IOP | Institute of Physics
Education *Supporting Teachers*

Classroomphysics

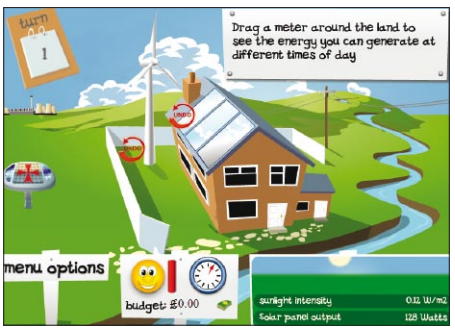
The newsletter for affiliated schools

September 2007 Issue 2

Interactive games motivate students

"If they were all as good as this, science would be great."
Comment from a student about SimSpace

Three brand-new interactive games are now available to use in your teaching of energy and space to 13–16-year-olds. They are designed to help students to engage with the physics they need to use to solve problems and win the games. In trials, three out of four pupils said they would like to play more games like these in science lessons.



SimEnergy 2: students learn about renewables.

SimEnergy 1
In this game the challenge for players is to help a family stay warm through the worst winter on record. *SimEnergy 1* simulates the factors involved in insulating a building and makes it more fun to learn the physics by taking an enquiry approach. Each of three rounds poses a different challenge for pupils to investigate:

- What everyday habits can be changed to reduce heat loss?
- Where is most heat lost from a building?
- Which forms of insulation are the most cost-effective?

Successful players in round three can be awarded an "eco-certificate".

SimEnergy 2
As with *The Sims*, the player is looking after a family and keeping their home supplied with electricity. In this scenario, the government has set a CO_2 quota for each household, thereby limiting their contribution to climate change. The player has to invest in renewable sources of electricity so that supply can match the family's demand. Along the way, they will find out which ones are cost-effective and their advantages and disadvantages. The main goal is to survive for four months, installing only one renewable per month. The supply from renewables is initially topped up using electricity from the grid but, because of the CO_2 quota, this may run out before the four months are up.

SimSpace
In this scenario, Earth is overdue for a civilisation-wrecking impact from an asteroid or comet. Players lead the effort to detect near-Earth objects (NEOs) that may be on a collision course. It's a game of increasing tension, as players are faced with evaluating many collision candidates, and trying all of the time to collect more data to establish the level of threat more precisely.

The game is based on realistic data collection and modelling tools, tracking with a telescope, modelling the object's orbit and predicting its impact. Players can estimate the size and energy of the NEO using its brightness, then decide whether they need to strike with nuclear weapons. All of this has to be done against the clock, as 30 years pass in 12 minutes and if they don't detect the killer comet or asteroid, they'll be wiped out.

For more information: www.iop.org. Click on "Schools and Colleges" to get the games. The files also contain teachers' notes and advice on using the games in lessons.

In this issue

SIMPhysics New interactive games 1
Editorial Welcome back! 1
News: Physics Updates, *physics.org*, Sun|trek 2
News: Earth Learning Idea, Science Enhancement Project, Teachers TV 3
Focus on Scotland 4
News: Physics Teacher Network, physics buskers, David Featonby (Physics Teacher Network coordinator) 5
Events for teachers and students 6
Teaching tips: Introducing waves, What if?, Odd one out, Dear Rita 7
Worksheet My pressure footprint 8

Editorial

Welcome back to the start of a new academic year. As ever, this promises to present plenty of change and challenges to science teachers all over the UK. I hope you are not feeling too overwhelmed by your head teacher's targets for the year.

This is the second issue of this newsletter going out to all secondary schools and colleges. If you want to continue receiving it automatically you will need to join our affiliated schools scheme. For more information, visit www.iop.org/activity/education/ and click on "Teacher Support".

Our front-page story is the launch of *SIMPhysics* – three brand-new, interactive student games for you to use to help to invigorate your teaching of energy and space.

We also have news of several other resources to help you in your teaching.

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Editorial (continued)

Some of them you may know about already but others are new, and it always helps to be reminded of the really useful resources that are out there. The new web-based resources to help with the teaching of astronomy and Earth science are Sun|trek (p2) and Earth Learning Idea (p3).

The Institute of Physics website, *physics.org*, has been relaunched and should prove to be a very useful resource for students (p2). There's also a reminder of what the Science Enhancement Programme (SEP) and Teachers TV have to offer (p3).

In England and Wales you may have had your first results for the new GCSE science and additional science courses, and now have the chance to reflect on how you delivered them and what you will do differently next time. Change is also afoot for September 2008 with new A-level specifications and a new Key Stage 3 curriculum. Scotland is also developing its Curriculum for Excellence, which shares many themes with the revised Secondary National Curriculum in England and Wales. Over the coming academic year there will be plenty of planning to do for these changes.

This issue has a Scottish focus – the Institute's new education manager, **Tom Dickson**, talks in depth about the current Scottish scene (p4).

Our Physics Teacher Network goes from strength to strength and **Gary Williams**, the national coordinator, explains what it can offer you in the way of support (p5). **David Featonby**, based in the north-east and one of our most active coordinators, talks about his experience as a network coordinator and the pleasure it has given him post-retirement (p5). It has been a busy summer, with lots of activities and meetings to promote physics and support physics teaching, and there are reports and pictures of some of those featured events (pp4 and 5).

Finally, there are some top tips for teachers, including several suggestions for unusual classroom activities (p7) and a photocopiable worksheet, "My pressure footprint" (p8).

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).

Improve your teaching skills with the next Physics Update

Physics Updates are three-day residential courses for physics teachers organised three times a year in April, July and December at different locations in the UK.

The lecture component of the programme is devised to update participants on innovations in physics, both pure and applied, and on curriculum matters.

Hands-on workshops provide teachers with the opportunity to experiment with new equipment, develop new IT skills, learn new experimental techniques, try out novel investigations and engage with alternative teaching and learning strategies.

They are usually held at universities, with comfortable accommodation, and are subsidised by the Armourers and Brasiers Company in association with the Institute. They are always popular with teachers of all ages and experience, and they are a great opportunity to improve your skills, network and enjoy a stimulating environment.

The next Physics Update will be at the Department of Engineering, University of Cambridge, on 7–9 December 2007.

For more information: http://www.eng.cam.ac.uk/news/stories/2007/physics_teachers/ has a detailed report on last year's course. To apply for the next Physics Update, contact Leila Solomon, e-mail leila.solomon@iop.org.

physics.org site gives physics mass appeal

The *physics.org* website has been redeveloped, giving it a new look and navigational structure.

The site now features changing content to complement Institute of Physics outreach activities for the general public. This includes regular features about various aspects of physics and answers to common physics questions. It is well worth recommending *physics.org* to your students.

There are five main sections:

- Explore;
- Interact;
- Study;
- Careers;
- Events and activities.

The Study and Careers sections have plenty of advice to offer secondary students, while the Explore section helps users looking for information on a specific topic.

As the number of quality physics resources on the internet grows, the site aims to act as a guide to the bewildering amount of information out there – there's a database of more than 4500 hand-picked sites.

Another section of the site, Interact, features interactive games and websites produced by the Institute and others.

Users can find out more about the physics in everyday life in Physics Life, explore the physics of martial arts in Kung Fu Science, or try one of Marvin and Milo's exclusive Do Try This At Home experiments.

Teachers and students will find a whole range of useful ideas for inspirational experiments and interactive games to play.

For more information: www.physics.org (or access the site from the Institute's homepage: http://www.iop.org).

Solar space project launches spectacular new site

The Sun|trek website has gone live. Take a trip into space and find out about the star on your doorstep, the place it has in our universe and the part it plays in our lives.

Aimed at 10–14-year-old students and their teachers, this site is about the Sun and its effect on the Earth. Sun|trek has been produced by a team of UK solar researchers and teachers. It contains spectacular images and movies (from solar space observations), which can be downloaded for classwork. Much of the material relevant to the "Earth and Beyond" part of the curriculum and also covers environmental issues, such as alternative energy sources.

Sun|trek can also be used to illustrate many physical concepts, such as electromagnetic radiation (UV and X-rays); waves; magnetism; and energy and gravity. It is narrated by "solar guides" (who are young solar researchers).

The website also contains classroom projects and ideas, together with links to other educational websites.

The project is led by Helen Mason, University of Cambridge, and funded by STFC.

For more information: www.suntrek.org/.

Earth science team's teaching ideas go global

The Earth Learning Idea team will be publishing a new idea for teaching Earth science every week during the International Year of Planet Earth 2008. The ideas are for use in classrooms that have minimal resources, and they should develop scientific understanding and thinking skills. Each one will encourage discussion through a blog to develop a global network of those interested in Earth science education.

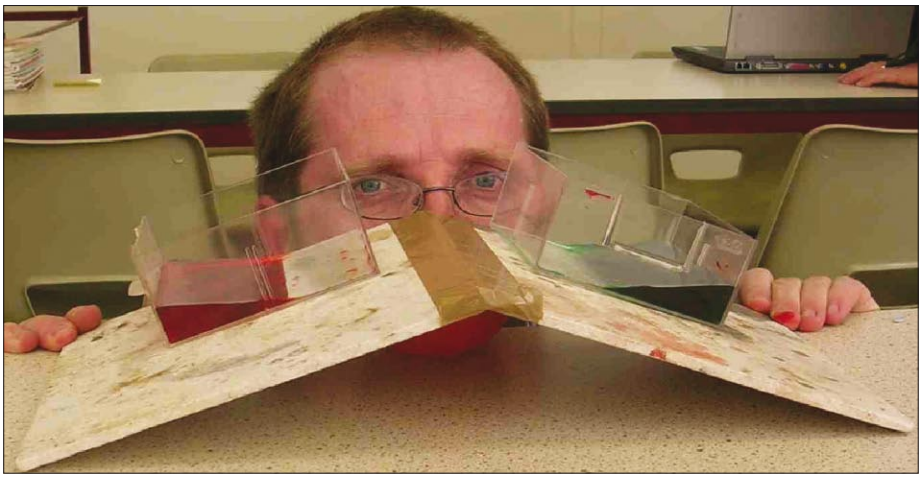
We think we have Earth learning ideas that will particularly interest physics teachers and teacher educators, such as:

- An earthquake through the window
- How heavy was the dinosaur?
- When will it blow? Predicting eruptions
- Quake shake – will my home collapse?
- Atmosphere and ocean in a fish tank
- DIY earthquake
- Building a mountain chain – cause and effect

Please help us by:

- sending the country; name; e-mail address; and institution of anybody you know who is interested in Earth science education to info@earthlearningidea.com so we can alert them to Earth learning ideas (the details we really want are those of science, geography and Earth science educators in teacher-training (pre-service education) institutions around the world, but the details of any interested teacher would be good);
- visiting http://earthlearningidea.com to see how it works and giving us your feedback through the blog, http://earthlearningidea.blogspot.com;
- spreading this information far and wide;
- giving us your moral support – we are doing this with no funding, on a voluntary basis, so we need all the support we can get.

Chris King, Peter Kennett and Elizabeth Devon, Earth Learning Idea team



When will it blow? You can predict eruptions by making a tiltmeter in class using minimal resources.

SEP offers free practical support in the classroom

The Science Enhancement Programme (SEP) was set up in 1998 by the Gatsby Charitable Foundation to develop innovative, low-cost resources to enhance secondary science education and provide support for science teachers at all stages of their career.

At SEP we are committed to creating resources that support teachers in delivering practical science education that can engage and inspire students. We develop high-quality but affordable equipment and publications – including booklets, CD-ROMs, interactive web-based projects and worksheets – all aimed at encouraging practical work in the classroom. We also support professional development through the delivery of tailored courses focused on practical work and scientific investigation.

The main support that we offer is through our free associate scheme, which offers members free publications; exclusive online resources; discounts on equipment and materials; and a growing community of more than 6000 teachers.

SEP has developed resources for investigations into modern materials; energy and power; electricity and motors; magnetism; light and optics; radiation; and, most recently, seismology. For many of these topics, we have designed and developed a range of low-cost practical equipment and materials in partnership with Middlesex University Teaching Resources (MUTR).

MUTR has previously developed equipment for teaching technology in schools, and our recent collaboration has produced a number of exciting materials for school science, which range from smart alloys to thermocolour film. By working closely with MUTR we aim to identify novel and interesting materials and to offer equipment that has been created while putting innovation and service ahead of profit.

Recent SEP resources include a booklet on *Energy Storage*, which looks at the different ways that energy can be stored, both in real-world applications and through hands-on, practical activities for KS3 and KS4. This can be used in conjunction with MUTR practical kits and the SEP-developed EnergyMeter, an innovative, affordable piece of equipment, to provide students with the opportunity to explore this key science topic.

For more information: To explore more SEP resources and to become an associate, visit http://www.sep.org.uk. Membership is on an individual basis so that all of the science teachers from one school can join and each can request the free publications offered.

Tune in to Teachers TV

Teachers TV is the only channel exclusively for those who work in schools. It is funded by DCSF but is editorially independent.

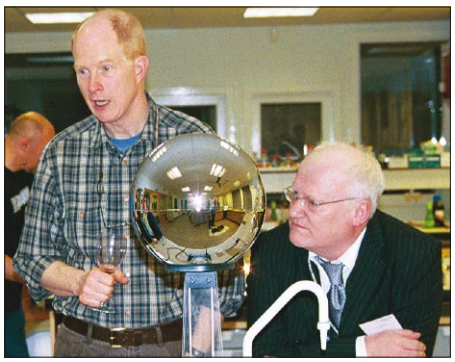
Whether you are looking for new ideas to teach physics or you need something to show in class, Teachers TV can help you. There are more than 1700 high-quality programmes on the website. These include cutting-edge documentaries, the latest education news, leading experts debating key issues and interviews with established figures from the world of education.

Teachers TV transmits 24 hours a day, seven days a week on digital satellite and cable, Freeview 88 (11.00 a.m. – 1.00 p.m. daily) and online at www.teachers.tv.

The website is constantly updated with new resources. Registration lets you download programmes and store for later viewing or for use in group CPD. There are great ideas for science lessons as well as practical solutions for common issues that arise in school.

For more information: Watch programmes online and learn how to get more involved with Teachers TV by becoming an associate at www.teachers.tv/associates (to see advance screenings, attend special events, and take part in the commissioning process).

Teachers are facing the fast pace of change



Bob Kibble (centre) and Tom Dickson (right) at the 7th Physics Summer School in Dunfermline.

The appointment of Tom Dickson to the Institute
Tom Dickson has recently taken up the post of education manager at the Institute of Physics in Scotland. He was principal teacher of physics for 16 years at Buckhaven High School before becoming science development officer for Fife Council. He has also been a Physics Teacher Network coordinator over the last three years. Dickson has worked extensively in both primary and secondary schools, and is a member of the King's College London tutor network, supporting CASE and other primary thinking skills programmes.

The Physics Teacher Network in Scotland
The network is very active, with six area coordinators, and has been able to build on the successful work of the IOP in Scotland.

The well established annual Stirling Physics meeting is the biggest gathering of physics teachers in Scotland, with more than 200 teachers attending the last meeting in June. The network also features a unique aspect – the SPUTNIK bulletin service. From this has arisen the SPUTNIK website, http://sputnik.iop.org, where registered teachers freely exchange resources to support physics education in Scotland. This has proved to be a very popular and effective means of assisting physics teachers across the country, especially in remote areas.

Scottish Schools Equipment Resource Centre
This body has an increasing part to play in supporting continuous professional development (CPD) in science in Scotland. It is the closest equivalent to CLEAPSS in Scotland. It has recently been awarded a grant from the Scottish Executive that will allow for the temporary appointment of more staff to support science curriculum innovation and development as well as increase in the programme of CPD for science in Scotland. New CPD events have been put on the calendar and will be publicised in leaflets to schools in the new academic year. The Physics Teacher Network supports these events through providing workshop content and leaders.

Curriculum for Excellence
Scotland is pursuing its biggest education reform programme for a generation under the Scottish Executive's *Ambitious, Excellent Schools* agenda. The Curriculum for Excellence (CfE) is central to this and is the programme of work that is reviewing the current curriculum. It aims to provide:

- more freedom for teachers;
- greater choice and opportunity for pupils;
- a single, coherent curriculum for those aged 3–18.

The curriculum principles have been widely welcomed by teachers in Scotland but there are still many who question how those aims and principles will be met in practice. Writing teams are busy working on content for 3–15-year-olds and several working parties from the Scottish examination board are looking at the physics content for 16–18-year-olds. There have been many well attended meetings of teachers to discuss issues around CfE. Teachers have had a positive reaction to the underpinning principles but there is mounting frustration at the delay in publishing details of the science content.

The challenge for the profession, as well as the Scottish physics community, is to develop both the curriculum and the pedagogy, while coming under pressure to maintain standards. We have to innovate and prepare our new citizens for a world that will be radically different from the one we are in today. The pace of change is accelerating and will continue to do so.

Teachers may ask themselves: "How do we prepare children for inventions and ideas that are yet to be developed; concepts that are yet to be discovered?". The answer is to be found, I believe, through an increasingly more effective collaboration between teachers and in the development of teachers' pedagogy. The Physics Teacher Network is well placed to continue to make a positive contribution in both of these areas.

Tom Dickson, e-mail tom.dickson@iop.org

For more information:
www.iop.org/activity/education/;
www.curriculumforexcellencescotland.gov.uk/.

Science centre hosts network coordinators

Tom Clark, Physics Teacher Network coordinator for the west coast area of Scotland, and Ronna Montgomery, who looks after west central Scotland, held their biannual meeting at the Glasgow Science Centre in May. This event, which attracted more than 130 physics teachers from all over Scotland, has become something of a tradition in the last few years and is enjoyed as an evening of information, fun and enjoyment, and the chance to meet and talk with other physics teachers.

A packed agenda was interspersed with time to relax, to grab a coffee (or glass of wine) and a sandwich, and chat about the SQA exams that had just taken place, while watching the spectacular views offered by the Glasgow Science Centre in its magnificent position on the banks of the Clyde.

The programme was varied and, among many other things, energy boards from SEP were offered to each school. The sheer scale of the meeting made it difficult to gather enough of these to go round but more boards will be found for anyone who did not get one.

Phil Lavery of the Digital Learning Foundation showed his latest software and John Nunn from NPL demonstrated his Virtual Lab. This was the big attraction of the evening, especially when the teachers saw the quality of his work and were offered a free copy, with a site licence, to take for their school in exchange for an e-mail address.

Catherine Wilson, national coordinator of the Physics Teacher Network, was given a bouquet of flowers to mark her retirement. She will be missed as national coordinator but has promised to attend meetings.

Catherine Wilson and Tom Clark reflect on the success of the Physics Teacher Network.

Network offers a helping hand

If you needed help, because you were stuck with a problem in teaching a bit of physics, who would you ask? Would it be someone from QCA, SQA, DELS (insert your own favoured T & LA here)? Your local policeman?

Of course not, you'd ask a physics teacher. Now, we're little gems, and unfortunately we're about as rare at the moment, so that may mean that you're the only qualified physics teacher in your school. Even worse, there may be none in your school at all. So wouldn't it be a good idea to have an arrangment where people teaching physics could meet to share ideas, and those with a bit more experience or, expertise or fresh ideas could help those finding it a bit tough?

That pretty much describes the way the IOP Physics Teacher Network runs. We have about 35 teachers (called coordinators in their network role) across the UK and Republic of Ireland running events that essentially represent the physics teaching community helping itself. The IOP provides the money for the events and the time that the coordinators – mostly experienced teachers – spend organising activities. We've provided about 2800 training days per year so far and most have cost schools nothing.

Key to the network is that it meets local needs. These vary from area to area but one thing is constant – the physics. So that's what we focus on. As well as coordinators sharing our expertise through our own workshops, we organise day meetings and twilight sessions, giving others the chance to share their experience. We also get the occasional injection of outside expertise.

We also provide some central workshops that seem to be gaining something of a reputation for being both high-quality education and entertaining.

Who's my local coordinator then? Take a look at www.iop.org/activity/education/ and click on "Teacher Network". What workshops are available? The best person to ask is your local coordinator, but some details are available on the website.

Helen Pollard leads a workshop for teachers.

Gary Williams, National Network coordinator, e-mail gary.williams@iop.org

Michael Grehan

Kevin Murphy demonstrates pressure using tubes.

Physics buskers engage general public in Dublin

On 26 May a group of enthusiastic science teachers set up stall on Grafton Street in Dublin, armed with exciting and interactive demonstrations to engage and interest the passing public. This team of innovative teachers had already represented Ireland at the Science on Stage 1 and 2 events.

Members of the public got to take part in demonstrations of Archimedes' law of forces, with a tug 'o' war; Bernoulli's law for fluid flow, with a giant windbag; and Faraday's law of induction, with a simple motor, a vortex blower, musical straws, windmills and rockets.

The event was sponsored by the IOP Public Engagement Grant Scheme (www.iop.org/activity/outreach/), which aims to raise public awareness of physics by bringing physics to the people, inspiring and enthusing people of all ages, and reaching audiences beyond the classroom and workplace.

Science on Stage demonstrations can be found online at http://www.scienceonstage.ie/.

A day in the life: teacher network coordinator

Retiring from teaching in 2003, I had little idea of the satisfying role in store for me as a Physics Teacher Network coordinator. Working for the IOP for a minimum of half a day a week, I have had some great opportunities to share expertise with, and learn from, a range of teachers of physics.

Although sharing new ideas through regular meetings and a termly newsletter to all local schools, giving details of events, has been the focus of activity, most reward has come from working with non-specialists, particularly those in primary and middle schools. There is no doubt that there has been some "not so good" physics teaching in years gone by – just ask any primary teacher what they thought of physics. However, there is nevertheless a real hunger to master what has for many been a closed book until now.

I have been thrilled with the enthusiasm shown, the contacts made and the obvious motivating effect that the training that I have given has produced. In addition, being a coordinator has opened the door for me to join with colleagues from all over Europe, enabling me to share my ideas and to learn how things are done elsewhere.

Being retired has advantages, not least that ideas seeded can be developed over time without the constraint of having to meet 11B on Monday mornings and that I don't have the burden of internal school meetings to attend, or have to ask permission to be out to attend a conference. There is a vast array of support material now available in print and online, and having time to peruse this is a luxury I did not have when teaching full time. Against this is the problem of keeping in touch with the many changes that continue to occur in the science curriculum and of keeping my working hours to half a day per week.

The network has developed a stock of workshops that can be shared with teachers, making our job as coordinators considerably easier. One of the most exciting is been the rocket workshop, in which teachers make a compressed-air launcher with several rockets and take ideas back to the classroom.

There's so much fun in physics. It's a real privilege to be able to share some of this with hard-pressed colleagues.

David Featonby, Physics Teacher Network coordinator North-East (North)

Events

EVENTS FOR TEACHERS

IRELAND

Frontiers of Physics 2007 Teachers of Physics Annual Conference
Department of Applied Physics and Instrumentation CIT, Cork and Blackrock Castle Observatory
29 September, 9.30 a.m. – 4.00 p.m.
A day of lectures, demonstrations and workshops for post-primary physics teachers.
Details: information will be sent to all post-primary schools in advance of the conference, or contact Paul Nugent, e-mail paulnugent@eircom.net; http://www.physics.cit.ie/frontiers2007

SCOTLAND

Glasgow Science Centre Meeting
10 October, 2.00–8.00 p.m.
Among the attractions will be Lab in a Lorry and members of the physics department at Glasgow University. All of the latest physics software and gadgets from our usual suppliers will be on show.
Details: Ronna Montgomery, e-mail ronnamontgomery@physics.org; Tom Clark, e-mail tomwc_41@hotmail.com. If you would like to contribute to this or any future meeting, please use the same contact details.

East Central Scotland Network Meeting
Edinburgh Grosvenor Hilton Hotel
25 October, 6.30–8.30 p.m.
Programme details: Tom Balanowski, e-mail tom.balanowski@wled.org.uk

Kelvin 2007
University of Glasgow, Kelvin Gallery
14 November, 10.15 a.m. – 4.30 p.m.
Lord Kelvin was a giant of 19th-century science, his fundamental contributions to thermal physics, electromagnetism and optics being matched by practical achievements ranging from undersea amplifiers to marine compasses. Glasgow, where he held the chair of natural philosophy for more than 50 years, plans to celebrate the 100th anniversary of his death by inviting four leading scientists to see where the fields that Kelvin started are now and where they are going.
Details: http://www.kelvin2007.org; Claire Garland, e-mail claire.garland@iop.org

ENGLAND AND WALES

Girls in Physics: What Works, What Next?
Vanbrugh Dining Room, University of York
13 September, 10.00 a.m. – 1.30 p.m. This free event, including a buffet lunch, will involve participants in actively exploring the next steps needed to engage more girls in physics.
Organised by the Institute of Physics and the network of Science Learning Centres as part of the BA Festival of Science 2007
Details: http://www.slcs.ac.uk/network/gip07

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

Extreme Physics Course
National Science Learning Centre, University of York
22–23 September
The Institute of Physics Education Group and the National Science Learning Centre are offering physics teachers the opportunity to attend an exciting and unusual weekend course. Talks and workshops will focus on the physics of rock climbing, lasers and fire walking, and the use of video cameras in experiments.
Details: http://www.slcs.ac.uk/national/extreme

A-levels in the Market Place: Cornwall A-level Science Conference
Penweathers Centre, Tresawls Road, Truro, Cornwall TR1 3LD
3 October, 9.15 a.m. – 4.00 p.m.
With changes to A-level specifications from 2008, this is a good opportunity for science departments to take stock and review their provision. This event is a chance for a meeting of minds and an opportunity for networking. Representatives from the exam boards and publishers will be there. A £25 fee for schools covers venue costs, refreshments, lunch, administration and materials.
Details and booking form: Claire Lamden, tel 01872 323 325, e-mail clamden@cornwall.gov.uk

Welsh Physics Teachers Conference
Christ College, Brecon
8 October
This is free for teachers of physics. More information to follow.
Details: Cerian Angharad, e-mail cerian@angharad.fslife.co.uk; David Grace, e-mail dgrace@abertieifi23.freeserve.co.uk

Institute of Physics Yorkshire Branch Teachers' Day
University of Sheffield, Department of Physics
13 October
The day will consist of lectures, seminars, presentations and workshops, and it will be suitable for all levels of experience. Places are limited to 60 teachers, so book early.
Details and booking form: David Hutchings, e-mail d_w_hutchings@physics.org

Visit to CERN
23–26 October
Details and booking form: http://www.slcs.ac.uk/london (course ref W069); contact the Science Learning Centre London, e-mail enquiries@london.slcs.ac.uk quoting ref W069.

EVENTS FOR STUDENTS

Institute of Physics 2007 Schools and Colleges Lecture: Light Fantastic: the Science of Colour
This successful free lecture for 14–16-year-olds continues its tour round Britain. Dates and venues are online at www.iop.org, or e-mail joanne.page@iop.org.

Physics in Perspective
University College London and the Institute of Education
17–19 February 2008
A three-day course for sixth-formers and college students, with the aim of bringing to participants some of the excitement, relevance and fun of physics. It will consist of a series of six lectures or lecture-demonstrations. Free time is scheduled in to allow participants an opportunity to explore other aspects of London.
Details: Leila Solomon, e-mail leila.solomon@iop.org

Advancing Physics Revision Roadshow
March and April 2008 will see the return of the ever-popular roadshow, and this year it's even better. For the first time we are pleased to introduce two London roadshows to accommodate all students who would like to attend. All venues will feature sessions for AS and A2 students.
Cost: £20 per student, including revision sessions, hand-outs, lunch and refreshments. Accompanying teachers are admitted free of charge.
Details and booking form: http://advancingphysics.iop.org; Anastasia Ireland, e-mail anastasia.ireland@iop.org

Introducing waves

Have you used *practicalphysics.org*? Here is a suggestion from the website for introducing waves and an additional comment about how you might use students to model seismic waves.

Experiment: waves along a line of students

A kinesthetic experience of tranverse and longitudinal waves can help students to understand and remember what they are.

Apparatus and materials

- Students.

Procedure

Students stand side to side and link arms in a line, sending gentle transverse waves and pulses along the line.

For longitudinal waves and pulses, students all turn right (or left) and place their hands on the shoulders of the student in front, with elbows kept bent.

Teaching notes

To carry out these experiments successfully, you will need class discipline almost at the military parade-ground level. However, they do illustrate clearly the motion of particles in a medium that constitutes a passing wave.

Review for waves along a line of students

I used this experiment to illustrate transverse and longitudinal waves and to help my students understand – and, I hope, remember – why transverse waves cannot move through a fluid but longitudinal ones can. This arose out of our studying earthquake waves and wondering why P-waves can pass through the liquid core but S-waves can't.

Earlier we had looked at the difference between the two types of wave using springs, particularly a slinky, and a rope. Instead of using a spring with its linked coils, or a rope with its linked fibres, we then tried linked students. By then, having been surprised by what they had discovered with the rope, they wanted to see what would happen, so they didn't fool around. They observed that, once again, linked particles (students, this time) could convey both transverse and longitudinal pulses (we didn't bother with waves because I wanted to move on and they seemed to take the corresponding wave behaviour as obvious). We then unlinked the students and showed how a transverse motion could not be propagated but – as long as the students were not too far apart – a longitudinal one could. We concluded with a useful discussion on the limitations of the model.

Tom Hickson

Classroom activities

To vary the pace of lessons and the kind of group activities that you do with your classes, you might like to try one or two of the following suggestions.

The idea is to maintain the engagement of everyone in the class and encourage all of them to feel more confident with what can be perceived as difficult material.

1. What if?

Ask the class to close their eyes and imagine a world...with no friction, where green plants can walk around, where gravity is 10 times its value on Earth, etc...

This is good with younger classes and great for extending ideas. The more ridiculous and outside the box the problem is, the better the activity works.

2. Odd one out

Present three totally different key words then ask the class to pick the odd one out and say why that's the case. (There should be many possible answers for this to work well.)

Example

LIGHT

SOUND

WATER

It's important to make sure there are no obvious correct answers.

3. Dear Rita

This method helps to make some issues more relevant but needs time to plan. Present questions in the form of a letter on a problem page and ask your students to respond. It works well with girls, and boys find it funny too.

Example

Dear Rita,

Please, please help. I have been learning in school today about mobile phones and that they can cause brain cancer! I don't always pay too much attention so I don't really want to ask my teacher if this is true in case she has a go at me for not listening. I use my phone all the time and often lie to my mum about the amount of time I have spent on it, so she wouldn't think to warn me about the dangers. I don't want to be a geek and use my phone less. What are the dangers? Will using hands free help and will I get cancer? Please help!

A worried textaholic!

Many thanks to **Alex Pettican**, Tanfield College of Science and Engineering, who contributed these ideas.

My pressure footprint

Equipment:

- weighing scales marked in newtons
- a piece of graph paper
- a pencil
- a calculator

Useful equation:

$$\text{pressure} = \frac{\text{force (N)}}{\text{area (cm}^2\text{)}}$$

You are going to find out the amount of pressure that you exert on the ground. To do this you will need to know your weight in newtons and the area of your foot or shoe in square centimetres.

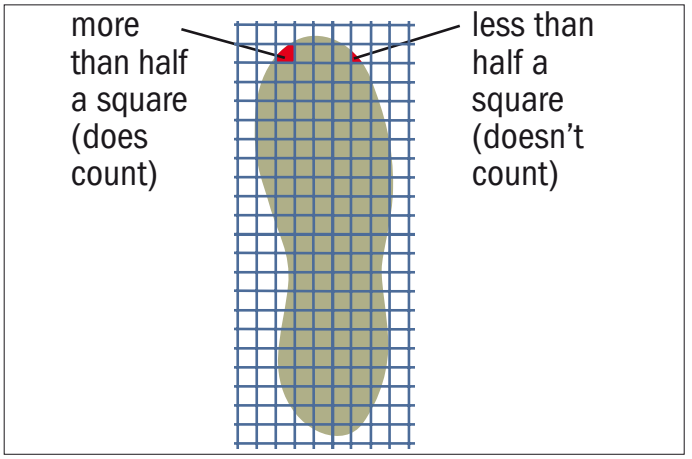
Instructions:

1. Weigh yourself on the newton scales and record your weight in newtons. Your teacher will direct you when to do this.

My weight = ...

2. Put your piece of graph paper on the floor and draw round your foot or your shoe, where it touches the ground. If your shoe has a separate toe and heel, only draw round the bits that are in contact with the ground.

3. Now start counting the centimetre squares inside the outline that you have drawn. Start by counting all of the whole squares – it might help to number them as you go.



4. Then count part squares. If more than half a square is included inside the outline, count it as a whole one. If less than half a square is included, don't count it in the total.

5. Add the totals from steps 3 and 4 above to find the area in square centimetres inside the outline.

The area of my foot/shoe in contact with the ground = ...

6. Now calculate the pressure you exert on the ground when standing on **two** feet.

$$\text{Pressure} = \frac{\text{force}}{\text{area}} = \frac{\text{my weight (N)}}{\text{2 x area of one foot/shoe (cm}^2\text{)}} = \text{.....}$$

Have you remembered to include units?

7. How does your answer compare with other peoples'? Is there a connection between height and pressure on the ground?

8. How does this compare with the pressure that you exert when pushing in a drawing-pin? Think of a way you could try to measure this.