

The Royal Society of Chemistry's response to Qualifications Wales GCSE 'The Sciences' proposals consultation

December 2022

Note: All questions have a scale of agreement from strongly agree to strongly disagree, with a follow-up question asking you to explain your answer. For each answer below, our level of agreement is shown in italics.

1. To what extent do you agree or disagree with our proposed qualification title of GCSE The Sciences (Double Award)?

Neither agree or disagree

We agree with the new qualification being called "The Sciences" rather than "Science" as it makes clear each of the sciences is a separate disciplinary area within the single route.

The inclusion of the 'double award' wording has caused confusion and misinterpretation in the teacher community. Teachers have expressed their concern over 'taking away the option of triple' and only allowing pupils to take the 'double course', despite the intention of the new qualification to reflect the best features of the old GCSEs it is replacing.

This new qualification is an opportunity to assess a whole new curriculum which is fit for the 21st century. Given the changes to the curriculum there is a need to make it very different from the existing courses it intends to replace, but the choice to use the 'double science' and GCSE labels have made people compare this new qualification to the old ones, with many believing that the new qualification is inferior to those it replaces.

3. To what extent do you agree or disagree that the proposed design of GCSE The Sciences (Double Award) supports the Curriculum for Wales?

Neither agree or disagree

At this stage it is difficult to answer this question as there is not enough detail in the proposals. It does appear that the 'what matters' statement, 'matter and the way it behaves defines our universe and shapes our lives', will be met through the outlined content. However, it is not clear from the proposal that the science-based' statements of what matters will be addressed holistically.

We have spoken to some teachers, and they raise concerns over both assessment options presented and instead propose a third option of separate exams for each subject spread across years 10 and 11. They feel that learners need that motivational push of sitting exams early, and they feel the current assessment model is working quite well for them. However, we have also heard that some teachers feel the modular examination model goes against the ethos of Curriculum for Wales, as it forces schools to follow the same path, teach things in the same order etc, reducing schools' autonomy and control over their curriculum. Linear exams at the end of year 11 would allow this freedom, and also give teachers (and learners) more time to prepare for external exams.

5. To what extent do you agree or disagree with the proposed purposes and aims of GCSE The Sciences (Double Award)?

Agree

Our position is that a single GCSE science qualification ensures equity of access to the sciences. The single qualification route must maintain disciplinary identity for each of the sciences – biology, chemistry, and physics. To do this, the single route should be timetabled separately so each discipline can be taught by subject experts, specified separately i.e. the exam specification should have separate sections marked Biology, Chemistry, Physics, and reported separately even within a combined grade. To support progression, students should receive a breakdown by discipline, whether raw marks or a grade, so they can identify how they did in each discipline.

We are supportive of sustainability being explicitly referenced in the aims and purposes. We conducted a survey of 11- to 18-year-olds and a survey of educators working with children aged 5 to 19 years old across the UK and Ireland, to find out what they think of the way climate change and sustainability are currently taught in science and chemistry lessons. The findings were published in our [Green Shoots report](#), with one of these being that four in five young people and four in five educators see climate change and sustainability as priority topics for the chemistry curriculum.

We do have concerns over the lack of detail about the mathematical elements of the course. Mathematical (and quantitative) skills are referenced in the aims; however, they are grouped in combination with others. As stated in our [Curriculum Framework](#), we believe that mathematics is integral to chemistry to produce and analyse quantitative results, and to help us predict chemical behaviour. Mathematical content and (the development of these) skills should therefore be a key component and aim of the new GCSE.

7. To what extent do you agree or disagree with the proposed content (knowledge, understanding, skills and experiences) for GCSE The Sciences (Double Award)?

Disagree

We agree that less prescription of content is important, to allow time within the curriculum to develop understanding and the flexibility for teachers to introduce meaningful contexts and applications that demonstrate the breadth of chemistry and its contribution to society. However, a defined learning entitlement is essential, that sets out clearly the level of understanding and skill that learners are expected to achieve. This level of demand should be aspirational but also allow an educational experience that is inclusive of all learners and aligned appropriately with the wider curriculum in related subjects.

All three 'Bringing the sciences together' topics should be covered by all learners – if there is an element of choice there is a risk that the chemistry-based topic could be left out due to shortage of expert teachers, added expense of chemistry activities, and perceived interest of learners. Some members of our community have called for more detail in the topic outlines, for example explicit bullet points written out to show where each of the three sciences fit into each topic. In addition, they have questioned whether there should be any new content in the 'Bringing the sciences together' unit and instead should focus on the application (and context) of the ideas introduced in the main specification.

As mentioned in our answer to question 5 we are supportive of sustainability being explicitly referenced in the aims and purposes. However, we note that as it stands, sustainability and climate change would only be included in one of the 'Bringing the sciences together' topics. Our [Green Shoots report](#) (a survey of 11 to 18 year olds and their teachers from across the UK and Ireland) found that 79% of young people see sustainability and climate change as a priority for the chemistry curriculum. 65% of 14 to 16 year olds feel there is too little content in the chemistry curriculum that directly refers to sustainability and climate change. Additionally, one of the 'Big Questions' (central areas of interest in studying chemistry) from our [Curriculum Framework](#) asks 'What is the impact of chemistry?', covering issues surrounding sustainability and climate change. This question and the associated knowledge and skills needed to answer it, should form part of a coherent and modern curriculum. We call on Qualifications Wales to integrate additional sustainability and climate change thinking and concepts into the main content listed in the design proposal. These topics should not be restricted to an additional stand-alone topic loosely associated with chemistry; they should be built into the fabric of the whole chemistry curriculum.

Members of our teaching community have expressed disappointment at the lack of quantitative chemistry in the course outline. They fear that without quantitative mathematical content being explicitly outlined in the proposal, it will not appear in the final course. These teachers felt that it would be a shame to lose the interplay between chemistry and maths, and by potentially leaving out content (for example moles calculations, concentration calculations) learners won't be as well prepared for studying the subject at A level.

Some teachers also felt that some of the content does not reflect a modern, relevant chemistry curriculum. In our own [Curriculum Framework](#), we proposed that the impact of chemistry should be a key component of any chemistry curriculum, including explaining climate change (including the effects of fossil fuels), and addressing the global challenges facing society through the production of materials. We suggested that any examples chosen to illustrate these ideas should reflect a wide range of contexts and applications; therefore, the role of fossil fuels could sit alongside other examples of material production and use. In addition, the role of fossil fuels in climate change could be more explicitly outlined in the course content to help learners understand the impact of chemistry, and how chemistry can contribute to solutions in relation to climate change.

9. We have proposed two options for how the external exams could be structured:

Option 1: Separate biology, chemistry and physics exams would be taken by learners at the end of year 11 (this could enable separate grades for each subject to be reported).

Option 2: Three exams, each one featuring a mix of biology, chemistry, and physics content, would be taken across years 10 and 11.

Which of these options do you prefer?

Not sure

We stress the importance of maintaining the separate disciplinary identity of chemistry (and biology and physics) within this single qualification. Learners should receive a breakdown by discipline, whether this is raw marks or a grade, but they, and employers, HE and FE should be able to identify how learners did in each discipline to support progression. The external examination structure which is eventually adopted should enable this as far as possible.

As a general principle, any programme of assessment should include assessment of understanding of and ability in practical work, and appreciation of the impacts of chemistry on society. A combination of a broad range of types of assessment is recommended, to cover a variety of competences, cater for a wide diversity of learners, and minimise the effect of any negative impacts associated with particular tasks.

We have spoken to some teachers, and they raise concerns over both options presented and instead propose a third option of separate exams for each subject spread across years 10 and 11. They feel that learners need that motivational push of sitting exams early, and they feel the current assessment model is working quite well for them. However, we have also heard that some teachers feel the modular examination model goes against the ethos of Curriculum for Wales, as it forces schools to follow the same path, teach things in the same order etc, therefore removing the possibility of schools having autonomy and control over their curriculum. Linear exams at the end of year 11 would allow this freedom, and also give teachers (and learners) more time to prepare for external exams. They also raised the issue that exams at the end of year 10 would force schools to make early decisions about a learner's pathway through the qualification, such as tier of entry, which could disadvantage learners who develop at a different rate.

11. To what extent do you agree or disagree with the proposed assessment arrangements, including the role of digital technology, for GCSE The Sciences (Double Award)?

Neither agree or disagree

The marks awarded for practical work should reflect its central place in the sciences, and act as a driver for its completion in schools.

Any prescribed practical activities and assessments should be fully funded, so that schools in challenging circumstances are not disadvantaged. Ideally, any practical assessment should assess skills and knowledge from all three of the sciences. Including only one of the sciences in the assessment could result in a lack of time afforded to practical skills development for the remaining two sciences.

We call for an effective assessment system, which will allow the majority of pupils to obtain a GCSE qualification. Some feel a two-tier assessment system is the best approach, as it will allow for a greater degree of stretch and challenge in the assessment items, while also allowing for lower-achieving students to receive a grade demonstrating their level of achievement. However, some international examples suggest that a single tier of entry is the most effective, as all of the content is potentially accessible to all. Some argue this allows learners to access any questions on content they feel comfortable with (rather than their tier of entry dictating which questions are most suitable), giving them more opportunities to gain marks. There is evidence supporting both approaches, so Qualifications Wales should consider all options and decide which is most appropriate for Curriculum for Wales.

13. To what extent do you agree or disagree that the proposal for GCSE The Sciences (Double Award) meets the reasonable needs of learners in Wales? Please consider factors such as accessibility, manageability, wellbeing and progression onto post-16 pathways.

Neither agree or disagree

This qualification should be a continuation and assessment of science that has been covered in progression step 4 (and 3, 2 and 1). There are likely to be differences in how/what has been taught in different settings – for example, teachers are encouraged to use local contexts, so learners around Swansea might learn about how science is used in the steelworks, whereas learners on Anglesey might learn about science in the context of nuclear power. Careful consideration will be needed to ensure that the assessment does not put either learner at a disadvantage.

The new qualification must be accessible, and support progression to the next stage, whether academic or vocational. Progression can be supported if the content choice is informed by the foundational knowledge and skills of chemistry; due regard should be given to ensuring content is included at a level that is accessible. As previously mentioned, the level of demand should be aspirational but also allow an educational experience that is inclusive of the vast majority of learners and aligned appropriately with the wider curriculum in related subjects.

Members of our teaching community have raised concerns over whether the new GCSE caters for learners at either extreme of ability. They are concerned over how accessible the new course will be for learners who may need more time to grasp the content; those who currently opt for a single award qualification so that they can move through at a slower pace (for example entry to a single GCSE science subject). Similarly, some teachers in our community worry about progression to A level and how learners may not be as well prepared as, for example, their peers across the border in England (this stems from fears over (perceived) reduced content and mathematical rigour). We ask for consideration of the distribution of content in each tier of assessment (if tiering is indeed adopted as proposed), to help mitigate any access issues for lower ability learners.

Until further details are known we cannot fully answer this question on aspects such as wellbeing and manageability, and we are limited in the comments we can make on progression to post-16 pathways and accessibility.

15. To what extent do you agree or disagree that the proposed GCSE in The Sciences (Double Award) is manageable for teachers to deliver? Please consider factors such as the size of the qualification, resources and the proposed approach to assessment.

Neither agree or disagree

Members of our teaching community have raised some concerns around the manageability of this new qualification. There is unease over Qualification Wales choosing to not put a specific number on the time/learning hours required for The Sciences GCSE. Some teachers feel this could result in schools not timetabling enough hours to science departments, for example if those schools do not have enough expert teachers of the Sciences. Also, teachers feel that if each school or learning authority can decide how much time to set aside for science, some schools will prioritise the course and some will not. This could result in different outcomes for learners depending on the school they are at, which reduces equality across the country.

There are concerns from some Welsh medium teachers over the timescale for Welsh language resources for the sciences GCSE. Teachers feel these resources are often an afterthought for the exam board (and associated suppliers), and teachers would need to rely on their own networks to share resources. We call for resources to be supplied in both Welsh and English, at the same time, upon introduction of the new qualification.

17. Overall, to what extent do you agree or disagree with our proposal for GCSE The Sciences (Double Award)?

Agree

We are broadly in favour of the overall proposal for GCSE 'The Sciences'. We are particularly in favour of a single route through the sciences for most learners. This single route will remove the need for decisions to be made at 14 that could limit learners' future choices, and give all learners an authentic, exciting and inspiring experience of the sciences, providing them with the skills and knowledge to succeed in their future endeavours, whether or not they decide to pursue the sciences beyond 16.

We are supportive of sustainability being explicitly referenced in the aims and purposes and included in the content outline. We are also supportive of practical skills being explicitly called out and separately assessed in the proposed model.

However, we do have some concerns around the proposals. The first is that teachers are not on board with this new qualification. Much of this stems from the perceived 'loss' of triple science, which the inclusion of 'double award' in the proposed qualification name has not helped. Combined with this, the choice to use the GCSE label have made people compare this new qualification to the old ones it is replacing.

A second concern is the apparent lack of mathematical and quantitative chemistry content. As we have stated in our [Curriculum Framework](#), mathematical skills are a key strand in the big question of 'How do we think about chemistry?'. To lose the interplay between chemistry and maths, and by potentially leaving out key content, the course is doing a disservice to any learners looking to study chemistry at A level.

It is also concerning that sustainability and climate change would only be included in one of the 'Bringing the sciences together' topics. Our [Green Shoots report](#) found that 79% of young people see sustainability and climate change as a priority for the chemistry curriculum. We believe additional sustainability and climate change thinking and concepts could be integrated into the main content listed in the design proposal. These topics should not be restricted to an additional stand-alone topic loosely associated with chemistry; they should be built into the fabric of the whole chemistry curriculum.

The new qualification should be aimed at the majority of 14-16 learners. It must be accessible, and support progression to the next stage, whether academic or vocational. Progression can be supported if the content choice is informed by the foundational knowledge and skills of chemistry, including an appropriate level of supporting mathematical content; due regard should be given to ensuring content is included at a level that is accessible.