Joining the Institute

Once you gain Qualified Teacher Status we encourage you to join the Institute in the following ways:

• If you have a degree in the physical sciences or engineering, you can apply to become an Associate Member of the Institute or, if you have an interest in but no formal background in physics, you can become an Affiliate Member. Both will give you access to IOP member benefits, such as publications (e.g. our international physics magazine Physics World), career advice, regional networks and discounted rates at meetings.

• If you are interested in subscribing to Physics World, join up as an IOP member.

For more details about joining the Institute, visit www.iop.org/membership.

The Institute also offers an affiliation scheme for schools and colleges. This entitles them to receive: Classroom Physics, Physics Education, Physics World, discounts on conferences and events, free resources and lots more. Contact affiliation@iop.org.
Dear Newly Qualified Teacher

Welcome to the physics community. Here at IOP, we believe that teaching physics is doing physics.

Let me explain:

Firstly, you will be doing physics simply by discussing physics with your students. You will be showing them what it is like to think like a physicist, helping them see the world in a physics way and, above all, demonstrating the beauty of a physics explanation.

Secondly, as a classroom teacher, you will be the single biggest influence on the physics future of your students. So you are directly improving the health and prospects of physics. This may seem a little daunting, but help is at hand through the Institute’s Education Department. We hope that you will engage with us as you develop as a teacher because we can offer support, resources and opportunities to get involved. This booklet describes just some of our activities.

We’re looking forward to working with you, and wish you well in your career!

Charles Tracy
Head of Education
Institute of Physics

Congratulations!

IOP support for NQTs

We have a range of cost-free support for all teachers who are learning to teach physics.

learning to teach physics

LTP supports early-career teachers of physics (whatever their specialism) through e-newsletters, resources and events. All trainee science teachers who sign up for IOP Student Teacher Affiliation automatically become part of the LTP programme. You can sign up online at www.iop.org/student-teacher.

A government-funded project to improve the teaching and learning of physics in England.

Regional workshops are open to all science teachers whatever your specialism, plus we offer partner schools bespoke support such as expert coaching, careers activities, residential courses and pupil support. Find out more at stimulatingphysics.org.

Talkingphysics.org

TalkPhysics is our online learning community for teachers of physics. It’s a safe space to ask questions, share ideas and access teaching resources – including Classroom Physics and the Supporting Physics Teaching materials. Join over 8600 science teachers at www.talkingphysics.org.

@TakeOnPhysics

Our Twitter feed is ideal for new teachers of physics. We use it to share ideas, events and resources: from the best physics apps to the first Vine from space, plus a new blog series reflecting on the challenges of teaching energy.

Follow @TakeOnPhysics to build your own teacher network and connect with the wider physics community.

Physics Teacher Network

We have 49 physics network co-ordinators (PNCs) in the UK and Ireland. Mainly practising or retired physics teachers, they organise and co-ordinate local CPD events and build links between school sectors, and between schools and universities. They act as a source of local physics-teaching information and generally provide help and advice in response to requests. www.iop.org/network.

School Affiliation

Make sure that your NQT school is affiliated to IOP. We currently have more than 1,700 affiliate schools and colleges. They receive our teaching newsletter Classroom Physics, all of the latest IOP teaching resources, invitations and discounts to our teaching events and conferences, access to our journal Physics Education, input into our education forum and other benefits. (There is a nominal annual fee for school affiliation.) www.iop.org/affiliation.
Our PGCE blogger’s year

Mia agreed to record her year, warts and all, as she studied for her PGCE in physics. Here are some edited highlights – any of it sound familiar? You can read her full postings and those of our NQT and Early Career Teacher bloggers at www.iop.org/ltpblogs.

September 2013 – Looking forward to starting
People say that the schools can make or break your PGCE experience so what I am dreading most is getting a difficult school. I am also nervous about the enormous workload that I have been hearing about; I am looking forward to meeting the kids and I’m trying to refamiliarise myself with the GCSE syllabus – it’s amazing how much I have forgotten!

October 2013 – My first placement
The workload that everyone warned me about is starting to creep up, but I am really enjoying the course. It’s challenging but challenge is a good thing. The best thing so far is that every day is different.

December 2013 – I’ve made significant progress
I have a job – woo! It’s at my current placement school, which gives everything a firmer approach to behaviour, which I didn’t do at the start of my diagnostic placement.

February 2014 – Second placement
I now have that familiarisation period again where I’m not doing much teaching and I’m observing different lessons. I will start by team-teaching Year 12 with the head of physics and I’m also hoping to joint-plan and deliver some lessons with some of my coursemates who are PGCE physicists at nearby schools but don’t have their own sixth form.

March 2014 – Got a job!
I have a job – woohoo! It’s at my current placement school, which gives everything a firmer approach to behaviour, which I didn’t do at the start of my diagnostic placement.

I am doing at the moment more focus as preparation for September. The interview process wasn’t that scary – we had to teach a 30 minute lesson, had a tour of the school and then an interview with the head of science and deputy head. Experiences my friends have had seem a lot more intense so I’ve got off lightly!

May 2014 – Just 14 days to go
I’m keeping my head down as it is a stressful time with coursework deadlines and exams now very close. The Year 11’s are only a week left in school so there is a slight sense of panic in the air. My classes are going well and I seem to be getting more efficient with planning and marking, meaning less work at evenings and weekends. Last week, I got my contract for September but before that, it’s the final push.

June 2014 – It’s all over
At times it felt like hell and I wouldn’t make it through it but the key for me was taking one day at a time. Looking back, the weeks have flown by and the odd disaster of a lesson was nothing in the grand scheme of things! Some people say the NQT year is much harder than the PGCE year and some much easier – I’ll just have to wait and see.

Halfway through their induction year, we asked a group of science NQTs how they were finding their first year of teaching physics. Here are some of the responses.

Best aspects?
- Being free of all of the paperwork that was involved during my PGCE.
- Having my own room, making my own decisions as to how I teach my own groups.
- One observation per half-term is manageable, much better form of feedback.

How your view of teaching changed?
I’ve realised it’s not about the work, it’s about relationships. I work in an inner city school and if you don’t take the time to build up the relationships, the learning doesn’t follow. What has surprised you most?
The state of my school’s science department – definitely not transparent at interview!
How some pupils speak to teachers: I only experienced high set classes in placements, so seeing how some of the bottom set classes behave is a surprise.

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How does IOP help you?
The Learning to Teach Physics e-mails are a useful reminder of what’s available and a reminder of where things are good. I tend to visit www.iop.org when I need resources or lesson ideas. Since our SoW are all relatively new, I go online when I need practicals to explain certain concepts.

The to-do list is never finished but everyone is in the same situation. How tired I am. I thought the PGCE was hard enough!

And lesson planning...?
I tend to design my own lessons rather than spending hours scouring others, but I use existing worksheets and rarely make my own.

I can now plan a 100 min lesson in less than 30 mins, which I’m very happy with! We have bought in schemes of work (SoW) which I adapt and take ideas from. Each lesson is my own twist on existing ideas.

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Teaching resources

Finding your own materials can be a minefield – wading through thousands of resources and checking that they are both relevant and correct. Fortunately, IOP has everything you need to teach physics at secondary level.

TAP Teaching Advanced Physics

www.tap.iop.org

Teaching Advanced Physics (TAP) offers a comprehensive set of detailed resources to help you to plan lessons for teaching physics to 16–19 year olds. Topics include: electricity; mechanics; vibrations and waves; fields; atoms and nuclei; energy and astronomy. The resources don’t assume that you have lots of equipment or advice from experienced colleagues – download them and adapt them so that they work for you.

Girls in Physics

For more than 25 years, only a fifth of students progressing on to A-level physics have been girls, despite similar success between the genders at GCSE. Addressing this imbalance is vital and early intervention is key. We have research and resources to help you become more gender aware in your teaching, so as to fully engage all your students and help them to see what physics can offer.

IOP Education Resources

These sets of videos and computer animations support teachers who are new to teaching these subjects at 11–16. They are available on our website at www.iop.org/teachingradioactivity or on DVD by getting in touch at education@iop.org.

Classroom Physics

If your school is affiliated with IOP, it will receive Classroom Physics, the Institute’s newsletter for teachers. It will keep you informed of meetings, INSET courses, resources and other support that the Institute and other organisations offer to all teachers of physics. It also includes some starter ideas, teaching tips and worksheets, particularly for 11–16-year-old students. You can find it online at www.iop.org/affiliation.

Physics Education

Physics Education is the Institute’s international journal on research into physics pedagogy. It contains informal articles about the teaching of physics, news, teaching tips and reviews of textbooks and software. It’s a great way to keep up with the latest ideas in teaching physics and to keep your teaching fresh. Affiliated schools have free access to the online archive. www.iopscience.org

Key Stages 3 & 4

Key Stage 5

Key Stage 3 onwards

Key Stages 3 & 4

Key Stages 3 & 4

Key Stage 5 and beyond
Tackling the marking mountain

Marking is one of the major pressures on all teachers’ time. It can seem like it is eating too much of your time, both inside and outside school. But there are a few tricks from the physics-teaching community that you may find useful.

Think about why you’re setting the homework

A lot of homework is set with no particular purpose other than to generate a mark and that usually means teacher marking. It’s worth asking the question — what is the purpose of homework? I imagine that most enlightened senior leadership teams would like teachers to spend time planning and would be dismayed if the marking load was getting in the way.

Research evidence shows that Assessment for Learning — giving feedback that focuses on what a pupil can do to improve — is one of the most powerful ways a teacher influences their students’ learning. There are no shortcuts as each student will have different needs but if you are going to spend time marking I recommend this approach where possible. Sometimes you do need to set homework to create a ‘mark’ for example, before a parents’ evening. But if that is your aim, is it worth you putting in lots of hours of marking? Self and peer-marking are possible, while ensuring your students engage with excellent ways to get your marking done of marking? Self and peer-marking are possibly one of the most powerful ways a teacher influences their students’ learning. There are no shortcuts as each student will have different needs but if you are going to spend time marking I recommend this approach where possible.

Set homework that is efficient and effective

As an NQT, I advise you to prioritise planning lesson content and developing your teaching skills over marking. Only then can you start thinking about homework. When that is in place, think about tests. And only when all that is working well can you realistically start working on how to get each individual student’s achievement levels up.

Physics has many mathematical elements, which can be easier to mark so homework designed to test understanding does not need to be marking-intensive. Filling in the blanks, solving problems and questions requiring short answers can test a wide range of topics and pick up where they are struggling.

Think like a physicist

I often find myself saying the same things over and over again — underline headings, put units in, results table headings, etc. So I wrote a list of all the things that crop up and put them onto a PowerPoint loop. When marking the reports, I just annotate them using a code e.g. M2 is method point 2, G4 is graphs point 4 and so on. On receiving the books the pupils have to write out the points in full as targets for the next time they write a report. I find they take the comments more seriously if they’ve written them out themselves.

To read more about marking — and to find some marking coding schemes – join the TalkPhysics discussion “Making marking less of a mountain” at www.talkphysics.org.

Fault-finding in simple electric circuits

Building simple electric circuits should be easy. But in practice, however well you and your lab technician have prepared, you’re going to need to get good at trouble-shooting your students’ attempts, says Alan Baugh, IOP Teaching and Learning Coach.

First and foremost, resist the temptation to start replacing components immediately. Look at what you have in front of you — a visual inspection may throw up obvious problems.

If you find circuits daunting, use our checklist below to help develop your fault-finding skills. Take it slowly, think logically and you’ll find you can soon get those circuits working every time.

Checklist

1. If it’s a complete bird’s nest of wiring, don’t even go there. Get the students to start again without using voltmeters. Then add voltmeters after the circuit is otherwise working properly.
2. Look for common mistakes such as:
   • incomplete circuit
   • reversed polarity components
   • a/c supply instead of d/c
   • apparently identical lamps with different current or voltage ratings
   • “Flat” batteries
3. Verify the power source (battery or lab pack) is producing the potential difference across individual components of the circuit is reasonable. There should be no p.d. across the connecting leads and contacts.
4. Use a voltmeter to check that the potential difference across potentially faulty components.
5. If you still haven’t been able to identify the source of the problem, now is the time to try swapping other common problems
   • “Flat” batteries
   • Apparently identical lamps with different current or voltage ratings
   • Connecting leads with internal breaks
   • Loose or corroded connections
   • Faulty ammeter shunts, voltmeter multipliers and “flat” internal batteries (e.g. on digital meters)
   • Finally, the most common problem of all: students. Sorry, but you can’t replace these.

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4. Use a voltmeter to check that the potential difference across potentially faulty components.
5. If you still haven’t been able to identify the source of the problem, now is the time to try swapping
Get your pupils talking in physics lessons

This may seem strange advice when others talk about class control. But it is essential to recognise the extent to which subject-specific vocabulary and technical terms are an essential part of the physics curriculum says Phil Badley, a Stimulating Physics Network Teaching and Learning Coach.

I have heard it said that pupils come across as many new words in KS3 science as they do in a modern foreign language. Pupils must be able to recognise the words, know their scientific meaning and be able to use them in appropriate scientific contexts.

This is particularly important in physics, where there are a lot of specialist words that are used in everyday talk. For example, power, work, resistance and energy all have very specific meanings for a physicist.

The development of appropriate literacy skills will take time and talk is an important element of the process. Use structured activities to encourage pupils to talk to each other about the physics they are learning.

Initial activities could involve identifying appropriate terms, sharing information from a comprehension or working together to match appropriate pieces of information. More advanced activities will take place and talk is an important element of the process. Use structured activities to encourage pupils to talk to each other about the physics they are learning.

Activity ideas

1. Identify groups of words/terms from a list and explain reasons for groupings.
2. Match appropriate cards showing terms, definitions, units, etc.
3. Give each group three different sheets of information about a famous scientist plus a series of questions that can only be answered by sharing information.
4. Talking Points – a list of 10 statements about a topic that may be correct, incorrect or just interesting. Groups discuss and then feedback their ideas.
5. Concept Map – key terms and words in a topic that the group arranges on an A2 sheet of paper and writes a link between the words.

Whatever the activity, don’t assume pupils will already know how to organise themselves or how to tackle the task.

Plan the activity carefully:
- control the groupings with allocated roles to suit the task
- give clear expectations and explicit outcomes
- demonstrate and scaffold the appropriate skills
- hold a plenary/debriefing to support learning about the content and the process.

Finally, a warning from bitter experience

Pupils who have been sitting quietly and passively in classroom-based lessons all day may need extra management when they get up for practical work or are invited to talk to each other...DON’T get put off...You may find it useful to think about energy being transferred between different energy stores during a process rather than it being converted from one form to another.

When students come to your lessons, they already have a strong idea of what energy is from everyday language. You, as a scientist, will have a more technical understanding. So, asks Jon Clarke, IOP Learning and Teaching Coach, what could possibly go wrong when you teach the energy topics in physics?

Many teachers starting out are surprised at the challenges they encounter when preparing lessons on energy. You will not be alone – the teaching of energy ideas has been debated for at least the last 50 years. So here are a few things to keep in mind.

In physics, energy is very much a book-keeping tool. Analysing energy in a system is useful because we know that it is conserved. So, we know the total amount of energy and can work out things like “How much fossil fuel do we need to burn to supply my electricity for a day?” or “How many chocolate bars do I need to eat to climb up this mountain?”

Using energy to describe a situation can make something sound scientific. But very often, it doesn’t explain anything.

Try excluding the word energy from your explanations and the processes underlying them become much clearer.

You may find it useful to think about energy being transferred between different energy stores during a process rather than it being converted from one form to another.

Find out more in the Supporting Physics Teaching Energy topic www.supportingphysicsteaching.net/EnHome.html.

For blogs about teaching energy visit www.talkphysics.org/groups/5238.


Example

Imagine a simple demonstration where you drop a set of keys and ask about the physics of the situation. Older students may want to tell you the keys have gravitational potential energy. But what does this actually tell you?

“The keys’ weight pulls them to the ground, where they make a noise.” All of this is valid, relevant physics and explains the situation well without any mention of energy. It’s only when we ask questions like, “How fast are they moving just before they hit the ground?” that it becomes useful to talk about shifting energy from the gravitational store associated with the keys, into their kinetic store. The only valuable reason to bring energy into the discussion is to answer a question that involves a calculation.