Science Spotlight

Issue one
January 2014

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Welcome

What's in this issue?

Welcome to the first issue of OCR's new Science newsletter, *Science Spotlight*. We plan to issue this newsletter on a termly basis to provide you with all the latest news and information you need to help with your teaching and delivery of science qualifications. We are launching the newsletter at the Association for Science Education Annual Conference (8–11 January) and we look forward to meeting some of you at this event.

In this issue we are particularly pleased to include articles from some teachers [Kris Smith reviewing his best and worst lessons in Physics; Celia Alcock reviewing the Science and Plants for Schools (SAPS) website], an article from our Research Division highlighting some items of particular relevance for Science (such as tiering and coursework), a pull-out resource on eutrophication, and information on our new vocational qualification (Cambridge Technicals in Science). Future issues will see articles from a range of teachers and science education experts plus items from the OCR Science team. If you are interested in contributing to a future issue, please do email us at **ScienceSpotlight@ocr.org.uk**

We appreciate that we are currently in a period of significant change to qualifications at both GCSE and A Level. While there are still some uncertainties around precise requirements for future qualifications, especially with regard to the new Science GCSEs, we have summarised what is known at this point. To be kept up to date, please visit our dedicated website, **www.ocr.org.uk/gcsealevelreform**

We hope you enjoy reading this issue and look forward to hearing views on the first issue via **ScienceSpotlight@ocr.org.uk**

Steve Evans
Assistant Head of General Qualifications Reform

Strengthening the arrangements for A Level science coursework units

Recently, we have written to centres concerning strengthening arrangements for A Level science coursework units, and a copy is shown on the right.

Dated December 2013.

Dear Colleague ,

Over the last few months, all awarding organisations have been working with the regulator, Ofqual, to strengthen the controls, moderation and administration that are in place for practical assessments for GCE science qualifications. These changes are intended to increase the level of confidence that we all can have in the validity of the outcomes for these assessments.

Changes will be introduced over the next 12 months to achieve the degree of strengthening that is necessary. These changes have been agreed with the regulator. We will be issuing a Notice to Centres to confirm these changes, and the Notice will be available on the relevant qualification pages on the OCR website.

Moderation tolerance

Starting in the Summer 2014 series, Moderators will apply a slightly tighter tolerance for the following GCE coursework/practical skills units:

- Biology, F213 and F216
- Human Biology, F223
- Chemistry A, F323 and F326
- Chemistry B (Salters), F333
- Geology, F793 and F796
- Physics A, G483 and G486
- Science, G643

For each of these units, the moderation tolerance will reduce from 3 marks to 2 marks. This change is intended to improve the consistency with which the mark schemes/assessment criteria are applied across all centres. Centres should take note of this change when assessing and carrying out internal moderation of candidate work prior to submitting the centre marks to OCR in May 2014 and subsequent years.

Availability of mark schemes

In line with other awarding organisations, we have agreed to delay the publication of the mark schemes for practical skills tasks from June until the following December. This will commence for tasks to be submitted in the 2015 series. The 2015 tasks and confidential teacher instructions will be published via the OCR secure Interchange website on or just after 1st June 2014, as in previous years. We appreciate that teachers may be concerned about allowing candidates to undertake the assessment without being fully aware of the expected outcomes. To address this concern, and to ensure that practical procedures work in centres as intended, additional information or guidance may be given in the confidential teacher instructions. The mark schemes will be published on Interchange on 1st December 2014. It will still be permissible for centres to carry out the tasks at any time after publication, and in advance of having access to the mark schemes.

This change will apply to the following GCE coursework/practical skills units:

- Biology, F213 and F216
- Human Biology, F223
- Chemistry A, F323 and F326
- Chemistry B (Salters), F333
- Geology, F793 and F796 (for Centre-based and Evaluative Tasks only)
- Physics A, G483 and G486
- Science, G643 (for the practical task only)

This change is intended to provide more security for the confidential mark schemes.

Supporting you through the changes

Our aim is to help you at every stage and we want to reassure you that we'll continue to support you through these changes. The individual GCE science subject pages can be accessed online from **www.ocr.org.uk/science**

On the subject page you will find the latest edition of the specification document, along with a practical skills/coursework handbook to support you through the delivery and administration of the practical units.

Practice tasks (as well as the live assessment tasks) are available to registered centres through our secure Interchange website, **https://interchange.ocr.org.uk** under the **'Coursework and Tests'**, then **'Science Coordinator Materials'** links.

Exemplar materials and past INSET packs are available through the OCR CPD Hub, **https://http://www.cpdhub.ocr.org.uk** where you will also find details of face-to-face training courses.

Queries relating to live tasks can be emailed to the Science team at **GCEScienceTasks@ocr.org.uk**

In addition, OCR also offers a Coursework Consultancy Service, in which candidate work that you have marked will be reviewed by a senior Moderator prior to moderation. To make use of this service, post photocopies (not originals) of three marked pieces of work (along with a Coursework Enquiry coversheet, available from the OCR subject page on the website to the following address: Science Team, OCR, 1 Hills Road, Cambridge, CB1 2EU. Typically, centres are encouraged to send work that covers a range of attainment or which illustrates particular points of concern. The scripts should be marked and annotated before being photocopied. A senior Moderator will review the work and will write a report on the centre marking, which we will email or post back to you within six weeks. You can then make adjustments to your marking, if you wish, before submitting marks for moderation in May.

Why not join us as a Moderator?

We are currently recruiting Moderators across the range of GCE (and GCSE) science subjects for the Summer 2014 examination series. We would welcome applications from teachers who are currently delivering our qualifications. As part of the Moderator role you will be offered training in the process, and undertake standardisation to help you moderate work to the expected national standard. As well as being paid for the moderation you undertake for OCR, this represents an excellent professional development opportunity, and will give you a thorough understanding of current practical skills assessment in your subject. Information on applying and the application form can be found on the OCR website:
http://www.ocr.org.uk/ocr-for/assessors/marking-moderating-and-verifying-tasks/

Need more help?

If you have any questions regarding the changes, our team is happy to help. You can contact us on **01223 553998** or at **general.qualifications@ocr.org.uk**

Stephen Diston
Subject Team Manager
Science Qualifications Team

www.ocr.org.uk/gcsealevelreform

GCSE Science update

In February 2013, the Department for Education (DfE) announced plans to 'comprehensively' reform GCSEs.

Based on the most recent announcements from the DfE and Ofqual on 1 November 2013, here is a summary of the current proposals for new Science GCSEs:

- There will be reforms to the assessment and content for new Science GCSEs
- In addition to separate Science GCSEs in Biology, Chemistry and Physics, there will be a combined science (double award) option
- First teaching of the new Science GCSEs will be in September 2016, with the first examinations in Summer 2018
- A new grading scale will be introduced that uses 1–9 to identify levels of performance (with 9 being the top level)
- Tiering will remain in GCSE Science papers
- GCSEs will be linear with assessment to be taken at the end of the course
- The DfE's consultation on draft criteria closed on 20 August 2013, with the final content due to be published in 2014
- Maths has been embedded within the content in the draft criteria
- Draft criteria have been proposed that retain an element of coursework, through indirect assessment, with a weighting of 10%.

OCR's response to the consultation on GCSE Science subject content

OCR submitted a detailed response to the DfE's consultation on the proposed content for the new GCSEs in Science.

Our positive response to the proposals included detailed feedback on the proposed criteria statements. We confirmed that we believe the 'proposed subject content and Assessment Objectives' cover the appropriate knowledge and understanding and have offered proposals for how to better manage the assessment of practical skills within the curriculum. We also raised concerns around the use of 'command' words within the criteria and the potential to seriously restrict assessment options.

In response to a question on progression opportunities from combined science, we have identified the need for further thought to be given to this, particularly of how the issue of tiering will be addressed if the proposals are to avoid the combined specification being seen as the 'poor cousin' from the outset.

A Level Science update

Autumn 2013 has been a period of significant activity around the development of Science A Levels (in Biology, Chemistry and Physics) for first teaching from September 2015.

Professor Smith's report

Professor Mark Smith's independent report on current A Level specification content **http://ofqual.gov.uk/standards/research/international-comparability** was published in September 2013. OCR, and colleagues in the other main awarding organisations (AQA, Pearson and WJEC), provided extensive feedback to Professor Smith to help with the formulation of this report using evidence from our ongoing consultation with teachers on what is important to them in future qualifications. In summary, for the three A Level sciences – Biology, Chemistry and Physics – it was recommended by Professor Smith that these qualifications could be developed for first teaching from September 2015 with minimal changes to the criteria content. In the case of Chemistry, Ofquals recent international comparability study (using OCR's A Level Chemistry A specification) showed that current Chemistry A Levels compared well with international offerings, see **http://ofqual.gov.uk/standards/research/international-comparability**

Recommendations around practical assessment were unresolved in the Smith report and there was a requirement for a weighting to be given to the assessment of maths within science A Levels (this builds on concerns raised within a report by SCORE on the assessment of maths within the sciences, see **http://www.score-education.org/policy/qualifications-and-assessment/mathematics-in-science).**

DfE and Ofqual consultations

October 2013 saw the much-awaited publication, by DfE and Ofqual, of the A Level criteria for science and a consultation on regulatory requirements. A summary of the changes, for both AS and A Level, is included in Table 1.

Full details of the DfE consultation on the Science criteria (closed 20 December 2013) are available at: **https:/www.gov.uk/government/consultations/new-a-levels-subject-content-consultation**

Full details of the Ofqual consultation on regulatory requirements (closes 17 January 2014) are available at: **http://comment.ofqual.gov.uk/a-level-regulatory-requirements-october-2013**

www.ocr.org.uk/gcsealevelreform

What we will be developing for OCR's A Level sciences

We currently offer two specification suites in each subject, namely,

- Biology A, Biology B
- Chemistry A, Chemistry B (Salters)
- Physics A, Physics B (Advancing Physics)
- All of these qualifications are popular and we hear from teachers that they value the variety offered within the two approaches. We plan to continue to offer two specification suites in each subject for first teaching from September 2015
- As the content changes are minimal, we plan to develop specifications that are a familiar evolution from the current offering (and are easy for teachers to use) while making the revisions required as part of the development and improving areas where we have received feedback that a change is needed. We would welcome any feedback from teachers to help shape our plans for the new A Levels **(ScienceDevelopment@ocr.org.uk)**
- We are aiming to develop an AS that will be easily co-teachable with the A Level
- We are aiming to reduce the administrative burden of the A Level-endorsed practical, while genuinely rewarding development of practical skills and reducing the possibility for malpractice (see a separate item in this issue around malpractice.)

New AS Level	New A Level
Linear assessment, first teaching September 2015	
First AS assessment June 2016	First A Level assessment June 2017
Limited changes to content	
Standard as now	'Standard as now' but to be clarified as to whether this means the current A2 standard or the current A Level standard which would be an aggregate of AS and A Level standards
No change to grading	No change to grading but rules around A* to be clarified
AS is stand-alone, it does not count towards the A Level but could be designed for co-teachability with A Level learners. Learners could complete the AS and then do the full A Level	
No more than three papers at AS	No more than three papers at A Level
100% external assessment for AS (no coursework or practical exam), practical skills assessed within written papers	External assessment of practical skills within question papers for A Level (as AS) but also a separate practical endorsement (internally assessed by teachers, moderated by awarding organisations) to reward development of practical skills. Does not count towards the A Level grade but is reported alongside it
Requirement for more open-ended questions with less predictable and more synoptic assessments	
Appendix of maths skills reworked	Requirement to include a minimum weighting of maths skills within the assessment: Biology (10%), Chemistry (20%), Physics (40%)
Sciences outside of Biology, Chemistry and Physics are developed at a later time	

Table 1. A summary of the changes for the new AS and A Level qualifications for first teaching from September 2015

Keep up to date with GCSE and A Level developments

There is a lot of work for us to do to develop the new GCSE and A Level Science qualifications and we welcome the opportunity to talk with teachers and share ideas to ensure that we are developing the best possible qualifications to meet the needs of future leaners. There are a number of ways to keep up to date with developments:

- Sign up for GCSE and A Level reform email updates at **www.ocr.org.uk/updates**
- Visit **www.ocr.org.uk/gcsealevelreform** and sign up for email updates
- Follow us on Twitter, **@ocr_science**
- Email us at **sciencedevelopment@ocr.org.uk**
- Join our OCR Science Community **(http://social.ocr.org.uk/groups/science)** There is a specific discussion forum for **'GCSE and A Level Reform Science'**
- Visit the team on our stand at the ASE annual conference.

Review of Science & Plants for Schools (SAPS) website

www.saps.org.uk

Searching for ways to investigate limiting factors on photosynthesis, I came across the SAPS website. The website is funded by the Gatsby Charitable Foundation and is linked to several universities. The website contains an impressive variety of free resources based on plant science. It includes videos and PowerPoint presentations that can be used alongside the practical suggestions provided. There are also teacher and technician notes, student instruction sheets and worksheets – all well thought-out and linked to the practicals. A wide range of activities is available that cover all Key Stages.

The website looks great and is incredibly easy to navigate – not only can you search by Key Stage or topic but also by exam board specification, a very handy tool. The activity I found particularly useful was titled 'Algal Balls' Photosynthesis using algae wrapped in jelly balls. With the notoriously unreliable pondweed having been the staple for investigating photosynthesis, this novel idea seemed worth a go. The algae is grown and then immobilised in sodium alginate jelly balls. Instead of waiting painstakingly for the bubbles to appear, changes in the colour of the hydrogen-carbonate indicator solution (also called bicarbonate indicator) are used to investigate the rate of photosynthesis under different environmental conditions. The balls can be made by learners themselves or in advance and stored as they can last for months. The challenge with this practical is the time needed to prepare and practise before trying it with learners. If you don't have everything to hand, a kit of the resources is available for £65.00 to get you started (available via the website: **www.saps.org.uk/secondary/teaching-resources/123-investigating-photosynthesis-with-the-saps-ncbe-photosynthesis-kit**)

There is more!

Other great practicals are:

- **Hydroponics –** This practical activity outlines how to grow plants hydroponically in the classroom. It aims to give learners an understanding of the basic growth needs of plants. It also shows how hydroponics can be utilised to provide food to humans as our population expands.
- **Phytoremediation –** This practical activity investigates the use of hyperaccumulating plants to clean up copper-contaminated soils. This activity aims to develop learners' plant-based practical skills and awareness of applications of plant science in the real world. It also raises environmental awareness and how humans affect the environment.

Admittedly, using some of the resources presents challenges as new ideas often do – for example, high-powered lights and data loggers are needed for the phytoremediation investigation.

And that's not all!

There is a learner section that provides information on careers, and ideas and tips for investigations. The news section has all the latest plant-related news, and a science club section gives ideas, both practical and research, to establish a science club focused on plants alone. Add to this a large, free-to-use image collection, journal articles, newsletters, external links and related CPD courses and you have a comprehensive, high-quality resource for all things plant related. I would highly recommend taking a look!

Celia Alcock
Teacher of Science – Birley Community College, Sheffield

Pull-out

Cambridge TECHNICALS

Cambridge Technicals in Science Level 2

Unit 7 – Food Production

Eutrophication Learning Outcome 2: Understand the key factors that affect crop production.

Teacher's notes

This activity is designed to develop learners' understanding of eutrophication and it would be useful if learners had awareness of why farmers use fertilisers before carrying out this activity.

Eutrophication is a process involving complex relationships and it has been shown that even at university level learners can find it difficult to describe the process correctly. Learners often have difficulty in recognising and explaining the causal relationships in eutrophication and this can result in learners missing out steps in their explanations or being unable to work back through the process when questioned (Rowbotham, 2011). This activity has been designed to draw out these causal relationships.

This activity also provides opportunities to reinforce other key biological concepts:

- Photosynthesis and respiration
- Ecosystems and interdependence
- The interaction of biotic and abiotic factors.

Instructions:

A set of eutrophication statements should be printed, cut out and shuffled – enough for one per group or individual that will be completing the activity.

Task 1:

Learners should rearrange the statements into the correct order (the statements are laid out in the correct order in this document). This should be checked before learners continue. Learners can be prompted to identify and trace key words such as fertiliser, nutrients, light and oxygen if they are finding the statements difficult to sequence.

Task 2:

Learners should then use the ordered statements to help them complete the 'causality statements' in which learners need to make explicit the relationships implied in the ordered statements.

Sample answers could include:

The level of nitrogen and potassium in lake water can increase if *rain water carries fertiliser from farm land into the lake.*

An algal bloom can form over the surface of a lake if *the levels of nitrogen and potassium increase in the lake water.*

The plants living within the lake can die if *an algal bloom on the surface of the lake blocks out the light meaning that the plants can't photosynthesise.*

The fish (and other animals) living within the lake can die if *the plants within the lake stop producing oxygen through photosynthesis and if decay of dead plant matter and algae uses up dissolved oxygen in the water.*

Task 3:

Learners could then use a simple storyboard to design an advert to educate farmers about the problems caused by eutrophication. This provides an opportunity to explore the benefits of using fertilisers balanced against the potential risks.

These activities could be extended by exploring real-life examples of eutrophication:
www.ukmarinesac.org.uk/communities/infralittoral/ik5_3.htm
www.unep.or.jp/ietc/publications/short_series/lakereservoirs-3/2.asp

References

Rowbotham, K.L. (2011). Green, stinky and sick: undergraduates' misconceptions of eutrophication, *Proceedings of the GSA Annual Meeting*, **43**, (5), 68.

Eutrophication statements

Fertilisers used on crops contain nutrients
(e.g. nitrogen and potassium) which support plant growth

Rain water can dissolve fertilisers and carry them into water courses
(e.g. rivers, lakes or oceans)

An increase of nutrients in the water encourages the growth of algae.
This can cause an algal bloom over the surface of the water which
stops light reaching the rest of the lake

Plants living within lakes require light to carry out photosynthesis:

$$\text{carbon dioxide} + \text{water} \xrightarrow{\text{light energy}} \text{glucose} + \text{oxygen}$$

Plants living within the lake die if they cannot carry out photosynthesis

The process of photosynthesis releases oxygen into the water
– if the plants living within the lake die then the dissolved oxygen
levels in the water will decrease

The decomposition of dead plants and algae also uses up
dissolved oxygen in the lake water

Fish and other animals living within lakes rely on dissolved oxygen in the
water to carry out respiration:

$$\text{Glucose} + \text{oxygen} \longrightarrow \text{energy} + \text{water} + \text{carbon dioxide}$$

Fish and other animals living within the lake die if they
cannot carry out respiration

Cambridge Technicals in Science Level 2

Unit 7 – Food Production
Eutrophication Learning Outcome 2:
Understand the key factors that affect crop production.

Task 1: Eutrophi-what now?

You have been given a series of cards containing step-by-step statements on how eutrophication occurs. You should read these and then place them into the order that you think explains the process fully.

Task 2: Causal relationships in eutrophication:

Use the information on the ordered cards to complete these sentences:

The level of nitrogen and potassium in lake water can increase if _____

_____

_____

An algal bloom can form over the surface of a lake if _____

_____

_____

The plants living within the lake can die if _____

_____

_____

The fish (and other animals) living within the lake can die if _____

_____

_____

Task 3: Spreading the word:

Create a storyboard for an advert designed to educate farmers about the problems caused by eutrophication. Think about the best way to visually represent eutrophication – each shot of your advert should have a picture and a caption summarising what the shot would capture.

Cambridge Technicals in Science – A new vocational qualification

The Cambridge Technicals in Science is a new set of vocational qualifications that has been developed by OCR.

The science sector continues to innovate and grow, and the Cambridge Technicals in Science aims to prepare learners for a wide range of career opportunities in this sector.

The Cambridge Technicals in Science is a Level 2 qualification developed for post-16 learners, in either a school or FE environment.

Through this qualification we aim to:

- Provide a robust scientific foundation
- Be engaging and relevant for learners
- Provide a good foundation for learners going on to further education/ higher education/workplace
- Provide support and resources for teachers/tutors.

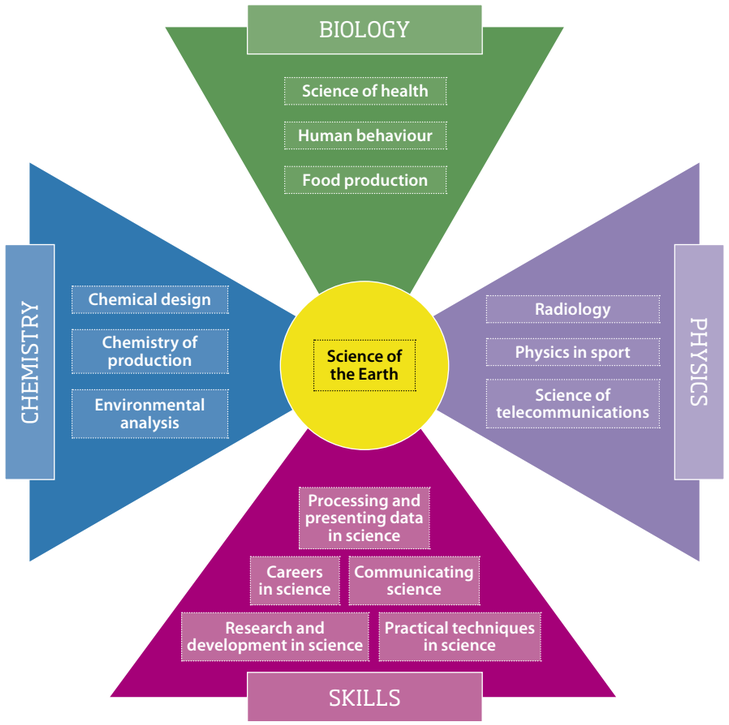
Structure

A variety of qualification sizes are available, and a qualification in the Cambridge Technicals in Science can be built to suit learner and centre needs. The qualifications available are shown in the table below.

Qualification	Total number of credits	Total number of guided learning hours
Certificate	15	90
Extended Certificate	30	180
Diploma	60	360

Cambridge Technicals in Science

There are 15 units that can be combined in a variety of ways to produce a qualification. The units cover the traditional disciplines of Biology, Chemistry and Physics. There are also units centred around some of the skills required in science. The diagram on the right shows the different units available.



The units are worth either 5 or 10 credits, as shown in the table below.

Discipline	Type of unit	Title of unit	Number of credits
Biology, Chemistry & Physics	Mandatory	Science of the Earth	10
Skills	Optional	Processing and presenting data in science	5
Skills	Optional	Careers in science	5
Skills	Optional	Communicating science	5
Skills	Optional	Research and development in science	5
Skills	Optional	Practical techniques in science	5
Biology	Optional	Science of health	10
Biology	Optional	Human behaviour	10
Biology	Optional	Food production	10
Chemistry	Optional	Chemical design	10
Chemistry	Optional	Chemistry of production	10
Chemistry	Optional	Environmental analysis	10
Physics	Optional	Radiology	10
Physics	Optional	Physics in sport	10
Physics	Optional	Science of telecommunications	10
	TOTALS	15	125

Cambridge Technicals in Science

Rules of combination

In order to achieve a qualification in the Cambridge Technicals in Science, learners must undertake the mandatory unit (Science of the Earth = 10 credits). Learners can make up the rest of their qualification from the remaining 14 units.

Example 1

To achieve a Level 2 Certificate in Science (15 credits in total), learners could complete the mandatory unit (Science of the Earth = 10 credits), plus the unit 'Careers in science' (5 credits).

Example 2

To achieve a Level 2 Diploma in Science (60 credits), learners could complete:

- The mandatory unit (Science of the Earth = 10 credits)
- Three Biology units (30 credits)
- One Chemistry unit (10 credits)
- Plus the skills units of 'Practical Techniques in Science' (5 credits) and 'Communicating Science' (5 credits) in a biological context.

Assessment

Key features of the assessment of the Cambridge Technicals in Science are as follows:

- Assessment is **100% portfolio-based**
- Assessment of units is by centre-devised assignments or tasks. This provides you with opportunities to tailor assignments or tasks to meet the needs of the learner
- Assessment of all units can take place at a time to suit learners and your centre
- Teachers/tutors and assessors can draw on real work-based opportunities for learners to generate evidence. This approach has been found to motivate learners and increase the likelihood of them staying on the programme. Even where work-based activities are limited, these qualifications are designed to enable learners to generate assessment evidence in a vocationally relevant context
- Performance at unit level is graded as Pass, Merit or Distinction. These grades are aggregated to provide an overall grade for the qualification. Qualifications above Pass grade are graded Merit, Distinction and Distinction*
- There is no external assessment – all units are assessed by your centre and externally moderated by an OCR Visiting Moderator.

Documentation and support for centres

Each individual unit of the Cambridge Technicals in Science consists of:

- Learning outcomes and Assessment Criteria
- Aim of the unit
- Teaching content – exemplification of what must be taught, including guidance and examples where appropriate
- Delivery guidance – suggested learning activities for teachers and learners
- Suggested assessment scenarios and guidance on assessment.

Additionally, we offer the following free materials to aid teachers:

- Centre Handbook
- Skills Guide
- Rules of combination calculator
- Progress tracker.

There are also additional free materials available for a number of units:

- Delivery Guides
- Resources Link documents
- Unit introduction presentations
- Lesson elements.

We also have CPD events available in the spring and summer terms – for more information, see **https://www.cpdhub.ocr.org.uk**

Where to go for more information about the qualification:

Cambridge Technicals – Science Level 2 Certificate/Extended Certificate/Diploma – 05783, 05785, 05788 – OCR

Naomi Rowe
Qualifications Team Manager A Level Sciences

Best and worst lessons

Biography

Kris Smith is the Head of Science at Fakenham Academy Norfolk and Fakenham College. He has been teaching for over 17 years. During this time he has held a number of roles including Extra Curricula Leader at Fakenham College, Head of Physics, Leader of e-Learning, and Advanced Skills Teacher. He has worked as an Examiner for GCSE Science and Physics, revising papers and controlled assessments and writing exam questions. Kris also spent two years teaching Science in Guyana, South America, as a VSO volunteer.

Best lesson

One of the best lessons that I ever taught was a lesson on distance-time graphs.

It was the start of Year 11 Additional Science – forces and motion with a 'tricky', lower ability group with some behavioural problems, a few enthusiastic kids, and plenty of quiet and reluctant learners.

The previous lesson had been about using the equation: speed = distance / time, and we had been outside in the playground measuring distances, running up and down, and measuring the time taken. This had then led nicely on to working out the speed. This had worked well with the group and I now wanted them to move on to the graphical representation of motion.

The starter was a few simple questions on the board as they came into the lesson. They were to answer these on mini-whiteboards – they were much happier to have a go and make mistakes on these rather than in their books! To ensure a swift start to the lesson, I put on a timer to inject some pace to the initial part of the lesson.

Most of them had remembered what they had done in the previous lesson and the way to answer the questions – so far so good! Then it was on to the new stuff!

I drew a simple graph on the board to represent a person walking 20 metres in 10 seconds followed by a pause (5 seconds), then a faster section for 10 seconds and then an immediate return to the start; standard fare for this unit. I challenged the class that by the end of the lesson they would understand not only this graph but a more difficult one. They were sceptical to say the least!

Using the values on the graph and the formula they learned and used in the last lesson, I teased out the ideas of moving forward with a speed, staying still, moving faster (dividing by zero is always fun) and then returning to the start. They drew this in their books and labelled each section.

Then came the proof of the pudding: 'Walking the graph'! I had a PowerPoint which featured some distance-time graphs. Each graph took about 10 seconds and involved the learners walking the length of the classroom. Initially I told the group I had enough for one each and that everyone would be having a go. I asked for volunteers – I got about 6 or 7. They lined up ready to use the graph from the PowerPoint to determine their motion.

The learners did really well and could follow the more straightforward graphs easily. Then the graphs became harder and the learners became more reluctant to volunteer. However, they really got involved and they all got up and had a go. Some found it tricky but everyone had a try. By the end of this lesson I didn't even have to tell them if they got it right, the learners just clapped if they did or suggested changes if they got it wrong. By the end they understood curved graphs and graphs that went below the axes.

I used the same method for speed-time graphs in the following lesson and it was just as effective.

Worst lesson

We have all had them! The lesson was planned in detail. There was a PGCE learner working with the group as well. What could go wrong?

I had planned for half the class to be doing a piece of coursework they had missed (Geography trip I think) collecting data on resistance of a wire. Another group of learners were working on drawing a graph of their results, and those who had been there every lesson were beginning their conclusions. The plan was that the PGCE learner would help the learners carrying out the practical. Thus, three different activities happening at the same time.

In retrospect I can see I was being a little ambitious, especially with a potentially challenging class, and should have known the writing was on the wall when half of them were late to the lesson due to a careers convention.

Every time I started to explain what I wanted them to do someone else would arrive. Needless to say I was running around like a headless chicken, telling groups what they should be doing, handing out pencils and rulers, asking others what they had done with their results. At this point I looked over at the PGCE learner's group only to see smoke rising from the ni-chrome wire mounted on a ruler!

Fortunately, there wasn't a full-scale fire, no one was hurt and the ruler was only scorched at one end!

We tried again next lesson and it was much more successful – it would have been hard to not be really!

Science conferences

A Level Chemistry Conference 2013 – From theory to practice

The first OCR A Level Chemistry Conference in July was a great success, with over one hundred teachers attending and very positive feedback.

The conference provided teachers with an opportunity to take a fresh look at key topics relevant to A Level Chemistry. Delegates left equipped with new ideas for practical work and to enhance teaching in the classroom.

The event was held at the Royal Institution (RI) in the Faraday Lecture Theatre, made famous by the televised Christmas lectures and more recently in 'The Science of Doctor Who'. Delegates also had the opportunity to explore the Faraday Museum in the historic RI headquarters in Mayfair, London.

Practical demonstrations from the Naked Scientists and from Dr Hal (and his Bigger Bang! team) provided the wow factor, as well as new ideas for exciting practical work that can be used in the classroom.

Dr David Read (University of Southampton) ran an interactive session on Analytical Techniques, showcasing the use of voting keypads. Delegates commented *"Very much enjoyed Dr Read's interactive presentation"* and *"Book Dr David Read again – fantastic stuff!"*

Other sessions included Dr Dewi Lewis (UCL) on 'A lesson in how science works' and the Royal Society of Chemistry who showcased their range of free online resources.

Delegates felt *"All the talks were really engaging"* and the conference offered *"The chance to listen to inspirational speakers"*. We also received the comment *"Fantastic day! Thank you!"*

OCR is planning to build on this success with more A Level Science conferences for Biology, Chemistry, Geology and Physics in 2014.

Ruth Roca-Terry
Qualifications Manager A Level Chemistry

A Level Science Conference at The Royal Institution in London

We are now close to finalising our programme for the first of our three-day **A Level Science Conference** at the Royal Institution in London.

The events will once again be held in the famous Faraday Lecture Theatre.

Biologists should save **Monday 30 June 2014** when they will have the opportunity to hear from experts in their field, as well as hone their lab techniques with some hands-on sessions. We are delighted that **Professor Brian Sutton**, Professor of Molecular Biophysics at King's College London, will take us through 'The Story of DNA'. **Dean Madden** and **Frank Schollar**, National Centre for Biotechnology Education at the University of Reading, will take delegates through the practical session.

Chemists and **Geologists** will join forces on **Tuesday 1 July 2014**.

Chemistry – Back by popular demand is **Dr David Read** from the University Southampton who will lead a session on Kinetics. We will also have **Professor David K Smith**, University of York, who will present 'Medicine beyond the Molecule – real-world applications of non-covalent interactions'. Presenting a lecture on Practical Chemistry, we have **Dr Ben Littlefield** from the University of Reading.

Geology – We are delighted to have **Professor Iain Stewart** from Plymouth University and BBC television series 'Fracking: The New Energy Rush' presenting. We will also have **Dr Laurance Donnelly**, Chartered Engineering and Exploration Geologist at Halcrow Group Limited, who will take us on a shocking journey through Forensic Geology, which is not for the faint-hearted. **Professor Rory Mortimer**, Visiting Professor at the University of Leeds, will run a session on Chalk Engineering.

Physicists can put **Wednesday 2 July 2014** in their diary! We anticipate that we will have a laser demonstration to open the day, to be followed by **Anu Oja**, Director of Education and Space Communications, National Space Centre, who will give a presentation on 'Sky diving & Red Bull – The Physics behind the stratos sky dive', and then **Dr Peter Cole** from the University of Liverpool will talk about Medical Imaging. We also anticipate having some hands-on sessions available throughout the day.

On all three days there will also be an opportunity for attendees to receive an update on A Level redevelopment, take a tour of the Royal Institution, and explore the Faraday Museum.

Check **cpdhub@ocr.org.uk** for more details and booking information.

Naomi Rowe
Qualifications Team Manager A Level Sciences

Research notes...

Frances Wilson, Research Officer in Cambridge Assessment's Research Division, introduces the research team and their work in educational research.

What is the Research Division?

OCR is part of Cambridge Assessment, which operates and manages the University of Cambridge's three awarding bodies: OCR, Cambridge International Examinations, and Cambridge English. As a long-standing department of the university, we take research very seriously, and have the largest research capacity of its kind in Europe, with more than 70 researchers employed across the organisation. The Research Division comprises statisticians, educationalists, psychologists, psychometricians and social scientists.

What do you enjoy about working in educational research?

I've always been interested in how people learn, and educational research lets me look at that issue from a range of different perspectives. By working closely with teams who are developing new qualifications, my work can have a direct impact on the development of qualifications that support high-quality learning.

What is the most interesting piece of educational research you have come across?

A paper by researchers at the University of Leeds, published recently in the *British Educational Research Journal* [Homer, M., Ryder, J. and Donnelly, J. (2013), Sources of differential participation rates in school science: the impact of curriculum reform. *British Educational Research Journal*, 39, 248–265, DOI: 10.1080/01411926.2011.635783, see **http://onlinelibrary.wiley.com/doi/10.1080/01411926.2011.635783/abstract**], showed that recent moves to encourage more learners to take triple science GCSEs have increased the number of girls who take triple sciences. This may be good news for the number of girls continuing to study Science post-16: work published recently by Carmen Vidal Rodeiro, a colleague in the Research Division, found that learners taking triple science GCSE are much more likely to progress to post-16 qualifications in Science [Vidal Rodeiro, C.L. (2013) Comparing progression routes to post-16 qualifications. Research Matters: A Cambridge Assessment Publication, June 2013, Issue 16, see **www.cambridgeassessment.org.uk/Images/142074-research-matters-16-june-2013.pdf**].

How does the work of the Research Division relate to OCR and Science developments?

Cambridge Assessment uses research findings to support the development and administration of qualifications wherever possible. We have been working closely with the OCR Science qualification development team to supply research evidence to support their development work. For example, we have been talking to teachers and employers about their views on Science qualifications as well as looking at more technical features of the assessment, such as tiering.

What projects are the Research Division involved with?

The research projects that we design and conduct are many and varied. While some extend over several years, others are much shorter, taking place over a few months or even a few weeks. Some projects focus on individual subjects or qualifications, while others make comparisons across subjects and levels. Our projects involve a wide range of interested stakeholders, including schools and colleges, professional subject associations, the educational assessment community, government departments, and Ofqual.

We also regularly attend conferences and present our findings (see next page). Our Group Director, Tim Oates, will be presenting at the ASE Annual Conference in Birmingham (**www.ase.org.uk/conferences**), 9th January 2014. His talk will be based on a recent piece he wrote about coursework marks which will be of particular relevance given the proposed practical assessments for Science (see **www.ocr.org.uk/news/view/time-to-end-coursework-marks-counting-towards-gcse-results**). We also share our findings with organisations such as SCORE.

Where can we find out more about the Research Division?

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

Some recent Research Division reports include:

Examining the impact of tiered examinations on the aspirations of young people

(Tom Benton, presented at the British Educational Research Association conference, Brighton, September 2013, see ***www.cambridgeassessment.org.uk/Images/145926-examining-the-impact-of-tiered-examinations-on-the-aspirations-of-young-people.pdf****)*

Many GCSE examinations use tiering to ensure that learners sit papers that are tailored to their ability level, leading to more accurate measurement of their ability and a better assessment experience, because they do not have to answer many questions that are either too easy or too hard. However, the limited grade range on the Foundation tier (maximum grade C) has led to concerns that the future aspirations of learners who are entered for this tier may be capped. This research made use of data available from the Longitudinal Study of Young People in England (LSYPE). The LSYPE began in 2004 collecting data on the attitudes of around 16,000 Year 9 pupils in a representative sample of English schools. These pupils have been followed up in every subsequent year so that data has been collected on their educational and attitudinal development over time. Although a link between tier of entry and aspirations was found, once level of achievement and other background characteristics were taken into account, there was very little difference between young people entered for Foundation and Higher tiers in terms of their intentions to remain in education post-16.

A comparison of assessment at university and A Level

(Frances Wilson, Simon Child and Irenka Suto, presented at the European Conference on Educational Research, Istanbul, September 2013, see ***www.eera-ecer.de/ecer2013****)*

Recently, A Levels have been criticised because it is felt that they do not provide an adequate preparation for university study. It has been suggested that differences in the form of assessments used at A Level and university may be part of the problem. Assessments at A Level and the first year of university were compared in three subjects: Biology, English Literature and Mathematics. For Biology, university assessments were much more diverse than at A Level, and included many different forms of practical assessment, coursework and presentations. While many university assessments would be difficult to 'scale up' to a large entry qualification such as A Level, the diversity of university underlines the important role that teachers play in providing learners with a wide range of experiences during their A Level course. Compared to A Level, university assessments had fewer structured questions, and were more likely to ask learners to produce extended writing, rather than the short answer questions that are prevalent at A Level.

Radical solutions in demanding times: alternative approaches for appropriate placing of 'coursework components' in GCSE examinations

(Tim Oates, see ***www.ocr.org.uk/news/view/time-to-end-coursework-marks-counting-towards-gcse-results****)*

In his paper, Tim Oates (Group Director of the Assessment Research Division) argues that the skills which are developed through coursework, such as writing and practical skills, are educationally desirable. However, coursework is vulnerable to parental involvement, while controlled assessment makes heavy demands on teaching and learning time. Current school accountability measures place teachers in a contradictory position: at the same time they are required to be impartial markers, but are under pressure to meet accountability targets. Tim proposes that coursework marks should not count towards the final qualification, but that learning activities should be specified in the syllabus. Teachers would keep a log of these activities, and knowledge linked to coursework, such as knowledge of practical work, would be assessed in an external examination.

Tim Oates, Group Director, Assessment Research Division

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