IOP Institute of Physics
Education *Supporting Teachers*

Classroomphysics

The newsletter for affiliated schools
June 2007 Issue 1

Paperclip Physics Competition 2007: Girls from Sutton High School explain the physics of bubbles.

SciCast Physics: a new competition for students

"I must admit that when I was teaching we didn't do competitions. It wasn't just that I didn't think my students would win but it was more that I didn't think writing an essay or producing a poster would really get my students excited about physics."
Daniel Sandford Smith

As a replacement for Paperclip Physics, SciCast Physics is going to be different. It's a competition that you and your students (of any age) will being part of. You won't need to take students anywhere (unless you want to) and it will reward the imagination and creativity that's needed for someone to be a good physicist.

SciCast Physics is part of Planet SciCast, which is an online, mini-science-movie-making competition run by Planet Science and the Engineering and Technology Board. The Institute of Physics SciCast Physics prize will encourage good communications and teamwork. We hope you will be entering to take part rather than to win, but to win a SciCast Physics prize you should:

- produce two minutes of video to explain a physics concept rather than simply demonstrate it (e.g. tell us why you can stick a kebab skewer through an inflated balloon without it popping instead of just showing that it's possible).
- remember that the judges will be looking for creativity, imagination and ingenuity as well as an explanation that a non-scientist can easily understand.
- show physics in a broader context; in life outside the lab.
- use correct physics.

SciCast Physics films will be judged regionally by panels including a physicist, a non-scientist and a teacher. As well as receiving a regional prize, winners will have the chance to win the national award.

All of the competition entries, accompanied by a written description, will be available at www.planet-scicast.com, which is intended to become a useful resource for teachers and to provide engaging material for young people – a *YouTube* of the science world.

To find out more about the competition, as well as to see some of the films that have already been made, visit www.planet-scicast.com/physics. The closing date for videos for SciCast Physics is 4 January 2008 and national prizes will be awarded during National Science and Engineering Week in March 2008.

"SciCast Physics is a real opportunity to highlight to young people how imagination and creativity are important elements of physics and I'm looking forward to seeing the entries."
Dr Robert Kirby-Harris, chief executive of the IOP

In this issue

Editorial

Welcome to the first edition of our relaunched newsletter, *Classroom Physics*. Our aim is to keep you informed about the meetings, resources and other support that the Institute of Physics offers to all teachers of physics, whether you are an experienced specialist or an NQT who is struggling to make your physics lessons more enjoyable and relevant to students.

Affiliated schools will receive the newsletter four times a year and you should expect the next edition some time in September this year.

This issue has a special feature on choosing a GCSE textbook (p4). The advice given here is the result of a close investigation into all that is on offer, following consultation and discussion with a group of teacher reviewers.

In addition, we aim to offer some starter ideas and practical tips for the 11–16 age range that might be useful for your lessons (p7). On the back page of this issue is a photocopiable worksheet that provides you with a fun way for your class to delve into the law of reflection.

If you have any comments or requests for future issues, do get in touch. **Clare Thomson**, editor, tel 020 7470 4981, e-mail clare.thomson@iop.org.

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Events

EVENTS FOR TEACHERS

33rd Stirling Physics Meeting: 100 Kelvin – Physics is Kool

University of Stirling
6 June
The largest meeting for the physics teaching community in the UK.
Organized by the Institute of Physics in Scotland, http://scotland.iop.org
Details and booking form: Leila Solomon, e-mail leila.solomon@iop.org

19th Rugby Physics Meeting

Rugby School
7 June
For all teachers of physics in schools and colleges. A mixture of information, stimulation and communication.
Details and booking form: Leila Solomon, e-mail leila.solomon@iop.org

Physics: Enriching your AS/A2-Level Teaching

The Cambridge Centre, Villiers Park, Foxton, Cambridge CB22 6SE.
26–28 June
The latest research and developments, particularly in nuclear physics. Tutor Martin Freer, professor of nuclear physics at the University of Birmingham, will be supported by expert practitioners as guest tutors.
The £325 fee includes accommodation, meals, refreshments and course materials.
Organized by Villiers Park Educational Trust in partnership with Headstart
Details and booking form: www.villierspark.org.uk; Villiers Park, 01223 872601, vp@villierspark.org.uk

Annual Liverpool Physics Teachers' Conference

University of Liverpool, Chadwick Laboratory
28 June
This free event will include workshops, discussions and an exhibition to provide extra background for A-level and GCSE, plus the opportunity to question a panel of experts. Talks will cover the LHC, how science works, and ICT and physics teaching.
Programme: http://www.liv.ac.uk/~iop/PTC/index.html. Details: David Cox, e-mail davidcox@physics.org

Preparing to Teach Advancing Physics

University of Birmingham, Department of Physics and Astronomy.
3–5 July
Introduction to AS, 3 July; introduction to A2, 4 July; technicians course, 5 July
These will cover all aspects of teaching and learning, including sessions on coursework. Special rates are available for early bookers and schools affiliated to the Institute.
Booking form: Anastasia Ireland, e-mail anastasia.ireland@iop.org

Physics Update: a Course for Practising Teachers of Physics

School of Physics & Astronomy, Cardiff University
6–8 July 12.30 p.m. Friday – 1.00 p.m. Sunday
This includes an evening visit to Techniquest, with a fun lecture, a buffet supper, wine tasting and a chance to view the exhibits. Residential £130 (£110 members and affiliated schools); non-residential £70 (£55 members and affiliated schools). Grants are available to help with fees.
Details: Leila Solomon, e-mail leila.solomon@iop.org, tel: 020 7470 4821

Preparing to Teach AS Salters Horners Advanced Physics

University of York
9–11 July
A residential course for teachers
Details: see the "news and updates" section of the SHAP website at www.york.ac.uk/org/seg/salters/physics; Elizabeth Swinbank, e-mail es14@york.ac.uk, tel 01904 434 537

Extreme Physics

National Science Learning Centre, York
22–23 September
A two-day extravaganza with fire walking and board breaking
Organized by the Education Group of the IOP
Details: http://www.pegresources.net/Meetings%20and%20Events/Meetings%20and%20Events.html

EVENTS FOR STUDENTS

Light Fantastic: the Science of Colour

Institute 2007 Schools and Colleges Lecture
This free lecture for 14–16-year-olds continues its tour round Britain. Dates and venues for the next few weeks are:
Furtherwick Park School, Canvey Island
26 June, 9.30 a.m., 2.00 p.m.
Details: Marion Walford, e-mail mwalford@furtherwick.essex.sch.uk
University of Kent
27 June, 2.30 p.m.
Details: Cyril Isenberg, tel 01227 823 768, e-mail c.isenberg@kent.ac.uk
Queen Mary University of London
28 June, 10.30 a.m., 2.00 p.m.
Details: Mrs Kate Shine, tel 020 7882 5051, e-mail k.r.Shine@qmul.ac.uk
University of Leeds
3 July, 10.00 a.m.
Details: Alex Brabbs tel 07795 831 434, e-mail alex.brabbs@iop.org
University of Sheffield
4 July, 2.00 p.m.
Details: John Williams tel 0114 234748, e-mail j.williams@sheffield.ac.uk
Hull Collegiate School
5 July, 10.30 a.m., 2.00 p.m.
Details: Steve Pearce tel 01482 657 016, e-mail steve.pearce@church-schools.com

Physics Challenge Day

University of Birmingham
21 June
For students studying physics, this will include a lecture on new experiments at CERN, a set of short lab challenges for teams and a problem-solving class.
Details: Lynne Long, tel 0121 414 4656, e-mail l.long@bham.ac.uk

Maths, Science and Engineering Summer School

4–6 July
University of Surrey
A free three-day residential course where students will experience a day in each of two subjects across engineering, biology, physics, chemistry, maths and computing.
Details and application form: http://www.surrey.ac.uk/EdLiaison/students/taster/; Pete Tivers, e-mail p.tivers@surrey.ac.uk, tel 01483 689 392

Pre-University Physics Course

4–6 July
School of Physics, University of Exeter
Lectures, social activities and the chance to use the sports facilities. The cost, including accommodation and meals for three days, is £90 (non-residents £30).
Details and booking form: http://newton.ex.ac.uk/pupc/more.html

The School of Physics and Astronomy Summer School

10–11 July
University of Southampton
For students considering physics and/or astronomy at university. Lectures, an evening cruise around the Solent for fun and a stay in a hall of residence.
Details: http://www.phys.soton.ac.uk/outreach/

Residential Summer School

11–12 July
University of Birmingham
For AS students studying physics and maths.
Details, previous feedback and application form: www.ph.bham.ac.uk/prospective/schools under "forthcoming events"

The MODEL Project
a resource for practical work

Students enjoy practical work and they are far more likely to engage with physics if they can see its relevance. The MODEL Project: Practical Physics at Work will help you to provide both engaging and relevant practical experiences for your students.

The MODEL Project resource provides ideas for practical physics activities with student instructions and worksheets together with guidance for teacher and technicians. The activities are supported by related video sequences, which show people using physics in the jobs that they do. The topics covered are listed in the table below.

Many of the practicals make use of new materials, such as nitinol wire, thermo film and rare-earth magnets. These can add an interesting twist to traditional experiments. Teachers who trialled the material were particularly excited by nitinol wire, which shrinks when it is heated. This property has been used in experimental work to show how muscles work. Another popular experiment has been making a simple electric motor from wire, rare-earth magnets and a paper cup.

The activities were designed for 14–16-year-olds and the resource includes links to the relevant UK specifications. The practical exercises will be particularly appropriate for applied qualifications.

- This resource has been sent free of charge to all affiliated schools. If you would like a copy, you will be sent one on becoming affiliated. (The scheme is only open to UK and Eire schools and colleges.) Affiliation costs £40. If you do not wish to become affiliated, the resource can be purchased for £30. See the "schools and colleges" section of www.iop.org for more details.

MODEL PROJECT TOPICS

Theme	Topics	Video
Harnessing Energy	photovoltaic cells, temperature and heat, thermal insulation, windmills	a physicist working at the Centre for Alternate Technology
Making a Spectacle	smart materials, using lenses, sunglasses, the electromagnetic spectrum	people working in an opticians
Sounds Good	speed of sound, acoustics, sound waves, musical instruments	researchers improving the acoustics of a concert hall
Cutting Edge Material	work done, muscles, measuring temperature	researchers working on materials
Bright Sparks	fuses, generating electricity, making motors, heating effect of a current	electricians refurbishing an office building
Physical Health	radiography, spectroscopes and spectra, colorimeters and pulse oximeters	medical physicists using various diagnostic techniques

Practical work: often the easiest way to enthuse students about physics.

Speaking volumes

choosing GCSE textbooks

In the majority of schools and colleges you've probably chosen which of the new science GCSE courses you'll teach in September 2007, but what about the textbooks that you'll use? There's a bewildering array of support material out there, so here are some suggestions of what to think about when making your selection.

From speaking to teachers from a range of schools, it's clear that textbooks are used for a variety of purposes, and this will influence your choice of book. However, publishers and writers don't always seem to have an articulated idea of what their books are for. Some attempt to be a summary and learning device, while others try to expand and explain complicated ideas. Not all authors appear to have noticed that science education has moved on, and there is often very little acknowledgement of what students may know already. Some of the published packages have concentrated on providing extensive e-resources, which may compensate for the shortcomings or limitations of the books.

Some of the things to consider when choosing textbooks are:

- the quality of the explanations, particularly for difficult concepts – are there any significant errors in the physics?
- the appropriateness of the examples used to illustrate ideas and concepts – are they up to date and relevant to both boys and girls?
- the layout of the pages and the difficulty of the language used – are they appropriate for the target students?
- the level being targeted – do you want to separate foundation and higher-tier books or to choose one that caters for a range of abilities?
- the level of differentiation that the book makes – is this sufficient if you choose a single book?
- the degree to which the content reflects students' reality – do the examples and photographs recognize the diversity of backgrounds and experience of students?
- the value of the illustrations – do they add value or just fill space?
- their overall usefulness – will they be used both in class and for homework?
- the amount and appropriateness of the questions included – are there enough questions suitable for practising calculations?
- how well "how science works" is addressed – is it done in a separate chapter or as part of the main text so that it arises out of the context under discussion?
- what is the coverage – do you need science and additional science books or separate physics, chemistry and biology texts?
- For a summary of all of the resources available, see the "Schools and Colleges" section at www.iop.org. For more details and opinions about individual books, see the reviews section in the May and July issues of the IOP Publishing journal *Physics Education*. There is also a very useful summary by Steven Chapman in the 2 June 2006 issue of the *Times Educational Supplement*.

THE BEST AND THE WORST

The best books have:

- a clear sense of who the book is written for;
- photographs and drawings that are fresh and that add both value and interest to the written text;
- experienced authors who have the skills to embrace new approaches and keep the science accurate, even if there is relatively little text.

The worst books have:

- illustrations of ancient demonstrations that may not work and have long been superseded.
- photos of familiar objects to illustrate obvious points and fill up space;
- elision of complicated ideas into one or two sentences that do nothing to explain or acknowledge that these are difficult ideas.

Help us to reward excellent teaching

A previous winner in action: Bernard Taylor, in the spotlight at the ASE annual meeting in 2006, was the winner of a Teacher of Physics Award back in 2002.

Do you know a great physics or primary science teacher? Do you have a colleague who is an inspirational and dedicated teacher? If so, why not nominate them for an Institute of Physics Teachers Award?

"I think I am doing a good job, but I never knew that other people were going to recognise that."

Nicola Waller, winner of the 2007 Primary Science Award

Particularly at a time when good science teachers are so hard to find, the Institute's Teachers Awards, which are sponsored by Corus, are a great way to acknowledge and celebrate their hard work and dedication and to give them some of the recognition that they deserve.

There are several awards available for teachers of physics and teachers of primary science. Nominations can come from a variety of sources, including headteachers, colleagues, governors, advisers, Institute branch representatives, parents and even students. Each year the winners are chosen by a panel of current and former teachers and there are no restrictions on the number that can be made.

In particular, the panel will be looking for teachers who:

- are outstanding teachers of physics;
- have inspired both pupils and colleagues;
- have made physics both exciting and relevant with an effort beyond the call of the normal timetable;
- have successfully coped with frequently revised curricula.

In addition, award winners have typically racked up a minimum of 10 years' teaching experience.

Good nominations use anecdotes and examples to bring classroom experiences to life and explain how and why the teacher makes such a difference. Evidence from current and former pupils is very helpful in illustrating some of a teacher's exceptional qualities. Instructions for making nominations are given in the box below.

"An award by the Institute of Physics is highly prestigious and any physics teacher would be delighted and honoured to receive it. My award has further raised the profile of the Physics Department."

Terence Owens, winner of a 2007 Teacher of Physics Award

NOMINATIONS

The Institute is now accepting nominations for the 2008 awards. If you know of an excellent teacher who deserves recognition, we'd be delighted to hear from you. We'd particularly welcome nominations for candidates in the primary sector. Any teachers nominated must still be teaching physics/science for most of their working time and be citizens of the UK or Ireland.

Nomination forms can be requested from Gita Tailor (e-mail gita.tailor@iop.org, tel 020 7470 4823). They can be submitted electronically or by post.

Regional events organized by Institute branches and Teacher Network coordinators

NORTH EAST

Rocket Launcher Workshop
Hexham Middle School , Northumberland
12 June, 4.00 p.m.
Make-and-take workshop to construct launcher and make rockets, and discussion on use in the classroom. Booking essential.
Details: David Featonby, tel 01661 853 552; e-mail david.featonby@onetel.net

Tour of water features at the Alnwick Garden
14 June, 1.30 p.m. (2.30 p.m. Rocket Launcher Workshop in the garden)
Free entry. Booking essential.
Details: David Featonby, tel 01661 853 552; e-mail david.featonby@onetel.net

Teachers Workshop on the Physics of Water *Alnwick Garden, Northumberland*
15 June
Workshops on water, pressure, surface tension, the Coanda effect, fountains and tornado tubes – lots to take back to class.
Details: Alison Hamer, the Alnwick Garden; David Featonby, tel 01661 853 552; e-mail david.featonby@onetel.net

Northumberland and North Tyneside Primary Science Day
Langdale Centre, Wallsend
21 June
Several workshops, including "Seeing the Invisible: Forces for Non-Specialists" and "Electricity for Primary Schools".
Details: Northumberland LEA advisors; David Featonby, tel 01661 853 552; e-mail david.featonby@onetel.net

Network meeting
Hartlepool
5 July, 4.30 p.m.
Bookings and free SEP?? materials: Ruth Wiltsher, e-mail ruth.wiltsher@physics.org

NORTH EAST

Physics Can Be Easy: Merseyside KS3 and KS4 Conference
University of Liverpool
14 June
For all teachers of physics. NQTs, PGCEs and non-specialists are very welcome.
Details: Lucas Hayhurst, lht@blueyonder.co.uk

MIDLANDS

Concepts for the Non-Specialists
Walton Girls High School, Grantham
5, 12, 26 June
Hampton College, Peterborough
25 June and 3, 12 July
A course covering forces, energy, light and sound, electricity and magnetism, and space.
Details: e-mail hjp@oakham.rutland.sch.uk

Teacher Network Physics Day
Science Learning Centre, Keele
5 July
This is the first event of its kind in the area. Please give it your full support. Places are limited, so early booking is advised.
Details: Mike Melling, email: m.j.melling@talk21.com, tel: 01782 661 740

Teacher Network Physics Day
Oakham School, Physics Department
22 September, 10.30 a.m. – 3.00 p.m.
For everyone teaching physics, including a lecture, workshops and free resources.
Fee £10, including lunch
Details and booking: Helen Pollard, e-mail hjp@oakham.rutland.sch.uk

SOUTH EAST

A Day of Physics at the School of Physics and Astronomy
University of Southampton
5 June
This free event will include a session making holograms and discussions with researchers.
Details: Ian Galloway, e-mail irg@soton.ac.uk; Trevor Plant, e-mail trevor.plant@portsmouth-college.ac.uk

A Physics Twilight Session
River and Rowing Museum, Henley on Thames
6 June
Aimed at KS3 teachers, there will be cheese and wine plus some hands-on work on forces, linked to the museum's exhibition. Topics will include Bernoulli and particles; levers, rowing and the Greek Trireme; pulleys; floating meta-centre; and balanced forces.
Small fee.
Details: Ian Galloway, e-mail irg@soton.ac.uk

Physics Teachers' Day
Queen Mary College
22 June
A free event. Update your physics knowledge; find out about our undergraduate teaching; learn about the variety of careers for physics graduates; refresh your experimental skills.
Details and booking: Laura Jackson, e-mail l.f.jackson@qmul.ac.uk, tel 02078 823 020

A Day for Teachers of A-Level Physics
National Physical Laboratory
6 July
Details and registration (and a link to the NPL page with downloads of last year's presentations) http://www.iop.org/activity/education/Teacher_Support/Teachers_Network/London/page_5267

IRELAND

Northern Ireland Physics Teachers Conference
Physics Department, Queens University, Belfast
27 June
Physics in practice: lectures, demonstrations and a chance to quiz a panel of teachers.
Details: Vida Given, e-mail v.given@btinternet.com

SCOTLAND

Kelvin 2007
University of Glasgow, Kelvin Gallery
14 November
Lord Kelvin was a giant of 19th-century science. Glasgow, where he held the chair of natural philosophy, will celebrate the 100th anniversary of his death by inviting four top scientists to look where the fields that he started are now and where they are going.
Details: www.iop.org; Claire Garland, e-mail claire.garland@iop.org

WALES

EISTEDDFOD
Flintshire and District
4–11 August
The Institute of Physics in Wales is at the National Eisteddfod this year. In the science tent will be exhibits from Lab in a Lorry and an Institute stand with some small demonstrations.
Details: http://www.physics.org/hostedpages/physicstogo/tricks.asp)
To lend us a hand during the week: Angharad Thomas, e-mail angharad.thomas@iop.org

Make and take your own Rocket Launcher and other amazing workshops outdoors
National Botanic Garden
11 July
Details: Cerian Angharad, e-mail cerian@angharad.fslife.co.uk; David Grace, e-mail dgrace@abertieifi23.freeserve.co.uk

Welsh Physics Teachers Conference
Christ College Brecon
8 October
Free for all teachers of physics.
Details: Cerian Angharad, e-mail cerian@angharad.fslife.co.uk; David Grace, e-mail dgrace@abertieifi23.freeserve.co.uk

Revision quiz: magnetism

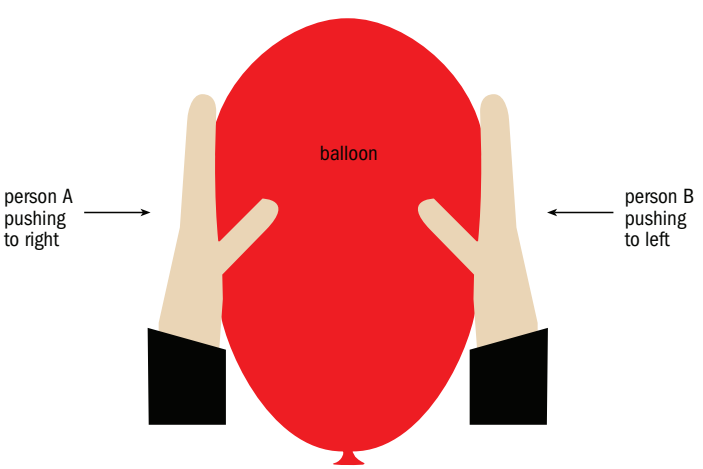
Give them the answers and then let them figure out what the questions are.

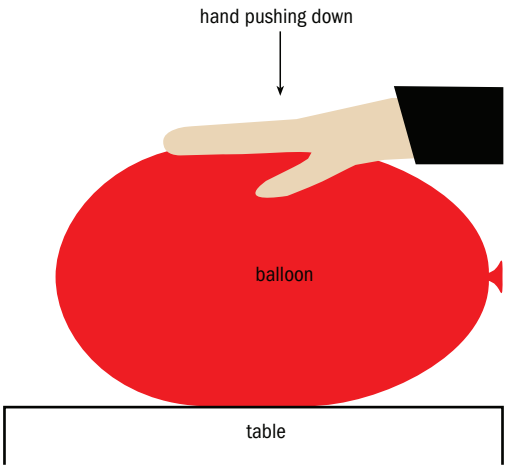
1 Iron, cobalt and nickel.
What elements are magnetic?
2 They repel each other.
What do two north poles or two south poles do when close to each other?
3 It lines up with the magnetic field.
What does a compass needle do?
4 A region of space where a magnetic material experiences a force
What is a magnetic field?
5 New 1p and 2p coins contain steel.
Why are some "copper" coins attracted to a magnet and others are not?
6 Increasing the number of coils on an iron core.
How could you increase the strength of an electromagnet?
7 Away from the north pole and towards the south pole.
Which way does a compass needle point near a magnet?
8 You end up with two smaller magnets.
What happens when you break a magnet in half?

There are various ways to use these questions, including getting students to work at them on their own or in groups. They may find it quite hard to formulate some of the questions accurately, so this should promote discussion.

Practical tips: forces

A demonstration that shows that tables and floors do actually exert a reaction force.





- Get two students to hold a balloon stationary between their hands.
- Get them to agree that they are both pushing (exerting a force) if the balloon is to stay still.
- Then push the balloon down onto a table.
- The table must be pushing back on the hand (via the balloon) to keep it stationary, as before.

Hide-and-seek with a light ray

Equipment you'll need:

- ray box
- two barriers
- three mirrors and supports
- Lego person
- blob of Blu-Tak
- ruler
- pencil

Now follow the instructions in number order.

1 Start your ray from the ray box here and place the two barriers as indicated.

3 Place the three mirrors so as to bend the light and shine it onto the hidden person.

barrier

barrier

2 Stand your Lego person on Blu-Tak here.

4 Draw on lines to show the position of each mirror and the path of the light ray.