OCR A Level Sciences

Working in partnership with OCR to create resources for the new 2015 AS and A Level specifications

Available January 2015

To request inspection copies of any of the above AS or A Level resources for 2015, email hayley.durston@oup.com.
Welcome back to a new term and the autumn 2014 issue of Science Spotlight. It’s been a busy summer here – At the time of going to press, we are pleased to announce that Biology A, Biology B, Physics A and Physics B have been accredited by Ofqual. For Chemistry A and Chemistry B (Salters) Ofqual has requested some minor revisions and our hope is that these will be accredited shortly. We’ve published our draft AS and A Level specifications, specimen assessment materials and summary brochures and spoken to over 1,800 teachers at our ‘Expo’ events (see our update on GCSE and A Level reform). More events will be available this term – you’ll find details at cpdhub.ocr.org.uk

In this issue, you can read some interesting items about the new A Levels from our Subject Specialists. Sarah Old tells you more about the new AS and A Level Biology qualification she’s been involved in developing: Biology B (Advancing Biology). The pull-out resource for this issue is also for Biology B (Advancing Biology), while John Dewis demystifies the new Ofqual requirement around Level 2 assessment of mathematical skills in A Level sciences. Over the autumn, we’ll be working on two new resources for the new A Levels (a Maths Skills Handbook and a Practical Skills Handbook, one for each of Biology, Chemistry and Physics).

We’re now progressing well with our GCSE redevelopments, with our publisher partner OUP, and look forward to sharing more details with you over the coming months. See the ‘Research notes’ for Frances Wilson’s summary of some research on tiering at GCSE. We’re keen to make sure we support teachers as effectively as possible for the new qualifications, so if you have ideas for resources you’d like to see, please do email us at ScienceSpotlight@ocr.org.uk

This autumn, along with all the other awarding organisations, we’ll be trialling features of the A Level Practical Endorsement that will be common to all boards (moderation, record-keeping requirements, common assessment criteria). This trialling is at the request of Ofqual and will lead to finalised arrangements being available in spring 2015. A number of teachers have contacted us, keen to be involved in the trial. If you’re interested, please email us at ScienceSpotlight@ocr.org.uk. The Practical Endorsement continues to generate interest (see the summary of Professor John Holman’s practical seminar in ‘Out and about…’ on page 22 and articles in the Telegraph), and at the time of going to press we’re waiting for details of an Ofqual consultation on practical assessment at GCSE.

We hope you enjoy this issue of Science Spotlight. As always, if you have a suggestion for an article for a future issue, please email us at ScienceSpotlight@ocr.org.uk

Enjoy the autumn term and we look forward to seeing some of you at our stand at ASE in Reading in January or in our training events over the coming months.

Steve Evans
Assistant Head of General Qualifications Reform
Ofqual hasn’t published any more information on requirements for the new GCSE Science since issue 2 of Science Spotlight. There has, however, been an update on its plans for the remaining GCSE science subjects, eg Additional Applied Science (see the box on the next page).

The draft criteria for GCSE Science have been published (www.gov.uk/government/collections/gcse-subject-content) and we’re working on drafting specifications based on this content. At the time of going to press, Ofqual is still intending to run a further consultation for GCSE Science around assessment of practical work from September 2014. There’s been a suggestion that GCSE could follow a model similar to the A Level Practical Endorsement, so please do visit the Ofqual website (ofqual.gov.uk) to look at this important consultation.

Want to get involved?

Through the autumn, we’ll be 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 you’d like to share around future GCSEs.

At the time of going to press, we are pleased to announce that Biology A, Biology B, Physics A and Physics B have been accredited by Ofqual. For Chemistry A and Chemistry B (Salters) Ofqual has requested some minor revisions and our hope is that these will be accredited shortly. We will update our website as accreditations are received as well as posting via Twitter (@OCR_science). The draft specifications, specimen assessment materials and summary brochures are all available on our website: ocr.org.uk/alevelbiology
[see page 8 for an item on our new A Level, Biology B (Advancing Biology)]
ocr.org.uk/alevelchemistry
ocr.org.uk/alevelphysics

We’ve found your feedback really useful

We’ve really enjoyed meeting teachers and talking about our development proposals over the summer, seeing over 1,800 teachers at conference centres and sports grounds from Exeter to Newcastle. The team has found it really useful to hear your feedback and find out where you have concerns around A Level changes and what we can do to help with delivery of the new specifications.

Through the autumn and beyond, we’ll continue to publish materials to give further support on our qualifications. For example, there’ll be a Practical Skills Handbook, a Maths Skills Handbook and further Lesson Elements and Transition Guides. If you have queries on any of the qualifications, please get in touch.

It’s been very important to us to make sure that what we’ve developed works for teachers and students. We’ll keep talking to teachers and other stakeholders to gain views on how to continue to best support our qualifications and to help with our focus on GCSE development over autumn 2014. Throughout the current development, we’ve had discussions with over 100 centres (including trialling of specimen materials in around 20 centres) and we’ve been able to gain views from across a range of centres, universities and employers through our subject forums. If you’re interested in being involved with future subject forums, please email us at ScienceDevelopment@ocr.org.uk

You have been able to look at draft specifications and specimen assessment materials on our website from early July (subject to change depending on Ofqual submission deadlines).
Ofqual has announced its plans for the remaining science qualifications not currently scheduled for development. It ran a consultation that closed on 30 July 2014. At the time of going to press, the proposals were:

- AS and A Level Applied Science and AS and A Level Human Biology to be discontinued, final awards June 2016
- AS Level Science – unclear from proposals but potentially to be discontinued, final awards June 2016
- GCSE Additional Applied Science, and Environmental and Land Based Science (ELBS) to be discontinued, final awards June 2017
- AS and A Level Geology to be redeveloped for first teaching September 2017.

As we’re so early in the redevelopment process, it’s too soon to predict how a redeveloped AS and A Level Geology might look but we anticipate that requirements will be similar to those in the new Biology, Chemistry and Physics A Levels. As always, we’re very happy to hear from you if you’d like to talk to us about what you’d like to see in the new Geology qualifications.
Using the backward design approach to curriculum planning

Mary Whitehouse

Many teachers reading this will be dealing with a new National Curriculum for Key Stages 1–3 and also looking towards the changes to A Levels for teaching from September 2015 and new GCSE specifications from September 2016. When planning new schemes of work, three of the key influences you will think about that affect what happens in the classroom are:

• The curriculum (what we teach)
• Pedagogy (how we teach)
• Assessment (how we find out what has been learned).

Most lesson planning focuses on the first two of these, with assessment often considered as an afterthought at the end of the process; however, “assessment is a central – perhaps even the central – process in education” (Wiliam, D. 2010).

One aspect of the influence of assessment on teaching is what happens when new specifications arrive in school; teachers immediately turn to the sample assessment materials (SAMs) that the awarding bodies provide to find out:

• What do the specification statements mean?
• What will the examination questions that assess those statements look like?

Looking at the assessment helps to identify the intentions of those specification statements.

We should not just be concerned about the assessment that comes at the end of a two-year course; assessment should also be at the front of our minds when writing the learning intentions for each lesson. Until we have identified a question or task that would provide evidence that a student has met a given learning intention, we do not really know what the intention means, and we cannot communicate it clearly to others.

So when planning a teaching module, begin by selecting the questions and tasks that will provide you with evidence that a student has (or has not) achieved each of the learning intentions. Selecting these questions and tasks will help to clarify the intended outcomes of the lesson. Only then plan activities that will help students learn what they need to learn to complete such questions and tasks. Starting the planning by thinking about the end point of the lesson ensures that the teaching activities are clearly directed towards the intended learning. This ‘backward design’ approach to curriculum planning was introduced by Grant Wiggins and Jay McTighe (2005) in their book ‘Understanding by design’. The approach is summarised in Figure 1.
What kind of questions and tasks are useful?

In the Science Education Group at York, we have been using this backward design approach in our most recent project, York Science, in which we are developing questions and tasks that will provide evidence of students’ learning at Key Stage 3. Having identified the key ideas that we want students to understand, we take the available research evidence on children’s ideas about science and use it to develop diagnostic questions that not only identify which students have the correct idea, but also show the thinking of those who have alternative ideas about a science concept.

Figure 2 shows a diagnostic question that probes students’ ideas about electric circuits – questions like this were developed by the EPSE (Evidence-based Practice in Science Education) project (Millar, 2002). Teachers have found questions like this a good stimulus for group discussions which can reveal much about students’ understanding of key science ideas.

You can read more about such diagnostic questions on the project website (yorkscience.org.uk). Questions of this kind are useful at the beginning of a sequence of teaching to find out where students are in their understanding, or to check on progress during a lesson. Many examination questions can be used as the basis for diagnostic questions. I have looked at the Chief Examiner’s Reports to Centres and the mark schemes to identify common ‘weak’ and ‘wrong’ answers to parts of questions and then used those to create multiple-choice questions using confidence grids. You can read more about that work on the York Science website too (yorkscience.org.uk).

Mary Whitehouse is a member of the Centre for Innovation and Research in Science Education at the University of York and is joint Project Director for York Science and for Twenty First Century Science.

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Introducing Biology B (Advancing Biology) – a new and innovative approach

Are you interested in a Biology A Level course that has biological concepts taught and assessed through up-to-date and fascinating contexts?
Would you like to deliver a course that has an emphasis on practical skills in biology?

Our new GCE Advancing Biology qualification has been developed as an alternative approach to OCR Biology A and, like our other ‘B’ specifications, gives students relevant and modern contexts in which to set their study of the challenging biological ideas that make up an advanced level course. For example, cell structure and function are considered in the context of the blood and the cells found in it, and photosynthesis is approached in the context of food production and management of the environment.
Advancing Biology places an emphasis on practical work, encouraging the development of hands-on practical skills and problem solving in a practical context. We’ve flagged the many opportunities for practical work throughout the specification and indicated where these can be used to support the Practical Endorsement (part of the full A Level).

Advancing Biology is split into five modules:

<table>
<thead>
<tr>
<th>Module</th>
<th>Title</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Development of Practical Skills</td>
<td>Details about the development of hands-on practical skills</td>
</tr>
<tr>
<td>2</td>
<td>Cells, chemicals for life, transport and gas exchange</td>
<td>Cells and chemicals for life Transport and gas exchange systems</td>
</tr>
<tr>
<td>3</td>
<td>Cell division, development and disease control</td>
<td>Cell division and cell development Pathogens, immunity and disease control Non-communicable diseases</td>
</tr>
<tr>
<td>4</td>
<td>Energy, reproduction and populations</td>
<td>Energy metabolism and exercise Reproduction Food production and populations</td>
</tr>
<tr>
<td>5</td>
<td>Genetics, control and homeostasis</td>
<td>Genetics in the 21st century Nervous control Homeostasis</td>
</tr>
</tbody>
</table>
How have we decided on the content?

60 per cent of the course content is determined by the criteria laid down by the Department for Education and so the common content required in all GCE Biology qualifications is present. This includes cell biology, biochemistry and biodiversity. We’ve used the other 40 per cent to cover some of the most interesting content that students and teachers at this level want to study and deliver. Topics include immunity, human evolution, reproduction, and modern genetics techniques and theories.

Modules 1 to 3 are studied to achieve the stand-alone AS Level qualification and Modules 1 to 5, combined with the Practical Endorsement, constitute the full A Level. Development of practical skills (Module 1) underpins the whole specification, and covers the practical skills that students should gradually develop through hands-on practical work during the course. They’ll find questions about the practical skills in this module in their written examinations and, for A Level only, the skills will be assessed within the Practical Endorsement.

Advancing Biology emphasises the development of biological literacy skills, which are assessed at the end of the course using an Advance Notice article. In this Advance Notice, students will find a biological article relating to content in the specification. They’ll be able to read and research this article from its release in the March before the June examination series, and will then have to answer up to 20–25 marks worth of questions relating to it on Paper 2 of their A Level examinations. In this way, we hope the article will help students to develop their literacy skills in biology and will also spark classroom discussion about interesting and relevant biological topics.
Which one will you select?

We’re rolling out a package of creative and high-quality resources, the first of which are designed to support teachers in the decision-making process about which GCE Biology qualification to choose from 2015. We’ve taken on board research about how students learn and common misconceptions, and created a variety of styles of resources to save teachers time and support them as they deliver new courses including Advancing Biology.

We’ve supported new content, such as that on human evolution, with a Topic Exploration Pack that provides a novel and interesting approach to this material. We’ve illustrated topics that are covered at more than one key stage, such as transport into and out of cells, in Transition Guides that give ideas on how to check a student’s understanding at one level before moving on to look at the subject in more depth.

Free resources

You can download all these free resources from the Advancing Biology page on our website (ocr.org.uk/alevelbiologyb). An example is included in the pull-out resource for this issue of Science Spotlight (see pages 11-14).

You’ll also find the draft Advancing Biology specification there, along with specimen assessment materials (question papers and mark schemes) for both the AS qualification and the A Level. There’s a summary brochure for download on this page too, which gives an overview of this qualification, including details about the Practical Endorsement.

If you have questions or want to get in touch about the qualification and how we might support the delivery of Advancing Biology, email the team

GCEScience@ocr.org.uk

We hope you’ll consider these new and innovative approaches to GCE Biology and use them to inspire your students to further biological studies.
A Level Biology B

Transport across membranes

Task Guidance

- Modelling task, could be used at the end of GCSE to assess understanding or as a starter at the start of A Level.
- Students are challenged to produce A4 summary diagrams using templates.
- Can be done individually or in small groups.
- Limited number of template pieces means careful thought is needed.
- Annotations can be added to the diagrams.

This resource is an exemplar of the types of materials that will be provided to assist in the teaching of the new qualifications being developed for first teaching in 2015. It can be used to teach existing qualifications but may be updated in the future to reflect changes in the new qualifications. Please check the OCR website for updates and additional resources being released. We would welcome your feedback so please get in touch.

To view all of our sample resources for GCSE and A Level Reform, visit ocr.org.uk/reformresources
Transport across membranes

Using the templates of oxygen, water, glucose, vitamin molecules, membrane templates, and membrane protein pieces, along with some key word labels, complete three A4 summary diagrams to show:

- diffusion,
- osmosis,
- active transport.

Add your own annotations as well as using the pre-provided templates.

Think carefully about each of the processes before you start making your summaries, as there are a limited number of template pieces and you will need to decide which pieces you are going to use for each of your explanations.
water  water  water  water  water  water  water  water  water  water  water
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# A Level Biology B

**KS4-KS5 Transition Guide**

**Checkpoint Task**

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**OCR resources: the small print**

OCR's resources are provided to support the teaching of OCR specifications, but in no way constitute an endorsed teaching method that is required by the Board and the decision to use them lies with the individual teacher. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. © OCR 2014 - This resource may be freely copied and distributed, as long as the OCR logo and this message remain intact and OCR is acknowledged as the originator of this work.

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The results are in

Our preliminary analysis (Figure 1) of the 178 responses we received shows just how complicated it can be to make the best decision about tiers for borderline students. Teachers indicated that they use multiple sources of information to make the best decisions for their students. As might be expected, a student’s prior and predicted attainments were considered to be important or very important by the overwhelming majority of teachers. Teachers said that they measure prior attainment using a variety of different sources of information, including tests they’ve developed, students’ work in class, and students’ performance on past GCSE papers.

Other key factors

The ability to cope with written examinations and the perceived relative difficulty of the grade C on each tier were also important. Comments made by some teachers indicated that they thought this varied by student: some students feel more confident if they can answer more of the less demanding questions on the Foundation tier, while other students prefer the challenge of answering a smaller proportion of the more demanding questions on the Higher tier. Furthermore, teachers commented that tiering allowed them the flexibility to choose an assessment suitable for their students, both in terms of demand and literacy level.

Although teachers and their departments play the most important role in making decisions on tier entry, teachers also reported that they take their students’ opinions and aspirations into account. About a third of teachers reported that parents are also involved in the decision.

The reformed GCSEs will use a new grading scale, with grades from 9 (the highest) to 1 (the lowest). We expect that the new Foundation tier will span grades 1 to 5, and the Higher tier grades 4 to 9, with an overlap at grades 4 and 5. Particularly in the early years of the reformed GCSEs, it will be crucial that teachers have the appropriate support to help them make sure that their students are entered for the most appropriate tier.

Figure 1: Teachers’ views on the importance of various factors for deciding tier entry for borderline students.

Where can we find out more about the Research Division?

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. cambridgeassessment.org.uk/our-research.
What is the connection between the halogens and salami?

Dr Simon Rees, Teaching Fellow, The Foundation Centre, Durham University

It sounds like the sort of question that Stephen Fry would ask on an episode of QI, but would you or your students know the answer? Or, more importantly, do they know how to work out the answer?

That is to say, you may know the answer to this because you have seen it before or you may be able to answer it because you are equipped with the linguistic skills to be able to decipher the meaning of these words and thereby determine the connection between them.

My students have remarked to me in the past that "it’s like you are talking a different language" as I introduce them to a plethora of words unique to chemistry. These include specialist terms such as stoichiometry or everyday words that are used in a specific chemistry context, eg reduction. As a result, the language of chemistry can be a significant barrier to student understanding and it is important to equip students with the skills to tackle this challenge. Pyburn et al. (2013), for example, state that:

"efforts to prepare students for success in general chemistry should include both content and the development of language comprehension skills."

To this end, a research project is under way at Durham University (the FOCUS Project) to develop teaching strategies to improve student understanding of the language of chemistry. In particular, the project has been applying the principles of corpus linguistics to explore the connections between different words in chemistry (see Rees et al., 2014) so that students can develop strategies to interpret new and unfamiliar vocabulary in a chemistry context.

The project has developed a collection of Durham students’ writing, from foundation to postgraduate level, that can be searched for specific terms in a similar way to a web search engine (see community.dur.ac.uk/foundation.focus). This resource may be used with students in a number of ways, such as to improve understanding of scientific affixes, explore common collocations, expand scientific vocabulary and improve academic writing. A search for the prefix ‘hydro’, for example, will reveal all words within the corpus containing this prefix, showing the context in which the word is used – ‘before’ and ‘after’ (an example result is shown in Figure 1).

The student can then develop understanding of the term ‘hydro’ and its usage in different words in different contexts and thereby improve their scientific language comprehension skills.

Developing this greater linguistic dexterity may enable a student with an understanding of the Greek origins of the prefix ‘halo’ and its connection with the Latin origin of the prefix ‘sal’ to make an educated response to the initial question (both refer to salt, eg halogen = ‘salt maker’). We believe that equipping chemistry students with these linguistics skills can help demystify the subject, improve accessibility and thereby raise achievement. If you are interested in finding out more about this project and being involved, please contact Dr Simon Rees simon.rees@durham.ac.uk

It sounds like the sort of question that Stephen Fry would ask on an episode of QI, but would you or your students know the answer? Or, more importantly, do they know how to work out the answer?
Before

I are polar molecules. The slightly positive on or fluorocarbon chain, and the lyophilic arbon has a high surface activity. Bonds with ch is only observable after a long period of range 5.4 - 9.8 and different sensitivities to reducing either syngas (carbon monoxide and electronic packaging needs good resistance to ionic catalyst was regenerated by boron ester (headgroup) and Chapter 1: Introduction 3 ated fatty acid which like sucrose contains a s shown in 1951 by Barker and Cromwell that a he parent compound is metabolised to methyl 4 hydrotreating followed by hydrocracking and operties of AMPs. High amphipathicity, 21 high the enantioselectivity of esterases in ester rds-eye view. To each concentration, 5 cm³ of cross marked on it. upon the addition of the hiosulphate need to collide with particles of

After

(hydrogen) (hydrophilic) hydrogen, hydrolysis. hydrolysis34. hydrogen) hydrolysis. hydrolysis. hydrolysos hydrogenic hydrophilic -hydroxy- -hydroxy- hydroisomerization. hydrophobicity, hydrolyses. hydrochloric hydrochloric hydrolyses. and negative parts (Oxygen) of the water mol group would be ionic or highly polar. Surfa hydroxyl and carboxyl groups can be formed a If the iodine crystals and water had been le Introduction of CF3 groups as a replacement or bio-oil as an intermediate; this is done Therefore aromatic esters 6 and 7 (Fig. 1.1) (Scheme 1.3). Further mechanistic studies (tailgroup) regions determining the propertie (water-loving), polar, hydroxyl group (-OH -piperidyl-phenyl-propiophenone decomposes 2: ((4-methoxy-6-methyl-1,3,5-triazin-2yl)

Figure 1. Search result for words beginning with ‘hydro’

References


What’s the story with these maths weightings I’ve heard about?

History demonstrates that mathematical skills are of great importance in science. From Archimedes and the ancient Greeks to Enrico Fermi and the age of the atom bomb, mathematics has played an important role in the development of science. Today, mathematical skills are as important as ever. Mathematics is an integral part of the teaching and learning of the sciences. The burden of proof in scientific discoveries and trials frequently relies on the correct analysis of data and the language of mathematics is essential in understanding and describing scientific ideas and processes.

For the development of the new A Levels in the sciences, Ofqual and the awarding organisations agreed that the mathematical requirements for A Level science qualifications should develop students’ confidence and competence in using mathematical skills. It was also agreed that the mathematical skills required by students for their science assessments would be made clear within specifications and that a minimum weighting of the assessments should assess these mathematical skills, within the context of the science, at a level of difficulty known as ‘Level 2’.

What are the weightings of mathematical skills assessment within science A Levels?

These are the minimum weightings for the assessment of mathematical skills content in science A Levels:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Mathematics skills weighting (at Level 2 difficulty*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>10%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>20%</td>
</tr>
<tr>
<td>Physics</td>
<td>40%</td>
</tr>
</tbody>
</table>

*Not all mathematics assessed has to be of Level 2 difficulty, but mathematics of lesser difficulty will not contribute to the weighting.
Why is there a weighting of mathematical skills?

The SCORE report ‘Mathematics within A-level Science 2010 examinations’ (2012) measured the extent, type, difficulty and appropriateness of mathematics assessed within science A Level examinations (including practical work). The report was critical of the wide variation between awarding organisations in the amount and difficulty of mathematics assessed in the sciences, and also raised concerns that questions requiring mathematical skills were of insufficient difficulty, often only requiring single-step calculations involving simple recall.

Higher Education Institutions have also expressed concern that students struggle with the mathematical demands of courses in science.

To ensure a consistent approach to the assessment of mathematical skills in the sciences, Ofqual and the awarding organisations agreed to signpost the mathematical requirements of their courses in their specifications and adhere to a specified minimum weighting and difficulty of mathematics assessment within the A Level sciences.

What's this 'Level 2' difficulty you keep mentioning?

To count towards the weighting, the mathematics assessed must be of a sufficient order of difficulty, known as 'Level 2'.

Essentially, questions involving GCSE standard mathematics skills that involve only simple substitutions or single-step calculations with little application required will be deemed as Level 1, and won't contribute towards the mathematics weighting.

Questions involving GCSE mathematics that require evidence of application and understanding or multiple-step calculations will count towards the Level 2 mathematics weighting.

Any mathematics skills of A Level standard and above will be deemed Level 2 for the purposes of the mathematics weighting. Mathematics skills that are beyond GCSE will also be signposted in the specification and a Maths Skills Handbook to make sure that teachers identify any areas of mathematics where students may need extra guidance.

I still don’t get it, show me an example:

A car of mass 900 kg is travelling at a speed of 20 m s⁻¹. Calculate

(i) the kinetic energy of the car

(ii) the deceleration of the car when the braking distance is 24 m.

Part (i) is straightforward substitution into a formula – kinetic energy = ½mv² – so this would be deemed a Level 1 skill and would not count towards the Level 2 mathematics weighting, although questions like this may still be assessed.

Part (ii) requires application, understanding, and some manipulation of the formula: v² = u² + 2as – so would meet the requirements for the Level 2 weighting.

Does this mean the new A Level sciences are harder?

We’ve agreed with other awarding organisations a consistent standard for the amount and difficulty of mathematical skills assessment within the sciences. The standard of A Level sciences will remain the same as for the current A Level.

Our current A Level sciences already feature a significant proportion of mathematical skills assessment at a suitable level. The key driver behind the mathematical requirements for the new specifications is to ensure a consistent approach to mathematical skills across awarding organisations and to help you identify the mathematical skills required of your students.

What about AS?

The maths requirements carry the same weightings at AS and A Level.

How is OCR helping teachers with the maths requirements of the new specifications?

We’ve referenced a mathematics appendix throughout our new science specifications to help you identify the mathematical skills required for specific science content. We’ll also produce resources including a Maths Skills Handbook, Lesson Elements and Delivery Guides so you have access to essential tools to help you deliver the mathematical requirements of our science specifications with confidence.
2. Fig. 2.1 shows the path of a golf ball which is struck at point F on the fairway landing at point G on the green. The effect of air resistance is negligible.

The ball leaves the club at 17 m s\(^{-1}\) at an angle of 60° to the horizontal at time \(t = 0\).

(a) Show that the speed of the ball at the highest point H of the trajectory is between 8 and 9 m s\(^{-1}\).

\[
\text{speed} = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \text{m s}^{-1} \tag{2}
\]

(b) At \(t = 1.5\) s the ball reaches point H. Calculate

(i) the maximum height \(h\) of the ball

\[
h = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \text{m} \tag{3}
\]

(ii) the distance between the points F and G.

\[
\text{distance FG} = \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \text{m} \tag{2}
\]
Using ‘Next Time Questions’ in Physics teaching

As part of the ongoing drive to improve results and to support the personalisation of learning for my new A Level students, I set out to positively identify their individual understanding of fundamental physics. The results of this are inextricably linked to the identification of misconceptions.

The following website was recommended to me and, having successfully used the resource, I’m now passing that recommendation on.

The ‘Next Time Questions’ by Paul Hewitt, the author of ‘Conceptual Physics’ (11th edition, Pearson, 2013), are conceptual cartoons with diagnostic questions attached targeting both conceptual understanding and problem-solving skills. They rely very much on the visualisation of the problem and are mostly qualitative rather than quantitative.

As detailed in the link, the questions are copyrighted but are available for free download by teachers for use with their classes from: arborsci.com/next-time-questions

Using the questions

Paul Hewitt’s original intention was that the questions be posed at the end of a lesson to provide stimulus in the intervening time between lessons and to promote discussion among students.

I used them in two different ways. Firstly, at the top of the VLE homepage for both AS and A2 Physics, I pasted different ‘Next Time Questions’ related to the topic being studied. The same pictures were printed out and put next to the classroom door, visible to those waiting to enter or passing by. This promoted discussion throughout the week, including with those interested in the style of questions and concepts.

Secondly, in class, different groups of students would work on presentations to explain their allocated ‘Next Time Question’. Peer review was used to identify errors and suggest improvements. Rather than correcting and displaying perfect answers, we then displayed the original answers complete with comments on post-it notes. As well as promoting the discussion of the concept, this encouraged students to be prepared to review their work and identify improvements under exam conditions.

Specifically:

‘Dart gun’ provided an alternative take on the concept of acceleration due to gravity and Galileo’s experiment:

arborsci.com/NTQ/NTQ_NL1&2_11QA.pdf

This was extended in ‘Pisa drop’:

arborsci.com/NTQ/NTQ_NL1&2_13QA.pdf

‘Monkey shoot’ provided an interesting variation on the standard monkey and hunter question:

arborsci.com/NTQ/NTQ_PROJMOT_3QA.pdf

It’s really worthwhile to look through these and pick those questions that match teaching topics. This is made simpler by the way they’re separated into topics on the site.

Ultimately, if students will talk among themselves about the questions posed, it will help structure their understanding and promote problem-solving skills, which was my experience with members of staff from other teaching areas reporting back that the dialogue had continued in their lessons.
Out and About...

Assessment of practical work in A Level and GCSE sciences – time to try harder?

This was a Cambridge Assessment seminar given by Professor John Holman on 17 June and attended by Ofqual, a range of learned societies, some HE representatives and a few practising teachers. There were many strong views presented at the event and serious concerns from learned societies, in particular around the ‘death of practical science in schools’. Interestingly though, there was the reverse argument from a number of teachers, especially in discussions that ran on after the talk, that the new Practical Endorsement could free teachers up to actually do a wider range of practical work than they do now – and do it in a more meaningful way.

This is an interesting view that has some resonance in a recent posting by Helen Rogerson, see geordiescience.blogspot.co.uk/2014/04/why-getting-rid-of-practical-assessment.html

The take-away message for us was: Everyone agreed that current practical assessments need to change. However, there was much less consensus on how…

Find a full record of the event at: cambridgeassessment.org.uk/insights/assessment-of-practical-work

Wessex Group Chemistry Teachers’ Conference

This event in early June was organised by Chemistry at the University of Southampton in collaboration with the Science Learning Centre South East.

Dr David Read opened the conference and gave an update on his work for the Science Foundation Year at the university. This included an interesting demonstration of using an e-portfolio for recording, self-assessment and teacher assessment of practical skills – very relevant for the forthcoming Practical Endorsement.

Our own Steven Evans gave a presentation on the forthcoming changes to the GCE and AS Level Chemistry specifications and assessments, outlining both the changes across the board and our approach. There were many questions from attendees, particularly about the Practical Endorsement.

Introducing the changes to GCSEs and A Levels – a series of OCR events

Teachers at these events we held around the country saw draft copies of the specifications and resources, and took home summary brochures. They were really impressed by the quality and range of our resources for the new specifications, and were reassured about the reforms through speaking to the Subject Specialists.

Comments included “I had a really good day at your event at the Oval today… We don’t currently do your board but I thought everything today was very slick and we will definitely consider changing over to you,” “Professional, efficient and thorough” and “Excellent in every way! Fantastic venue too!”

There was particular interest surrounding two areas: what content has changed and what’s happening about practical work? Here’s a bit more about what we discussed on each of these:
What content has changed?
Most teachers were quite happy when the changes were described because the new content topics were some they are already teaching. For more details of subject-specific changes, please email the subject team sciencedevelopment@ocr.org.uk

What’s happening about practical work?
The teachers were reassured that the practical skills being assessed will be embedded in their teaching and that we will give clear guidance on the records they need to keep. This is likely to be some sort of log book, and will therefore not mean extra work.
The talks, held throughout the day at each event, gave an overview of the reforms and how we can support teachers and students in the best ways possible. The teachers were very pleased with the clarity of the presentations, describing them as informative and the presenters as knowledgeable. All in all, some very successful events!

In May, the Open University (OU) held its 3rd annual conference promoting innovation, scholarship and enterprise in open and distance learning in the STEM subjects. There were a wide range of parallel sessions, including a demonstration of the Online Experimentation website currently in development by the Royal Society of Chemistry.
The site is designed to offer interactive on-screen experimentation to support practical investigative work in schools. This complements the OU’s Open Science Laboratory project opensciencelab.ac.uk which will also be of interest to schools and colleges.

A workshop entitled ‘Science and the citizen’ explored the growing range of online citizen science projects that enable students to participate in ‘real’ science projects on a national or international scale. Example projects included the OU’s own iSpot, Treezilla, Flight of the Fritillary and Sense-it projects.

OCR Geography, Geology and Science Premier event: Improving practical outdoor fieldwork skills – a hands-on workshop for teachers.

This enjoyable event was hosted by the Isis Education Centre in Hyde Park on 3 July 2014. It saw teachers turning their hands to a range of fieldwork techniques.
The BETT Show

ExCeL, London
Wed 21 – Sat 24 January 2015
www.bettshow.com

We’ll be returning to the BETT Show in 2015, with our biggest presence yet! As the world’s largest education technology event, the BETT Show brings together leading technology brands and the entire education market to provide a showcase of the latest inspiring and innovative education technology available.

We’ll have information available on key areas of the curriculum, from our leading ICT provision to skills development in STEM and innovation across a wide range of subjects and levels. We’ll also be demonstrating our new, innovative and interactive support surround, which brings learning and teaching to life.

Visit our exhibition stand to find out about our new science A Levels and to get updates on the development of our new GCSE in Computing. You’ll also be able to explore our vocational offerings such as Cambridge Nationals in Science.

ASE (Association for Science Education) Annual Conference

University of Reading
Wed 7 – Sat 10 January 2015
www.ase.org.uk/conferences/annual-conference

We’re proud to be supporting the ASE Annual Conference 2015. This flagship event, organised by the largest subject association in the UK, attracts over 2,000 science educators from all phases of science education. If you’re coming along, visit our exhibition stand for more information on our science qualifications, including our new science A Levels and the latest on mapping our Cambridge Nationals in Science to GCSE. We’ll soon be announcing a busy schedule of talks at the conference, so keep a lookout for these.

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