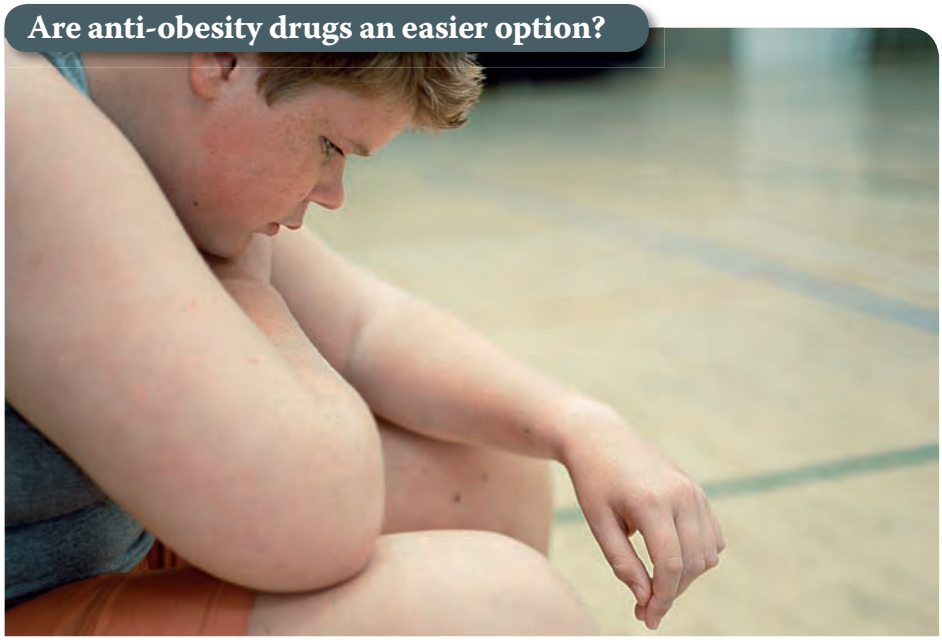
$$\frac{\text{a person's weight in kg}}{(\text{height in m})^2}$$

A BMI between 25–30 is deemed 'overweight' and over 40 is 'morbidly obese'.

Unfortunately being obese comes with serious health risks. Obese people are much more likely to develop type 2 diabetes compared with people who are not. Type 2 diabetes is associated with a loss of response of the liver, muscles and fat tissue to insulin. This hormone (a chemical messenger molecule) controls the production and use of the body's energy source (glucose). Insulin resistance can lead to high levels of glucose in the blood which is toxic and can lead to damaged organs. Coronary heart disease, stroke, osteoarthritis and cancers of the colon, prostate and breast are also more common among obese people than the general population.

Unfortunately the 'leaner diet, more exercise' approach has a poor record when it comes to treating obesity. And when all else fails many morbidly obese people turn to surgery which, though effective, comes with its own risk. Over the past 30 years, however, there has been a growing interest in the development of drug therapy to treat obesity. Many pharmaceutical companies are investing millions in what might become tomorrow's blockbuster drug.

Are anti-obesity drugs an easier option?



GUSTOIMAGES/SCIENCE PHOTO LIBRARY

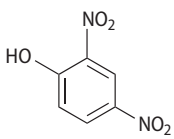
Early anti-obesity drugs

The idea of an anti-obesity drug is not new. People have been using herbal remedies for aeons to control their weight with debatable success. Extracts from the Hoodia cactus found in the Kalahari desert, for example, were apparently used by tribes to suppress their appetite as they went in search of food. Over the past couple of centuries, however, several synthetic drugs to control appetite have come and gone because their side effects outweighed the benefits.

In the late 1890s chemists used a thyroid hormone, extracted from thyroid glands, to treat obesity. This natural product led to weight loss by increasing the body's metabolic rate, and thus energy expenditure. However, the hormone also caused heart problems, excessive protein and water loss as well as fat loss, and so was abandoned. Ideally an anti-

HAT COST?

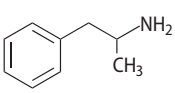
Fat-munching lipase



(*1*) Dinitrophenol

obesity drug should target fat only.

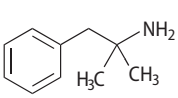
In 1933 2,4-dinitrophenol (*1*, DNP) was the active ingredient in diet pills. DNP had been used extensively in the manufacture of explosives during World War I, and was linked to the weight loss of women who worked in munitions factories and had to handle this chemical. As a fat fighter, DNP works by uncoupling a specific metabolic reaction (oxidative phosphrylation), which has the effect that fuels (sugars and fats) are burnt without the production of ATP (adenosine triphosphate) – the molecule that supplies energy for cellular processes. Some of the wasted energy ends up as heat, which



(*2*) (±)-Amphetamine

sometimes led to fatal fevers and so DNP diet pills were withdrawn from the market.

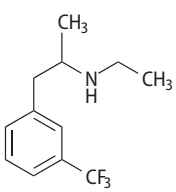
By the late 1930s scientists had stumbled on the fact that amphetamine use led to weight loss. Amphetamine (1-phenyl-2-aminopropane, *2*) was being used to treat depression and anxiety as well being abused as a 'recreation' drug for its performance-enhancing effect. The stimulant effect is caused by the release of the chemical messenger molecules noradrenaline and dopamine from brain cells (neurons). As a side effect patients



(*3*) Phentermine

and addicts lost weight probably because of their increased energy expenditure as they became more active, or hyperactive. However, side effects – raised blood pressure, agitation, irritability, nervousness – again stopped its use as an anti-obesity drug.

Other anti-obesity drugs that were related to amphetamine, in terms of their structure and their mode of action in the body, followed. Phentermine (*3*), which had less severe side effects to amphetamine and was not addictive, is still prescribed today in the US for short-term use (up to three months). Others had limited success.



(*4*) Fenfluramine

In 1973 fenfluramine (*4*), as the racemic mixture (containing both chiral isomers), came on the market. Although similar to amphetamine-like drugs structurally, fenfluramine stimulates the release of a different chemical messenger molecule – serotonin – and inhibits its re-uptake by neurons, which has an appetite-suppressing effect. The drug was used for 24 years in Europe for treating obesity, and eventually the more active D-isomer was licensed in the US. However, the Americans discovered that D-fenfluramine caused heart-valve defects and irregular heart beats, and the drug was withdrawn worldwide.

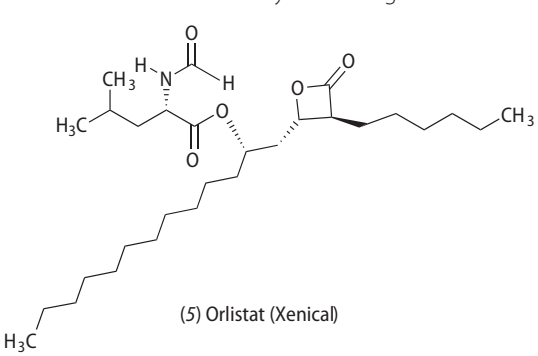
Today's offerings

Today there are just two prescription drugs available for treating obesity, though many others are in clinical trials, some of which have sought to improve on older remedies others take a completely new line of approach.

Orlistat (*5*) which was developed by Swiss chemists came on the market in 1987 as Xenical. The drug works by inhibiting the digestion of fats and carbohydrates in the intestine. Specifically, it inhibits the enzyme pancreatic lipase, which breaks down triglycerides into monoglycerides and free fatty acids, which can then be absorbed into the gut. Orlistat has recently been approved for use in the US and in Europe as an OTC ('over-the-counter' medication) at half the strength of Xenical, and this is being marketed as alli.

The big advantage of orlistat is that it is safe, the only side effects being some discomfort in the stomach and faecal incontinence. (The latter has the added advantage that it encourages patients to eat less fat.) There was initial concern that patients on orlistat may become deficient in fat-soluble vitamins, but this is unlikely because most people have too much fat in their diet anyway.

Orlistat gives an average weight loss of 2.8–2.9 kg (*ca* half a stone), which plateaus after about six months. It doesn't amount to much cosmetically but the regulators are more

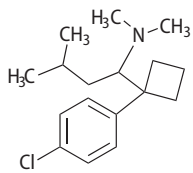


(*5*) Orlistat (Xenical)

PROFESSOR K. SEDDON & DR T. EVANS, QUEEN'S UNIVERSITY BELFAST/SCIENCE PHOTO LIBRARY

"... BY 2050... 50 PER CENT OF ALL 6–10-YEAR OLDS IN THE UK WILL BE OBESE."

Bangers and fat



(*6*) Sibutramine

interested in its potential medical benefits – even small weight loss is significant in terms of reducing blood pressure, the risk of type 2 diabetes and heart disease.

The other drug currently available on prescription is sibutramine (*6*) (Reductil). This tertiary amine was originally investigated as an antidepressant, but failed in clinical trials and again by chance the researchers noticed that it caused weight loss in users. As an anti-obesity agent it works like many antidepressants – it inhibits the re-uptake of noradrenaline and serotonin into neurons after they have been released in the brain. It is mainly viewed as an appetite suppressant but some scientists hypothesise that it also increases energy expenditure. However, among its side effects are raised heart beat and blood pressure, which for the obese person, who probably already has high blood pressure, is not ideal. In clinical trials the drug, taken for 12 months gave 4.2–4.4 kg weight loss, plateauing at around six months. So, potentially, the weight loss could compensate for the tendency of the drug to raise blood pressure. The drug is only licensed for use, like orlistat, for up to 12 months.

A steroid-based compound (P57) has recently been isolated from the Hoodia cactus and is under investigation as a potential anti-obesity drug, but hasn't yet received approval in terms of its safety and efficacy.

Drug companies are now taking a more rational approach to the design of anti-obesity drugs. The discovery in 1994 of the hormone, leptin, that regulates hunger in the brain by controlling the release and uptake of small peptides is leading to new targets for such drugs, some of which are in clinical trials.

With or without the drugs, healthy eating and regular exercise are still the recommended first line of attack to reducing weight.

Kathryn Roberts

Acknowledgement: *this article is based on an interview with Jon Arch, professor of metabolic research at Buckingham University.*

that's chemistry

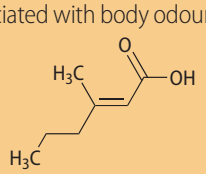
Simmon Cotton, chemistry teacher at Uppingham School, looks at the molecules in our lives. In this issue: **sweaty smells**

Is sweat just water?

No. Sweat contains many other molecules besides water. Ninety-nine per cent of our body is covered in sweat (eccrine) glands. These glands produce a dilute solution of sodium chloride, potassium chloride and urea, together with small amounts of metabolic waste products such as lactic acid. This sweat is essentially odourless.

So what causes the smell?

Aprocrine glands, sweat glands which are found only in the armpit and groin, produce small amounts of fatty secretions comprising compounds such as cholestrol and steroids. Bacteria on the skin surface and on nearby hair follicles break down these compounds, producing carboxylic acids which are responsible for the smell associated with body odour (BO).



(*1*) (*E*)-3-Methyl-2-hexenoic acid

One of the most pungent of organic acids produced is (*E*)-3-methyl-2-hexenoic acid (*1*), the scent of which we recognise as BO. This compound is particularly prominent in males, proving that boys are smellier than girls.

So what can you do about the smell?

Washing regularly with soap and water is a start. Then there are deodorants and antiperspirants, which share many ingredients but work differently.

Deodorants act only to reduce BO by killing the odour-causing bacteria. They are usually alcohol-based, giving them antibacterial properties, but they also contain antibiotics, such as neomycin. Added fragrances help to cover any smells that might develop.

Antiperspirants have a dual action. Like deodorants they contain antibiotics to kill the bacteria and control BO. They also contain aluminium chlorohydrates, $Al_2(OH)_5Cl$ and $Al_2(OH)_4Cl_2$, which as well as having antibacterial properties, block and close the eccrine glands to reduce sweating. ■

ON-SCREEN CHEMISTRY

Jonathan Hare asks…

FREE FALL: *could you parachute to Earth from space?*

What's really amazing about Joe Kittinger's space flight (*The planets*, BBC TV)[1] is not just that it's footage of the first manned trip into space but that you see him make the trip without a spacecraft. So how did he do it?

Of balloons and gondolas

In 1960, a year before the Soviet Yuri Gagarin made his historic single orbit around the Earth in a spacecraft, Joe Kittinger's US air force team was pioneering high altitude helium balloon ascents. As part of Project Excelsior, Kittinger aimed to fly to 31 km (*ca* 102 000 feet) in a balloon-supported gondola. His only protection from the changes in atmosphere and harsh solar radiation was a basic spacesuit. This suit also controlled his temperature and supplied him with air.

The Earth's atmosphere consists of 78 per cent nitrogen, 21 per cent oxygen, 1 per cent argon, 0.04 per cent carbon dioxide and traces of other gases, including variable amounts of water vapour (*ca* one per cent). Although there is no sharp cut-off point, by 20 km the atmosphere is so rarefied it is basically considered as space. Most of the atmosphere is near to the Earth's surface: 75 per cent of the mass of the atmosphere is contained within the first 11 km. The weight of the gas above us produces the atmospheric pressure. If you go up into the atmosphere there is less weight above you and so the pressure drops.

At an altitude of 15 km Kittinger's right hand spacesuit glove developed a hole and started to leak. The outside pressure at these altitudes is so low that his skin around the hole was therefore exposed to a vacuum. The water and blood in his hand would evaporate considerably and even boil at such low pressures. Rather than abort the historic mission though he simply plugged the hole with his other glove and continued.

An hour and a half after lift-off he was at 31 km (102 000 feet). Here the air is so thin that the characteristic scattering of sunlight by the atmosphere, which makes the sky appear blue, does not take place and so Kittinger found himself looking out into black space. At this altitude the ambient temperature is around –70 °C.[2]

Once up at this altitude Kittinger spent just a few minutes making routine measurements and then set up his equipment for his descent. He simply stepped off the gondola to make a free-fall parachute jump back to Earth. At first he felt no sensation of falling because the pressure/density of the atmosphere was too small to make an impact. Within a few minutes though he arrived back into what we would consider the main part of the Earth's atmosphere and at 5.5 km he pulled his parachute cord and, completing this amazing trip, landed safely. ■

Joe Kittinger starts his epic descent

NATIONAL MUSEUM OF THE US AIR FORCE

REFERENCES

1. *The planets*, BBC TV, 1999 series, video or DVD, see episode 6 – *Atmosphere*.

2. *Eyewitness companions – weather*. London: DK & Met Office, 2008 (ISBN 978 1 40 533093 0).

Dr Jonathan Hare, The CSC Centre, chemistry department, University of Sussex, Brighton BN1 9ET (www.creative-science.org.uk/TV.html).

Did you know?

If you are starting an engineering-, science- or maths-based degree at a UK university in 2009, you could win £2000 to support your studies by taking part in the annual Corti Trust Science Prize. The Corti Family Trust is a charity dedicated to encouraging UK A-level students to do science-based courses in higher education.

To enter this year's competition you must write a 1500-word essay that explains a recent advance in renewable energy generation and relates this to the UK's energy demand over the next decade. The closing date for entries is Thursday 2 April. For further information on the competition and to download an entry form visit http://cortiscienceprize.org/.

BACKYARD CHEMISTRY

DR HAL SOSABOWSKI PRESENTS EXPERIMENTS YOU CAN DO ON YOUR OWN

IN THIS ISSUE: the collapsing can and atmospheric pressure

THE SCIENCE

This experiment demonstrates Boyle's Law, the relationship between pressure and volume of a gas:

PV = a constant

ie, if the pressure goes up, the volume goes down and vice versa.

If we boil a small amount of water in an aluminium fizzy drink can, it will change from a liquid into a gas. A gas occupies much more space than the liquid which gave rise to it. Since a mole of any gas occupies 22.4 l, then 18 cm^3 (1 mole) of water when boiled will occupy 22.4 l, enough to fill 11 two- litre bottles with some to spare.

As the water turns into a gas, it displaces the air from the inside of the can, so the can is full of water vapour (and some boiling water). If you then invert the can and immerse it in a bowl of cold water, it collapses as if squeezed by an invisible fist – but why?

The instant before the can is immersed in the cold water, it is full of water vapour. If the temperature of vapour falls below 100 °C, it will condense back into a liquid, which, as we have said occupies much less space than the gas from which it comes.

In this case, 330 ml of gas will produce 0.265 cm^3 of liquid which is much less than the volume of the can. The remainder of the space in the can is 'occupied' by a vacuum. Moreover, the can is immersed in water and so as the gaseous water condenses, the air from outside can't get into the can to fill the vacuum and the water cannot rush in fast enough. At this point the whole atmosphere is pushing the outside of the can with nothing on the inside to balance the force, so the can collapses.

Another way of looking at it is this. An empty can sitting on a table has equal forces inside and out – air molecules are pushing from the outside-in and causing pressure but air molecules are also pushing from the inside-out and so causing equal pressure so the can stays as it is. If you remove the force inside the can pushing out, the can will collapse.

MATERIALS

You will need:

- 500 ml fizzy drink can (most of these are 330 ml and do work, but you can get some which are 500 ml and these give a more spectacular result);
- expendable drinks coaster;
- Personal Protective Equipment (PPE) obtainable from DIY shops: gardening gloves and safety glasses;
- bowl of cold water.

HEALTH & SAFETY

This experiment involves boiling water so eye protection, a long-sleeve top, and gardening gloves are required. The experiment must be done under adult supervision the first time. The can must not be allowed to boil dry since the aluminium may melt. Place the hot can on to a coaster to avoid damaging any work surface.

METHOD

Boil a kettle of water and pour the water into the can to a depth of 3 cm. Put the can onto a medium gas flame. The water will start to boil (steam will come from the hole). Allow the water to boil for one minute but do not allow to boil dry. Take the can off the flame by holding the top rim (you should still have your PPE gloves on) and turn the flame off. Place the can on a coaster and then pick it up by the bottom and invert it over the bowl of cold water, allowing any remaining hot water to fall out. Immerse the can to about one third of its length in the water. The can will collapse as if squeezed by a giant fist.

Note

This experiment also works well with a five-litre metal oil can – *ie* the old Castrol-GTX type, which have now been superseded by plastic cans though the metal ones are still to be found in people's garages. ■

A DAY IN THE LIFE OF…

SENIOR SCIENCE TECHNICIAN:
Chris Towers

Chris has spent the past 18 months working as the senior science technician at Gateway College. He talks to Rachel Bolton-King about his typical day.

Chris Towers

Gateway College is based in Leicester city centre and has *ca* 1500 students, most of who are 16–18-year olds. There are five faculties and Chris works within the science and mathematics department where he is the senior of two technicians. He is the technician for chemistry and physics courses, including GCSE, BTec and A-Level, and also supports the biology-based technician.

Practical-based learning

Chris' work follows a weekly cycle. Every Thursday he meets with staff teaching courses in chemistry, physics and sometimes biology for an hour. They discuss the curriculum specifications and targets for the forthcoming week and decide on practicals that will illustrate and enhance students' understanding of the topics to be covered. The title of each experiment is written on a white board in its relevant lesson period. Using this timetable, Chris plans and organises the equipment required for each lesson in advance.

On Fridays, Chris puts the chemicals and apparatus required for each practical into separate labelled trays. On Mondays, he tests the apparatus and chemicals to ensure all experiments work correctly. This can take him two–three hours and he makes changes if there are problems, for example he might have to re-make contaminated solutions. Chris also demonstrates and explains unfamiliar practicals to teachers to ensure they can do the experiments competently.

Prior to a practical lesson, Chris sets up any demonstrations required. He then arranges equipment around the laboratory, leaving the students to learn how to set up their apparatus. Some students arrive at the college with little lab experience so to improve their practical skills the faculty runs science courses that involve more experiments than suggested in the curriculum. Chris uses his scientific training to devise practicals to explain complex topics, such as reversible reactions. He uses resources, such as the Royal Society of Chemistry (RSC) website and RSC publications, to help design experiments.

The students' lack of practical experience requires Chris to be present in up to 60 per cent of lessons to provide extra support for the students and principal teacher, and to minimise risk associated with using hazardous materials, such as handling concentrated acids. By helping in the classroom Chris can provide teachers with valuable information on students' progress as well as highlight instances where students may require further support.

After each lesson, Chris takes the apparatus to his prep room and washes dirty glassware, first by hand and then in a specialist dish-washer. He then either resets the tray for another group or puts the equipment away carefully. Chris also manages the faculty's budget for reagents and glassware, and orders new stock as required.

Other than lab-based work, Chris plans and organises visits to local science sites, such as Leicester University and AstraZeneca. He accompanies the students on these visits, which are designed to enhance students' understanding of science and show industrial applications of specific techniques, *eg* mass spectrometry.

Insight into teaching

Chris applied to be a technician to build on his scientific experience, gain insight into secondary science education and explore his career prospects in teaching. He aims to start a teacher training course in a couple of years. ■

PATHWAY TO SUCCESS

- *2007–present, senior science technician, Gateway Sixth Form College, Leicester*
- *2006–07, gap year travelling across Europe*
- *2003–06, BSc biomedical science with accreditation (2.i), De Montfort University*
- *1999–2003, biology, chemistry, psychology A-levels and GNVQ double advanced health and social care, Longslade Community College, Leicester*

***PhD student, Rachel Bolton-King was given a grant by* Chemistry: the next generation (C:TNG) *to write this article in collaboration with* Education in Chemistry.**

£50 OF HMV TOKENS TO BE WON!

Benchtalk

ISSUE 115 MARCH 2009

PRIZE WORDSEARCH No. 44

Students are invited to find the 34 words/expressions associated with drug development hidden in this grid. Words read in any direction, but are always in a straight line. Some letters may be used more than once. When all the words are found, the unused letters, read in order, will spell a further 12-letter word. Please send your answers to the Editor at the usual address to arrive no later Thursday 9 April. First correct answer out of the editor's hat will receive a £20 HMV token.

E	S	U	R	I	V	A	Z	N	E	U	L	F	N	I	G	A
M	S	G	N	U	L	S	L	L	E	C	T	S	O	H	E	D
Y	L	U	H	U	M	A	N	S	R	E	T	A	W	N	Y	A
Z	U	R	T	L	O	S	Y	M	P	T	O	M	I	Y	R	P
N	L	D	A	F	L	I	C	P	N	N	O	C	L	E	T	T
E	F	L	E	H	E	A	S	O	A	I	C	S	D	S	L	G
U	G	A	R	S	C	N	U	W	I	A	Y	E	B	A	U	E
R	N	R	T	I	U	F	R	D	V	R	D	K	I	E	O	N
A	O	I	D	N	L	L	I	E	A	T	O	I	R	T	P	E
M	K	V	N	A	E	U	V	R	P	S	B	P	D	O	C	T
I	G	I	A	P	B	I	R	D	F	L	U	S	S	R	I	I
N	N	T	T	S	T	S	C	I	M	E	D	N	A	P	T	C
I	O	N	S	C	R	E	L	E	N	Z	A	C	I	D	S	A
D	H	A	E	M	A	G	G	L	U	T	I	N	I	N	E	L
A	R	F	T	A	M	I	F	L	U	O	N	I	A	P	M	L
S	F	T	D	E	R	I	V	A	T	I	V	E	S	E	O	Y
E	C	A	T	A	L	Y	T	I	C	S	I	T	E	I	D	N

ACID
ADAPT GENETICALLY
ANTIVIRAL DRUG
ASIAN FLU
AVIAN
BIRD FLU
BODY
CATALYTIC SITE
DERIVATIVES
DOMESTIC POULTRY
EFFECTIVE VACCINE
ENZYME
HAEMAGGLUTININ
HONG KONG FLU
HOST CELLS
HUMANS
INFLUENZA VIRUS
LUNGS
MOLECULE
NEURAMINIDASE
PAIN
PANDEMICS
POWDER
PROTEASE
RELENZA
SPAINISH FLU
SPIKES
STRAIN
SYMPTOM
TAMIFLU
TEST AND TREAT
VIRUS
WATER
WILD BIRDS

January PRIZE WORDSEARCH No. 43 winner

The winner was Amy Thompson from Brayton College, Selby.
The eight-letter word was MOLECULE.

FIND THE ELEMENT No. 7

Students are invited to solve Benchtalk's *Find the element* puzzle, contributed by Dr Simon Cotton of Uppingham School. Your task is to complete the grid by identifying the nine elements using the clues below.

ACROSS

1. The least reactive alkali metal.

2. Heat any metal nitrate and you form this gaseous element.

3. This divalent metal doesn't react significantly with acids; it forms a soluble nitrate but insoluble carbonate and sulfate.

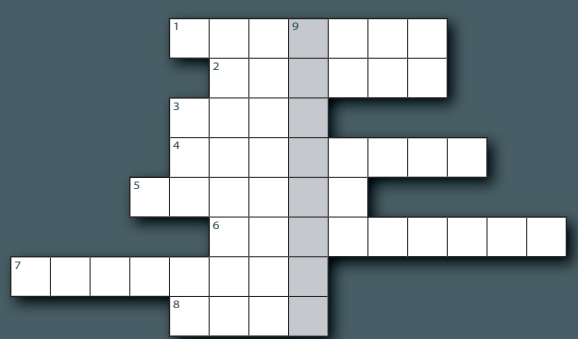
4. This gaseous element combines with hydrogen to form a gaseous hydride which turns moist red litmus blue.

5. This element forms two oxides, one of which burns with a blue flame forming a gas that turns limewater milky.

6. This metal will displace Zn and Al from their compounds, but not Group I metals.

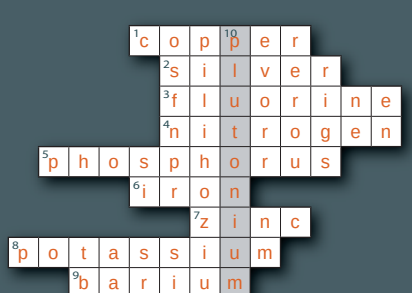
7. Element formed by oxidation of hydrogen chloride.

8. Metal responsible for oxygen transport in the blood.



If you have found the correct eight elements, in 9 down you will have generated the name of the element produced when magnesium reacts with dilute acid.

Please send you answers to: the Editor, *Education in Chemistry*, the Royal Society of Chemistry, Burlington House, Piccadilly, London W1J 0BA, to arrive no later than Thursday 9 April. First out of the editor's hat to have correctly completed the grid will receive a £30 HMV token.



Find the element no. 6 solutions and winner

The winner was Jessica Black from Oban High School, Argyll.