Providing support and promoting excellence in science education

SciTalk

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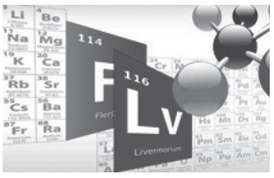

Further changes to the Periodic Table

This year in May, the International Union of Pure and Applied Chemistry (IUPAC) officially approved the names and symbols of two super-heavy elements (SHEs) – nearly a year after they joined the Periodic Table. Element 114 is now named flerovium, with the symbol Fl. Element 116 is now named livermorium, with symbol Lv.

The name flerovium honours the Flerov Laboratory of Nuclear Reactions in Dubna, Russia where SHEs including flerovium have been synthesised. Georgiy Flerov (1913–1990), after whom the laboratory was named, was a renowned Russian physicist. The name livermorium honours the Lawrence Livermore National Laboratory (in California, USA) that has been involved in the discovery of SHEs 113–118.

Flerovium and livermorium now join Elements 110–112, whose names were only ratified in 2011 by IUPAC as darmstadtium (Ds), roentgenium (Rg) and copernicium (Cn), respectively.

A number of claims have been made for the discovery of the remaining Group 7 elements in the current last row of the Periodic Table, namely elements with atomic numbers 113, 115, 117 and 118. However, the claims to their discovery are not conclusive, and the evidence is considered to not yet meet the criteria for discovery.

It should be noted that whilst the existence of all these SHEs have been proposed through chemical models and certified by experiments, they cannot be experimented upon. They are unstable and

… continued on page 4

INSIDE SCITALK ▶▶▶▶

★★ ATTENTION ★★

After you have read this, please write/tick your name below and pass it on.

☐ 1. .....
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Please return to file or noticeboard.

PRIZES TO WIN!

See pages 1, 11 & 12

Send in your entries now

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Past issues of *SciTalk* are available at www.odlumgarner.com

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These books for Years 7 & 8 Science and Years 9 & 10 Science provide students with questions and answers to help them to revise the essential knowledge, skills and understanding areas of their Science courses. The Year 7 & 8 book also includes a Stage 4 Science Test for students to practise their exam techniques in preparation for school-based Science tests.

TO WIN: Send your name, school & school address (& subject) on an envelope **by 21 September 2012** to: Book Giveaway, PO Box 442, Freshwater 2096

★ ★ ★

Winners for *SciTalk 2/12*

Belinda Stone (New England Girls School), Sally Stoddart (Ambarvale HS) & Maria McDougall (Hurstville BHS) respectively won *Biology, Chemistry & Physics 2001–2011 Past HSC Papers with Worked Solutions* (rrp $36 ea) published by Odlum & Garner.

Diary Dates

2012 – *International Year of Sustainable Energy for All*

For: Shell Questacon Science Circus 2012 program:
www.questacon.edu.au/html/on_the_road.html

2012 INTERNATIONAL YEAR OF SUSTAINABLE ENERGY FOR ALL

AUGUST 2012

8	Chemistry Olympiad Exam. www.asi.edu.au Close date: 18/7/12. Ph: 6201 2552
10, 13, 17	Physics is Fun at Luna Park Sydney. Enquiries: ph 9939 6107, fax 9939 6105 – come on one of these dates to celebrate National Science Week
11–19	National Science Week. School theme: 'Energy Evolution'. www.scienceweek.net.au
13	Biology Olympiad Exam. www.asi.edu.au Close date: 18/7/12. Ph: 6201 2552
15	Physics Olympiad Exam. www.asi.edu.au Close date: 18/7/12. Ph: 6201 2552

SEPTEMBER 2012

14, 17	Physics is Fun at Luna Park Sydney. Enquiries: ph 9939 6107, fax 9939 6105
23	Spring Equinox (12.49 am EST)

OCTOBER 2012

14–20	Earth Science Week. www.earthsciweek.org & www.ga.gov.au/education/events, ph 6249 9111
15	HSC examinations commence
19	Biology Teachers PD Day. Museum of Human Disease, UNSW, Ph: 9385 1522
20	Astronomy Open Night at Macquarie Uni. Enquiries: ph 9850 7111. Details: http://physics.mq.edu.au/community/AFA/opennight/
15, 19, 22, 26, 29	Physics is Fun at Luna Park Sydney. Enquiries: ph 9939 6107, fax 9939 6105

NOVEMBER 2012

2, 12, 16	Physics is Fun at Luna Park Sydney. Enquiries: ph 9939 6107, fax 9939 6105
19, 23, 26, 30	Physics is Fun at Luna Park Sydney. Enquiries: ph 9939 6107, fax 9939 6105

DECEMBER 2012

3–19	Physics is Fun at Luna Park Sydney. Enquiries: ph 9939 6107, fax 9939 6105
21	Summer Solstice (10.11 pm AEDT)

JANUARY 2013 National Youth Science Forum. Forms to local Rotary club by 29/5/12, interviews from July. Only for Yr 11 in 2012. Enquiries: 6125 2777, email: nsss@anu.au, www.nysf.edu.au/

While all dates have been checked to ensure that information in DIARY DATES is correct, no responsibility will be accepted by the publisher or Editor for any omissions or inaccuracies in it.

2012
Science
HSC Examination Dates

16 Oct	Earth & Environmental Science: 9.25 am–12.30 pm
19 Oct	Biology: 9.25 am–12.30 pm
26 Oct	Senior Science: 1.55 pm–5 pm
2 Nov	Physics: 9.25 am–12.30 pm
6 Nov	Chemistry: 9.25 am–12.30 pm

We make a living
by what we get,
we make a life
by what we give.

… Sir Winston Churchill

TIWEST **Night Stalk** **1 September–16 October 2012**

You can help Australian scientists and conservationists to save our native species by taking part in this year's national Tiwest Night Stalk spotlight survey.

It's easy, fun and free. Schools can participate by focusing on the numbers and distribution of native animals and feral pests. All you need is a torch and a Spotter's Log. Choose one or more nights between 1 September and 16 October and spotlight in your local bushland. Record all native/introduced animal species: mammals, birds, bats, reptiles and frogs that you find and send your Spotter's Log to Perth Zoo. You can download a Night Stalk Teacher Support Pack to find out how to incorporate conservation into your science program. Student Activity Sheets are also available.

Now in its 14th year, this survey collects information about animals still living in the wild, especially near urban areas, and their distribution over time.

For information: Tiwest Night Stalk
PO Box 489 South Perth WA 6151
Visit: www.perthzoo.wa.gov.au/Act/Nightstalk/ to download a Spotter's Log or complete one online or contact Tiwest Night Stalk Coordinator, Suzi Greenway, 08 9474 0457 (Wed–Fri).

PERTH ZOO

Update on BOS matters

Regularly check the BOS website to ensure you have the latest data – for syllabuses, past exam papers, news, Official Notices, Board Bulletins, statistics archive & more.

Senior secondary Australian curriculum

The BOS consultation period on the draft Australian curriculum content finished on 27 July. The BOS will provide ACARA with formal NSW feedback about the quality and suitability of the curriculum. As with the K–10 curriculum, NSW will implement the senior curriculum through the BOS. This will require a syllabus for each of the Science subjects to be developed. There is no timeline yet for this.

NSW Draft Syllabus for K–10 Science

The draft K–10 syllabus for Science v2 (February 2012) can be obtained from the BOS website. Consultation for this concluded on 30 April 2012.

Australian Curriculum for NSW

Schools are to use the existing *Science Years 7–10 Syllabus* (updated in 2009) in 2012 and 2013 (see BOS 37/11).

Record of School Achievement (RoSA)

The RoSA credential in NSW is for students who leave school after Year 10 and before they receive their HSC. It will be available electronically and as a verifiable hard copy on demand with the most up-to date information on a student's achievements, across all subjects and a range of extra-curricular activities. Eligibility requirements for the RoSA are essentially unchanged from the School Certificate.

Results for Year 10

Whilst formal RoSA credentials are only for school leavers, all Year 10 students will be able to access their results electronically and print a transcript of their results through 'NSW Students Online'.

Approved scientific calculators for 2012 HSC exams

The list of approved scientific calculators is now available on the BOS website.

BOS enquiries

Ph: 9367 8111, fax: 9367 8484
Website: *www.boardofstudies.nsw.edu.au/*
BOS contacts for Science:
- Inspector Science, K–12 & Senior
- Assessment Officer – Science

NOTE: Your purchase of the Odlum & Garner Past HSC Questions & Worked Solutions books for Biology, Chemistry and Physics helps to support the production of their Past HSC books for Earth & Environmental Science and Senior Science. Thank you to all the teachers who support these projects.

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IMAX THEATRE SYDNEY

31 Wheat Rd, Darling Harbour, Sydney 2000

⋆ TO THE ARCTIC 3D ... NEW FILM LAUNCHED

An extraordinary journey to the top of the world, the documentary adventure 'To The Arctic 3D' tells the ultimate tale of survival. Narrated by Oscar® winner Meryl Streep, the film takes us on a never-before-experienced journey into the lives of a mother polar bear and her twin seven-month-old cubs as they navigate the changing Arctic wilderness they call home. Rated G. Running time 45 minutes.

Schools will have a unique resource for studies of polar environments, if they pair 'To The Arctic 3D' with the classic IMAX film 'Antarctica'.

Price: $10.50 per student (single film), $16.50 per student (double film deal), or $9.50 per student for joint excursion packages with other approved venues.

For bookings call 02 9213 1600 or email education@imax.com.au
Visit *www.imax.com.au/schools* for film news and educational resources.

WILD LIFE SYDNEY & SYDNEY AQUARIUM

Darling Harbour, Sydney

WILD LIFE Sydney … a rare Golden Brushtail Possum can be viewed here – this is the third born since 2008 as part of Wild Life Sydney's breeding program. One of Australia's largest arboreal marsupials, yet are rarely seen in the wild, these possums are found mostly in small pockets of Tasmania, where they survive due to a lack of predators.

Sydney Aquarium ... a critically endangered Sawfish, measuring 1.6–2 m in length, can be seen in the *Great Barrier Reef* exhibit. These evolutionary marvels can live in both salt and fresh water. Their long saw-like rostrum (nose) has evolved to forage for food under the ocean floor. This exhibit – the world's largest with around 2 million litres of water – also features tropical reef sharks and vibrantly-coloured tropical fish.

For information: *sydneyaquarium.com.au* OR *wildlifesydney.com.au/*

For school bookings: phone 02 8251 7801
or email: *sydneyaquarium@merlinentertainments.com.au*
OR wildlifesydney@merlinentertainments.com.au

MUSEUM OF HUMAN DISEASE

2012 EXCURSION OPTIONS & TEACHERS DAY

The Museum of Human Disease is a pathology museum at UNSW offering interactive programs with amazing insights into the nature and progression of disease in its many forms. We offer 2 hour curriculum-based programs in the following areas:

HSC Biology – *The Search for Better Health*
HSC Senior Science – *Bionics*
Junior Science – *Infectious & Non-infectious diseases, microorganisms*

The **2012 Professional Development Day** for Senior Biology teachers will be held on Friday 19 October. Information and registration forms will be distributed to schools in Term 2.

Further information and bookings:
T 02 9385 1522
E diseasemuseum@unsw.edu.au
W www.diseasemuseum.unsw.edu.au

MUSEUM OF HUMAN DISEASE
UNSW THE UNIVERSITY OF NEW SOUTH WALES

SHIPWRECKS, CORROSION & CONSERVATION

STAGE 6 CHEMISTRY

This program relates to the *Shipwrecks, Corrosion and Conservation* option. Students attend an AV presentation on conservation and restoration, including footage taken during the recovery of material from HMS *Bounty*. Students then participate in a hands-on workshop focusing on desalination of metal objects, metal and corrosion product identification, methods of protecting metals and rates of corrosion.

This is followed by a guided tour of shipwreck material in the museum. Students may also visit the destroyer HMAS *Vampire* and submarine HMAS *Onslow*.

The program is 4 hours, at a cost of $22.00 per student (teachers free).

Bookings & Information:
Phone: 02 9298 3655 Fax: 02 9298 3660
Email: bookings@anmm.gov.au
Location: 2 Murray Street, Darling Harbour

AUSTRALIAN NATIONAL MARITIME MUSEUM

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  - **Stellar Evolution** – planetarium program for HSC Physics
  - **Superconductors & Liquid Nitrogen** – live science show
  - **Energy and Motion**
  - **Changing Worlds and Visions**
  - **Dinosaurs, Fossils & Coal**
- ★ School entry includes two floors of hands-on exhibits, a science show, plus a ***planetarium / laser show***.
- ★ ***Also available***: environmental field trips, science shop, kiosk, science fun bags, membership programs.
- ★ ***Book now*** for an excursion. Information/bookings: 02 4286 5000
  Website: *http://sciencecentre.uow.edu.au*

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- **DETAILS:**
  IMAX: www.imax.com.au/schools
  SYDNEY AQUARIUM: www.sydneyaquarium.com.au/
  WILD LIFE SYDNEY: www.wildlifesydney.com.au/
  FUN PARK EXCURSION (through Physics is Fun): www.odlumgarner.com
- **WHAT TO DO:** Allow 1 hr for IMAX (any film), or 2 hrs for a Sydney Aquarium/Wild Life Sydney excursion. Then 2–3 hours for Physics is Fun at Luna Park (rides open 11 am, Mon/Fri + any school day in December).

BOOK & PAY SEPARATELY FOR EACH EXCURSION

Further changes to the Periodic Table

(... continued from p1)

only exist for very short periods of time before decaying into more basic elements, e.g. some only last microseconds or nanoseconds, while others may last seconds or minutes. As such, they are very difficult to study, and not much else is known about them.

In Science, as new discoveries are made or new interpretations of existing data are proposed, theories may be revised or even changed. This is illustrated in the way the Periodic Table constantly changes as new elements are discovered or as new data to explain the chemical behaviour of existing elements becomes known. The Periodic Table in most published textbooks is out-of-date by the time the book is released.

The layout of the Periodic Table has been refined and extended many times since Mendeleev's original Periodic Table was published in 1869, with the sixty nine then-known elements, as well as a number of gaps for other elements that Mendeleev predicted. Most of these predictions have been subsequently proved correct, as these elements have been discovered and found to have properties close to those predicted by Mendeleev.

Currently, the Periodic Table contains 90 naturally occurring elements with atomic numbers ranging from 1–92 (the two elements with atomic numbers 43 and 61, technetium, Tc, and promethium, Pm, do not occur naturally). Any element that has an atomic number higher than 92 is a synthetic element and has been synthesised in one of a variety of nuclear reactions. All elements with an atomic number above 82 are now known to be radioactive. Many textbooks incorrectly list Element 83 (Bi^{209}) as a stable nuclide. However, alpha decay of Bi^{209} with a half-life of 2×10^{19} years has recently been discovered. So the heaviest stable element in the Periodic Table is Element 82, lead (Pb).

Please note that the Periodic Table used in HSC Science exams is slightly different to the IUPAC official table, as some data has been modified for simplification.

References:

- http://pac.iupac.org/publications/pac/pdf/2012/pdf/8407x1669.pdf
- http://pac.iupac.org/publications/pac/pdf/2011/pdf/8307x1485.pdf
- www.llnl.gov/news/newsreleases/2012/May/NR-12-05-07.html
- Image credit – Lawrence Livermore National Labs

Learning is a treasure that
will follow its owner everywhere.

... Chinese proverb

Science Updates

• Arctic oil drilling has too many risks

Shell has overcome the last major legal obstacles to Arctic drilling. They do have an oil spill response plan and this effectively grants them permission for exploratory drilling in the Beaufort Sea, north of Alaska. Shell intends to drill from July and must stop in late October, before the dark, bitter cold and ice set in for winter. It received permission to drill in the nearby Chukchi Sea in February, and is now waiting for permits from environmental agencies.

Shell's rig contains numerous sensors and automatic shut-off systems to detect early problems and deploy the cap. However, if oil did enter the water, Shell and the US Department of the Interior agree that containing it with booms would be ineffective as floating sea ice would obstruct them. Shell says it has several backups, including dropping dispersants from helicopters, burning the oil, and skimming it off the surface. But authorities think these plans are problematic. Dispersants can leave fish more exposed to oil's harmful effects. And it's not clear how well they would work in the Arctic: even in mid-summer, low-angle sunlight and cold water could fail to activate the chemicals. The flammable materials added to spills for burn-offs would also be less efficient there. Even though Shell plans to have ice-breakers on hand to create a path for skimmers, the broken ice may create its own problems. Tar oil mixed with broken sea ice does not allow a full recovery. And if oil gets under the ice, it could stay there indefinitely since it won't be degraded by sunlight or bacteria. Shell says it can track the oil under seasonal ice using sensors, and recover it in the spring. But recovering oil that has been carried out to sea would be too dangerous for skimmer ships.

[Source: NewScientist 7 April 2012]

• Is artificial photosynthesis possible?

Researchers are busy trying to unlock and/or harness the processes in photosynthesis to make clean, green energy for all. They are looking at how to mimic the reactions occurring in photosynthesis, to bring about an artificial photosynthesis process to produce the fuel, hydrogen.

Natural photosynthesis stores energy from sunlight by splitting water molecules and rearranging their constituents into chemically more energetic forms. So far, scientists at Sun Catalytix have come up with a wireless 'artificial leaf', but it lacks efficiency. The search is still on to find a system that will produce hydrogen cheaply and efficiently. The hard part is finding the right catalysts, materials and conditions to achieve the necessary chemical reactions.

[Source: NewScientist 14 April 2012]

Progress of the Global Polio Eradication Initiative

The Global Polio Eradication Initiative illustrates the importance of immunisation. This initiative, launched back in 1988, has been spearheaded by WHO, Rotary International, the US Centers for Disease Control and Prevention (CDC) and the United Nations Children's Fund (UNICEF). This followed the eradication of smallpox in 1980, progress during the 1980s towards elimination of the poliovirus in the Americas, and Rotary International's commitment to raise funds to protect all children from the disease.

As a result of this initiative, more than two billion children worldwide have been immunised. Polio cases have decreased by over 99% since 1988, from an estimated 350,000 cases in more than 125 endemic countries then, to 1352 reported cases in 2010. In 2012, only parts of three countries in the world remain endemic for the disease – the smallest geographic area in history – and case numbers of wild poliovirus type 3 are down to the lowest-ever levels. The persistent pockets of polio transmission in northern Nigeria and along the border between Afghanistan and Pakistan are key epidemiological challenges.

More than eight million people who would otherwise have been paralysed are walking today because they have been immunised against polio since the initiative began in 1988. By preventing a debilitating disease (see Box 1), the Global Polio Eradication Initiative is helping reduce poverty, and is giving children and their families a greater chance of leading healthy and productive lives.

In most countries, the Global Polio Eradication Initiative has expanded the capacity to tackle other infectious diseases, such as avian influenza or Ebola, by building effective disease-reporting and surveillance systems, training local epidemiologists and establishing a global laboratory network. This capacity has also been deployed in health emergencies such as the 2010 floods in Pakistan and the 2011 drought in the Horn of Africa.

Routine immunisation services have been strengthened by bolstering the cold chain, transport and communications systems for immunisation. Improving these services helped to lay the groundwork for highly successful measles vaccination campaigns that have saved millions of young lives.

Vitamin A is often administered at the same time as polio vaccinations. Since 1988, more than 1.2 million childhood deaths have been prevented through this method of providing vitamin A.

As well as the obvious humanitarian benefits, economic modelling has found that the eradication of polio in the next five years would save at least US$40–50 billion, mostly in low-income countries.

BOX 1. SOME POLIO FACTS
– illustrating why immunisation is essential

Poliomyelitis (polio) and its symptoms:
Polio is a highly infectious disease caused by the virus, Poliovirus. It invades the nervous system and can cause total paralysis in a matter of hours. The virus enters the body through the mouth and multiplies in the intestine. Initial symptoms are fever, fatigue, headache, vomiting, stiffness in the neck and pain in the limbs. One in 200 infections leads to irreversible paralysis (usually in the legs). Among those paralysed, 5–10% die when their breathing muscles become immobilised.

People most at risk: Polio mainly affects children under five years of age.

Prevention: There is no cure for polio, it can only be prevented. Polio vaccine, given multiple times, can protect a child for life.

Reference: www.who.int/mediacentre/factsheets/fs114/en/

High achievement always takes place
in the framework of high expectation.
… Charles F Kettering

Science Updates

- **Connecting up will gain knowledge about the universe**

Five existing radio telescopes in Australia and Korea have been linked up for the first time – the two CSIRO dishes near Coonabarabran and Narrabri in NSW, a telescope of the University of Tasmania near Hobart, and two telescopes operated by the Korean Astronomy and Space Science Institute: one in Seoul (at Yonsei University), and a second near Ulsan in the southeast of the country (at Ulsan University). These telescopes will form forming a system acting as a gigantic telescope more than 8000 kilometres across and with 100 times the resolving power of the Hubble Space Telescope.

The reason for linking telescopes is to improve resolution. The resolution of a telescope is how well it can distinguish between the details of an object. Generally speaking, the bigger the telescope, the greater the resolution, the more detail it can see. The distance between the Australian and Korean telescopes leads to a resolution 100 times greater than the Hubble telescope.

Australia has been making similar linkups with Japan and China for many years, and now is also doing initial tests with telescopes in India.

[Source: www.csiro.au/Portals/Media/Korean-connection-makes-an-8000-km-telescope.aspx]

- **The human need to socialise**

Evolutionary anthropologist Robin Dunbar has provided some insight into humans. Online social networking sites lock into one of our most abiding concerns – how to keep contact with friends we can no longer see in person. An untended friendship will gradually fade away, but keeping up with old friends online prevents this. However, it also means that we have less time to meet new friends offline. Online networks cannot increase the number of friendships we are able to maintain, since that is constrained by our psychology. And herein lies the dilemma: should we keep up with our distant old friends or meet new ones? Keeping up with old friends might seem nice, but most will be living too far away to help out when needed. And time spent online with them means we are not making the new local friends who would have provided that help.

Despite its imperfection, the digital world allows us to enrich our social circles by meeting a wider range of people online. This may become more important as the world becomes more politically interconnected and economically interdependent. Local friends may often be more valuable in times of need, but having friends who are geographically dispersed could help us feel that we belong to the global village, and so make us more committed to the planet and its future.

[Source: NewScientist 7 April 2012]

Senior Science Fun Park Excursion to Luna Park Sydney

Many first-hand experiences in the Senior Science syllabus are covered by doing a *Senior Science Excursion* to Luna Park Sydney **through** ***Physics is Fun***. Worksheets are provided for:

- ★ ***Preliminary Topic 8.4 Humans at Work*** – students assess the impact of science in the design/construction of safe rides; identify & assess potential hazards/factors that increase risk of injury; perform an occupational health & safety style audit; determine what safety measures will protect the human body from injury.
- ★ ***HSC Option 9.8 Disasters*** – students explore the possible consequences of a disaster such as the collapse of a ride at Luna Park Sydney, and how emergency services would assist in the minimisation of the effects of such a disaster.
- ★ ***HSC Topic 9.4 Information Systems*** – students investigate the need/use of these.
- ★ ***HSC Option 9.5 Polymers*** – students investigate the types used & their impact.

Interactive learning is a great way for students to learn and have fun at the same time. Details are on page 6 of this *SciTalk*.

Enquiries: ph 9939 6107, fax 9939 6105, *www.odlumgarner.com*

2012 editions: Past HSC Papers with Worked Solutions

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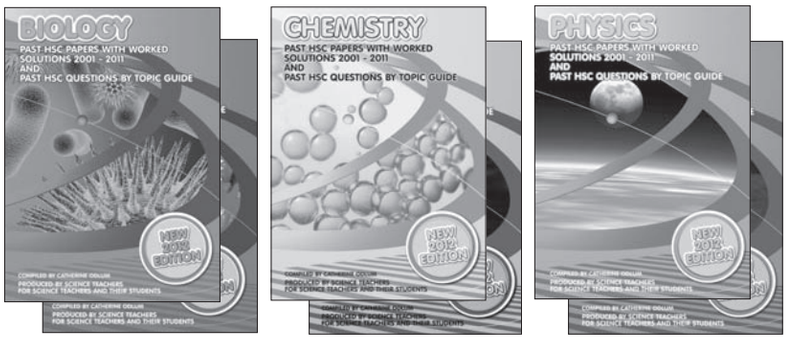

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	2009–2011 Senior Science Past HSC Papers with Worked Solutions **… NEW**	978 1 921741 09 8	$22	

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3/12.CLO

Photo Spot Tungsten

Tungsten is a very hard, dense, silvery-white, lustrous transition metal. Its atomic number is 74. Its chemical symbol, W, comes from its original name, wolfram. It tarnishes in air, forming a protective oxide coating. In powder form, tungsten is grey.

Tungsten was identified as a new element in 1781 and first isolated as a metal in 1783. Its name comes from the Swedish language *tung sten*, meaning 'heavy stone'.

In 2010, China produced 85% of the world's output of tungsten, followed by Russia with 4%. Until now, tungsten has only been mined in Australia to a very small extent.However, an increase in the demand for tungsten, together with restrictions on exports of tungsten concentrates from China, has led to an increase in exploration and re-evaluation of tungsten mines and deposits, mainly in north Queensland, Tasmania and WA. Australia is estimated to have 14.5% of the world's known tungsten resources.

Tungsten is not found free in nature, but rather is only found in chemical compounds. Its principal ores are wolframite (an iron manganese tungstate) and scheelite (calcium tungstate, $CaWO_4$). Commercially, the metal is obtained by reducing tungsten oxide with hydrogen or carbon. Tungsten has the highest melting point of all metals. At temperatures over 1650°C, it also has the highest tensile strength. Pure tungsten is ductile, and tungsten wires, even of a very small diameter, have a very high tensile strength.

Uses of tungsten

Tungsten and its alloys have been widely used for filaments in older style (not energy saving) electric bulbs and electronic tubes, as well as in X-ray tubes (as both the filament and target), cathode ray tube and vacuum tube filaments, and in superalloys. Tungsten is also used as the filament in tungsten halogen lamps. These lamps use halogens like bromine and iodine to prevent the tungsten filament from degrading and are therefore more energy efficient than standard incandescent light bulbs (see Box 1).

Tungsten is used in heavy metal alloys because of its hardness. Its hardness and high density also give it military applications in penetrating projectiles. High speed steel (which can cut material at higher speeds than carbon steel), contains up to 18% tungsten. Tungsten is also used widely as tungsten carbide, which has a hardness close to diamond and is used for cutting and wear-resistant materials, primarily in metalworking, mining, oil drilling and construction industries.

Tungsten's high melting point also makes tungsten suitable for aerospace and high-temperature uses such as electrical, heating, and welding applications, notably in the tungsten inert gas (TIG) welding process. Because of its conductive properties and relative chemical inertness, tungsten is also used in electrodes, and in the emitter tips in electron-beam instruments, such as electron microscopes. In electronics, tungsten is used as an interconnect material in integrated circuits. Tungsten compounds are most often used industrially as catalysts. Tungsten is also used in some jewellery because of its hardness and wear resistance. The density of tungsten is similar to that of gold, which allows tungsten to be used as an alternative to gold or platinum in jewellery.

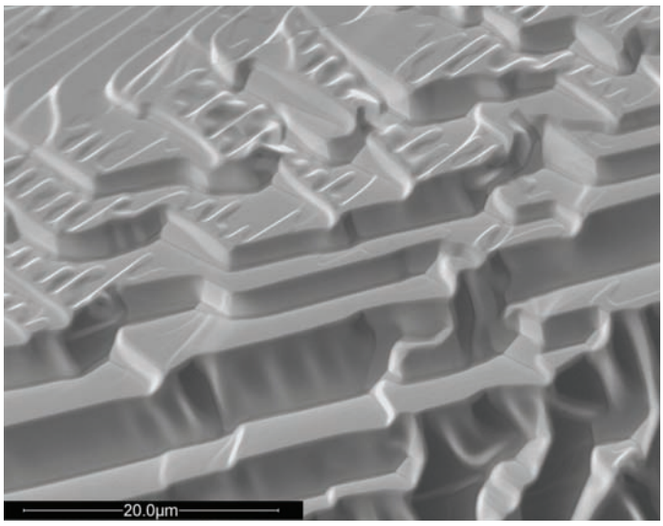
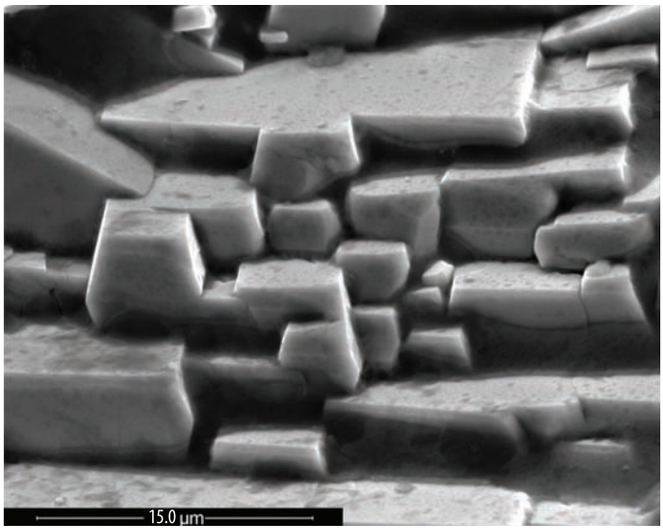


FIGURE 1 (above): 'Terraces' – a tungsten cathode surface from an X-ray tube after operating for 200 hours

FIGURE 2 (below): 'Roman steps' – fine step-like tungsten crystallites formed at high temperature

... both of these SEM photomicrographs were taken by Thor Bostrom, Analytical EM Facility, QUT, Qld



Tungsten is the only metal from the third transition series that is known to occur in biomolecules, where it is used in a few species of bacteria. It is the heaviest element known to be used by any living organism. Tungsten interferes with molybdenum and copper metabolism, and is somewhat toxic to animal life.

References:
- *www.chemicool.com/elements/tungsten.html*
- *minerals.usgs.gov/minerals/pubs/commodity/tungsten/myb1-2009-tungs.pdf*
- *The Electric Light series by Edison Tech Center*
- *www.australianminesatlas.gov.au/aimr/commodity/tungsten.html*

BOX 1 Tungsten halogen lamps

These incandescent lamps contain halogens, like bromine and iodine, which prevent the tungsten filament from degrading. Their outer envelope is quartz, which can withstand higher heat than glass. When the filament operates, the tungsten atoms that evaporate off the filament usually combine with the halogen atoms in the bulb. As this compound cools, the tungsten atoms are deposited back on the filament. Thus the filament can be run at a higher temperature and produce more light than a normal incandescent bulb. They have a great colour rendering and are more energy efficient and longer-lasting than standard incandescent bulbs. However, one must not touch the outside of the quartz bulb with fingers as skin oils cause the quartz outer casing to heat up unevenly. This causes the bulb to become discoloured and might result in it cracking or exploding. Therefore they should only be held by the base when installing, or by using a piece of tissue paper to hold the quartz.

Tungsten halogen lamps, also known as halogen lamps or quartz halogen lamps, were developed in the 1950s. They are commonly used as car headlights, floodlights and downlights.

FIGURE 3: Tungsten halogen lamp

BRIGHT YOUNG STARS WIN GLORY AT INTERNATIONAL SCIENCE OLYMPIADS

Australia's bright young Science stars took on the world's intellectual heavyweights to bring home 12 medals – four silver and eight bronze – from the 2012 International Science Olympiads. These were held during July in Estonia (Physics), USA (Chemistry) and Singapore (Biology). More than 100 countries competed in this annual competition, by taking a five hour theory exam and undertaking five hours of practical laboratory tests in a quest to prove their scientific superiority.

The Australian Science Olympiad (ASO) program selects Year 10, 11 and 12 students to represent Australia based on their outstanding achievements in a series of challenging exams and training sessions. Of the 3287 students that sat the Australian Science Olympiad Exams, approximately 75 (25 per discipline) were selected to attend an intensive Summer School held at Monash University in January. From that 75, the final 13 were selected to represent Australia.

The Science Olympiads provide high-quality training for top performing students to develop their talents in science, helping them to become the next generation of Australia's scientists, engineers and medical researchers. Our young science Olympians deserve the same esteem and support that our Olympic sporting heroes receive.

As well as the academic challenge and the chance to earn glory for their country, the students had opportunities to relax, enjoying sightseeing, local food and culture, and the opportunity to form friendships and international networks.

AUSTRALIAN SCIENCE OLYMPIADS

Congratulations to the following students:

- **PHYSICS** (Estonia):

4 Bronze Medals – Jonathan Lay (Newington, NSW); Eric Huang (Nth Sydney BHS, NSW); Nicholas Salmon (Brisbane Grammar, Qld); Chris Whittle (John Monash Science School, Vic).
1 Honourable Mention – Siobhan Tobin (Ballarat Grammar, Vic).

- **CHEMISTRY** (in Washington DC):

1 Silver Medal – Lachlan Vom ((Sydney Grammar, NSW).
3 Bronze Medals – Timothy Cashman (St Patrick's College Sutherland, NSW); Brian Gao & Marco Lee (James Ruse Ag HS, NSW).

- **BIOLOGY** (in Singapore):

3 Silver Medals – Hannah Mugford (PLC, NSW); Jennifer Volaric (University HS, Vic); Janelle San Juan (Melbourne Girls Grammar).
1 Bronze Medal – Nicholas Rosa (University HS, Vic).

* * * * *

Enquiries: ph 02 6201 2552 email: asi@asi.edu.au *www.asi.edu.au/*

Advances in technology help those with hearing losses

Humans are social animals and so are in constant communication with other humans. We rely extensively on our five senses to learn the various visual, vocal and auditory signals that we use to express our thoughts and ideas. Hearing is just one of these senses that are so essential in communication. It aids in the sending, receiving and interpreting of signals between people.

Yet it is often not until one experiences a loss of hearing themselves that a person realises the importance of hearing. Just think how students with any form of hearing loss cope in the classroom! Have you ever taught such students? If so, you will realise the importance of facing them when you speak and the need to enunciate words clearly to help them lip-read while you speak.

In the HSC Biology course, students learn about the advances in technology that are assisting people with difficulties in communicating because of hearing problems. Today, hearing technologies, such as hearing aids and cochlear implants, are helping to provide affected people with a better quality of life as it assists them in communication, allowing them to lead more independent, active and productive lives, rather than becoming a burden on others either socially or financially.

Hearing aids amplify sound waves from the environment and help to overcome hearing problems related to the outer/middle ear. They do not work for all individuals, do not pick up all frequencies, nor do they work well with background noise. Cochlear implants are used in profoundly deaf people who have missing or damaged hair cells in the cochlea. Cochlear implants are more expensive than hearing aids and can only be put in with surgery, which has associated risks. They also require the person to wear a permanent device on the side of their skull and to carry a speech processor, which can be an inconvenience.

A cochlear implant (or 'bionic ear') is a prosthetic replacement for the inner ear or cochlea. Electrical stimulation of the ear was first tried by Volta, the inventor of the battery. The Australian team that developed the first multi-channel cochlear implant was led by Professor Graeme Clark, following the earlier work of Simmons (USA).

It is interesting to look at the effect of hearing loss in the famous music composer Beethoven, who began to lose his hearing by age 30, when he complained he could not hear the high notes of instruments or voices. Beethoven was totally deaf by the time he was about 50 years. Scientific analysis of his music shows that his middle works used much more of the middle and low frequency notes that he could still hear in performances, presumably because he was unable to hear the higher notes. The high notes returned in his late works, composed after he was totally deaf, as he was then using his imagination and memories of sound in producing these new compositions.

It's never too late to be
who you might have been.

… George Eliot

Astronomy

Winter and Spring skies

... Robert Garner

Earth constantly moves, affecting what we see in the night sky. Winter and Spring skies are excellent places to begin exploring the constellations, planets and other celestial objects in the night sky.

Spring Equinox – 23 September, 2012

The Earth's Spring equinox occurs at 1 am (EST) on 23 September, when the Sun crosses the celestial Equator (a projection of the Earth's Equator onto the celestial sphere) heading into the Southern Hemisphere for our summer months. An equinox occurs twice a year in March and September, and is when the tilt of the Earth's axis is inclined neither away from, nor towards the Sun. On the Spring equinox, day and night time hours are equal at the Equator. The name 'equinox' is derived from the Latin *aequus* (equal) and *nox* (night).

Using a Sky Chart / Planisphere

Remember, viewing the night skies is much simpler if you have a Sky Chart / Planisphere. See Box 1 about easily obtaining one of these.

Constellations

With each season, different constellations are more prominent than others. The pattern repeats itself every 12 months, and so the constellations for Winter are always the same as the previous Winter, whereas the Moon and planets differ from one year to the next.

Crux, the Southern Cross, can now be seen on its side with the two pointers (α and β Centauri) almost directly above it (see Figure 1). *Crux* is so named from the Latin meaning 'cross', due to the pattern formed by its main stars. *Crux* is always visible from the Southern Hemisphere at any time of year as it never disappears below the horizon, so it makes a good night time activity for students to observe and practice their skills in drawing a scientific diagram. If they observe *Crux* at the same time each night over a period of a 3–4 weeks, they should be able to see how it appears to change its orientation. *Crux* does not actually move – its apparent movement occurs because Earth rotates on its axis as it orbits around the Sun, thus causing the Earth to be approximately one degree changed in orientation each night compared to the celestial sphere.

Crux is great for teaching about star clusters such as the Jewel Box and nebulae, such as the Coalsack. Like *Crux*, the Jewel Box and Coalsack are easily visible to the naked eye. The Coalsack appears as a dark region between the two brightest stars of *Crux*, α Crucis and β Crucis, while the Jewel Box is next to β Crucis (Figure 1).

In Australian Aboriginal astronomy, the Coalsack is the head of the 'Emu in the Sky'. The Emu's long neck runs through the two pointers to *Crux*, its body starts to form here and continues across *Scorpius* and down into the *Sagittarius* constellation (Figures 2 &3).

Winter is a great time to see the *Scorpius* constellation, which contains the red star, Antares. *Scorpius* will be overhead around sunset onwards, with its 'scorpion tail' near the 'teapot' in *Sagittarius*. By 21–24 September, the Moon can be used as a guide around 9 pm to find *Scorpius* and *Sagittarius*.

The centre of the Milky Way Galaxy lies towards *Sagittarius*. It crosses the sky from north to south almost directly overhead and will make good viewing in dark skies away from city lights. The Milky Way derives its name from its appearance as a dim 'milky' glowing band arching across the night sky. It appears like a band because it is a disk-shaped structure being viewed from inside and the naked eye cannot distinguish its countless, individual stars.

Meteor showers

Meteor showers ('shooting stars') are best seen on moonless nights, and often provide spectacular celestial light shows. August–September are poor months for seeing meteors. The *Orionids*, associated with Halley's comet, will be active in October, peaking on 21 October (one day before a first quarter Moon). As with all showers, the best time for viewing will be from around 3 am until an hour before sunrise.

The Planets

The two inner planets, *Mercury* and *Venus* are never far from the Sun in direction. *Mercury* is never more than 30° from the Sun and *Venus* is always less than 50° from the Sun, so when we see them at night they are never far from the horizon. Being closest to the Sun, *Mercury* orbits the Sun in just under 88 days and so makes just over four orbits of the Sun each Earth year. With each of its orbits, *Mercury* is briefly visible low in the eastern pre-dawn or western evening twilight. In August, *Mercury* is low in the pre-dawn sky, but will be difficult to see. *Mercury* then moves behind the Sun until late September and will reappear in the early evening sky by late September. On 5 October, *Mercury* will be close to *Saturn* about 10° above the western horizon

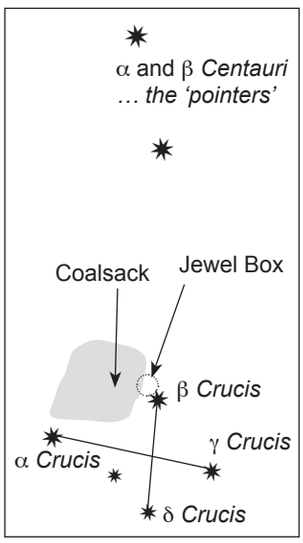


Figure 1: Southern Cross (*Crux*), Coalsack and Jewel Box

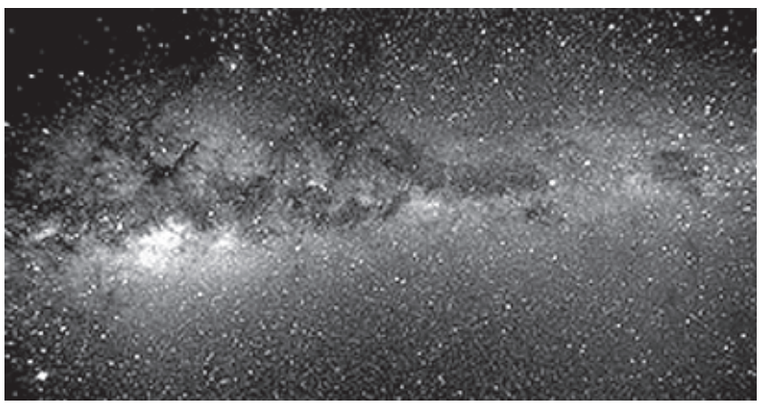


Figure 2 (top right): The 'Emu' as seen in our night sky – it appears to be 'flying', with its head on the right. [Source: NASA]

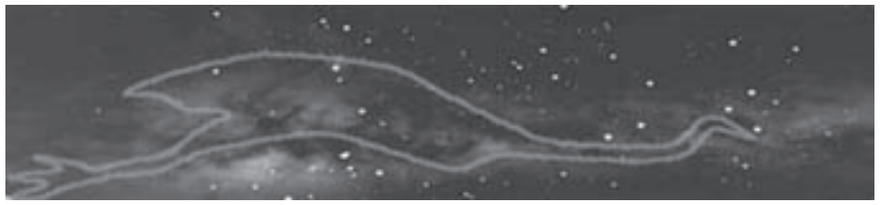


Figure 3 (bottom right): 'Emu in the sky', a 'constellation' defined by dark clouds rather than stars. Its head on the right is the Coalsack, with *Crux* above it.

[Source: B & R Norris ... from Wikipedia]

just after the end of twilight. Late October will be the best time of the year to see *Mercury* in the evening sky as it is close to its greatest angular separation from the Sun at this time.

Venus and *Jupiter* are currently morning stars, rising in the east. On 12 August the Moon will be just below *Jupiter*, on 13 August it will be mid-way between *Venus* and *Jupiter*, and on 14 August it will be just below *Venus*. This is a great chance to make daytime observations with the naked eye of these two planets, using the Moon to locate them (see Box 2).

Venus will become more difficult to observe as it appears progressively lower in the pre-dawn sky during the rest of August and through Spring, as it heads towards superior conjunction with the Sun in March 2013. Meanwhile, *Jupiter* rises earlier each day and so by late September and on into October it can be seen before midnight in the north-eastern sky.

Mars will be visible in the western evening sky during this period setting a little earlier each night. *Mars* sets around 10.30 pm (EST) in August and by 10.30 pm (AEDT) by the end of October. In late October, *Mars* will be close to the red star Antares in *Scorpio*.

Saturn will be a low western evening sky object, best seen in August soon after sunset. By late September and during October, Saturn will be setting too early in the evening to be seen easily against the Sun's glow. During August and September, *Saturn*, *Mars* and the bright star Spica are close together doing a 'celestial dance' and visible each night. Best nights to observe them are 14 August around 7 pm, as they will be in a line and on 22 August when the new Moon will be next to Mars, with Spica and Saturn below.

Box 1: Sky Charts & Planispheres

- You can download free sky charts each month to explore the night sky (planets, stars & constellations) from: *http://skymaps.com/downloads.html* Make sure you scroll to 'Southern Hemisphere Edition'.
- A planisphere (star wheel) helps to find *stars* and locate *constellations*. These are inexpensive and available from astronomy shops, or you can download one from the internet – make sure it is for the Southern Hemisphere. There is a planisphere (star wheel) to print and use at: *http://members.ozemail.com.au/~starrylady/resources.html*

Box 2: Daytime viewing of the Moon, Venus and Jupiter

Many people wrongly assume that the Moon and planets such as Venus and Jupiter cannot be seen in the daytime. In fact, the Moon is often visible in daytime. It is relatively easy to see as we can focus our eyes on it and it is bright against the blue sky. When the Moon is close to a planet, it can be used as a reference point to locate a planet and focus on it. Binoculars will help – focus them on the Moon first and then try to locate the planet. Then lower the binoculars and try to see the planet with your eyes, using the Moon to focus. Make sure that you do NOT look at the Sun when doing this, as it will cause serious eye damage – stand in the shade, so the Sun is not an issue.

MACQUARIE UNI OBSERVATORY & PLANETARIUM PUBLIC FRIDAY NIGHT OBSERVING

These are located in the grounds of Macquarie University (access via Gymnasium Rd) & open to the public every Friday night (March–Nov inclusive). The planetarium opens 6–7 pm & the observatory, from 8–9.30 pm (when AEDT) or 7–8.30 pm (in non-AEDT). Bookings are essential and can be done online at: *www.physics.mq.edu.au/community/observatory/public/* If doubtful weather, check online after 5 pm.

On clear nights, the 'starfinder' (planisphere) sessions demonstrate how to identify bright stars, constellations and planets. This is followed by observing with the telescopes. Even with the light pollution of the city, we can easily see double and multiple stars, open and globular star clusters, and the brighter nebulae. The Moon and planets, when in suitable positions, are easily viewed with any of our instruments. On dark, moonless nights with good seeing, we may also observe the brightest galaxies.

Nobody will believe in you
unless you believe in yourself.

… Liberace

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www.odlumgarner.com

To find out more about shows/concerts in Luna Park Sydney's Big Top, or their function venues or The Deck restaurant with their spectacular harbour views, go to: *www.lunaparksydney.com*

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Physics is Fun - Luna Park Sydney Teacher Offer
PO Box 442, Freshwater NSW 2096

WINNER: Kelli Forrester, Trinity Catholic College, won a Luna Park Sydney family pass for *SciTalk No. 2–2012.*

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Sydney Aquarium at Darling Harbour is a great science excursion venue. It showcases Australian aquatic habitats, their fauna and flora, information on habitat characteristics, animal adaptations and conservation issues. Bookings are essential. Excursions are self-guided. Information: *www.sydneyaquarium.com.au/*

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Sydney Aquarium Sydney Teacher Offer
PO Box 442, Freshwater NSW 2096

WINNER: Lisa Fuss, Lakes Grammar, won a Wild Life Sydney family pass for *SciTalk No. 2–2012.*

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★ ✧ ★ ✧ ★ ✧ ★

TO WIN A FAMILY PASS* TO IMAX (for 2 adults and 2 children worth $83.50) … send in your name, school, & school address on an envelope **by 21 September 2012** to:

IMAX Give Away, PO Box 442, Freshwater NSW 2096

* This pass will be valid for any one film for any session, except public holidays/films advertised as 'no free list'. Details at: *www.imax.com.au*

WINNER: Evette Martinovich, Kincoppal Rose Bay, won an IMAX Sydney family pass for *SciTalk No. 2–2012.*

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HOW TO ENTER: Send an answer to the Quiz Question, your name, school and school address on an envelope to: Competition Corner, PO Box 442 Freshwater 2096 – by 21 September 2012.

Winner for *SciTalk 2/12*: *Pearson Science 7* books published & donated by Pearson Australia were won by Ann Nosworthy, West Wallsend High.

SciTalk 2/12 answer: Lead

QUIZ QUESTION: What is the name and chemical symbol for element 114 in the Periodic Table? (Hint: see page 1)

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SciTalk **is a newsletter for secondary Science educators. Now in its 18th year, it has been produced quarterly by Odlum & Garner as a service to Science teachers since 1995. It is sent FREE-of-charge to all secondary Science faculties in schools and TAFEs throughout NSW and the ACT.**

SciTalk **aims to provide science teachers with up-to-date information, important dates, the latest products available, plus 'what's on' in various excursion venues, and more.**

Please pass *SciTalk* on to all Science teachers at your school so they can benefit from it – or put it up on your notice board for reference.

Contributions, advertising and inserts are welcome.

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CLOSING DATES

- ***SciTalk*** **No. 1–January 2012 ... Dec 16**
- ***SciTalk*** **No. 2–May 2012 ... April 5**
- ***SciTalk*** **No. 3–August 2012 ... June 8**
- ***SciTalk*** **No. 4–October 2012 ... Sept 21**

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