Science Spotlight

Issue 4 - January 2015

In this issue:

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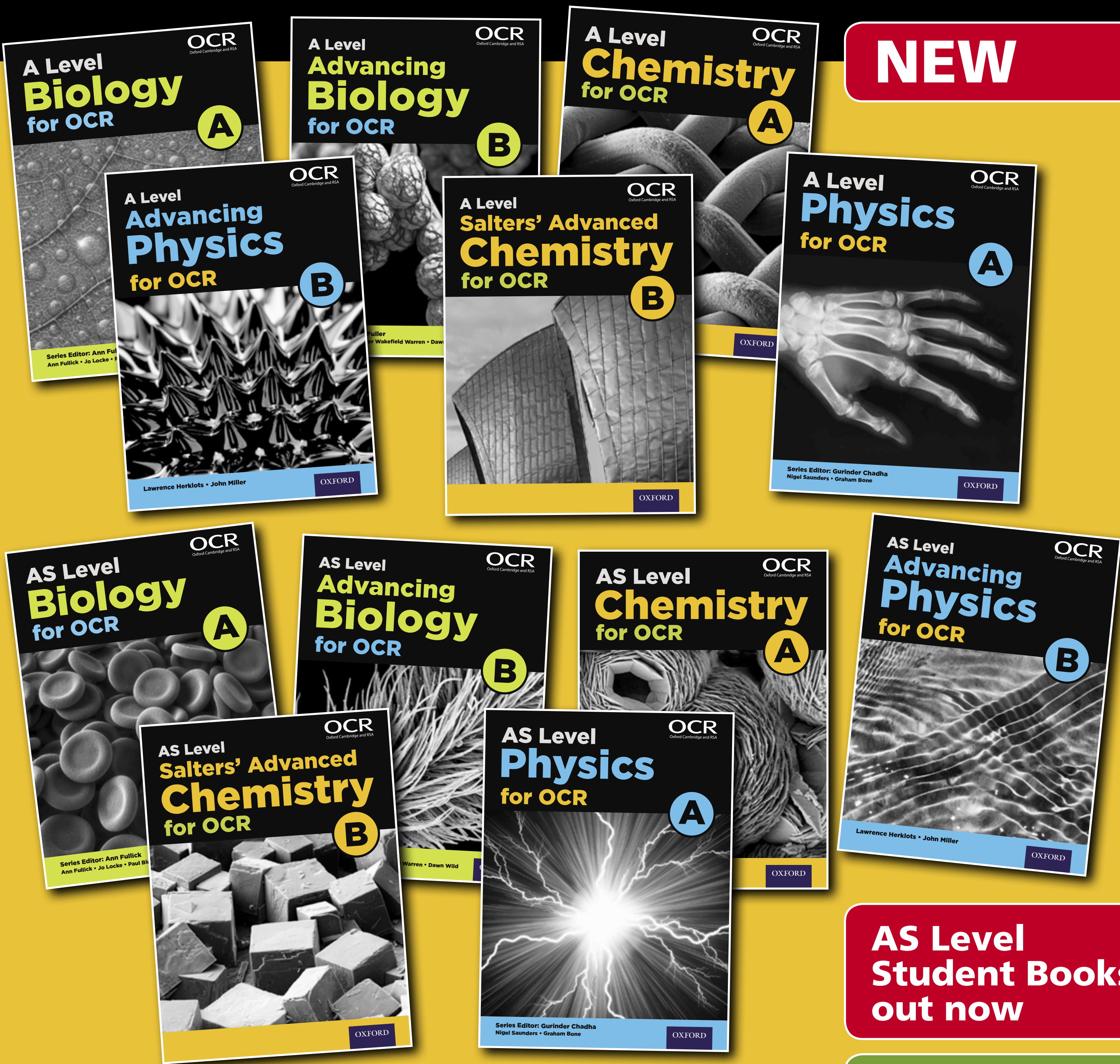

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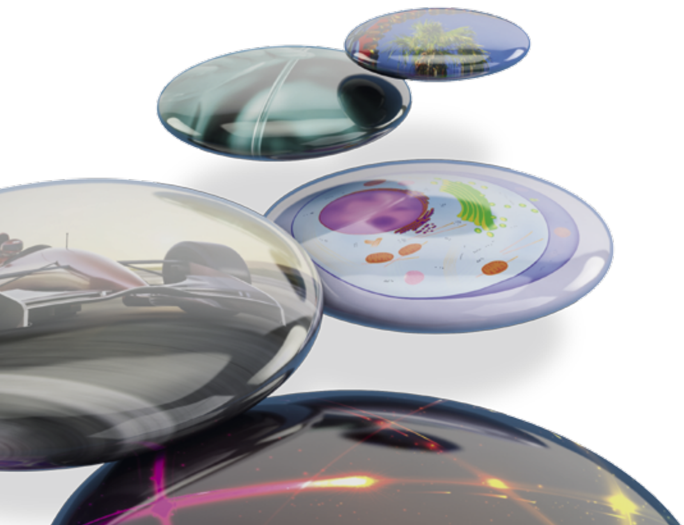
Headline

What's in this issue?



Welcome to the spring 2015 issue of Science Spotlight. Redevelopment work is now in full-flow for the GCSE sciences, so in this issue we're taking the opportunity to introduce our GCSE Subject Specialists to you. Ever wondered how we start to write a new specification? The answer is by looking at conceptual pathways, with a clear focus on identifying student misconceptions. Our article on pages 10 & 11 describes the work we have carried out to date.

This issue's pull-out resource is taken from our GCSE Chemistry resources. 'Equilibrium – the board game' provides a recently published game based lesson element to help students tackle common misconceptions around Le Chatelier's Principle, and the fact that equilibrium positions can change. We would welcome feedback on the science resources, at **resourcesfeedback@ocr.org.uk**.

We're always happy to share teachers' perspectives on the delivery of our qualifications, and we are pleased to include an article written by John Stokes, Head of Science at Gordano School, abut their use of Entry Level Science alongside GCSE qualifications. We would welcome contributions from Science Spotlight readers for future issues. It could be the experience of your best and worst lessons, a review of a valued resource, or perhaps sharing research findings from your own school or college. Please email any ideas for an article you might have to: **ScienceSpotlight@ocr.org.uk**.

Stephen Diston
Head of Sciences and ICT

Update: GCSE and A Level reform

Steve Evans, Head of General Qualifications Reform, OCR

GCSE Science update

What's happening on the draft specifications?

At the time of going to press, we're still waiting for clarification from Ofqual as to how practical work will be assessed for the GCSE Sciences. The continued uncertainty in this area clearly makes developing the new qualifications very difficult. Many teachers have talked to us about their concerns around when draft versions of the new specifications may be available, to allow them to follow their common approach of teaching the GCSE course over three years.

In terms of high-level timelines, we can confirm that the specifications are due for submission to Ofqual in July 2015 with accreditation decisions likely around September/October 2015. Draft specifications will be published online as soon as possible once they're submitted to Ofqual, most probably by the end of July at the latest. The draft criteria for GCSE Science are published (**www.gov.uk/government/collections/gcse-subject-content**) and these give a good indication of what the specifications will contain.

Interested in helping us trial materials?

We are now drafting specimen assessment materials for our two GCSE Science suites (successors to our legacy Gateway and Twenty First Century Science qualifications). Please contact us at **ScienceDevelopment@ocr.org.uk** if you're interested in being involved with trialling materials, or have any thoughts or comments around future GCSEs that you'd like to share.

A Level Science update

Delivering on Science

The end of 2014 saw the 'great despatch' of our new science qualifications to 5,830 centres including non-OCR schools around the country. Each Head of Department received a distinctive pack containing a hard copy of our new specifications for their subject and samples of assessment materials, as well as information about relevant resources and CPD for teachers. You can also find specifications and resources on our website **ocr.org.uk/science**.

Practical Endorsement – what's the latest?

Through the autumn, we've provided evidence at a Select Committee reviewing Ofqual's decision on A Level practical assessment. (www.parliament.uk/business/committees/committees-a-z/commons-select/science-and-technology-committee/news/140901-school-practical-science-/) We've also been working closely with the other awarding bodies on trialling the Practical Endorsement requirements that will be common across all boards (namely the Common Practical Assessment Criteria, record keeping requirements and monitoring arrangements). Ofqual should confirm these details early this year to allow us to let your centre know about the complete requirements for the Endorsement. Starting in 2016 we will be doing more specific trial work with our centres looking at the materials and support we've developed for our Endorsement. If you'd like to be involved with these OCR-specific trials, please email us at ScienceDevelopment@ocr.org.uk.

A number of teachers have asked about the place of an individual investigation in new the A Levels. While it doesn't form part of the Endorsement requirement, our practical guidance materials will be showing how you can use our Practical Endorsement to springboard into our Extended Project Qualification (EPQ). See the article by our EPQ Subject Specialist, Rebecca Wood, on page 21, which gives details of what we offer for EPQs.

If you have queries on any of our new qualifications or want to know more about practical assessment in new qualifications, please do get in touch.

Using Entry Level Science in my school

John Stokes, Head of Science,
Gordano School

For the past two years I have been running Entry Level Science in my school. We are a fairly traditional high-ish performing 1900 student comprehensive academy serving the town of Portishead in the West Country. We had always loved the modular GCSE courses, and had done well with them, entering all of our students for early modules and by getting them very well prepared for that first exam, reaping the rewards of that success in student motivation. But now with linear exams, we find that many students pay little attention to mock exams. This is particularly true of our lowest three sets where revision has been non-existent and the results are as you might expect! So how to motivate students right at the very start of their GCSE courses in year 9?

OCR's Entry Level Science ties in thematically with the GCSE courses we run and has been spectacularly successful. We have entered 80 of our lowest ability students (about a quarter of the year) and seen their motivation for and interest in science rise amazingly fast. The entry level course is real science but in one of its simplest forms. The basic ideas are laid out but it is up to schools to decide which activities, experiments and teaching methods to use. The various elements of the course mimic GCSE assessment, but in a gentler pattern; and there is no terminal exam. We have chunked the course down into four lesson pieces (see box):

Lesson 1	Feedback from the last test and basic ideas of the topic always with a practical.
Lesson 2	'Can do tasks' and more detailed ideas.
Lesson 3	Practice questions and a skills task (measuring, graphing, interpreting graphs).
Lesson 4	Creation of a revision tool and the test.

The cycle then repeats with the next 'item' until all topics (Biology, Chemistry and Physics) are covered. Incidentally we teach this as specialist teachers. The level of the science is not high so this is not done in any way for reasons of difficulty of material. Instead we have decided that we should bring the same spark that we have with our highest ability students studying triple science to this grouping. The fast pace of the course suits the students as there is no time to tire of a topic before moving on to a fresh one.

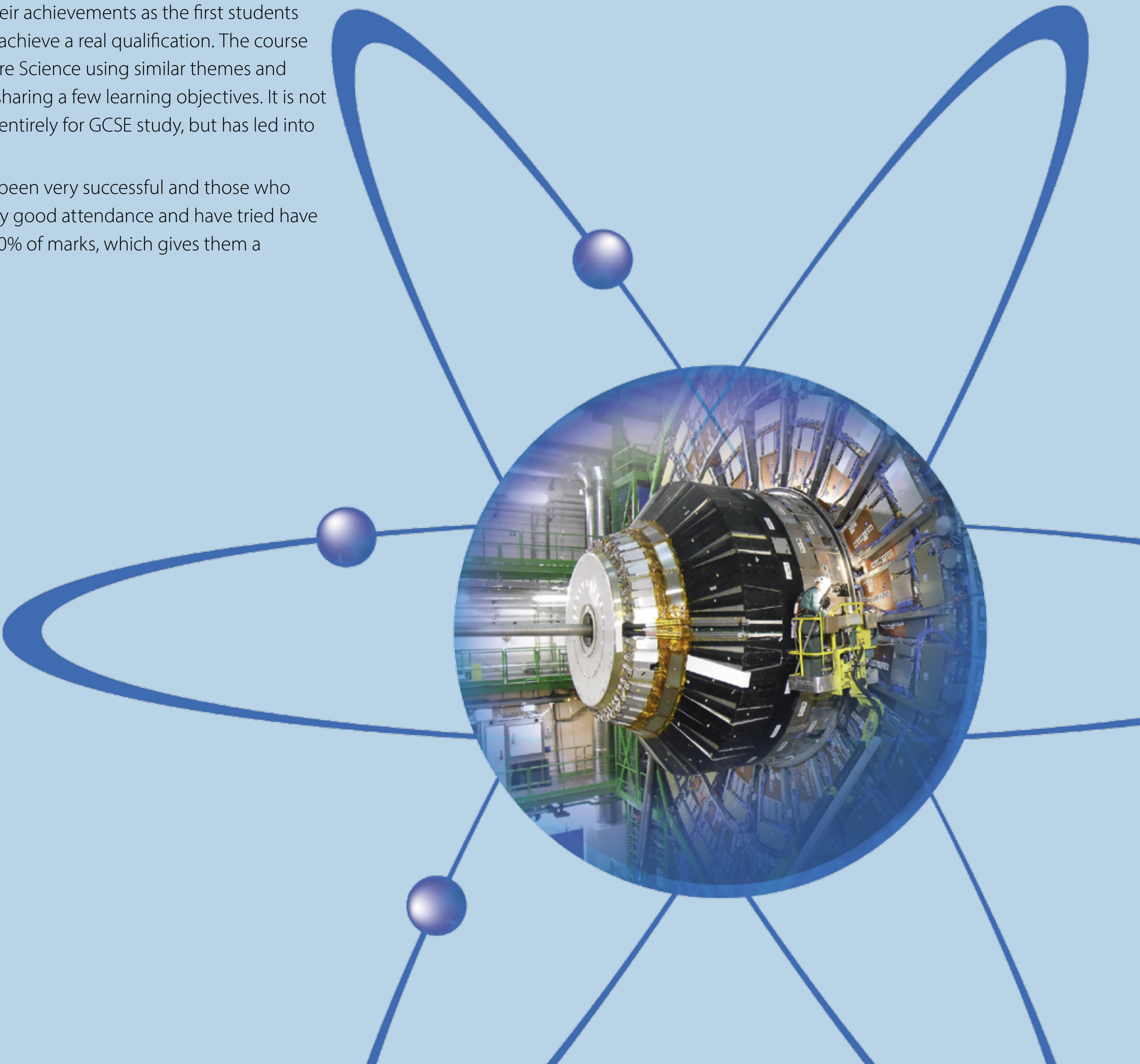
The 'can do tasks' are simple to administer and accessible to every student. For instance they might need to prove that they can separate a simple mixture of iron filings and aluminium, make a chromatogram, to measure the speed of a moving object etc.

There is a practical task which you can adapt and write for your students. We chose to do an experiment involving falling objects, but it could have been anything at all we wanted them to do practical work on. The course has clearly been written by people who understand the classroom. As a Head of Faculty I have not had to buy any new apparatus to complete the course, and can fill in any perceived gaps in student knowledge with just the right task.

The supplied item tests are short and simple, but not entirely without challenge. Students can complete them in ten minutes or so, and the questions involve a large variety of tasks involving a full range of types of answer. The best 35 test scores out of 39 count so students don't have to be firing on all cylinders every day to be successful. The good publisher resources (OCR endorsed) have helped with preparation for these, and marking of a test is straightforward. The main hurdles we have had to overcome are in tracking performance, evidencing progress and creating formative assessments. Since the course is by nature summative there is a danger that no formative marking appears and that students do not fully reflect on their learning and skills. We have insisted that the start of each cycle of lessons should begin with a reflection process where students don't merely note their score but the kinds of question they do well in and those that they are missing. Spotting patterns and reflecting on performance are skills we want all of our students to take into their GCSE years especially now that they will have all of their exams at the end of year 11.

These students have now moved on to Gateway Science GCSE courses and are far more motivated than similar students who did not study entry level. They are more confident in their skills and knowledge and are proud of their achievements as the first students in their year to achieve a real qualification. The course links well to Core Science using similar themes and language and sharing a few learning objectives. It is not a replacement entirely for GCSE study, but has led into it very well.

Students have been very successful and those who have reasonably good attendance and have tried have achieved the 80% of marks, which gives them a Gold Award.



Meet the GCSE development team

Work on the new GCSE specifications is now well underway. Here's a brief introduction to the members of our development team and the experience they bring to their roles. (You can read about the A Level development team in Issue 2.)

Ann Wolstenholme, Subject Specialist, Chemistry

Ann is lead on development for Twenty First Century Sciences. She's been working on GCSE Sciences for the past five years; first with GCSE Additional Applied Science and then on the main Twenty First Century Science suite.

Before working here at OCR, Ann worked in schools in a support role and then as a teacher, after she'd completed her Open University degree in Chemistry and Maths.

In her spare time, Ann enjoys cooking and involvement in the local village community where she lives.

Vinay Thawait, Subject Specialist, Computer Science and ICT

Vinay has taught for over 14 years, working in the public and private sector education and IT industry as a physics, science, ICT and computer science teacher for 11-19 age range students. His experience also includes working as the whole school ICT coordinator, secondary education ICT consultant, ICT and educational pedagogy trainer, VLE/MLE project lead, blended and e-Learning trainer and senior leadership in schools.

Previously, Vinay's worked for three different local authorities within school improvement services as an ICT Consultant, School Improvement Advisor (SIA) and Leader of the Building School for the Future (BSF) Procurement for IT Services. His public/private sector work includes: Capita BSF & IT Services as the BSF ICT National Bid Lead Consultant (B2B/B2C) and ICT transformation change manager, engagement manager, quality assurance controller and management of projects with large scale (£15M-£90M) ICT service transition/IT operations.

Most recently, Vinay taught computing and IT at a secondary school within Cambridgeshire. Before this, he worked as the Head of Operations India (based in England) for an AV technology hardware and educational software development company.

Natasha Chowdhury, Subject Specialist, Physics

Natasha joined our team in June 14 after working as a science teacher for ten years and leaving in a leadership position. She has responsibility for developing the physics specifications. She's hoping to produce fun and innovative resources that can be used by teachers and pupils to enhance science lessons around the country.

She has a degree in Astrophysics from Bristol University and an MA in Educational Leadership and Management. Before entering the world of education, she worked around the world in a variety of roles in the music industry, programming, sales and marketing.

In her spare time, Natasha enjoys going to see bands play, takes any opportunity to explore a different part of the world and has been known to be part of a professional fireworks crew.

Michelle Hawley, Subject Specialist, Physics

Michelle started working here at OCR on the 1st September this year. She's part of the GCSE team currently working on the redevelopment of the Gateway Physics qualification.

Before starting here, Michelle spent six years as a physics specialist science teacher, teaching pupils aged 11-18 in Hertfordshire and Essex. As a teacher, Michelle enjoyed the opportunity to inspire future scientists as her teachers had done for her. She now looks forward to having the chance to improve the teaching and assessment of science on a larger scale through her work here.

Outside of work, Michelle's a busy mum of two children, a daughter aged 4 and a son aged 20 months. She hopes they'll both inherit her love for science and education.

Rob Leeman, Subject Specialist, Computer Science and ICT

Rob's leading on the development for GCSE Computer Science after working on the A Level. Rob was previously Head of ICT and Computer Science at a secondary school in Cambridgeshire and has taught and managed A Level IT in his previous roles. Rob also used to work in IT support before he started teaching and is a keen proponent of Open Source.

In his spare time he likes to exercise his dogs, indulge in crossfit, airsoft, diving and clay pigeon shooting.

Crawford Kingsnorth, Subject Specialist, Biology

Crawford's currently working on the development of the Biology GCSE Gateway Suite. He was, until recently, a Teacher of Science and Head of Faculty. He's passionate about teaching by novel approaches, particularly when used to open science up to students that are currently disaffected by the topic.

Before teaching, Crawford worked as a Higher Scientific Officer for the Civil Service at Horticulture Research International and Rothamsted Research. He has a Microbiology degree from the University of London and a D.Phil. from the Department of Plant Sciences, University of Oxford, where he investigated transcription factor induced gene regulation in filamentous fungi.

During his spare time he plays the 96 bass accordion and Irish bouzouki in both a ceilidh band and with a three piece group. He's also been known to do the odd Morris dance or two. When he has any time left over, he's trying to maintain his 1967 Series 2a Landrover and an MGB GT with his daughter.

Puj Ladduwahetty, Subject Specialist, Chemistry

Puj has a Masters Degree in Chemical Engineering and a Post Graduate Diploma in Computer Science. He worked in Cambridge Assessment for several years within the Operations division before moving on to join us at OCR, where he's been a Subject Officer, a Qualifications Manager and now a Subject Specialist. He was responsible for the very popular Suffolk Science course and more recently, for the Gateway Science Suite.

Puj is currently leading on the development of the new Gateway Science Suite, which he hopes will enthuse candidates of all abilities and inspire them to go on to further education and other science-related careers.

Outside work, Puj likes to spend time with his family enjoying a good walk in the countryside and visiting stately homes.

Chae Cruickshank, Subject Specialist, Geology

Chae is the Geology Subject Specialist and also a member of the GCSE science team. He joined us at OCR in April after working as a Field Studies Tutor and Earth Science Tour Guide in Iceland for eight years. Chae has a passion for hands-on geology and active learning to inspire students.

He has a degree in Environmental Science from University of East Anglia and spent three field seasons in the Arctic studying glacial sediments, where on one occasion he almost mistook a snoring German palaeontologist for a polar bear. Chae worked as a Marine Geologist and Geophysicist in the Middle East and Africa on a range of shallow and deep water projects. During this time he was a member of the first commercial team to use 3D seismics for shallow risk assessment in the North Sea.

Chae spent nine years as a classroom teacher in Norfolk before the lure of learning outside the classroom drew him back to the field. He loves to cook and believes that no fact is insignificant. After seven years living in the Scottish Highlands, Chae's learning to appreciate the Chiltern Hills where he gets to practise loud singing while out on his mountain bike.

The big questions – developing a conceptual pathway through KS4 Science

When the Department for Education first announced the potential reform of the Science National Curriculum and GCSEs in science subjects, we took the opportunity to carry out a wide-ranging research project in this area. As part of Cambridge Assessment, we're committed to using education research as well as carrying out our own research to inform our qualification and resource developments.

Getting back to basics

The aim of the project was to develop evidence-based conceptual pathways in science subjects that would identify common student misconceptions and barriers to progression. In essence the question we explored was – starting from first principles, what should a science curriculum contain and how should it be structured and phrased?

The project drew on two main areas of evidence:

- An in-depth mapping and review of the curriculum content for science subjects in international jurisdictions that have demonstrated high performance in international tests such as PISA (Programme for International Student Assessment) and TIMMS (Trends in International Mathematics and Science Study).
- A large-scale review of research evidence about teaching approaches, common misconceptions and how students learn.

Where we started

The first stage of the project involved extracting and coding up the science curriculum content across all available age ranges from high performing jurisdictions including: Australia (2012), Alberta, Canada (2003), Singapore (2001), Hong Kong (2007), New Zealand (2007), Finland (2003), Massachusetts, USA (2006), and the USA National Standards (1996). The science frameworks for PISA (2009) and TIMSS (2011) were also included as well as, for national context, the England 1999 and 2007 National Curriculum content.

For control and comparison, we also included a number of international jurisdictions that have high ratings on the Human Development Index but aren't considered to be high performing in science in international tests. A curriculum doesn't, of course, exist in isolation so we also collected a vast amount of information about the education system, assessment structure and background social context of each jurisdiction included in the study.

Moving on to mapping

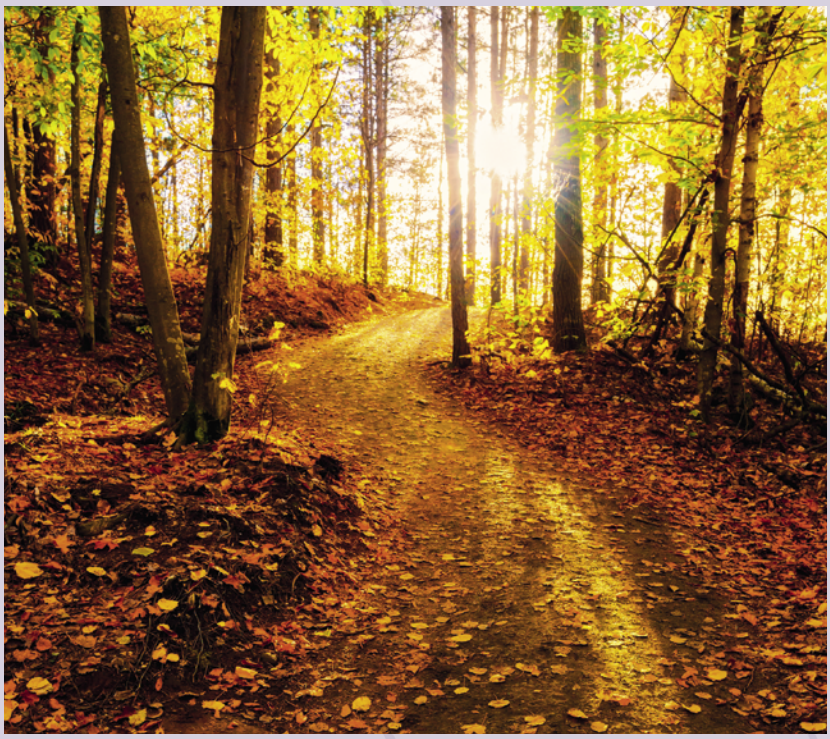
Each individual curriculum statement was coded by jurisdiction, year of curriculum implementation and age range. A small team then worked on mapping the individual content statements against a backbone of the England 1999 curriculum. The first phase involved direct mapping of content in each age range and then a second phase identified where content was introduced earlier or later in different jurisdictions. This mapping enabled us to directly compare when and how the same topics were introduced in different jurisdictions.

We brought in education experts with extensive experience in science education research and teacher education to review the international statements and carry out a process of optimisation. The way in which each individual topic was represented was examined and what were considered 'optimal representations' were selected or constructed from the range of international statements. This created a full list of statements that incorporated what was considered to be best international practice in terms of how to represent the topics in a way that makes the level of demand clear and avoids misleading implications.

Constructing a conceptual pathway

To build conceptual pathways through each subject, additional experts were brought in to review the optimised statements in the light of an extensive collection of logged science education research on teaching approaches and how students learn. This included identifying key dependencies in terms of understanding concepts (e.g. where certain concepts required prior understanding of other concepts) and common misconceptions that could be addressed through specific wording and ordering of statements. The conceptual pathways were then reviewed by a wide number of teachers, university representatives and other members of the science education community and are being used in the redevelopment of our GCSE Gateway Science Suite of qualifications.

The conceptual pathways themselves aren't intended to represent a restrictive teaching order – instead they provide a framework in which we can present the content of our Science GCSEs in a way that highlights the fundamental concepts and exposes common misconceptions/barriers to learning within the subject.



Q & A: meet the Science Examiner

We interviewed Julie Gauntlett, a Science Examiner, and asked her about her role.

Q: Julie, could you tell us a bit about yourself?

A: I have been teaching for almost 30 years, starting my career in a mixed comprehensive school in Hampshire. I am currently Assistant Headteacher in a Federation of a boys' and a girls' school in the North West and I teach OCR GCSE Gateway Science, Additional Science and Chemistry across both schools. I became a GCSE Assistant Examiner for OCR in 1993 and from 1999 worked as a Team Leader before being appointed to my current role as Principal Examiner, responsible for setting and leading the marking of papers, in 2008. I have also worked as a GCSE Coursework Moderator, and Team Leader, for 14 years before giving up that role in 2011 (to spend a little bit more time with my family!).

Q: What made you initially sign up to be an examiner?

A: As a young teacher of science, keen to further my career, it did not take much persuasion from my then Head of Science to join her in applying to be an examiner. She was convinced that examining work would benefit me professionally and would bring departmental benefits in terms of teaching. That has certainly proved to be the case. My husband and I had also just bought our first house and the extra money certainly came in useful!

Q: How do you manage to fit it in around being a full-time teacher?

A: I won't deny that the exam marking season can be very busy, juggling examining and school work. However, provided you are disciplined, it's not a problem. Before I begin marking, I prepare by making sure that I am as on top of my school work as possible. The marking period itself only lasts for about 4 – 5 weeks and coincides with Year 11 and Year 13 being on study leave so my time at school is a little more flexible.

Q: What do you enjoy about being an examiner?

A: Examining has given me added confidence as a teacher. I am secure in the knowledge that I am interpreting the specification in the way that it will be examined. When students ask me "So what might a question on this topic look like?" I am able to immediately draw on a wealth of past exam questions that I remember marking to illustrate what they might be asked.

Even though only the Senior Examiners attend standardisation meetings, examiners still have telephone contact with their Team Leader. I thoroughly enjoy the interpersonal aspects of the role and have made some great friends during the years that I've been examining for OCR. I get a tremendous amount of job satisfaction from examining. After all, if it wasn't for the teachers who mark GCSE and A Level exams how would our students get the results that we work so hard to prepare them for?

Q: How has it changed the way you teach?

A: The most recent redevelopment of the Gateway specification saw the introduction of 6 mark questions, which are marked using a level of response mark scheme. By learning how to apply these mark schemes I think I've been able to take the 'fear' out of these longer questions for my own students. I often write sections of sample answers at Levels 1, 2 and 3 for my students, which they then have to build into answers at each level using the mark scheme. This gives them an in depth understanding of what is required to achieve 6 marks. Students are often surprised that you don't necessarily have to write a long answer to gain full marks. It's about understanding what the question is asking and not waffling! I am also meticulous in teaching my students key terms and phrases, which I know will secure the marks in the exams.

Q: What are some of the challenges of being an examiner?

A: Time management can be tricky, juggling school work and examining. However, provided you are organised and plan your time then it's not a problem. In order to maintain the consistency and accuracy of marking, it's important to mark at a steady pace during the marking period, rather than rushing as marking deadlines approach. You have to be able to always apply the mark scheme accurately, even if there are times when you don't entirely agree with an aspect of it. The Senior Examiners attending the standardisation meeting will have spent a long time considering the mark scheme and a large range of candidates' answers. The job of an examiner is not to question the Senior Examiner's decisions, but rather to apply them to the marking process.

Q: What support do examiners receive?

A: Examiners receive thorough training in the consistent application of the mark scheme. Through a process of marking practice scripts, then standardisation scripts, examiners become familiar with the mark scheme and receive feedback and guidance on their marking (via telephone conversations and in writing) from their Team Leader. This enables them to become confident that they understand the mark scheme before they mark the test scripts prior to being approved to mark. Examiners then receive feedback on 'seeding scripts' throughout the marking period, ensuring that their marking remains consistent and accurate. An examiner always has someone to refer problems to – their Team Leader. A Team Leader can consult the Principal Examiner, and the Principal Examiner can consult the Chief Examiner. There's a clear line of support so that any difficulties are resolved swiftly.

Q: Would you recommend examining to others?

A: Absolutely! I honestly believe that the benefits of examining, both on a personal and school level, cannot be underestimated. I have been able to share my expertise with colleagues, talking specifically about the specification and giving advice on the interpretation of mark schemes. It's effectively free 'in house' training. I can advise my students about the pitfalls of particular questions, giving examples of key misconceptions around topics and the kind of answers that fail to gain credit. When it comes to marking mock exams (a chore for many teachers), I already have an expert knowledge of the mark scheme and am able to advise the department on its consistent application. My colleagues often comment that I am able to mark mock papers faster than they can, as I am already very familiar with the mark scheme. Teachers are increasingly required to make expert grade predictions for their students and I am able to do that with a unique insight and knowledge. I've also been able to mentor new staff and develop their confidence in preparing students for examinations.

For more information about becoming an examiner, please visit **ocr.org.uk/i-want-to/become-an-assessor/**
or e-mail **assessor.recruitment@ocr.org.uk**.

CHALLENGE

$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$

Temperature increases.
Forward reaction is exothermic.

Move 1 space.

EQUILIBRIUM

You take off the lid from the pop bottle allowing gas to escape.

Move 2 spaces towards the product.

CHALLENGE

$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$

Pressure decreases.

Move 2 spaces.

EQUILIBRIUM

Additional Nitrogen added in Haber Process.

Move 3 spaces towards product.

CHALLENGE

$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$

Pressure increases.

Move 1 space.

EQUILIBRIUM

Iron Thiocyanate (product) is added to the reaction between Iron and Thiocyante ions.

Move 1 space towards reactant.

CHALLENGE

$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$

Temperature decreases.
Forward reaction is exothermic.

Move 2 spaces.

EQUILIBRIUM

Catalyst speeds up forward and reverse reactions at the same rate.

Miss a go.

CHALLENGE

$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$

Concentration of steam increases.

Move 2 spaces.

EQUILIBRIUM

$2NO_2(g) \rightleftharpoons N_2O_4(g)$

Temperature increases move 2 spaces towards the reactant as reverse reaction is endothermic.

CHALLENGE

$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$

Catalyst added.

Who Moves?

EQUILIBRIUM

$2NO_2(g) \rightleftharpoons N_2O_4(g)$

Temperature decreases move 2 spaces towards the product as forward reaction is exothermic.

EQUILIBRIUM

$H_2O(l) \rightleftharpoons H_2O(g)$

Dew forms on leaves in the evening.

Move 2 spaces towards the reactant.

EQUILIBRIUM

$CH_4(g) + H_20(g) \rightleftharpoons CO(g) + 3H_2(g)$

Pressure increases move 2 spaces towards the reactant.

EQUILIBRIUM

$H_2O(l) \rightleftharpoons H_2O(g)$

You use the car fan to demist the car window.

Move 2 spaces towards the product.

EQUILIBRIUM

Ammonia is removed from the Haber Process reactant vessel.

Move 1 space towards product.

EQUILIBRIUM

$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

Calcium Carbonate is heated in an open system. Reaction moves to completion.

Move 2 spaces towards the product.

EQUILIBRIUM

Catalyst added.

Miss a go.

EQUILIBRIUM

$CH_4(g) + H_20(g) \rightleftharpoons CO(g) + 3H_2(g)$

Pressure decreases move 2 spaces towards the product.

EQUILIBRIUM

Pressure in the pop bottle increases.

Move 2 spaces towards the reactant.

This is a sample of the GCSE Chemistry lesson element 'Equilibrium'. To download the full lesson element visit the GCSE Chemistry qualification page at http://www.ocr.org.uk/qualifications/gcse-twenty-first-century-science-suite-chemistry-a-j244-from-2012/

Equilibrium
the Board Game

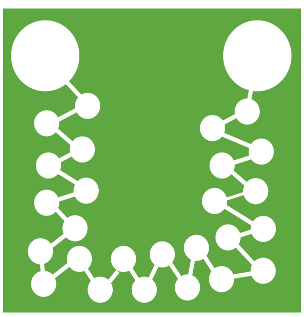
This board game attempts to tackle common misconceptions around Le Chatelier's Principle as students sometimes find it difficult to grasp the idea that Le Chatelier's Rule is about disturbing the equilibrium and driving the system to a new equilibrium state.

The key aim of this activity is for students to consider the impact, on the direction of the equilibrium, of changing various conditions by introducing the factors which can be of importance.

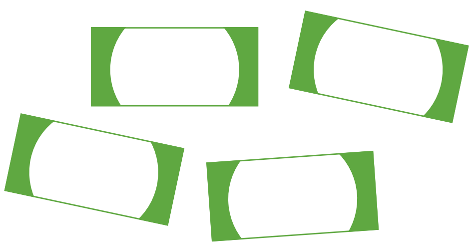
- Students work in pairs (two taking on role of reactants and two taking on role of products)
- Reactant pair throw the die and move the counter around towards the product circle. They repeat their turn three times
- Product pair then join in throwing the die and moving the counter towards the reactant circle.
- Then each team takes it in turn to move the counter
- When players reach an 'Equilibrium' block on the board they select a card and follow instructions
- Challenge questions require candidates to make a decision about how conditions affect the equilibrium position
- The game should be played for around 15 minutes or until one party reaches the other end
- Players then answer some questions relating to the game format.

Resources required per group:

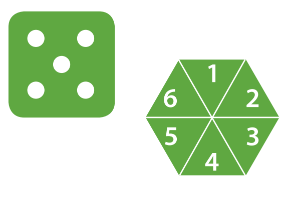
Laminated Equilibrium board

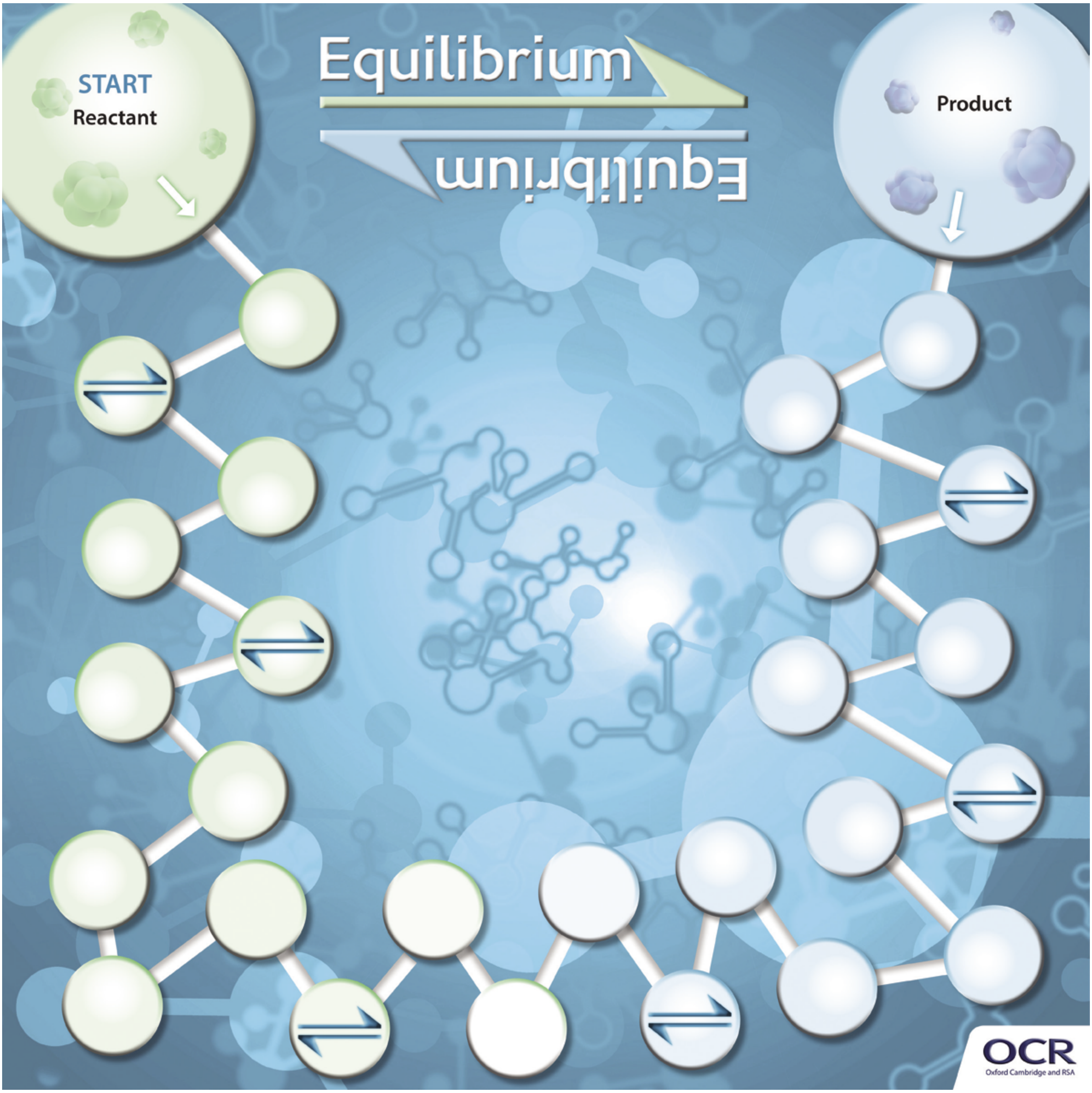


Laminated Equilibrium cards



1 die or spinner and a counter





Equilibrium the Board Game

Rules

- You will need one die and one counter.
- Mix the Challenge and Equilibrium cards up and place them face down in the centre of the board.
- Work in pairs (two taking on role of reactants and two taking on role of products).
- Reactant pair throws the die and moves the counter around the board towards the product. The reactant pair then throws the die a further three times and moves the counter with each throw.
- Product pair then starts rolling the die and moving towards the reactant.
- Take it in turns to throw the die and move towards your goal.
- When you reach an 'Equilibrium' block on the board select a card from the centre of the board and follow the instructions.
- If you get a Challenge question you need to make a decision about how the conditions on the board affect the equilibrium position. If you want to, you can pass on a Challenge question.

The game should be played for around 15 minutes or until one party reaches the other side.

Follow up questions

1. Why do you think the reactants players are allowed a 'head start?'

2. What is meant by exothermic and endothermic?

3. Why is the thermal decomposition of calcium carbonate not normally considered as a reversible reaction?

4. Describe the factors that affect the equilibrium position.

5. Why is it important to understand the impact of these factors on a reaction?

6. Why were both teams allowed to move when a catalyst was added?

7. Explain the link between equilibrium and rate of reaction.

'B' Different

Consider our new Science 'B' specifications for all these reasons…

Sarah Old and Neil Wade, Subject Specialists, OCR

At OCR, we're committed to continuing to offer alternative A Level specifications for physics, chemistry and, most recently, biology. These B specifications have been developed over time with input from professional bodies such as the Institute of Physics, the Institution of Engineering and Technology (formerly the Institution of Electrical Engineers) and the Salters Institute.

What are B qualifications?

These qualifications were established to give an alternative approach to each subject, providing knowledge and techniques that can then be applied to problems linked to a variety of contexts. The qualifications are thus particularly well suited to linear assessment.

In the current specifications, practical investigation has a key role in the development of understanding, with requirements for research projects and extended investigations. These extended investigations don't suit all centres, due to limitations in timetabling, the use of a variety of equipment and the substantial technician support required.

A Practical Endorsement with flexibility built in

The requirement for an extended investigation is now gone and has been replaced by the Practical Endorsement, which is common with our other specifications. Our endorsement is written in a way that allows those who favoured the existing structure, such as the physics sensor project in Year 12 and opportunity for a full investigation in Year 13, to continue with these. However, these no longer contribute to the A Level grade and will need to be supplemented with further short practical tasks.

The endorsement allows practicals to be embedded in the teaching and learning, overcoming the need for longer periods for practicals, a large variety of equipment and extended technician time.

The B specifications may be different to the more standard approach at A Level, but those who take them aren't in isolation, with over 20,000 candidates studying the B specifications last year. They're not a qualification taken by the majority of students, but are taken by a significant minority.

Dispelling the myths

Myths about the B specifications are that they're harder to pass than other qualifications, or don't suit students likely to achieve an E grade. However, the truth of the matter is that it's the specification of choice for some of the country's top schools. The awarding process, overseen by Ofqual, establishes comparability of exams over time and comparability across specifications, such that any student's expected to achieve the same grade whichever exam they sit.

There's much discussion and support around these specifications with many experienced teachers dedicated to maintaining the style and ethos of the courses. We're committed to supporting this with opportunities to meet and network with other staff teaching B specifications.

'B' different, consider the possibilities of our B specifications.

What is Salters A Level Chemistry? How is it different?

Chris Otter, Project Director, Science Education Group at the University of York

Salters A Level Chemistry is a unique course with an established history in the world of science education. It was first examined in 1991 with a cohort of approximately 300 candidates rising to 17,500 studying the course across the two years of the course in 2013.

Central to the Salters course is the philosophy that chemistry takes place in the world around us. Using this idea the course has been developed as a context led programme. In order to access the necessary chemistry, students are introduced to content through what are called **Chemical Storylines** (called **Chemical Ideas** in the student resources). These **Chemical Storylines** cover a wide range of contexts, from art restoration to drug synthesis, from the use of alternative fuels to the formation of the Universe.

The **Chemical Ideas** are introduced on a 'need to know basis' to enable the student to understand the storyline. This means that the same concept can be revisited and developed through a number of different **Chemical Storylines** (or modules). The course has been planned so that student understanding of chemical concepts develops gradually, giving them the chance to consolidate thinking before moving on to more advanced aspects of that concept.

You can see an example of how one concept, intermolecular forces, is developed in the current edition of the course in the table below. The concept is gradually established via a range of different contexts, such as dissolving polymers for use in hospitals for laundry bags through to understanding why some different dyes attach to different fibres. The latter context brings together all of the ideas relating to intermolecular bonding, so consolidating learning.

Teaching module	Area covered	Context
Elements of Life	Bond polarity	What are we made of?
Elements from the Sea	Temporary and permanent dipoles	Halogens and halogenoalkanes in the sea
Polymer Revolution	Hydrogen bonding	Dissolving polymers
The Oceans	Hydrogen bonding in water	The role of the oceans in global temperature control
Colour by Design	Comparison of all IM bonding	Fabric dyes

To support student knowledge and understanding the course materials also include a range of activities. These can be practical work, investigative work, card sorts, guided research activities or group work activities. All of these student resources are coherently integrated, allowing students, teachers and technicians to see at a glance how the different aspects of the resources link together.

There is also a range of teacher and technician support including extra information relating to practical work, activities and answers to questions in the student resources.

In addition to published teaching and learning materials there is a regular newsletter sent out to Salters centres, a website with up to date information and a raft of teacher produced materials, that are shared free of charge, a free helpline, user group networks and regular training workshops for teachers and technicians.

What is happening from September 2015?

We are really looking forward to the introduction of first teaching of the revised specifications for A Level Chemistry in September 2015 and have worked hard to revise and update the **Chemical Storylines and Chemical Ideas.**

AS Level will continue to be a subset of A Level, so that students intending just to take AS can be taught together with students in the first year of the full A Level. There will be separate assessments for AS Level and for A Level. Students who sit the AS assessment may choose to continue into the second year of A Level, but their AS marks will not count towards their A Level grade; they will need to sit the entire A Level assessment at the end of the course.

Ofqual have stated that direct assessment of practical skills by teachers should not count towards an A Level grade. Rather, the intention is that practical competence should be recognised by an 'endorsement' alongside the A Level grade, and that aspects of practical work should be assessed within the written tests. Details for this A Level endorsement are being developed at OCR, to integrate into the teaching scheme for Salters Advanced Chemistry.

OCR Chemistry B (Salters) course materials are being revised to match the new requirements. We will be working in partnership with Oxford University Press to produce revised student materials incorporating storylines and chemical ideas alongside each other in the same publications. There will be a wide range of electronic materials to support teaching and learning. The teaching and learning materials are co-ordinated through the Science Education Group at the University of York.

For more information regarding the teaching and learning materials please contact Chris Otter, Project Director, on **chris.otter@york.ac.uk**

How to offer even more to STEM A Level students

Take a look at the EPQ – the perfect qualification for budding inquisitive scientists

Rebecca Wood, EPQ Subject Specialist, OCR

The A Level Science Practical Endorsement values the development of investigative skills (see the Endorsement Appendix in our specifications, **ocr.org.uk/science**). However, an individual investigation on its own is no longer needed to meet the A Level practical assessment requirements. Options for centres are:

- To carry out shorter investigative activities to meet the endorsement requirements
- To use the endorsement activities as a potential launch pad to a practical investigation carried out as an Extended Project Qualification (EPQ).

The resources we provide to support the Endorsement will show how activities carried out as part of the endorsement could be extended into investigations as part of an EPQ using investigative and research skills.

Helping students stand out from the crowd

The EPQ's increasingly recognised as a valuable Level 3 qualification that builds investigative and analytical skills while encouraging independent learning. Many universities are keen advocates of this qualification, using it to gain a holistic view of a student. In some cases it may make the difference between winning a place on a course and just missing out.

The EPQ allows students the freedom to study any topic they want. This could be used to extend and develop existing skills and knowledge or to learn something completely different. The EPQ can also play a vital role in ensuring that students have the right experience and skills before progressing on to HE or into the workplace. This is one of the reasons that the Wellcome Trust became involved in research around the EPQ via the Extended Project Support Group (see **www.wellcome.ac.uk/Education-resources/Education-and-learning/News/2013/WTP052068.htm**). As Matt Hickman from the Trust says:

"We would like to see more students doing independent practical projects and the EPQ is a great way to do this. However, we are aware that there are various challenges when it comes to students undertaking practical science EPQs."

The Wellcome Trust is currently developing resources to help support centres and teachers in the delivery of a practical EPQ. Here at OCR we're developing our own set of resources that focus on how to deliver and assess a STEM EPQ and we'd be very happy to discuss approaches to investigation work.

The EPQ in brief

- It's worth up to 70 UCAS points and graded A* to E
- Grew 9% last year, had around 33,000 candidates and is now the ninth largest Level 3 qualification by entry
- There are January and June moderation points allowing delivery to be very flexible
- The 50 hours of contact time can be a combination of taught sessions and supervised study
- It's centre assessed, externally moderated.

The focus on enquiry and investigation and the freedom it allows makes the EPQ the perfect qualification for budding inquisitive scientists. If you'd like to explore how you might incorporate an EPQ into your future science offer please do get in touch either with the science team (**GCEScience@ocr.org.uk**) or with me, Rebecca Wood, EPQ Subject Specialist (**Rebecca.Wood@ocr.org.uk**).
Also see **ocr.org.uk/extendedproject.**

Research notes

Investigating context-led courses… Considering performance in PISA tests… Getting in touch

Frances Wilson, Senior Research Officer, OCR

What is a context-led approach to science teaching?

Internationally, there have been longstanding concerns about science education, with many people reporting that students aren't very motivated to study science. They often fail to understand the relevance of what they're learning in science to their everyday lives (Bennett & Lubben, 2006).

In the early 1980s, the Salters project began in response to these concerns and Salters introduced a new, context led way of teaching science. This approach uses *"contexts and applications of science as the starting point for developing scientific understanding"* (Bennett *et al.*, 2005). For example, a context-led course might introduce biochemical concepts through the context of a boy who has had a stroke, revisiting these concepts in other contexts later in the course. Since then, this approach has been adopted in many countries, including Germany and the USA.

What can research about this approach tell us?

During the development of our new context-led A Level specifications, we decided to take a look at some of the research that's investigated how this approach to science teaching works and what the challenges and advantages might be.

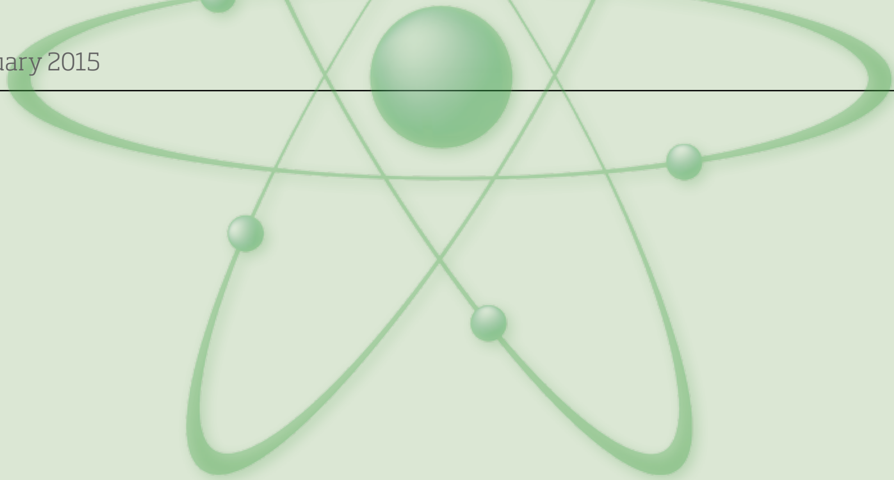
Context-led science courses have been associated with an improvement in student motivation in biology (Braund *et al.*, 2013), chemistry (Bennett & Lubben, 2006) and physics (Ogborn, 2003), and teachers following the OCR Salters Chemistry A Level have reported that they found the course interesting to teach (Bennett *et al.*, 2005). However, some teachers are concerned about the impact of introducing contexts into an already full curriculum. This was the case in Germany where context-led units have been introduced (Parchmann *et al.*, 2006).

Overall, comparisons of students following traditional and concept-led courses suggest that students' understanding of fundamental concepts is similar, regardless of teaching approach (Braund *et al.*, 2013). Despite this, there are some challenges associated with context-led science courses. Course designers need to select contexts that are engaging for students, and allow them to explore important concepts in a systematic way throughout the course, so they can transfer their conceptual understanding to different contexts and problems.

What about assessment?

Pilot and Bulte (2006), further note that it's also important assessments reflect the nature of the course, so the assessment of context and concept-led courses should reflect the two different approaches. Additionally, context-led courses typically use a student centred approach to pedagogy, using activities that allow students to become actively engaged in learning, and develop independent study skills. It's therefore essential to provide teachers with appropriate support materials that enable them to implement context-led courses with their students. To access our comprehensive resources and support materials, go to **ocr.org.uk/science**.

If you'd like to read more about context-led science courses, please see the next edition of Research Matters, which will be available on the Cambridge Assessment website from February 2015. **www.cambridgeassessment.org.uk/our-research/all-published-resources/research-matters**.



The relationship between time in education and achievement in PISA in England.

Current OECD publications suggest that each additional year of schooling has a substantial impact on the performance of pupils in PISA (Programme for International Student Assessment) tests. However, their figures are based on simple models that compare the performance of pupils in different school years but don't differentiate between the effect of additional schooling and the effect of pupil age. It's already well known that on average, within any given year group, the oldest pupils will outperform the youngest (Benton, 2014).

Tom Benton's study compared the performance of the youngest pupils in one year group (that is, August-born children) with the oldest pupils in the year group below (that is, September-born children) while accounting for the general trend in the relationship between age and achievement. Because August-born children are in a higher year group and have typically been attending school for a longer period of time, this difference provides an estimate of the likely impact of additional schooling on performance.

The findings indicate that once the age of pupils is taken into account, there is in fact no relationship at all between additional schooling and performance in the PISA tests. This points towards uncoupling what's historically been taught in English schools and what's being tested in PISA. This in turn raises questions about the extent to which performance in PISA can be used to assess the quality of teaching in England.

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Where can you find out more about research at Cambridge Assessment?

If you'd like further information about our research, many of our papers are available on our website, including our own research publication Research Matters (**www.cambridgeassessment.org.uk/our-research**.)

The challenge of the triplet

Dr David Read, Head of Education Group and Director of Outreach (Chemistry), University of Southampton

Chemistry is one of the most challenging subjects on the curriculum, of that there is no question. As teachers we bombard students with content, urging them to make sense of tangible, observable processes by applying abstract concepts and visualisations that appear to have been conceived to confuse the uninitiated. To compound things further, we ask them to represent these processes using symbols and formulae which might pass for some sort of hieroglyphic code. It's no wonder that many are turned off from the subject early on, consigning themselves to a lifetime of apologising that they 'just couldn't do science, especially chemistry. Urgh!'.

Understanding what actually makes chemistry difficult can help us to support students in getting to grips with the nuances of the subject. There is a huge body of research into chemistry education, with a common theme being the 'chemistry triplet' and its role in confounding those studying the subject. Alex Johnstone (1982) was the first to describe the three faces of chemistry, which are generally now referred to as the 'macroscopic', 'sub-microscopic' and 'symbolic' domains of chemistry. Figure 1 illustrates the triplet using liquid water as an example.

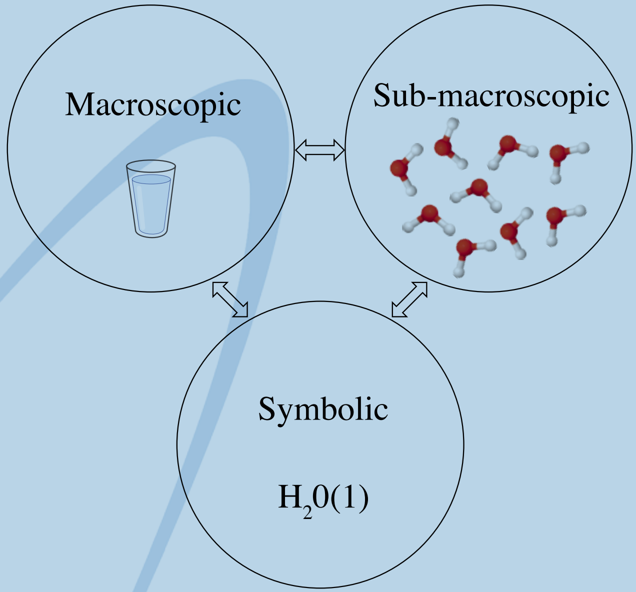

Figure 1: The three faces of liquid water

Children derive their early ideas about scientific processes from their experiences of the world around them i.e. the macroscopic domain. Puddles disappear over time and sugar 'melts' into a cup of tea, to give examples of observations which can evolve into deep-seated misconceptions later on. Key Stage 2 science may introduce pupils to a rudimentary particle world, but this is some way removed from genuine sub-microscopic insight which remains elusive until students have a good understanding of molecules and the forces that act between them. The symbolic domain can prove particularly troublesome, with students often struggling to link the content of a chemical equation to a particulate (or sub-microscopic) description of a process.

Therein lies the challenge. Our ability to deal with the discipline is strongly linked to our ability to switch between domains (Johnstone, 1991). Teachers can seamlessly transition from one to another, but students may need time, and perhaps also a little guidance to move between different levels. It is impossible to do justice to the importance of the triplet here, but teachers can do a lot to smooth the transition between different domains in their teaching, and in so doing can help to break down the barriers to understanding of chemistry.

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Marking graphs can be even quicker…with SPLATA

"…it is memorable for teachers and learners, and it makes the walk around class checking work much more effective."

Richard Tateson, Biology Science Specialist, OCR

About Richard

Richard joined us in August 2014 to help provide support and resources for the new and current A Level Biology qualifications. His recent experience as Head of Biology at Ipswich School has cemented his enthusiasm for practical work and made him keen to promote and explain the new practical endorsement that replaces practical coursework. His favourite field trip was a week in Arran during his previous teaching post at Hartismere Academy, although the more local countryside of Suffolk and Norfolk also has its charms.

Before training as a teacher Richard did a Biochemistry degree and a Developmental Biology PhD on fruitfly genetics in the Zoology Department at Cambridge. He then spent several years in industrial research, developing nature-inspired computing and networking technology for BT. In his spare time he goes swimming, walks dogs, makes jam and plays the guitar when no-one is listening. Here, he explains to us about his SPLATA concept and how to use it in your science lessons.

As a young keen pupil, I finished my chemistry data collection and carefully plotted a graph. In hope of praise but fearful of censure I showed the result to my teacher. Wordlessly he grasped it firmly with his tongs, always at hand, and scrutinised it briefly but intently. Then to my horror and my classmates' rapidly mounting interest, he drew it into the flame of a Bunsen. The flames leapt high and soon left only a blackened husk. As he tapped the charred fragments on to the heatproof mat three syllables emerged from beneath his grizzled moustache: "no title." In that moment I vowed I would one day become a teacher, as cruel and mad as this.

But when, nearly 30 years later, I had my own class of Year 7s, eager to learn the ways of science, and of course Years 11, 12 and 13 eager to avoid losing coursework marks, I found that my soft heart, and the increasingly stringent health and safety regulation, made this pedagogical approach impossible. I needed something to communicate quickly to all ages what was required in a graph, to allow pupils themselves to assess and correct their own work, and to make my marking of the end result rapid and comprehensible. Naturally I came up with an acronym. Henceforth all year groups from 7 to 13 would be told to SPLATA their graphs.

S - size of the graph: does the bit with actual plotted points in take up at least half the paper? Try folding the paper – how small can it be folded and still show all your data points?

P - plotting: is every data point within half a little square of where it should be? Are your points so big and blobby nobody really knows where they're meant to be?

L - line of best fit: if there's a trend in your data, is it indicated with a smooth curve or straight line? Even though it gives me pain, is there perhaps a case for joining data points with straight lines?

A - axes right way round: the thing you changed (independent variable – ooh, fancy!) along the bottom; the thing you measured (dependent variable – we're rolling now!) up the side

T - title: should remind me what this graph is about when I find this bit of paper in six months' time

A - axis labels: name of each variable with the right unit.

Clearly this isn't profound stuff but it is memorable, for teachers and students, and it makes the walk around class checking work much more effective.

'Is this right Dr T?'

'Is it SPLATA?'

'Yes!'

'Really?'

'Oh, no title, I'd better add one.'

Marking graphs is quicker for me and easier for students to understand. I write SPLATA vertically on the graph and tick off what's right, then add a comment to what's not. More organised colleagues have ordered in stamps to speed things up.

And nobody's work gets burned. More's the pity.

My best and worst lessons

Rachael Tomkins, Chemistry Science Specialist, OCR

About Rachael

Rachael is a Subject Specialist here at OCR. Until recently, she was Head of Science at Hampton College in Peterborough. She has a Biochemistry degree from Imperial College, London and completed her PGCE at the University of Nottingham.

Rachael started her teaching career in Japan where she taught English to all age groups in Tokyo and in Fukushima. On returning to the UK she taught science across Nottingham during her PGCE and then moved to Fernhill School in Farnborough before moving back to Peterborough where she taught at Hampton College. Rachael had the role of Co-ordinator of Work Related Learning before becoming Second in Department and eventually Head of Department. She is an alumna of the National Science Learning Centre in York and was recently nominated for a Lead Science Teacher Award.

Best lesson

It was my interview lesson at Hampton College and possibly the shortest lesson I've ever taught. I had 25 minutes to teach any aspect of 'How Science Works' to a Year 7 mixed ability class. It needed to be quick. It also needed to be safe and easy. So I decided to use: 'How many drops of water fit on a penny?'

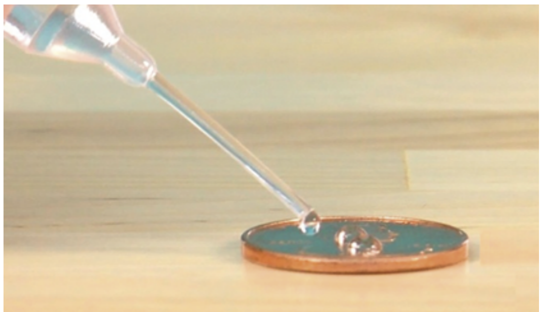
It's a really simple idea: pennies, small beaker of water, a pipette and a paper towel per student. They made predictions, they then had a go. It's surprising how many drops of water fit on the penny. Then students started identifying a range of variables that might affect their results: side of coin, height of drop, size of drop, temperature of the water etc. As they were repeating the experiment, they were evaluating the practical and saying that they needed to repeat it to check their results…that it wasn't a fair test…what about other coins – and they began searching their pockets!

They were really enjoying it, thinking scientifically and having great discussions.

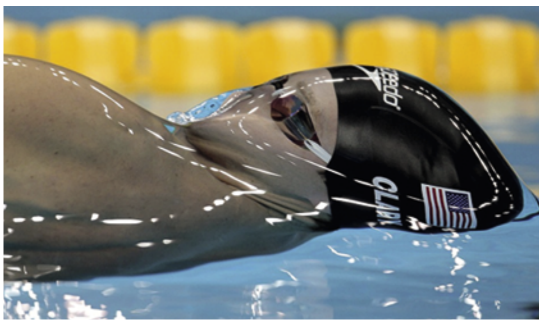
The time flew by, but luckily there were enough opportunities to start a discussion on surface tension with some of the students who were surprised at how many drops could form, and even about the material used to make pennies (pre-1992 coins aren't magnetic). The students could have carried on all day collecting results. When I told them it was time to pack away, there were some really positive comments – they'd really enjoyed the lesson.

The observer commented: *"In all the time I have observed lessons for interview that's the first time I have ever seen something different!"*

I got the job! I've repeated this lesson a number of times since and it always goes down well.



www.stevespanglerscience.com/lab/experiments/penny-drops



www.estatevaults.com/bol/archives/scientific_wond/

Worst lesson

It was Friday period 5 and Year 11 BTEC – 12 girls. Luckily for me, a wonderful teaching assistant was assisting me in the class and we were reviewing some work the students had been doing in the library the day before, about wind turbines.

The students came in and sat down, busy chatting about the plans for their Friday night – what they were going to wear, who was going out with whom. On the board I had a starter that was an anagram of the word 'wind turbine'. They puzzled over this for a while. Eventually a student worked it out. At this point another student began to vocalise that she'd never heard of a wind turbine, ever in the history of her life. I pointed out to her that was what she was researching yesterday in the library. She was still adamant. I showed her a picture – but she was still adamant she'd never seen one.

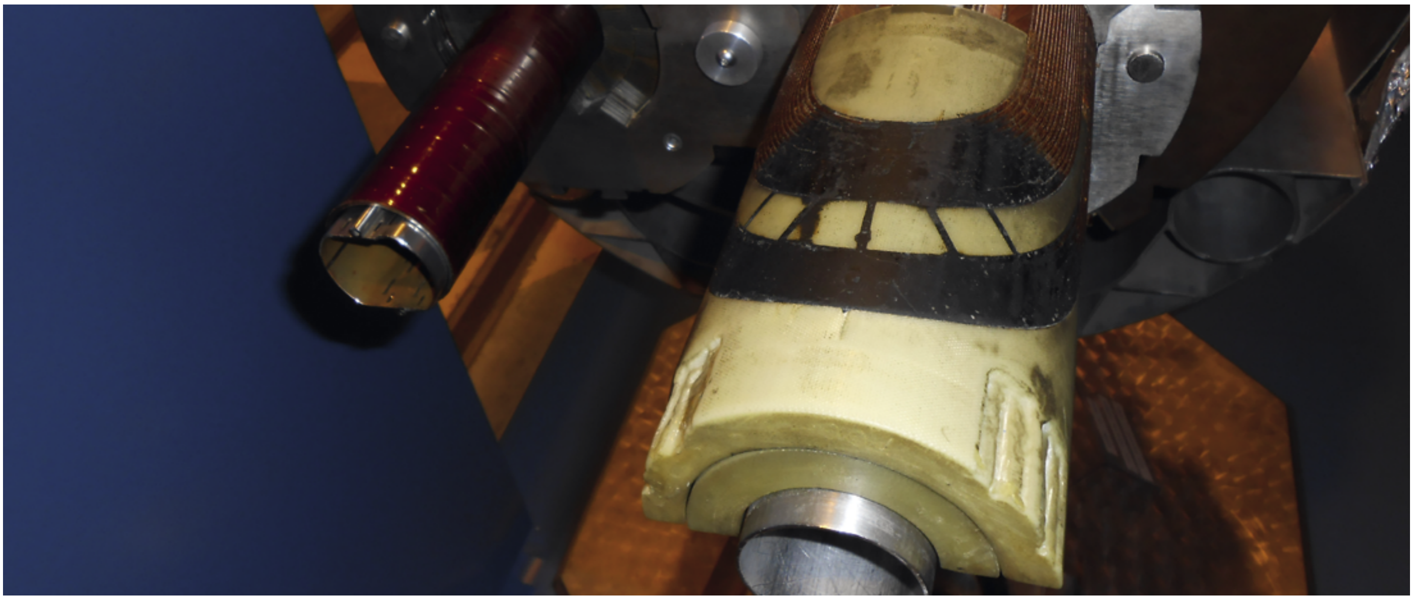
I asked her to open the work she'd done the day before and turn to the second page. Here she had copied the same picture into her work and written two paragraphs about that picture. She went quiet. Her response then came *"…But I just copied and pasted!"* At this point we had a discussion about plagiarism – a useful one for BTEC students.

So the lesson moved on and we actually built our own wind turbines and recorded the voltage generated. Many students were excited about the opportunity to do practical work and get stuck in. A few, because it was hot, decided this was a perfect opportunity to sit in front of the fan and cool off. This was until the girl who had argued about never hearing the term 'wind turbine' started to re-enact a hair shampoo commercial and got her hair extensions stuck in the fan. Screaming ensued and the teaching assistant and I quickly went to the rescue. Her extensions had to be cut out. She was crying. Her friends were concerned about whether she'd still be able to go out that night. Her parting comment was: *"I hate wind turbines."*

Out and about …

An 'awesome' scale of engineering at CERN

Neil Wade, Physics Subject Specialist, OCR

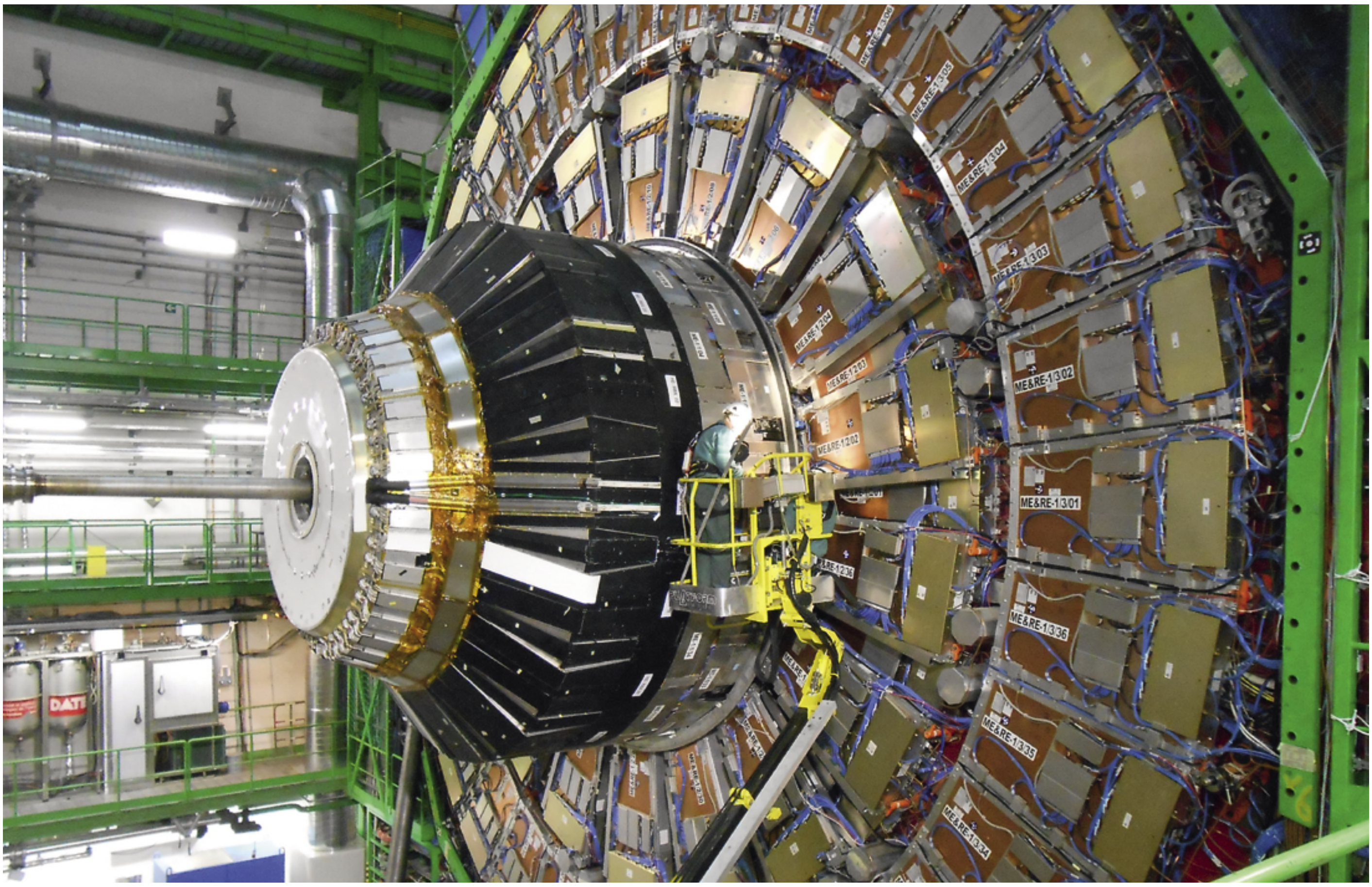


As part of a National Science Learning Centre study visit to CERN, thirty teachers spent three full days in Switzerland, with the occasional excursion across the border into France.

The lectures from members of staff covered a wide range of A Level Physics and provided many possible current research contexts to link with sub-atomic particles and fields.

While the minute scale of the collisions being monitored is mind boggling in its order, the scale of the engineering required to achieve these precisely controlled events is awesome at the other extreme.

Many of us will remember the old dexterity game with a metal ring along a twisted metal rod.



At CERN each beam of protons is five microns across, travelling around the 27 km tube 11,000 times a second and yet it's controlled to remain within the confines of a tube approximately 50mm diameter.

To do this requires the application of electric and magnetic fields and superconductivity.

The detectors by contrast are massive. This particular tour was the last for four years to go down to the detectors before the cooling process starts to bring the system down to a temperature of within two degrees kelvin of absolute zero. The Compact Muon Solenoid, the detector responsible for the data that's supported the existence of a particle matching the predicted characteristics of the Higgs-Boson is around five storeys high and has a mass of over 12,500 tonnes.

While it may logistically be difficult to justify taking a group of students to visit CERN, there are alternative ways to engage with the work that's taking place there.
(**http://home.web.cern.ch/students-educators**)

The experience and information available for teachers enables current front line science to be integrated and referred to throughout the A Level course.

Looking beyond the fundamental particle research, there are also significant spin-offs for medical physics with diagnosis and treatment using proton beams or novel detection methods.

So what has CERN done for us? Consider where we would be without the world wide web or the capacitative touch screen, spin offs we now take for granted.

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Talking fieldwork at the Field Studies Council

Sarah Old, Biology Subject Specialist, OCR

The Field Studies Council (FSC) headquarters are based in a fantastic Queen Anne country house to the west of Shrewsbury, Shropshire. I was invited to talk to their Biology tutors from learning locations all over the country about the changes to A Level Biology and, specifically, how we might be able to continue to work with them to encourage fieldwork and the development of ecology skills in post-16 Biology students. Our AS and A2 Biology Practical Skills units have traditionally included tasks that are ecology-based and students often have the chance to complete these at the various FSC locations.

With the introduction of the Practical Endorsement at A Level, it's clear there'll need to be a different approach to fieldwork in biology. The tutors at the FSC are clearly very interested and willing to engage with us and we're excited about their ideas and the prospect of producing resources in partnership with them. And it's always a delight to visit a spot where there are so many opportunities for outdoor learning.

#YorkTU

Mary Whitehouse, Joint Project Director for York Science & Twenty First Science, University of York

Rachel Tomkins, Subject Specialist, Chemistry, OCR

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@ocr_science

On the 18 August, the University of York Science Education Group UYSEG **www.york.ac.uk/education/projects/uyseg/** hosted the annual York TweetUp, a Science Teachmeet **teachmeet.pbworks.com/w/page/19975349/FrontPage** organised by Mary Whitehouse, @MaryUYSEG. Most of those there were science teachers in secondary schools but there were also people from primary schools and higher education, as well as from awarding bodies, equipment suppliers, and independent science educators.

There were numerous presentations, too many to list, covering a wide range of topics including science content, pedagogy and INSET. **@ocr_science** now follows all the contributors, so you can find them from there. Look out for #YorkTU and #ASEChat to find out about the next Science Teachmeet in your area.

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