

SciTalk

ISSN 1323-7667

Number 3 – July 2015

Solar and wind are booming across the globe

Worldwide, electricity production using renewable energy sources is increasing rapidly as more and more people and countries are turning away from using fossil fuels and nuclear power to using hydropower, wind, biomass and solar energy to try to reduce the human contribution to global warming. Sadly, Australia has yet to follow this trend.

Wind power is a clean energy source. A wind turbine creates reliable, cost-effective, pollution-free energy. It is affordable, clean and sustainable. Because wind is a source of energy that is non-polluting and renewable, wind turbines create power without using fossil or nuclear fuels. Wind power production produces neither greenhouse gases nor radioactive or toxic wastes.

Photovoltaic solar modules use sunlight to produce electricity. In Australia, many households already have such solar panels on their rooftops. Large-scale photovoltaic generating ‘farms’ such as the Nyngan Solar Farm have more than a million solar panels that produce enough solar electricity to supply 50,000 homes.



Figure 1 Wind turbines adjacent to a dike protecting farmland in the Netherlands [Credit: George Steinmetz, National Geographic]

Another type of solar energy system has been put to use in Spain and elsewhere. This system is a ‘concentrated solar energy system’ using large panels of mirrors to focus sunlight onto a small area to heat synthetic oil. The heated oil is used to superheat water vapour to spin turbines to produce electricity without the use of fossil fuels. Molten salt tanks store surplus heat so that the turbines can be kept spinning for six hours after sunset or if it is cloudy (see article in *SciTalk* No. 3-2014).

The US and China are two countries that are particularly notable for their ‘green’ electricity production. They have vastly increased their electricity generation using wind. By 2012, the US was producing over 140 billion kilowatt hours per annum, while China was producing

... continued page 4

★★ ATTENTION ★★

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★★★

Winner for *SciTalk* 2/15

Bronwyn Sandeman, MacKillop College, Warnervale, won *Biology Past HSC Papers & Worked Solutions 2001-2014* (rrp \$39.95), published by Odlum & Garner.

★ 2015 editions Past HSC Questions & Worked Solutions ... see p7 ★

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Diary Dates



**INTERNATIONAL
YEAR OF LIGHT
2015**

Update on BOSTES matters

You should regularly check the BOSTES website at www.bostes.nsw.edu.au to ensure you have the latest data – on syllabuses, past exam papers, news, Official Notices, Board Bulletins, statistics archive and more.

Personalised HSC timetables

Students can access their personal HSC timetable in Students Online by logging in to their personal account via My Details. Schools are requested to remind students to check their timetables for accuracy.

Scientific calculators for use in 2015 HSC

A list of approved calculators, including features permitted or not permitted, is available on the BOSTES website.

New/revised personalised HSC materials (BOS 15/15)

Many HSC exam materials will be pre-printed with a student's number, centre number and, usually, their name, e.g. from 2015, HSC Chemistry papers will have this.

Multiple Choice in HSC Examinations

Multiple-choice questions in the HSC will be ordered according to their level of difficulty – from easier questions to more challenging questions.

Remember: Stage 5 & Preliminary course student work samples to be retained

A minimum of 3 work samples, showing the upper, middle and lower range of achievement of the current cohort, should be retained for Science 7–10, Biology, Chemistry and Physics in a format that can be uploaded electronically. These should demonstrate performance towards the end of the stage that is typical of students awarded a particular grade (A to E) by the school. From 2018 schools will be required to keep work samples for all their Stage 5 and Preliminary courses.

Revised Stage 5 Course Performance Descriptors (CPDs) (BOS 04/15)

The revised CPDs are to be used by schools from 2015 to grade student achievement for the Record of School Achievement (RoSA).

BOSTES enquiries

Ph: 9367 8111, fax: 9367 8484

www.boardofstudies.nsw.edu.au

Science contact: Inspector Science, K–12

2015 International Year of Light 2015: www.light2015.org/

For Shell Questacon Science Circus 2015:
www.questacon.edu.au/outreach/programs/science-circus

JULY 2015

23 National Chemistry Quiz. schools.raci.org.au/competition/ancq/ ... registrations close 9 June

AUGUST 2015

- 1 Jeans for Genes Day. www.jeansforgenes.org.au/
- 5 Chemistry Olympiad Exam. www.asi.edu.au/olympiads/ Close date: 6/7/15. Ph: 6201 2552
- 7 Earth & Env Science Olympiad Exam. www.asi.edu.au/olympiads/ Close date: 22/7/15.
- 10 Biology Olympiad Exam. www.asi.edu.au/olympiads/ Close date: 22/7/15. Ph: 6201 2552
- 12 Physics Olympiad Exam. www.asi.edu.au/olympiads/ Close date: 22/7/15. Ph: 6201 2552
- 14, 17, 21 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105
– come on one of these dates to celebrate National Science Week
- 15–23 National Chemistry Week. www.raci.org.au Ph: 9663 4960
- 15–23 National Science Week. Schools theme: Making waves – the science of light.
www.scienceweek.net.au/schools/

SEPTEMBER 2015

- 7, 11 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com
- 12 (tbc) National Schools Titration Competition (Sydney) ... entry is by invitation – see page 11
- 22 HSC revision day for Biology students at Museum of Human Disease – see page 3
- 23 Spring equinox (6:20 pm AEST)

OCTOBER 2015

- 11–17 Earth Science Week. www.earthsciweek.org
- 12 HSC commences
- 16, 19, 23, 26, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com

NOVEMBER 2015

- 2, 13, 16 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com
- 20, 23, 27, 30 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com

DECEMBER 2015

- 1–16 Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com
- 22 Summer solstice (3:48 pm AEDT)

JANUARY 2016 National Youth Science Forum. Forms to local Rotary club by 31/5/15, interviews from July. Only for Yr 11 in 2015. 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.

2015 Science HSC Examination Dates

- 15 Oct Earth & Environmental Science: 1.55 pm–5 pm
- 19 Oct Biology: 9.25 am–12.30 pm
- 22 Oct Senior Science: 1.55 pm–5 pm
- 23 Oct Chemistry: 9.25 am–12.30 pm
- 27 Oct Physics: 9.25 am–12.30 pm

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as ability.*

*... Martin Seligman &
Angela Duckworth
(2005)*

... continued from page 1

nearly 100 billion kilowatt hours per annum using wind.

At present, the total electricity produced in Australia per annum is around 185 billion kilowatt hours, but only about 4% is produced by wind. More than 75% is produced using coal. Australia could be producing much more ‘green’ electricity if we harnessed solar and wind energy as is happening elsewhere around the globe.

In the past, China has been a large importer of Australian coal to produce electricity. With China now trying to reduce air pollution by converting to ‘green’ energy sources, the market for Australian coal will gradually decline. Does Australia really need to be destroying productive agricultural land for more coal mines when wind and solar options now exist for electricity production?

Countries like Denmark and the Netherlands have set up off-shore wind turbines along their coastlines, as shown in Figure 1. Denmark, which generated a larger share of its electricity from wind in 2012 than any other country in the world, is hoping to have 50% wind power in their electricity system by 2020.



Figure 2 (above) The world’s first floating photovoltaic system was installed in 2007 by SPG Solar on a pond at Far Niente Winery in Napa, US.

[Credit: SPG Solar, Inc]



Floating solar panels, as shown in Figure 2, have evolved in varying degrees for use in ponds, reservoirs, canals, rivers and oceans and are being used in many countries worldwide. Floating panels solve the problem of not all rooftops being suitable for solar. Japan, which has been moving away from nuclear power after the 2011 meltdown at its Fukushima Daiichi plant, is turning to the Sun. Last year, after China, it added the second-largest amount of solar capacity to its power grid. In Japan, where land space is scarce, solar panels have been set up to float in waterways, as in Figure 3.

Figure 3 (left) In Japan, solar arrays floating on water take advantage of open water where land space is constrained.

[Credit: Kyocera Corporation]

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Germany is phasing out its nuclear electricity plants and replacing them with solar and wind energy sources. In Germany, more than 50 billion kilowatt hours per annum of electricity was produced by wind power in 2012 representing 10% of Germany's power production. Another 10 billion kilowatt hours per annum were generated by solar panels. India, where one-fourth of the people lack access to electricity, had the world's fifth largest wind capacity by the end of last year.

Reducing the world's reliance on fossil fuels for the production of electricity will result in less greenhouse gases being produced and so help to reduce global warming and tackle climate change.

Australia should be doing much more to change over to generating our electricity from renewable sources. We need to abandon using coal-fired power stations and find ways to reduce our dependency on fossil fuels.

Scientists predict that even with planned reductions the greenhouse gases already released will continue to warm the Earth – it may be too late to stop climate change altogether, so we must also plan ahead to respond or 'adapt' to the likely impacts of global warming.

Most Australians it would appear are ready for the change. The challenge now is for our governments to act to protect the environment and start using solar and wind energy sources for electricity production.

References:

- news.nationalgeographic.com/energy/2015/07/150714-surprising-countries-leading-way-solar-wind/
- www.abc.net.au/news/2015-06-16/connor-voters-lare-backing-solar-power/6548438
- news.nationalgeographic.com/news/energy/2015/01/150116-floating-solar-power-japan-yamakura/
- www.pv-magazine.com/archive/articles/beitrag/land-to-water-_100006317/501/#axzz3gUQP2tm7

[last accessed 19-7-15]



**INTERNATIONAL
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2015 National Science Week theme:

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Bringing home the bacon: GM pigs with greater meat-yield

by Katrina Garner

Between bacon, ham, prosciutto, slow-roasted suckling pig, pork chops and crackling, there are certainly enough ways to enjoy the meat products of pigs. However, with the demand for pork products outstripping their availability, scientists have been prompted to research genetic mechanisms to boost porcine productivity. Collaboration between South Korean and Chinese scientists has uncovered a way to change gene regulatory mechanisms in pigs to allow increased muscle growth.

Jin-Soo Kim, from Seoul National University, and his team have used a gene knock-out technique to enhance the muscles of pigs. Normally, the muscle growth in pigs is regulated by the myostatin gene, which produces a protein called MSTN. The MSTN protein inhibits cell division in muscle cells, and thus acts as a regulatory mechanism to prevent excessive muscle growth. Kim's

team used a gene knock out technique known as TALEN. This involves a DNA binding protein being used to locate and bind to the myostatin gene, allowing an attached DNA-cutting enzyme to cut this gene. While the pig's natural DNA repair mechanisms will attempt to repair this cut, the repair is usually imperfect as some base pairs are often deleted or added in the process. The resultant errors in the gene render it dysfunctional. In the absence of a functional myostatin gene producing MSTN, the pigs experience additional muscle growth.

In order to ensure the myostatin gene is inhibited throughout an adult pig, the gene knock-out needs to occur in a foetal pig cell. Both copies of the myostatin gene need to be knocked out. This edited cell is then used to fertilise an enucleated egg in a process similar to whole-organism cloning. After this fertilised egg has undergone several cell divisions to produce a clump of identical cells, the clump can be split to create cloned piglets.

The GM pigs provide the benefits of increased meat-yield, as well as more lean meat. However, there are some drawbacks, especially reduced live births due to increased piglet size and short life expectancy. To reduce these issues Kim's team hope to be permitted to sell the sperm of their extra-muscly pigs to pig farmers, to be used for artificial insemination. This will hopefully achieve a balance between additional muscle and maintaining the health of the pigs.

If this research achieves regulatory approval, it will allow greater meat yield per pig and has the potential to assist in providing the increased food requirements of growing populations. Up until now, regulatory bodies around the globe have swiftly disapproved genetically modified meat products. However, usually the products in mind have been transgenic organisms (with genes transferred from one species into another). A key difference in this research is that the genetic modification is within the porcine genome, which may assist in getting it approved. The research team hopes to market the edited pig sperm to farmers in China, as there is a high demand for meat supplies in China to provide for its current population of 1400 million people – and this population is still growing at an alarming rate of 0.61% per annum (Worldometers, 2015).

References: • www.worldometers.info/world-population/china-population/
• www.nature.com/news/super-muscly-pigs-created-by-small-genetic-tweak-1.17874



Figure 4 GM pigs with greater muscle – these meaty pigs could become the first genetically engineered animals to be approved for human consumption.

[Credit: Xi-jun Yin]

[last accessed 30 June 2015]

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New alloy of steel created that's as strong and light as titanium

Lighter cars and airplanes could be on the horizon thanks to an advance in the manufacture of steel. Researchers have found a way to strengthen the metal and reduce its density, without increasing costs.

By altering the metal alloy at a nanoscale level, researchers at the Graduate Institute of Ferrous Technology (GIFT) at Pohang University of Science and Technology in South Korea have created a new material that has the strength of steel and the lightness of titanium alloy. Made from an amalgam of steel, aluminium, carbon, manganese, and nickel, the new alloy promises to be low-cost and readily available due to its mix of common minerals.

Previous research into lightweight steel has focused on mixing in aluminium in varying proportions to attempt to reduce the density, and hence the weight. Unfortunately, upping the aluminium content in steel also badly affects its ductility (the way that a material behaves under tensile stress) which results in its increasing vulnerability to fracture.

One method of making steel lighter is to add aluminium, a less dense metal. In steel, aluminium forms an ultra-strong compound with iron. That strength is an asset, but the compound tends to arrange into brittle bands. To disperse the aluminium compound and make the metal less brittle, researchers led by materials scientist Hansoo Kim of Pohang

University of Science and Technology in South Korea added nickel, which caused the aluminium compound to permeate the metal in nanometer-sized clusters instead of long bands. The clusters are too small to cause the undesirable brittleness, but the strength and lightness of the aluminium remain.

The researchers examined their steel with an electron microscope to confirm that the aluminium clusters had formed. Then they tested the metal by applying tension and found that it was stronger and less brittle than conventional steel.

Where the new metal really shines is in its cost. Other lightweight, strong metals such as titanium alloys are too expensive to be used in passenger vehicles. The low price of the metals used to produce the new steel means that the price will be closer to that of standard steel, so automakers could use it to lighten their loads without driving up costs.

The concept of producing a lightweight version of steel using an abundant mineral such as iron – the base component of steel – could open up a raft of possibilities. Not the least of which may be a new era of high-strength, lightweight steels that may one day usurp aluminium in the production of fuel efficient vehicles and other construction systems.

References:

- www.gizmag.com/steel-alloy-strong-light-titanium/35996/ [12-2-15]
- news.sciencemag.org/chemistry/2015/02/new-lightweight-steel-cheap-yet-strong [4-2-15]

Touch communicates emotions and promotes teamwork

The role of high fives, back pats, bum slaps etc play a fundamental role in our lives – these actions help to signal and to build trust and promote teamwork, win friends and influence people. Researchers believe such touching begins in the womb and guides the development of regions in our brain that govern social behaviour and help to give us our sense of worth. The psychological sense of being oneself seems to be linked to being touched in an emotional way by another person, probably starting with a parent's touch. The natural interaction between parents and an infant – the continuous desire to touch, cuddle, and handle – is providing the essential inputs that lay the foundation for a well-adjusted social brain.

Our skin – our touch detector – is our biggest organ. The skin is a communication interface with the outside world. Touch lets us communicate a range of emotions – from gratitude, to sympathy, love and more – all these can be conveyed with the briefest of touches.

Touch can help build relationships – but beware, as it can also be used to fake a relationship, e.g. by salespeople to build trust, or waiters to boost their tips!

Researchers have also found evidence that children with autism experience and process social touching differently to other children

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The role of social touch appears to be far more critical than has been realised in the past. Perhaps touching could be used to promote performance in the classroom, boost the success of teams and encourage commitment in close relationships. At the same time, however, there seems to be a trend towards less touching in society. Teachers are told to avoid touching children, physical contact is discouraged in the workplace and many of our close relationships are played out online.

Researchers are now suggesting that ‘we ought to be more tactile than we currently are – or at least we shouldn’t be so frightfully uptight about it’.

Reference: • *NewScientist* 28 February 2015

Arctic winter ice cover plunges to record low

Sea ice in the Arctic Ocean has fallen to the lowest recorded level for the winter season, according to US scientists, bringing the scary prospect of an ice-free Arctic a step closer. The maximum this year was 14.5 million sq km, said the National Snow and Ice Data Center (NSIDC) at the University of Colorado. This is the lowest since 1979, when satellite records began. The winter peak also occurred much earlier than usual. A recent study found that Arctic sea ice had thinned by 65% between 1975 and 2012.

Summer ice has hit a series of record lows in recent years as the Arctic has warmed by almost 2°C, twice as fast as the mid-latitudes. The ice builds up again each winter and the average extent of winter ice has been declining less steeply, although it has been getting thinner.

NSIDC researchers are wary of blaming global warming, pointing out that there is a lot

of natural variability in ice cover. The unusual path of the jet stream – a high-altitude wind that affects weather – this winter warmed the Pacific side of the Arctic, reducing Bering Sea ice in particular. The ice build-up was also cut short this year because the spring melt began two weeks earlier than usual.

The Arctic Ocean freezes every winter and much of the sea-ice then thaws every summer, and that process will continue whatever happens with climate change. Even if the Arctic continues to be one of the fastest-warming regions of the world, it will always be plunged into bitterly cold polar dark every winter. And year-by-year, for all kinds of natural reasons, there’s a huge variety in the state of the ice.

So what does this new record for the lowest level of winter ice actually mean?

For a start, it does not automatically follow that a record amount of ice will melt this summer. More important for determining the size of the annual thaw is the state of the weather as the midnight Sun approaches and temperatures rise. But over the more than 30 years of satellite records, scientists have observed a clear pattern of decline, decade-by-decade.

The extent of Arctic sea ice is monitored by satellites throughout the year. Scientists keep a close eye on the sea ice area because it is so crucial to the polar habitat and has considerable economic potential. Animals like polar bears and walrus depend on it to reach their food, and diminished ice makes the search for sustenance more difficult.

Changes in the sea ice area have also been linked to changes in weather patterns over North America, Europe and Asia, though the connection is still tenuous. So at some point this century, it would appear that the summers are on course to be clear of ice, opening up new shipping lanes, making it easier to access the region’s oil and gas and possibly also altering the path of the jet stream that drives our weather.

Meanwhile, at the other end of the world, researchers are puzzling over the growth of sea-ice around parts of Antarctica. Overall, there is a fall in the global total of sea-ice but with lots of questions about its pace.

References:


- *NewScientist*, 28 March 2015
- www.bbc.com/news/
- www.climatecentral.org/news/



Figure 5 Arctic sea ice is a vital habitat for the polar bear.

[Credit: Expedition Voyage Consulting/ EYOS Expedition]

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IMAX Sydney, at Darling Harbour, is open every day. More than 8 storeys high, it has the world’s biggest cinema screen to give the ultimate film experience. IMAX films are entertaining and educational. They constantly change and cover a range of themes. Resource materials & teacher guides are provided.


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WINNER: Stephen Debrincat, Mitchell High, won an IMAX Sydney family pass for *SciTalk* No. 2–2015.



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To find out more about Fun Park Excursions for schools, go to the *Physics is Fun* website at: www.odlumgarner.com

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

WINNER: Hanadi Barsoum, Georges River College - Penshurst, won a Luna Park Sydney family pass for *SciTalk* No. 2–2015.



Looking up to the heavens during Term 3

... Robert Garner

As winter progresses towards spring, the nights will remain cold – so dress warmly to view the night skies. Remember to tape some red cellophane/tissue paper over your torch to view your sky chart or planisphere, as red light will not affect your night vision.

The Planets

Mercury is visible in the eastern predawn sky early in July. However, it drops closer to the Sun with each passing day as it approaches its superior conjunction with the Sun on 24 July. Mercury then moves behind the Sun and reappears in the western evening dusk sky in early August. It will be close to Venus and Jupiter. It will be near the crescent Moon on 16 August and again on 15 September. The second half of August and the first three weeks of September this year provide the best opportunity for viewing Mercury. Being the closest planet to the Sun, Mercury can never appear very high in the sky. It will be a little higher each evening until 4 September when it is 27° east of the Sun. After that, it will descend a little each subsequent evening as it heads towards its inferior conjunction with the Sun on 1 October when it moves between the Earth and the Sun.

Venus starts July very close to Jupiter in the western evening sky. They will stay within 6° of each other for July. Venus appears lower in the western sky each night and will disappear in the Sun's glare by mid-August, as it approaches inferior conjunction on 16 August when it moves between the Earth and the Sun. Venus will reappear as the morning star at the end of August in the eastern pre-dawn sky. It will remain as the morning star until June 2016.

Mars cannot be seen in July as it remains close to the Sun after conjunction in June. It will appear in the pre-dawn sky in August but remains in the twilight and hard to see until early September when it will be visible in the eastern dawn sky. On 21/22 August, Mars crosses the Beehive Cluster – if you have good pair of binoculars or a small telescope, you will observe at least 75 stars in this cluster.

Jupiter starts July with magnitude -1.8 compared to the brighter Venus with magnitude -4.7 . Jupiter moves across the constellation, Leo approaching the bright star, Regulus with the closest approach of the two at 0.4° on 11 August. Jupiter will soon disappear from view as it is approaching conjunction on 27 August and will reappear in the pre-dawn sky in mid-September. Towards the end of September, Venus, Mars and Jupiter will all be visible together in the constellation, Leo.

Saturn will be high in the north-eastern sky after dusk in July. In August, Saturn will be high in the sky through the early evening providing good viewing conditions over this period. Saturn will set by around midnight in August and September. On 22 August Saturn will be near the First Quarter Moon and on 19 September it will near the crescent Moon.

Equinox

The spring equinox occurs at 6:21 pm on 23 September.

Constellations

The dominant winter constellations are *Scorpius* (the scorpion) with its hook-shaped tail and bright, red heart (the red star Antares), and *Sagittarius* (the archer) whose bright stars form the teapot asterism. These two constellations will be high overhead in the sky each night, and will not be setting until the early hours of the morning. *Scorpius* will appear below *Sagittarius*.

Crux (known as the *Southern Cross*) will be high in the south-west. On a clear, moonless night it should be possible to see the Coal Sack Nebula. This interstellar cloud of dust and gases will appear as a dark region that lies between the stars, α Crucis and β Crucis, the two brightest stars of *Crux* – so try looking for the Coal Sack

Nebula close to the new Moons on 13 August and 10 September. The colourful Jewel Box cluster of stars (NGC 4755) is easily visible to the naked eye as a hazy object (of fourth-magnitude) about 1.0° southeast of the first-magnitude star β Crucis in *Crux*. However, it is worth using binoculars or a small or large telescope to view this, which will reveal that it is actually a group of many stars showing distinctly different colours. This star cluster is considered by many astronomers to be one of the finest objects in the southern sky (see Box 2). Its brightest stars are supergiants.

Above *Crux* is the constellation *Centaurus*. The two brightest stars in *Centaurus*, α Centauri and β Centauri are better known as the 'pointers' for *Crux*. Although these appear as single stars to the unaided eye, α Centauri is a binary star and β Centauri is a trinary star. This constellation also contains Omega (ω) Centauri, the brightest globular cluster as visible from Earth and one of the largest known. To the naked eye, this appears as a faint fuzzy patch, but it actually is a cluster of about ten million stars. Omega (ω) Centauri is also a good object for you to aim your binoculars towards.

Meteor showers

Meteor showers are best viewed under dark skies, and preferably without the Moon. The Perseids, active from around 17 July until 24 August, are predicted to peak about 12/13 August and so their viewing will be favoured by a new Moon. The zenith hourly rate for the Perseids has often been around 90 meteors per hour in the past.

The Southern Taurids, active from 10 September until 20 November, are predicted to peak around 10 October. These often produce colourful fireballs and will be best seen from late evening to early morning.

Using a Sky Chart / Planisphere

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

Box 1: Sky Charts & Planispheres

- You can download free sky charts each month to explore the night sky from: www.skymaps.com/downloads.html Make sure that you scroll down 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 – make sure it is for the Southern Hemisphere. While the site itself is out-of-date, there is a planisphere (star wheel) to print and use at: <http://members.ozemail.com.au/~starrylady/resources.html>

MACQUARIE UNI OBSERVATORY & PLANETARIUM PUBLIC FRIDAY NIGHT OBSERVING

The Macquarie University **Astronomical Observatory** (access via Gymnasium Rd) is open to the public every Friday night (March–Dec inclusive), plus some Thursday nights. It opens 8–9.30 pm (in AEDT) or 7–8.30 pm (in non-AEDT). Bookings are essential and must be made online at: physics.mq.edu.au/community-schools/observatory/ If doubtful weather, check online after 5 pm.

There are also **planetarium sessions** on the first Thursday of each month (Mar to Nov) from 6:30–7:30 pm at Macquarie Uni. Tickets must be booked online at: physics.mq.edu.au/community-schools/planetarium/

Australian National Titration Competition is on again in September 2015

The Australian National Titration Competition has been conducted throughout Australia since 1984, with approximately 150 teams taking part in the National Finals each year. In 2014 the Dr Trevor G Appleton Memorial Award was commissioned. The school that wins the National Titration Competition will hold this Award for a year.

Teams that have achieved highly in their Regional Titration Competition are invited to take part in the National Finals of the Competition. The supervising teachers of the chosen teams will be informed of the local details by the Regional Coordinators. In most metropolitan regions, the Regional Coordinator will liaise with schools to run the Competition at a central venue. In other regions, teachers liaise directly with the National Coordinator who sends samples to their school. These teams complete the analysis on their school campus.

The three hour task involves two weighed samples of a solid acid (potassium hydrogen phthalate). The Standard Sample is used to standardise a dilute solution of sodium hydroxide. The difficulty of the analysis is increased by the addition of a small amount of insoluble barium sulfate to the Unknown Sample. Teams are judged on the accuracy with which each member determines the amount of

acid present in the Unknown Sample.

This competition is usually held in September each year. Detailed information about the competition can be found at: <http://schools.raci.org.au/competition/titration/>

2014 competition results

Congratulations to all the NSW schools that were selected to enter the 2014 National Titration Competition – seven of these schools were in the top 33 places: SHORE School (5th & 7th), Sydney Grammar School (9th), PLC (19th), Georges River College (20th), Holroyd HS (23rd) and James Ruse Ag High (32nd).

The Dr Trevor G Appleton Memorial Award went to Marymount College in Queensland.



Box 2: Getting a better perspective of the Jewel Box cluster

(a) The Jewel Box cluster and the rich star field in which it nestles



(b) A close up view of the Jewel Box cluster



(c) An even closer view of the Jewel Box from the Hubble Space Telescope – showing several bright, pale blue supergiant stars (on the left), a solitary ruby-red super-giant (upper right) and a variety of other brilliantly coloured stars, as well as many much fainter ones.



[Credit: Images are from ESO/NASA/ESA and were taken by: (a) the MPG/ESO 2.2-metre telescope at ESO's La Silla Observatory in Chile; (b) the Very Large Telescope at ESO's Paranal Observatory in Chile; (c) NASA/ESA's Hubble Space Telescope.]

Views of Pluto

These images of Pluto were taken by the Long Range Reconnaissance Imager (LORRI) aboard NASA's New Horizons spacecraft. The first image was taken on 11 July 2015, while the second image was taken on 13 July 2015 when the spacecraft was 768,000 kilometres from the surface. This view is dominated by the large, bright feature informally named the 'heart', which measures approximately 1600 kilometres across.



NASA's New Horizons mission has answered one of the most basic questions about Pluto – its size. Pluto is 2370 kilometres in diameter.

[Image credit: NASA/JHUAPL/SWRI]

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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 18 September 2015.

SciTalk 2/15 winner: Ian Mavin, Hastings Secondary College - Westport, won a *Pearson Science New South Wales Stage 5 Combo Pack* (rrp\$89.95), published & donated by Pearson.



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Also available as a 2009-2014 book (see page 7)

QUIZ QUESTION: Name the process that allows O₂ to enter and CO₂ to leave an alveolus.

SciTalk 2/15 answer: *New Horizons*

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SciTalk

SciTalk is a quarterly newsletter for secondary Science educators. Now in its 21st year, it has been produced by Odum & 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.

Copies of *SciTalk* are also available at:

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CONTRIBUTIONS

SciTalk is due into schools mid-term. All contributions for *SciTalk* should be directed to the Editor (contact details are below).

CLOSING DATES

- *SciTalk* No. 1–February 2015 ... Dec 19
- *SciTalk* No. 2–May 2015 ... April 2
- *SciTalk* No. 3–August 2015 ... June 26
- *SciTalk* No. 4–October 2015 ... Sept 18

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