

Classroomphysics

The newsletter for affiliated schools

December 2015 Issue 35

Resource

Teachers' top 10 practical activities

There are two types of science teachers: those who look forward to practical activities and those who don't. But hopefully all science teachers agree that they are an important part of teaching physics.

We recently carried out a poll on our online teacher forum, TalkPhysics (www.talkphysics.org), to find out which practicals teachers enjoy most. We had almost 200 responses, so thank you to everyone who completed the survey.

As it was originally intended as an informal poll, we did not provide a description of what we meant by 'practical', and the participants responded with a mix of demonstrations and whole-class practicals.

Some of the results are as expected. Who can fail to enjoy the charged atmosphere generated by a Van de Graaff – not least the teacher and lab technician team when the machine decides to work first time?

Some of the activities take some considerable time and expertise to set up, for example "Pearls of water". But they are clearly worth the trouble. And some are good old-fashioned classic physics, such as Brownian motion.

For the full results log in to TalkPhysics and search for "What are your favourite practical activities?". The details for many of these practicals can be found on www.practicalphysics.org.

Getting practical at A-level

From this September, the way that practical physics is assessed and reported at A-level has changed. The awarding organisations are providing guidance and, in most cases, a pack of teacher and student notes for 12 activities.

To support this, the Institute has listed



Students enjoying a classroom demonstration of a Ruben's tube.

The TalkPhysics top 10 practicals

Teacher demonstrations

1. Van de Graaff generator
2. Neodymium magnet and copper pipe
3. Pearls of water
4. Spark detector
5. Resonance tubes (Ruben's, Kundt's, Rijke's)

Whole-class activities

1. Cloud chamber
2. Brownian motion
3. Homopolar motor
4. Dispersion of light
5. Squishy circuits

the suggested practical activities identified within the three English examination boards (AQA, OCR and Edexcel) for students to achieve the practical endorsement to their A-Level physics award. Many of the activities are common to all boards but with slightly different wording. Schools are permitted to choose alternative activities. However,

schools will then need to undertake mapping of techniques to their chosen activity and ensure that their alternatives provide the same coverage of the techniques required for the A-level physics award.

The practical skills will also be examined through the A-level written papers, which may contain questions that make reference to these techniques but could be set in the context of different practical applications.

So we have gone through our two most relevant sets of resources (www.practicalphysics.org and tap.iop.org), looking at those that correspond to these suggested practical activities and suggesting similar and related activities to help widen teachers' repertoire of classroom practicals.

For more information: on practicals visit www.practicalphysics.org and tap.iop.org. To access the IOP list of suggested practicals to support the new approach to A-level practicals, visit www.iop.org/alevelpracticals.

The latest physics education news, resources and classroom ideas – from the IOP education team

In this issue



Opening Doors

A guide to good practice in countering gender stereotyping in schools is launched.

3



School grants

IOP scheme increases grant award to £600.

4



Teaching tip

Use the context of the Bloodhound Supersonic Car in your lessons.

8

Editorial



Welcome to the winter edition of *Classroom Physics*.

The education team at the Institute is now fully into the swing of the 2015/2016 academic year and colleagues have been busy on various teacher support activities, including revamping our online physics teacher community platform (TalkPhysics.org). Watch out for the website relaunch, it's coming soon.

Affiliated schools and colleges will again receive a bumper pack of resources with this newsletter, including two "Launch your life with physics" posters (details on page 3), an updated brochure outlining all the various teaching resources and posters the Institute provide free of charge (simply e-mail education@iop.org for printed copies), and a handy outline of all the IOP physics CPD sessions that are part of the Association for Science Education's Annual Conference programme early next year.

Don't forget the Anthony Waterhouse Fellowship is also available to teachers seeking funding to work on a physics-education research project. The application window is now open for fellowships commencing in the summer of 2016. For more details, visit iop.org/waterhousefellowship.

Thank you to all those who took the time to complete our survey. We received more than 270 responses and will be reviewing the affiliation scheme in light of the feedback given by teachers. The winner of the iPad mini prize draw from the September issue has received his Apple Store voucher – we hope he enjoys his prize.

Finally, with sadness we say farewell to Eloise Kohler, who has moved onto pastures new. Happily though we can introduce Caroline Davis as our new co-editor. Caroline brings a wealth of experience as a writer and editor.

As always, we appreciate any feedback you may have via the e-mails below.

Manchi Chung, editor
(manchi.chung@iop.org)

Caroline Davis, editor
(caroline.davis@iop.org)

Teacher support

Capital Physics: increasing A-level take-up in London



Capital Physics coach Robert Birke (right) leading a bespoke CPD session with teacher Maurice Brosnan (left) at Walthamstow Academy.



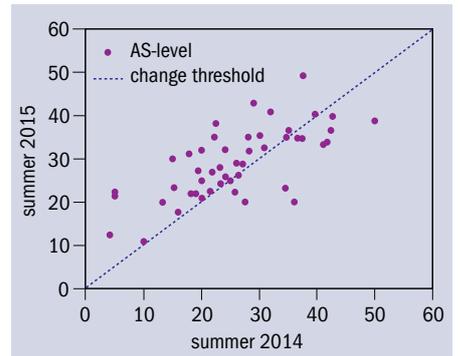
We all know that studying post-16 physics is a good thing. For example, virtually all students with physics A-level go on to university and most study a STEM-related subject.

But students' attainment is not as good as it could be, particularly across London. Access to – and achievement in – A-level physics is inconsistent in the capital's schools, and compares unfavourably to the rest of England. In 2012 there were 233 schools (64%) in London with no entries, low entries or low achievement.

So, in March 2014 we set up the Capital Physics project to address this issue with funding from the London Schools Excellence Fund. We recruited six London schools and colleges to act as the hub (or "Advocate School") for a network of 10 local schools, and then we employed IOP coaches to lead A-level focused bespoke CPD twice per term in each school.

These CPD sessions were complemented by termly "mini-conferences" held in each Advocate School and an annual day conference hosted by a London university. This programme of events in the year 2014/2015 generated 2000 teacher-hours of CPD, with 97% saying the sessions had made a positive change in classroom practice.

Now that we have some actual results,



AS-level physics UCAS points per student in Capital Physics Partner Schools from 2014 and 2015.

we can further measure its impact. We have found that in the schools we have been working with:

- 74% of schools reported improvements in results in AS-level physics
- the AS-level pass rate went up from 74% to 82%
- average progression from AS-level to A-level physics has gone up from 65% to 75%
- 70% of teachers taking part in the programme said their confidence had improved.

The Institute has secured funding for the programme to continue this term, but is now seeking funders to enable it to run for a full second year to the summer of 2016. If this is secured, we would hope to see these improvements having an effect at A-level.

For more information: and to access the project's external evaluation report, visit www.iop.org/capitalphysics.

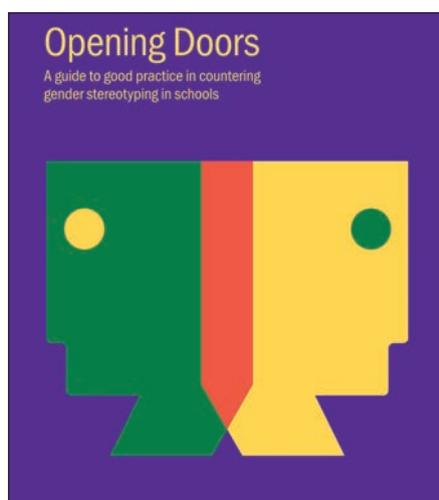
Gender balance

Countering gender stereotyping in schools

Gender still has a major influence on the subjects young people choose to study. But such stereotyping is not insurmountable, according to a guide launched by the IOP in October.

The first recommendation of *Opening Doors: A guide to good practice in countering gender stereotyping in schools* is to appoint a gender champion to the senior leadership team. His or her role is to bring the whole school together in a coherent campaign, and to get governors involved to reinforce the message to staff and students that this activity is a priority.

Other examples of good practice include raising awareness of sexist language with both staff and students, and giving students ownership of campaigns focused on countering gender stereotyping.



The *Opening Doors* report, launched by the IOP in October, aims to boost good practice in schools.

The guide was launched at an interdisciplinary conference discussing gender in education, organised by the IOP. It sparked a lively (and ongoing) debate on twitter (#OpeningDoors15), reaching more than 10 million users and spreading as far as South Africa and Minneapolis in the US.

The project was co-funded by the Government Equalities Office and the IOP. It worked with 10 schools and two networks to identify good practice and identify the barriers faced by both boys and girls in all subjects, career choices and day-to-day school life.

For more information: including an electronic version of the guide, visit www.iop.org/genderbalance. Printed copies are available by emailing education@iop.org.

Resources

Light and engineering feature in new posters

Affiliated schools and colleges will have received the latest careers resources from the Institute and Tomorrow's Engineers with this issue of *Classroom Physics*.

The two "Launch your life with physics" posters are based on the theme of light to mark this year's International Year of Light (IYOL). They feature Daniel, a lighting designer who works for theatres across London's West End and Lauren, a laser physicist who works at the Orion laser facility, which houses one of the largest lasers in the world.

The third poster, "Save lives as an engineer", is based on the aftermath of the Nepal 2015 earthquake. It demonstrates



the different types of engineering involved in disaster relief, including search and rescue, survival, rebuilding communities and reducing the impact of future disasters. The accompanying 12-page teacher booklet presents discussion topics related to this theme as well as lesson plans, useful websites and other education resources.

For more information: on IYOL visit www.light2015.org. Plus, your students can find out about how engineers are involved in rebuilding communities that have been affected by disasters at www.tomorrowsengineers.org.uk/savelives.

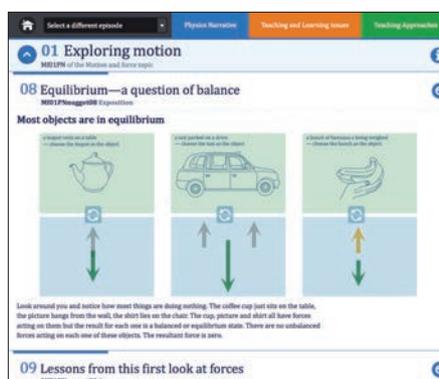
Resources

Supporting Physics Teaching expanded to include primary schools

We have extended our Supporting Physics Teaching (SPT) to cover topics for primary school teachers and their supporters. The materials are aimed at improving their confidence and competence at Key Stages 1 and 2.

Working in partnership with the Primary Science Teaching Trust, we have launched three new topics:

- Electric Loops – basic circuits, thinking about electrical charge, conductors and insulators.



A screenshot from the Motion and Force topic on the Supporting Physics Teaching website.

- Motion and Force – exploring motion and magnets and looking for forces.
- Sound and Light – seeing and hearing,

plus understanding day and night on Earth.

The topics follow the characteristic SPT pattern of being subdivided into three strands.

1. Physics narrative: an account of the physics at the level it will be taught at in the classroom.
2. Teaching and learning issues: highlights the key teaching issues plus the common misrepresentations and confusion amongst students.
3. Teaching approaches: resources, teaching tools and strategies that can be used to address the teaching and learning issues.

For more information: on these topics and the secondary SPT materials that are available online (nine topics at Key Stage 3 and three more at Key Stage 4), visit www.supportingphysicsteaching.net.

Teacher recruitment

Trainee teachers to receive up to £30k

Trainee physics teachers who win an IOP Teacher Training Scholarship for 2016/2017 will receive £30,000, the government has announced. This is an increase of £5,000 on the current scholarships, as the government continues to support the ongoing task of tackling the shortage of physics teachers.

The IOP Scholarship programme has supported more than 450 trainee physics teachers since its launch in 2011. Graduates with at least a 2.1 degree (or equivalent) in physics or a related subject are invited to apply. As well as the £30,000 tax-free award, scholars receive the following:

- mentoring from physics specialists
- free IOP membership
- events and educational trips exclusively for scholars.

If you are involved in physics teacher recruitment, please encourage any prospective applicants to visit www.iop.org/scholarships to find out if they are eligible to apply. Scholarships are available to candidates applying for university-led or school-led (unpaid) training.

In addition to the scholarship programme, the government has launched a suite of initiatives to increase the uptake of physics teaching. These initiatives are



Some of the new IOP scholars enjoying a discussion at our London celebration event in September.

part of the £67 million funding package to transform STEM teaching in England and include the following:

- **Teacher Subject Specialism Training** courses designed to enable non-specialists to take on physics teaching as an additional specialism or to retrain as a physics specialist teacher.
- **Return to Teaching** support for qualified physics teachers who wish to return to the classroom after a period of absence. Support includes one-to-one advice and school experience placements.
- **Paid Internship Scheme** to enable undergraduates to begin teacher training during their studies and to experience teaching before they commit to it as a career.

Welcome to our new scholars

In September, 110 new IOP scholars started their teacher training. We enjoyed meeting many of them at our scholar celebration events in London and Manchester, where they also met their IOP mentors and got to know each other. This year's cohort is an interesting bunch: as expected, most have physics backgrounds, but we also have 15 engineers plus an archaeologist, a zoologist and a qualified surgeon! And although more than half of the new scholars are aged below 30, there is a broad range, with about one in eight aged 50+.

For more information: about how the IOP is involved with these initiatives, visit www.iop.org/education.

Grants

Apply now for IOP and Royal Society grants

Our School Grants scheme supports projects or events linked to the teaching or promotion of physics or engineering in schools and colleges. It is run in conjunction with the Science and Technology Facilities Council and the Institution of Engineering and Technology – and for 2016 we will be increasing the maximum award available to £600.

In 2015, we funded 150 projects ranging from a Raspberry Pi arcade machine to a sundial garden. Other successful projects included planetarium shows, the construction of a Greenpower car and a weather station.

David Williams from Badminton School said, "We successfully applied for a grant to help us set up a programme to work with gifted and talented students from local primary schools. It enabled us to purchase magnetism equipment, including a superconductor and a high strength, variable gap magnet to show the



Primary pupils enjoy Badminton School's Magnificent Magnets Show.

paramagnetic properties of liquid oxygen. Girls from our sixth form have run sessions over the last six months, reaching more than 150 year-5 pupils. As well as popularising science to young, inquisitive minds, our sixth-form students have developed excellent communication skills through becoming 'a teacher for a day', and we are really grateful to the Institute of Physics for enabling this to happen."

The next application deadline is 1 February 2016 – this is for projects that will take place in the summer term.



Students at Bordesley Green Girls' School measuring a liner for their detector.

Applications are also now open for the Royal Society Partnership Grants scheme. You can apply for funding of up to £3,000 to enable students to carry out STEM investigation projects in UK schools and colleges. Application cycles run twice a year, and this round will be open until 1 February 2016.

For more information: visit www.iop.org/schoolgrants, e-mail schoolgrants@iop.org, and royalsociety.org/partnership, e-mail education@royalsociety.org.

Local CPD

School-led network triples in size

The Stimulating Physics Network (SPN) has created 10 more 'Link Schools with Advisers'. These schools provide no-cost CPD for teachers in the surrounding area, drawing on funding and experience from the IOP in supporting, developing and coaching teachers of physics.

They join five schools that were awarded this status in spring, and the 400 SPN partner schools across England.

Professor Frances Saunders, former president of the IOP, said: "This new direction of travel – enabling schools themselves to lead on teacher development while offering a framework to support the schools – meets schools' needs and enables relevant, effective and locally-tailored professional development for teachers."

- The 10 schools are:
- Bohunt School in Hampshire
 - Sirius Academy in Hull
 - Loreto Grammar School in Cheshire
 - Toot Hill School in Nottinghamshire
 - King Edward VI Five Ways School in Birmingham
 - Malmesbury School in Wiltshire
 - Townley Grammar School in Kent
 - St Richard's Catholic College in East Sussex
 - The Arnewood School Academy in Hampshire
 - Petroc in Devon.

For more information: visit www.stimulatingphysics.org/about-us.htm. Find a free workshop near you at www.stimulatingphysics.org/regions.

Teacher events

A stimulating science break at the SPN Summer Schools

How did you spend the summer break? Relaxing on a beach? Exploring a foreign city? This year more than 160 teachers attended the SPN Summer Schools in York, Cambridge and Oxford, immersing themselves in active CPD.

Teachers from 132 schools across England challenged and enriched their teaching practice through expert advice and peer learning. Led by Teaching and Learning Coaches (TLCs), our Summer Schools offer bespoke workshops, inspiring guest lectures and social activities, with all travel and accommodation costs met.

For some, Summer Schools are a chance to reinvigorate their passion for physics. For others, it is an open-minded environment in which to hone pedagogical skills. Workshops are based on the IOP's Supporting Physics Teaching (iop.org/spt) materials and emphasise not only subject knowledge, but also pedagogical confidence. From modelling the path of the sun with umbrellas to disco-ball pendulums and simple gravity models, sessions provide classroom-friendly practical tips, as well as insights into fundamental physics concepts.

Each programme is complemented by lectures from renowned physicists. Highlights include Pete Edwards, Durham University's director of science outreach, on "The Dark Side of the Universe" and Andrew Casey from the University of London on



Teachers "see sound" at the York Summer School.

"Colder = Quantum".

More than 800 teachers have benefitted from an SPN Summer School to date, all returning to the classroom with new tools to engage and inspire students.

For more information: or to register your interest in attending a Summer School in 2016, visit www.stimulatingphysics.org/summerschools. For a taster, see #SPNYork, #SPNCam or #SPNOxford on Twitter. Only teachers from our Partner Schools can attend these courses. Visit www.stimulatingphysics.org/join to apply for Partner School status.

Signal boost



STIMULATING
PHYSICS
NETWORK

ASE 2016

Don't miss out on the ASE Annual Conference, 6–9 January 2016. We're leading more than 25 STEM workshops, sharing new and innovative ideas to take back to your classroom. Our final day highlight will come from Laurence Cattermole, with **Lighting the Way: Engaging Girls with Physics**. Low-cost resources will be used to engage girls (and boys) with light, and we'll take a look at gender issues in science.

Register at ase.org.uk/conferences/annual-conference.

Sim Physics

Autumn term's digital highlight: new STEM simulations from Physics Education Technology. PhET sims are simple, interactive tools to reinforce classroom practicals across key stages. Access these resources free at phet.colorado.edu.

Activities this autumn across the regions

- Woodham Academy in Durham became our latest Partner School.
- More than 60 teachers attended SPEED 2015 in Cambridge – a full day of CPD for teachers across central England.
- West Yorkshire gained a new early-career mentor in Dan Hannard.
- Philippa Wynne (our Link School Adviser) ran a Teaching Practical Physics at KS3 workshop at Loreto Grammar School in Cheshire.
- 150 academics and practitioners attended the Opening Doors Conference in London; their findings will be used in our Improving Gender Balance programme.

Twitter



Follow us @TakeOnPhysics for the latest advice, ideas and events for teachers of physics.



Student events

Show your physics at the Big Bang Fair

Have your students carried out a practical physics project or some research that might inspire other students? The British Science Association are looking for projects undertaken by 11–14 year olds to exhibit at next year's Big Bang Fair – and we'd love to see more physics.

The projects will be shown at the Discovery Friday showcase during the 2016 Fair, which will take place at the NEC in Birmingham from 16–19 March.

If you haven't done any work like this before, our *Exoplanets Physics* resource will get you started. Full instructions for students on how to undertake 10 hours of independent research for a Bronze CREST



Award are available at: www.iop.org/exoplanets.

The Big Bang Fair will also host the UK final of the National Science + Engineering Competition, where students from across

the country who have won regional heats in 2015 will be presenting their projects.

The variety and invention of their ideas is truly inspiring, so bring your students along to see what they could do themselves. Once you have seen the competition, get your students involved by creating a project to exhibit at your regional Big Bang Near Me fair in summer 2016. They could then be the ones showing their work to more than 75,000 people at the Big Bang Fair 2017.

For more information: and to book free tickets, visit www.thebigbangfair.co.uk. To submit your project, visit www.british-scienceassociation.org/DiscoveryFriday.

Student competition

Design cheap, lightweight spacecraft shielding

The Space Science research team at the University of Kent is inviting groups of (ideally) lower sixth form students to get involved in their cutting-edge work. The challenge is to design spacecraft shielding that is cheap, lightweight and reproducible.

The winning group will be invited to spend a day at the university. The students will visit the School of Physical Sciences, where they will meet the scientists who are working on this problem and others such as: "Can life be transferred from planet to planet by meteorites?"

They will then visit the hypervelocity lab and test the shielding that they have designed using the university's Light Gas



The University of Kent's Light Gas Gun.

Gun, a state-of-the-art piece of equipment that is capable of firing projectiles at speeds of up to 16,000 mph.

The recommended group size for this

competition is four students, up to a maximum of six. More than one group can be entered per school/college but the entries will need to be different. Each student group will be required to submit a project report by 8 August 2016. The report can either be in the form of a written submission (two sides of A4 paper), or a five-minute-long video.

For more information: including the registration form for the challenge, visit www.kent.ac.uk/physical-sciences/outreach/competitions.html. If you have any particular queries contact Cordi Scott, outreach officer (e-mail science@kent.ac.uk).

Event

Celebrate the art of the physics demonstration at Demo Day 2016

To celebrate the art of the science demonstration, the British Science Association (BSA) annual Demo Day will be taking place on 17 March 2016 as part of British Science Week. The campaign focuses on encouraging secondary school teachers and technicians to use demonstrations to explore new concepts, provoke conversations and excite students.

To support your work in this area, the BSA has developed a range of resources.

- **Get Set Demonstrate** guides: bit.ly/1N2lupl.
- **Demo insights for teachers from science**



Some of the students taking part in this year's British Science Association Demo Day.

communicators pack: bit.ly/1020XBI.

● **Demo: The Movie** follows physics teacher Alom Shaha as he explores the use of demonstrations in teaching: sciencedemo.org/demo-movie.

Since its launch two years ago, the campaign has successfully run in hundreds of schools across the UK, and this year the BSA wants to make Demo Day bigger and



better than ever. It is asking teachers and technicians to pledge to run a demo so that they can be added to an interactive map which will display all the pledges from participating schools across the UK.

For more information: and to pledge to take part in the 2016 Demo Day, visit bit.ly/1Rxe5XP.

EVENTS FOR TEACHERS

Third Annual IOP Yorkshire Physics Teachers Conference

University of Leeds

5 January 2016

A day of lectures, masterclasses and workshops for anyone involved in physics teaching, with many parallel sessions to accommodate both experienced teachers/technicians and those new to the profession or in training. For details and booking: visit www.slcs.ac.uk/rp003.

Teaching Radioactivity with Confidence

Sir Christopher Hatton Academy, Wellingborough

13 January 2016

A programme of free physics CPD focussing on the topic of radioactivity to improve your subject knowledge and to try out a range of practical teaching strategies. For details and booking: contact Vanessa Forbes (e-mail forbesv@hattonacademyorg.uk).

National Space Academy Showcase Events

Ampleforth Abbey, York

27 January 2016

National Space Centre, Leicester

2 February 2016

The Academy's programmes have all been developed by a network of scientists working with current outstanding science teachers seconded to the Academy ("Lead Educators") to ensure maximum relevance to the curriculum and individual schools' needs. The showcase evening event (4.30–6.30 pm) will highlight how the programme works, and includes a free CPD session. For details and booking: visit nationalspaceacademy.org or contact Lisa Colford (e-mail nsa@spacecentre.co.uk).

WISE's People Like Me Workshop

University College London

27 January 2016

University of Bristol

(exact date TBC)

Women in Science and Engineering (WISE) are offering the opportunity for individuals to be trained in the use of the People Like Me resources. People Like Me is a novel approach for teachers and others working with young people to show girls that people just like them are happy and successful working in science, technology, engineering or maths. The training covers unconscious bias and the delivery of People Like Me resources. For more details and booking: visit www.wisecampaign.org.uk/training.



**PHYSICS
TEACHER
NETWORK**
England • Ireland • Scotland • Wales

IOP at the ASE Annual Conference
University of Birmingham
7–9 January 2016

The IOP will be leading more than 25 physics-focussed sessions at the ASE's 2016 Annual Conference. Throughout the event, there will be lots of valuable CPD opportunities, including an extensive exhibition area and drop-in activities. Affiliated schools and colleges will have received a flyer with this newsletter detailing all the IOP sessions at the Conference. Alternatively, you can see the full timetable at bit.ly/1kPD6uh. Book your place on the conference today and refresh your physics teaching: www.ase.org.uk/annual-conference/.



**STIMULATING
PHYSICS
NETWORK**

Charterhouse Physics Booster Courses

Charterhouse School, Surrey

Various dates

A series of hands-on workshops that concentrate on subject knowledge and developing understanding in the following areas: energy (quantitative approach), electricity basics, electricity and magnetism, waves and sound, and maths for GCSE physics. The sessions will use the Institute's Supporting Physics Teaching resources. For details and booking: contact Katharine Wilkinson (e-mail science@charterhouse.org.uk).

British Science Week

Nationwide

11–20 March 2016

There are lots of resources to support the planning of your school's science week. For details: visit www.britishscienceweek.org.

National Demo Day

Nationwide

17 March 2016

To celebrate the art of the science demonstration, the British Science Association's annual Demo Day campaign will be taking place during British Science Week next year. For details: visit bit.ly/1Rxe5xP.

EVENTS FOR STUDENTS

Lab in a Lorry, Wales

Swansea 12–15 January 2016

Anglesey 19–21 January 2016

North Wales 26–27 January 2016

Aberystwyth 4 February 2016

Pembrokeshire 9–12 February 2016

Powys 23–25 February 2016

This touring mobile laboratory provides students aged 11–14 the chance to explore a number of interesting hands-on experiments. For details of the venues and for the confirmed dates, please contact the Lab in the Lorry team. Details and booking: www.labinalorry.org.uk or e-mail labinalorry@iop.org.

Practical Physics Challenge for Girls

University of Nottingham

15 January 2016

A series of design–make–test challenges for teams of four year-10 girls. This event includes a separate meeting/workshop for accompanying teachers. For details and booking: contact Helen Pollard (e-mail helen.pollard@iop.org).

Year 12 Careers Conference

National Space Centre, Leicester

25 January 2016

The National Space Academy's Careers Conference links members of the UK space industry with KS5 students, making them aware of the exciting space-related careers paths available. For details and booking: visit www.nationalspaceacademy.org or contact Lisa Colford (e-mail nsa@spacecentre.co.uk).

STEM Clubs Week

Nationwide

1–5 February 2016

Find out more about STEM Clubs Week and see what schools did in 2015 by visiting www.stemclubs.net/stem-clubs-week-2015.

Your Universe Festival

University College London

10–12 March 2016

This festival will include school group tours and astronomy talks, and telescopes will be available to look at the Sun, Venus and the Moon (weather permitting). For details and booking: visit www.ucl.ac.uk/youruniverse or contact Francisco Diego (e-mail secondary-schools@star.ucl.ac.uk).

Big Bang Fair

Birmingham NEC

16–19 March 2016

The four days are packed with exciting and stimulating hands-on science, technology, engineering and maths. For details and booking: www.thebigbangfair.co.uk.

How to make a supersonic balloon car



The Bloodhound Supersonic Car.

The Bloodhound Supersonic Car was unveiled in September. The team behind it is now building up to attempt a 1,000 mph world land speed record with the thrust-driven car.

The Bloodhound engineers will need to know the thrust provided by the engines very precisely to predict the motion of the car in order to ensure that it will reach top speed over the measured mile. At top speed, the Bloodhound engineers estimate the thrust will be over 200,000 N.

A great way to explore thrust is for your students to create their own Bloodhound car – albeit powered by balloons rather than a jet and rocket engine.

Materials needed

- The template (download from bit.ly/1XPzNkK)
- Four milk-carton tops
- Two wooden kebab skewers
- Three straws
- A balloon
- Masking tape (50 cm)

Tips

The instructions are printed on the template, but here are some practical tips based on experience.

- Print the template out double-sided on thin card so you have the inside and outside of the car with a very easy outline to cut out.
- Score the fold lines before folding.
- Wheels can be problematic – we suggest kebab sticks for axles and milk-carton tops for wheels. Get your technician to spike the centre of each wheel with a sharp point and the kebab stick will then easily penetrate the wheel.
- Masking tape is better than sellotape for securing the axle tubes and the balloon to the car.
- There is a full set of instructions for the activity available at bit.ly/1ksJjvj.

Teaching notes

Use a motion sensor to obtain a velocity time graph for your balloon car and measure its gradient to find the acceleration. If you do not have a motion sensor, you can make a good estimate



A completed balloon-powered version of the Bloodhound Supersonic Car.

of the acceleration by noting that the velocity increases steadily to the point where the balloon is almost deflated. Simply use a stop watch and time the car over a measured distance to the point where the balloon is almost deflated and calculate the average velocity from distance (displacement) divided by the time. The final velocity is double the average velocity and the acceleration will be the final velocity divided by the time taken.

By weighing the car and assuming that friction and air resistance are negligible, you can calculate the thrust using $F = ma$.

For more information: the Bloodhound team have created a vast array of resources for use in the classroom: explore www.bloodhoundssc.com. If you want to go further than balloons, join the Bloodhound Model Rocket Car Challenge, visit www.bloodhoundssc.com/rocketcarchallenge. If you'd like an engineer to come and talk about Bloodhound in your school, visit bit.ly/1NPYkSO.

With thanks to Ian Galloway, Teaching and Learning Coach, for this tip.