NCCA
An Chomhairle Náisiúnta Curaclaim agus Measúnachta
National Council for Curriculum and Assessment

Background paper and brief for the review of the Leaving Certificate Physics and Chemistry

December 2024

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Introduction

The Senior Cycle Review: Advisory Report (NCCA, 2022) was published in March 2022 following the response from the Minister for Education, Norma Foley, TD. Actions outlined in the Advisory Report include a review of existing curriculum components - subjects, modules, and programmes. In March 2022, the Minister for Education requested that NCCA undertake a series of actions to support the realisation of her vision for a redeveloped senior cycle as set out in Equity and Excellence for All (DE, 2022.) One key action set out in this plan was that a schedule of senior cycle subjects and modules for redevelopment be prepared for approval by the Minister.

NCCA subsequently prepared a schedule of subjects for review, which was organised into a number of tranches. The redevelopment of Leaving Certificate Physics and Chemistry is included in Tranche 3, which will be completed in 2026 for introduction to schools in September 2027.

This paper provides a context for the review of Leaving Certificate Physics and Chemistry and has been informed by the views of teachers, school leaders and students, gathered through school visits conducted in a stratified sample of schools. It begins by considering the background of LC Physics and Chemistry with Section 1 presenting an overview of the current context, including consideration of relevant policy developments. Section 2 sets out how Physics and Chemistry related education is currently provided for within the Irish curriculum before focusing in more detail on LC Physics and Chemistry while Section 3 provides an overview of the insights gained through the school visits conducted and the lived experience of schools, teachers, and students. Section 4 considers similar education opportunities internationally and presents an overview of four different jurisdictions. Section 5 draws on the previous three sections to categorise and briefly discuss some issues identified for consideration in the redevelopment of LC Physics and Chemistry, before finally setting out a proposed brief for this work in Section 6, which will guide the work of the development group.

1. Background and context

This section sets out some of the significant changes and innovations in curriculum development and science education in Ireland in recent years, before focusing on the education and broader policy landscape which are important contextual considerations for the review and redevelopment of Leaving Certificate Physics and Chemistry.

Known colloquially as Phys-Chem, LC Physics and Chemistry is one of 39 subjects examined annually in the Leaving Certificate examination. Written over 50 years ago, the LC Physics and Chemistry (Phys-Chem) syllabus mirrors sections of the LC Physics and LC Chemistry syllabi that were offered in schools at the time, and as such students are not permitted to sit the LC Physics and Chemistry (Phys-Chem) examination if they are taking either combination of LC Physics or LC Chemistry. With its emphasis on content, approximately 50% physics and 50% chemistry, and in the absence of any aim or rationale, it is difficult to ascertain what group of students' needs the syllabus aims to meet. Student participation is low, with 0.7% of Leaving Certificate students taking the subject in 2024. Sections 2 and 3 of this paper *Physics and Chemistry in the curriculum* and, *Insights from school visits* will further explore participation trends.

It is beyond the scope of this paper to begin to summarise the relevant changes in education, science, and society in the 50 years since this syllabus was introduced. Instead, Table 1 outlines some of the more recent relevant policies and developments likely to affect LC Physics and Chemistry (Phys-Chem).

Table 1: Examples of recent policy development likely to impact the development of Leaving Certificate Physics and Chemistry (Phys-Chem)

Development	Date	Focus of change and implications for the review of LC Phys-Chem
Framework for Junior Cycle	2015	The Framework for Junior Cycle (brought about significant changes in the junior cycle curriculum, including: • the introduction of key skills across the junior cycle curriculum • the introduction of classroom-based assessments (CBAs) intended to reduce the focus on the final examination and to increase the prominence given to formative assessment • revised STEM subjects including Science (2015), Mathematics (2018), Applied Technology and Engineering (2019) • the potential for schools to develop their own short courses.
International Assessments	2009 - 2019	Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) collect data and benchmark student performance across a range of curriculum domains, providing comparable indicators across participating countries. Whilst Ireland's performance in PISA science assessments since 2000 has been consistently strong, with students frequently scoring above the OECD average. While the average science score in TIMSS for Irish students was significantly higher than the centerpoint of 500, placing Ireland among the higher-preforming countries, analysis by McHugh et al (2024) of the performance by Irish post-primary students in the most recent 2019 TIMSS study, identified Chemistry and Physics as areas of relative

		weakness. The criticality of scientific literacy to full participation in society is reflected in the fact that the PISA Science assessments in 2025 will focus on assessing students' ability to engage with science related issues, to use scientific ideas for informed decision making and to show an awareness of how science produces reliable knowledge.
Action Plan on Apprenticeship 2021 - 2025	2020	Aims to establish an approach to the apprenticeship model which focuses on fostering skill development and creating new opportunities in a range of occupations and industries, including STEM, which are spread across the National Framework of Qualifications, up to Level 10.
Ireland's National Skills Strategy 2025	2021	Outlines objectives that place a strong focus on providing skill development opportunities that are relevant to the needs of learners, society and the economy, and specifically references increasing participation in STEM education.
Digital Strategies for schools to 2027	2022	Sets out the potential of digital technology within the curriculum, placing an increased emphasis on the role of digital technology in supporting and enhancing teaching, learning and assessment and in fostering the development of 21st century skills, such as problem-solving, critical thinking, and communication skills.
Key Competencies in Senior Cycle	2023	Key competencies are being embedded in the learning outcomes of all senior cycle curriculum specifications. Their introduction is a crucial step towards preparing students to navigate today's ever-evolving world.
Primary Curriculum Framework	2023	Envisages students building on seven key competencies, or interconnected capabilities, which will help them adapt to the range of situations and challenges they may face as they progress through their primary and post-primary education. Situated within this framework, the new Primary STEM curriculum prioritises its aim to supports children's capacity to understand and engage fully with the world around them. Through engagement with the curriculum, students will learn to communicate with STEM language, be creative and innovative, and develop vital skills in the STEM area.
STEM Education Policy 2017 – 2026 and STEM Education Implementation Plan 2026	2017 and 2023	Ireland's STEM Education Policy 2017 - 2026 and the STEM Education Implementation Plan 2026 acknowledge the many strengths in STEM education in Ireland and identify a number of challenges, in particular the need to: • ensure that Irish students' learning in STEM disciplines keeps abreast with the ever-changing needs of society, including the further development of skills such as problem-solving, inquiry-based learning and team working to address demands from the world of work • diversify the profile of students choosing STEM subjects in post-primary schools, those progressing to STEM pathways in Further or Higher Education and those who take up careers in STEM, by ensuring opportunities for learners from all backgrounds, ability and gender • ensure young peoples' sustained involvement in STEM education.

As part of the scheduling of subjects for a redeveloped senior cycle, a number of curriculum developments have taken place which hold significance for the redevelopment of LC Physics and Chemistry (Phys-Chem). LC Chemistry (DE, 2024a) and LC Physics (DE, 2024b) were redeveloped and published in September 2024, to be introduced for fifth year students from September 2025. These subjects were designed with a unifying strand, The Nature of Science, that aligns with the Unifying Strand from Junior Cycle Science. This offers continuity and progression from Junior Cycle Science, while also allowing nuances of learning within each specific discipline of science to be realised.

The curriculum development field has evolved with implications for developments in Ireland and internationally. To reflect this, the NCCA have published a comprehensive examination of relevant research and practice on the technical form of curriculum specifications (NCCA, 2022) to help decide what format should be used when designing curriculum specifications for senior cycle. This research noted that the technical form of curriculum specifications should reflect the integrated development of knowledge, skills, values and dispositions and align with the key competencies of senior cycle. Further, when developing strands of study, the paper advised that the 'students learn about' column in future senior cycle specifications will offer more detail, with the emphasis on scaffolding of learning outcomes and finding a balance between providing support and avoiding over-elaboration.

Such broad-ranging and dynamic changes mean that redevelopment of Leaving Certificate Physics and Chemistry (Phys-Chem) is now timely and provides an opportunity to ensure that relevant Physics and Chemistry related learning is available to all students in senior cycle.

Section Summary

- The current LC Physics and Chemistry (Phys-Chem) syllabus was introduced over fifty years ago. Since its introduction there has been significant learning and advancements in curriculum development and the technical form of curriculum specifications.
- The Framework for Junior Cycle has seen the introduction of key skills across the junior cycle curriculum and a broader approach to assessment.
- Key competencies are being embedded across learning outcomes in new and redeveloped subjects and modules in senior cycle.
- The current syllabus offers students an opportunity to study the physical sciences at senior cycle.
- In the absence of any aim or rationale it is difficult to ascertain what group of students' needs the current syllabus aims to meet.
- There have been significant policy developments in the area of STEM over the last number of years that focus on the development of skills such as problem-solving, critical thinking, digital literacy and communication.
- While the performance of students in Ireland in international assessment is strong, analysis identified Chemistry and Physics as areas of relative weakness for Irish students.
- This redevelopment of Leaving Certificate Physics and Chemistry (Phys-Chem) is informed by other curriculum developments in the sciences.

2. Physics and Chemistry in the curriculum

This section provides an overview of the opportunities for learning related to Leaving Certificate Physics and Chemistry currently available to students within both the junior cycle and senior cycle programmes. It then focuses on participation rates in LC Physics and Chemistry (Phys-Chem), outlining the uptake of the programme among students and schools, before exploring the most recent Chief Examiner's report from the State Examinations Commission.

Physics and Chemistry related education in junior cycle

Junior cycle education offers several opportunities for students to learn about physics and chemistry. These opportunities are integrated into various subjects and through specific programs and initiatives.

Junior cycle subjects

The Junior Cycle Science specification (DE, 2015b) aims to develop students' understanding of the natural world and their scientific skills. The structure focuses on a unifying strand, Nature of Science, and four contextual strands – Physical World, Chemical World, Biological World, and Earth and Space. Students explore physical sciences through learning about motion, energy, electricity, matter, and energy changes. They conduct experiments to understand concepts like length, time, mass, and temperature, using appropriate measuring equipment. Understanding atoms, molecules, and ions helps them interpret observations and communicate using chemistry and physics conventions. They build simple electronic circuits, study energy transformations, and learn about material lifecycle sustainability issues.

While Engineering and Applied Technology may not be considered as having obvious links to LC Physics and Chemistry (Phys-Chem), insights from school visits indicates potential links to a redeveloped subject. Students explore sources of energy in Junior Cycle Applied Technology (DE, 2019a) and are encouraged to recognise the need for economic and sustainable use of energy and materials. The Junior Cycle Engineering (DE, 2019b) curriculum aims to equip students with the skills and knowledge to engineer products. The Mechatronics strand combines mechanical, manufacturing, electronic, and software engineering to explore how inputs, processes, and outputs interact.

Other areas of junior cycle

Students can further their study of physics and chemistry through short courses on environmental science and meteorology or by participating in science clubs and national competitions such as the BT Young Scientist & Technology Exhibition and SciFest.

Physics and Chemistry related education in senior cycle

The current syllabus for LC Physics and Chemistry (Phys-Chem) is a four-page document, with no specified objectives, aim or rationale, that sets out content, approximately 50% physics and 50% chemistry as a list of topics. The syllabus is presented as a common level document, with students

differentiating at the point of assessment, in this case a 100% final examination, which is offered at both Higher and Ordinary level. Table 2 provides an overview of the topics as outlined in the syllabus document.

Table 2: An overview of topics within the LC Physics and Chemistry (Phys-Chem) syllabus

	Physics	Chemistry
Topics outlined the LC Physics and Chemistry (Phys-Chem) syllabus	• Mechanics • Electricity • Energy • Gas laws • Heat and temperature • Light and waves • Magnetism • Nuclear physics	• Atomic structure • The Periodic table • Chemical bonding • Stoichiometry • Thermochemistry • Volumetric analysis and pH • Electrochemistry • Organic chemistry

Unlike all other science curricula in junior and senior cycle, experimental and practical work is not explicitly mentioned in the syllabus document. However, there are some references to demonstrations. There is very little detail in the four page syllabus on the learning students are to achieve, but clarity appears to have been achieved through custom and practice over many years by means of past examination papers and marking schemes. In the LC Physics and Chemistry (Phys-Chem) syllabus, objectives are not specified. For the purposes of the design of the examination paper and the evaluation of student work, objectives have been inferred from past papers and past marking schemes (SEC, 2015).
Students in senior cycle have several other opportunities to engage with subjects and modules that develop Physics and Chemistry related learning.

Transition Year (TY)

As part of the Student Dimension Being a Learner, in the recently redeveloped Transition Year (TY) Programme Statement (DE, 2024c), students have opportunities to build on their previous learning experiences and begin to develop as senior cycle students. In TY, students have the opportunity to continue with subjects they have engaged with in junior cycle as well as sample new subjects, they may consider as senior cycle options. Schools have a high degree of autonomy in designing their own TY programme and many schools use this autonomy to provide opportunities to engage in science related projects, through participation in national competitions, the aforementioned BT Young Scientist and Sci Fest to name but a few.

Leaving Certificate Established (LCE)

Many subjects within the Leaving Certificate Established have close links with learning in LC Physics and Chemistry (Phys-Chem) including Mathematics, Applied Mathematics, Construction Studies, Engineering and Technology. As mentioned earlier, new specifications for LC Physics and LC Chemistry have been developed as part of the first tranche of subjects within senior cycle redevelopment. Students however, cannot take study LC Physics and Chemistry (Phys-Chem) if they opt to study either of these two subjects. These specifications provide continuity and progression from junior cycle science and aim to empower students to build knowledge and

understanding of specified core concepts and fundamental principles of both physics and chemistry and to develop the skills, values and dispositions needed to apply this knowledge to explain, analyse, solve problems and predict events in a variety of systems and interactions in both the chemical and physical worlds. In addition, students of these subjects learn to demonstrate inquiry and practical skills consistent with the principles and practices of science, understand how society and science are interwoven, and the everyday relevance and the ethical implications of physics and chemistry.

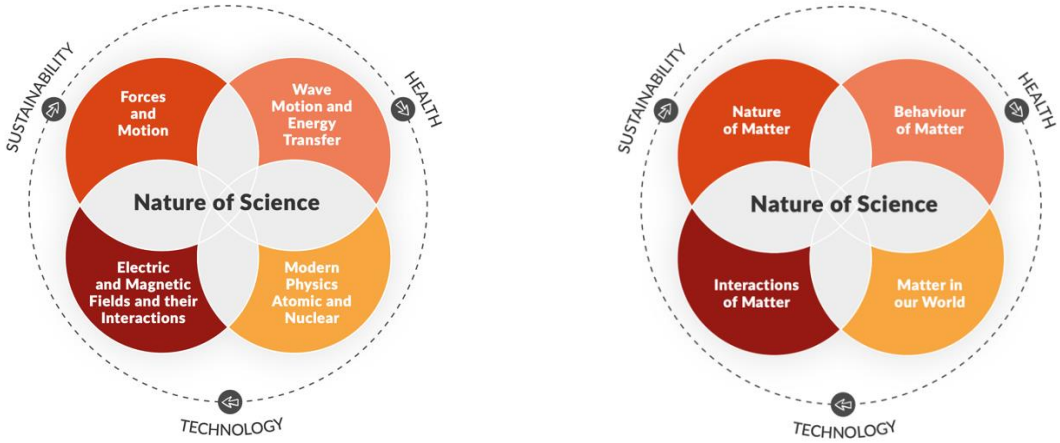

Figure 4: Structure of the LC Physics Specification and the LC Chemistry specification (DE, 2024 a & b)

LC Physics and Chemistry (Phys-Chem) in focus

This section explores participation rates in LC Physics and Chemistry (Phys-Chem) drawing on statistics from the State Examinations Commission (SEC) and the Department of Education (DE). It provides an overview of assessment for certification and insights from SEC/DE reports.

Student participation

Participation rates in LC Physics and Chemistry (Phys-Chem) are consistently low and appear to be on the decline with 376 students or 0.7% of the total LC student cohort sitting an examination in the subject in 2024 (Table 3).

Table 3: Leaving Certificate Physics and Chemistry (Phys-Chem) participation rates (2011 – 2024)

Year	Higher Level	Ordinary Level	Total Candidates	Total LC candidates	Phys-Chem as a % of total candidates
2011	379	93	472	54,341	0.8%
2012	309	96	405	52,555	0.7%
2013	330	93	423	52,713	0.8%
2014	361	105	466	53,976	0.8%
2015	437	115	522	55,006	0.9%

2016	439	140	579	56,791	1.0%
2017	481	110	591	55,731	1.0%
2018	415	103	518	54,396	0.9%
2019	464	74	538	56,071	0.9%
2020	460	69	529	57,668	0.9%
2021	382	57	439	57,952	0.7%
2022	369	61	430	58,056	0.7%
2023	344	63	407	58,006	0.7%
2024	309	67	376	56,791	0.7%

Assessment for certification

The LC Physics and Chemistry (Phys-Chem) examination at both higher and ordinary level is based on a written examination with one paper, worth 100%. Both examinations are of three hours duration, with 400 marks available to students. There is close correspondence between the structure of the papers at the two levels. There are no set questions, however it's important to note that trends within questions are prevalent. There are no compulsory questions at either level.

Some questions require short factual responses, while others require deeper knowledge and analysis of physics and chemistry concepts. Although the syllabus doesn't explicitly mention practical investigations, exam questions assume such experience and test understating of apparatus, procedures, and data sets used within experimental investigations.

Insights from the SEC and DE

The 2015 Chief Examiner's Report for Leaving Certificate Physics and Chemistry (SEC, 2015) highlights that students tend to avoid questions on electricity, magnetism, and organic chemistry, despite their significance in the syllabus. In 2015, only 10% of students who choose higher-level and 15% of students who choose ordinary-level attempted these topics. The Chief Examiner concluded that students likely lack the required knowledge due to insufficient study or teaching of these areas.

The report also emphasises the importance of practical work, urging teachers to incorporate numerous experiments to engage students. Questions on the examination allow students to demonstrate their practical skills, but it is noted that such questions cannot fully verify hands-on experience.

Challenges with mathematical elements are common across both levels, particularly in calculation and graph interpretation. Students who sat the higher-level paper typically show good understanding of basic concepts but struggle with analysis and applying knowledge to new situations. Whereas students who sat the ordinary-level paper face similar issues, with many leaving calculation questions unanswered and providing brief responses lacking detail.

Drawing on statistics from the Department of Education (PPOD), trends associated with the number and type of schools who offer LC Physics and Chemistry (Phys-Chem) were explored, as outlined in Table 4.

Table 4: School number and type who offer LC Physics and Chemistry (Phys-Chem) 2018-2023 (Department of Education (PPOD) Statistics)

	2023	2022	2021	2020	2019	2018
Total number of schools	37	40	38	43	44	46
Small (1-400)	19	19	18	20	20	18
Medium (401 – 800)	15	17	16	19	18	20
Large (over 800)	3	4	4	4	6	8

Points of interest associated with school type (school size and gender) indicate that:

- LC Physics and Chemistry (Phys-Chem) is mostly offered in small mixed schools.
- The large and medium sized schools that offer LC Physics and Chemistry (Phys-Chem) tend to be single-sex girls schools.
- The single-sex boys schools that offer LC Physics and Chemistry (Phys-Chem) tend to be small.

Section Summary

- Students have multiple opportunities to engage with Physics and Chemistry related learning in junior cycle with additional opportunities in senior cycle.
- In the absence of any clear aim or rationale the objectives of LC Physics and Chemistry (Phys-Chem) have been inferred, with classroom teaching and learning established through custom and practice over many years by means of past examination papers and marking schemes.
- Participation rates in LC Physics and Chemistry (Phys-Chem) have fallen consistently over the years, currently at an all-time low of 0.7%.
- Although the syllabus document is a common level syllabus, examinations are offered at both Higher and Ordinary level. Assessment is based on a 100% written exam. Students struggle with evaluation and analysis type questions and fall down on the expansion of and accuracy of answers.
- Evidence from the Chief Examiner's Report (SEC, 2015) points to students strategically distilling the learning and omitting significant topics from the course.
- The most recent report in 2015, identifies significantly low attempt rates for questions on electricity, magnetism and organic chemistry in both levels.

3. Insights from school visits

School visits were conducted as part of the scoping work for this Background Paper. A stratified sample was selected from schools that offer LC Physics and Chemistry (Phys-Chem) as part of their curriculum. Visits to these schools took place in October 2024 and involved focus group meetings with 43 senior cycle students, 9 teachers of LC Physics and Chemistry (Phys-Chem) and 9 school leaders. The following section provides an overview of the insights gathered through these visits.

Subject provision and uptake

Generally, schools offering LC Physics and Chemistry (Phys-Chem) are responding directly to the needs of their students by providing access to the physical sciences in senior cycle through what they consider to be, a more accessible and less intimidating route. The schools visited tended to be small to medium sized in nature and most offered LC Physics and Chemistry (Phys-Chem) alongside either Biology or Agricultural Science. Those schools cited lack of demand and the availability of suitably qualified teachers as reasons for not offering the other common routes through senior cycle physical sciences; LC Physics and/or LC Chemistry.

LC Physics and Chemistry (Phys-Chem) is not recognised as a science subject for some Higher Education courses. Whilst responding to the needs of their evolving student cohort and as a direct consequence of the specific subject requirement for chemistry for Higher Education courses in medicine, dentistry, pharmacy, dietetics and veterinary, some schools visited had either introduced or were planning to introduce LC Chemistry as a third science route through senior cycle.

Responding to the needs of a diverse range of learners

Participants across the school visits, teachers, students and management, unanimously spoke of the grounding in the physical sciences that LC Physics and Chemistry (Phys-Chem) provides in a less intimidating and more accessible space, than is provided in LC Physics and/or LC Chemistry. Teachers spoke of the time and space they experience within the subject, allowing opportunities to revisit experiments and concepts to support student understanding and would be keen not to overload any redeveloped specification in order to maintain this approach.

Students often spoke of the learning experience being different to other science subjects they were studying and referred to opportunities to engage with problem-solving processes, allowing them to apply their learning to new and unfamiliar contexts. They mentioned how the need to rote learn was reduced as a result of this approach. Students recognised the importance of this type of learning for future study and work and reported how the skills acquired in LC Physics and Chemistry (Phys-Chem) could be beneficial for a variety of post-school pathways.

There was awareness from both students and teachers of the need for a grounding in the physical sciences for many post-school pathways beyond the traditional Higher Education routes and there was strong support for ensuring an accessible route through the physical sciences in senior cycle. There is, it was noted, a cohort of students who are be intimidated by what was termed, an academic route through senior cycle and who would be challenged to experience success in LC Physics and/or LC Chemistry, but who would thrive in a more applied subject.

Some participants also spoke of the need to ensure students could take the subject ab initio, while others spoke of the opportunity LC Physics and Chemistry (Phys-Chem) provides in supporting students to understand the basics in physical sciences in a more relaxed environment, potentially sparking interest in STEM pathways. Students reported enjoying the subject, in particular the practical aspect of it and many spoke about having visited local industry and how motivating this experience was for them.

Challenges associated with the subject

Ensuring continuity and progression from junior cycle science, whilst interpreting the outdated and sparce syllabus document currently in use for the subject, pose the most significant challenge to those engaging with LC Physics and Chemistry (Phys-Chem). A lack of teaching and learning resources further compound this issue and the consequence is that the structure and format of the examination papers have become the major influencers of teaching and learning practices in the classroom. Teachers reported the need to engage with a range of learning not mentioned in the syllabus document to support engagement with the more complex topics, and so are choosing to omit some topics, focusing on those that best support their students to experience success in the examination, as well as experience a foundation in the physical sciences, likely to support their future engagement with further study, training and work.

Teacher recruitment poses a challenge. In responding to the needs of the student cohort by introducing the subject in their schools, senior leaders were grateful to teachers who, with only one appropriate qualification, either physics or chemistry, or in some cases out-of-field teachers agreed to teach the subject. Additional training and upskilling were cited as essential supports. Some schools overcame the recruitment challenge by capitalising on the segregated nature of the syllabus document and supporting examination and shared the allocation between two teachers; one physics and one chemistry. Whilst it was accepted that this practice was not ideal, it was perhaps the only way a school could accommodate the subject.

When discussing the examination many teachers reported that the segregated nature of the subject and supporting examination made it easy for them to support their students to be successful. Both teachers and students expressed significant frustrations with the language register of some examination questions and the focus on definitions that are connected to a key terms focused marking scheme. It was noted by many that students can rote learn to achieve success in the examination without understanding.

Perceived value and recognition of the subject

Some Higher Education courses in Ireland do not recognise LC Physics and Chemistry (Phys-Chem) as a science subject, leading to disparity with other LC science subjects. Participants see the subject's redevelopment as a chance for a complete rebrand of the subject that would result in the subject being recognised as a science subject for entry requirements in all Higher Education Institutes in Ireland.

Redevelopment of the subject

Schools reported that LC Physics and Chemistry (Phys-Chem) provides learning for a cohort of students who may ordinarily be intimidated by LC Physics and/or LC Chemistry. Participants in schools, particularly teachers and management, acknowledged the unique profile of this cohort who most often progress to broader STEM and technical post-school pathways, and were adamant that providing access to the physical sciences for these students should be central to considerations during the redevelopment. In this regard, the redevelopment is seen by many as presenting an opportunity to provide a physical sciences route through senior cycle with a more applied focus and geared towards the needs of learners hoping to progress to broader STEM careers and technical post-school pathways. Participants spoke about the potential of the redeveloped subject to include visits to industry and more experiential learning. There were many suggestions for the redevelopment, such as the reorientation of electricity towards electronics, environmental chemistry and green energy, opportunities to develop and progress learning in earth and space from junior cycle, the introduction of rates of reaction and a focus on computational problem-solving. Linking to aspects of engineering and developing concepts through this lens were also noted as an opportunity, as was the alignment to current developments in mathematics in junior and senior cycle. Participants noted the importance of prioritising learning that could build and progress across both physics and chemistry, identifying heat, energy and radioactivity as learning that naturally supports this integration.

Investigative work

Investigative work is valued and considered an essential component of any redeveloped specification. Currently students are experiencing varied approaches to investigative work, which, it is recognised, is not ideal. Some students report being disappointed that the course wasn't as hands-on as they had hoped. The need for flexibility in how the investigative skills are developed was highlighted given the current limited access to equipment and labs in many schools. Some suggestions on how to ameliorate this reality were made, such as specifying a minimum number of opportunities to gather primary data and other opportunities where secondary data would be sufficient and where simulations or modelling scenarios might be used to obtain data. There was significant support for ensuring continuity from junior cycle by retaining the Nature of Science as a unifying strand in the redeveloped specification, however, there were differing views on how aligned its inclusion should be with the Nature of Science strand in the recently redeveloped LC Physics and LC Chemistry specifications. Many participants outlined a unique approach to the Nature of Science in a redeveloped Phys-Chem specification likely to respect the constraints experienced by those currently availing of the Phys-Chem option. Opportunities were also identified as to how the redeveloped specification might align to broader engineering fields.

Additional Assessment Component

In discussing the AAC there was support for the recognition of an assessment component that values a type of learning not captured in an examination and for its 40% weighting. A number of suggestions were made as to the nature of the AAC:

- an extended experiment and/or research investigation
- case studies
- building an artefact

- computational problem solving.

Concerns were raised about:

- the need for additional supports for students in DEIS schools
- issues associated with two teachers teaching the subject
- how an AAC could appropriately link physics and chemistry together.

The importance of:

- allowing space and time to complete the AAC
- integrating the AAC into the regular classroom learning
- student choice as a way of promoting authentic engagement
- every student feeling they can succeed with an AAC

were noted as significant enablers to the success of the redeveloped subject.

Wider systemic issues

In addition to challenges associated with the subject, wider systemic challenges were noted by many. These include:

- funding to support access to labs and digital devices, as well as the restocking of consumables
- time provision for the necessary training and upskilling that will be required, suggestions were made for a variety of CPD models that would support teachers' professional development on an ongoing basis

There was support for the publication of specifications and supporting assessment documentation a year in advance of implementation.

Section Summary

- Schools offering LC Physics and Chemistry (Phys-Chem) are responding to the needs of their students by providing access to the physical sciences to support them in a variety of post-school pathways, in a more accessible format than is currently experienced in LC Physics and LC Chemistry.
- Significant challenges exist with the structure and format of the current syllabus document and a lack of teaching and learning resources, leading to an over reliance on examination papers to guide teaching and learning in the subject.
- Challenges associated with the perception and recognition of the subject were identified; suggestions were made to rebrand the subject so that it more accurately reflects the aim and rationale of a redeveloped specification.
- Opportunities to refocus the subject on real world applications, industry, earth and space and environmental chemistry were noted, in addition to the development of variety of investigative skills.
- There was a welcome for an assessment component that values the type of learning not captured in an examination, a number of suggestions were made as to the potential nature of the AAC.
- There was a unanimous welcome for the 40% weighting of the AAC.
- Concerns were raised about wider systemic issues, such as funding and resources, likely to impact the successful enactment of the redeveloped subject.

4. International trends in upper secondary education in the context of Physics and Chemistry-related learning

This section considers LC Physics and Chemistry (Phys-Chem) related education or similar learning experiences in a number of international jurisdictions. The Phys-Chem curricular provision is unique to Ireland, so the jurisdictions explored below have been chosen as they offer courses of study that provide additional opportunities to engage with the physical sciences in a variety of formats in upper secondary school.

In all of the jurisdictions examined, multiple pathways are provided for students to continue their science education from lower secondary school. In addition to a general science course for upper secondary students, a number of specialised subjects within science are also offered. In some jurisdictions a science course that explores science within the context of the workplace is offered.

The proceeding section explores the different opportunities offered by four jurisdictions, under three headings: Context, Curriculum and Assessment and Recognition. Physics and Chemistry is a discrete speciality subject for the Baccalauréat in France, and a discrete O Level syllabus in Singapore. In Alberta and Ontario, in Canada, the study of physics and chemistry can be engaged within broader senior secondary science courses.

Alberta, Canada

Context

Alberta has three years of senior high school, grades 10 through 12, leading to an Alberta High School Diploma. To achieve the Alberta High School Diploma students must achieve a minimum of 100 credits, which includes 5 credits from a 20 Level course in a science subject and 10 credits in one 30 Level course of their choice. 20 Level courses are usually Grade 11 courses, comparable to fifth year, while 30 Level courses are usually Grade 12 courses, comparable to sixth year. Students choose to study Science, Biology, Chemistry and/or Physics at Level 20 with the option to continue this study in a Level 30 course.

Students may also combine Science 10 and Science 14 courses, which are usual course pathways to achieve the Alberta High School Certificate of Achievement. These science courses focus on the introduction to biology, chemistry, physics and global energy systems and the application of scientific knowledge and skills to everyday experiences respectively. Students have the flexibility to combine Science 10 and Science 14 to enrol on a Science 30 Level course, demonstrating the flexibility of the different pathways within the Alberta High School Diploma. An overview of the 30 Level Science course is outlined below.

Curriculum

The 30 Level Science course focuses on the development of four scientific foundations. Foundation one encourages students to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society and the environment. Foundation two supports students to construct knowledge and understanding of concepts in life science, physical science and earth and space, and apply these understandings to interpret, integrate and extend their knowledge. Foundation three encourages

students to develop an understanding of the nature of and relationships between science, technology and society, while Foundation four focuses on the development of skills required for scientific and technological inquiry, solving problems, communicating scientific ideas and results, working collaboratively, and for making informed decisions.

The scientific foundations are developed through four contextual units:

1. Living systems respond to their environment: includes energy, equilibrium, matter, systems, with a focus on the principles of heredity and molecular genetics
2. Chemistry and the environment: includes energy and systems, with a focus is on the benefits and risks of chemical substances, acids and bases and organic compounds
3. Electromagnetic energy: includes diversity and energy, with a focus on electrical energy transmission and transformation technologies, and the role of electromagnetic radiation
4. Energy and the environment: includes energy and systems, with a focus on sustainable development and global energy demands.

Each unit requires approximately 25% of the time allotted for Science 30, which is 125 hours. Experimental and research investigations are developed across the course, with students expected to explore and engage with aspects of experimental design, data analysis and supporting conclusions. A number of research investigations are also outlined within the units, which focus on conducting research, interpreting data and drawing conclusions on issues connected to the outcomes in the units. In addition, students are encouraged to explore phenomena and concepts within the units through simulations and models.

Assessment and Recognition

Assessment for Science 30 in the Alberta High School Diploma includes a school-awarded internal assessment mark, worth 70% of the final mark, and 30% for the Diploma exam. Internal assessment is measured by performance against the general and specific unit outcomes of the course and awards students with credits.

Baccalauréat, France

Context

The study of Physics and Chemistry is compulsory for students in Year 11 of secondary education in France (age 15-16) and is an optional speciality subject for senior secondary. The general Baccalauréat is oriented towards further study and includes Years 12 known as the première and comparable to fifth year, and Year 13, known as the terminale and comparable to sixth year.

For the general Baccalauréat course, students engage in compulsory core curriculum and special subjects, known as specialties. Science Studies, is a compulsory common core subject in Grade 12 and 13, providing general scientific training to all students. In addition to the core curriculum, students choose three speciality subjects to study for Year 12, choosing to continue with two of these subjects in Year 13. Physics and Chemistry is a speciality subject choice for students in Year 12 and Year 13.

Curriculum

The Physics and Chemistry General Baccalauréat curriculum for Year 12 and 13 is structured around four themes:

1. Constitution and transformations of matter: includes monitoring and modelling the evolution and composition of a system; the physical and chemical properties of matter and the synthesis, combustion and chemical transformation of organic chemical species
2. Movement and interaction: includes the fundamental interactions and introduction to the notion of field; description and modelling of a fluid at rest and flowing and the movement and applications of a system
3. Energy: conversions and transfers: Includes energy and electrical phenomena; energy and mechanical phenomena; thermodynamics systems and energy balances
4. Waves and signals: includes waves and wave phenomena;; light - images and colours, wave and particle models in Year 12. While in 13 focusing on characterising wave phenomena; forming images, describing light by a flow of photons; studying the dynamics of an electrical system.

The Physics and Chemistry speciality offers students the opportunity to explore the real world through experimentation and modelling. An outline of the investigative skills are woven throughout the curriculum document as experimental and research activities that support the physical and chemical phenomena and supporting concepts.

Assessment and Recognition

Results for the Baccalauréat are based on continuous assessment in Year 12 and on final exams for Year 13. Final exam results make up 60% of the final grade of the Baccalauréat. Students take four final exams in Year 13: two focused on the speciality subjects chosen by the students, a written test in Philosophy and a 20-minute oral presentation on one or both of the speciality subjects. The Baccalauréat exams for the speciality subject of Physics and Chemistry involves a written and practical exam.

Ontario, Canada

Context

The three goals of the senior secondary science high school programme in Ontario are to relate science to technology, society, and the environment; to develop the skills, strategies, and habits of mind required for scientific inquiry; and to understand the basic concepts of science. The senior secondary (Grade 11-12) programme, comparable to fifth and sixth year, outlines how students learn science most effectively when they are active participants in their own learning, and when science concepts and procedures are introduced through an investigative approach and are connected to students' prior knowledge in meaningful ways.

Four types of Grade 11-12 science programmes are available:

1. University preparation courses designed to equip students with the knowledge and skills they need to meet the entrance requirements for university programmes, available in Biology, Chemistry, Physics and Earth and Space Science
2. University/college preparation courses designed to equip students with the knowledge and skills to meet the entrance requirements for specific programmes offered at universities and colleges, available Science and Environmental Science
3. College preparation courses that are intended to equip students with the knowledge and skills needed to meet requirements for entrance to most college programmes or for

admission to specific apprenticeship or other training programmes, available as Biology, Chemistry, and Physics

4. Workplace preparation courses designed to equip students with the knowledge and skills they need to meet the expectations of employers, if they plan to enter the workplace directly, or the requirements for admission to many apprenticeship or other training programmes, available as Science and Environmental Science.

Students choose between programme and course types on the basis of their interests, achievement, and post-secondary goals, and each of the available Grade 11 and 12 science courses, counts for 1 credit towards the Ontario Secondary School Diploma (OSSD). Successful achievement of the OSSD requires 17 compulsory credits, 13 optional credits, at least two online learning credits, and a literacy requirement. Two of the 17 compulsory credits must be in science, and one must be from the STEM-related course group (business studies, computer studies, cooperative education, mathematics, science, or technological education). Each 1-credit course for the Ontario Secondary School Diploma requires a minimum of 110 hours of scheduled instructional time. The information which follows focuses on the Grade 12 Workforce Preparation senior secondary science course.

Curriculum

In the Grade 12 Workforce Preparation senior secondary science course is organised around six strands, which develop the fundamental concepts of matter, energy, systems and interactions, structure and function, sustainability and stewardship and change and continuity. They are:

1. Scientific investigation skills and career exploration
2. Hazards in the workplace: knowledge and understanding of science to enable people to identify, explain and minimise hazardous situations in the workplace
3. Chemicals in consumer products: physical and chemical properties of chemicals determine how they can be used safely in consumer and industrial products
4. Disease and its prevention: the spread of diseases can be reduced through personal choices and the use of appropriate technologies
5. Electricity at home and work: electrical equipment can pose a safety hazard in the home and workplace if not used correctly
6. Nutritional science: knowledge of the role of nutrients and other substances found in food products enables people to make healthy lifestyle choices.

A specific focus on scientific investigative skills through research and experimental activities are outlined within the specification and students are expected to develop their scientific literacy through these activities, as they analyse, interpret and communicate scientific information in a range of formats, including reports, diagrams, graphs, tables of values physical model computer simulations. There is also a specific focus on the integration of technologies into the learning and doing of science, as a learning tool to support students in developing investigative skills.

Assessment and Recognition

All assessment is internal, with teachers assessing student achievement of the curriculum expectations. Teachers make judgements about student work that are based on clear performance standards and on a body of evidence collected over time. Teachers record a final grade for every course and grant 1 credit for every course in which the student's grade is 50% or higher. 70% of the final grade for each course is determined on assessments conducted

throughout the course, while 30% of the grade is based on a final internally set examination, performance, essay, and/or other method of evaluation suitable to the course content.

Singapore

Context

Students take Singapore Examinations and Assessment Board (SEAB) General Certificate of Education (GCE) Ordinary Level (O Level) qualifications at around the age of 16, on completion of secondary education. Science is a compulsory curriculum subject until the end of Grade 8/Secondary 2, age 14. Students must then take at least one maths/science subject for the SEAB GCE O Level. Towards the end of Secondary 2, students choose between Combined or Pure Sciences for the O Level examination. For Pure Science, the scientific disciplines (Physics, Chemistry, and Biology) are assessed as three separate subjects, while two out of three of the scientific disciplines are assessed together as one subject for Combined Science. The SEAB Combined Science syllabus, covers all combined options; Physics and Chemistry; Physics and Biology and Chemistry and Biology. An overview of Combined Science (Physics and Chemistry) is outlined below.

Curriculum

The Combined Science (Physics and Chemistry) syllabus aims to develop understanding and skills relevant to the practices of science and enable students to appreciate practical applications of science in the real world. The syllabus also includes 'Practices of Science', representing the set of established procedures and practices associated with scientific inquiry, which highlight that the discipline of science is more than the acquisition of a body of knowledge but is also a way of thinking and doing. It consists of three components:

1. Demonstrating ways of thinking and doing in science
2. Understanding the nature of scientific knowledge
3. Relating science, technology, society and environment.

Subject content for the GCE O Level in Combined Science (Physics and Chemistry) defines the factual knowledge that students may be required to recall and explain in the assessment for the O Level qualification.

Learning outcomes for Physics are set out under the following areas:

- Measurement: physical quantities, units and measurement
- Newtonian mechanics: kinematics, force and pressure, dynamics, turning effect of forces and energy
- Thermal physics: kinetic particle model of matter and thermal processes
- Waves: general wave properties, electromagnetic spectrum and light
- Electricity and magnetism: electric charge and current of electricity, DC circuits, practical electricity, magnetism and electromagnetism
- Radioactivity.

Learning outcomes for Chemistry are set out under the following areas:

1. Matter structures and properties, including experimental chemistry, the particulate nature of matter, chemical bonding and structure

2. Chemical reactions including chemical calculations, acid-base chemistry, qualitative analysis, redox chemistry, patterns in the periodic table, chemical energetics and rate of reactions
3. Chemistry in a sustainable world, including organic chemistry and maintaining air quality.

Assessment and Recognition

Assessment for the GCE Science O Level includes written examinations and a practical assessment. Examination papers are balanced within 50% of the marks allocate to knowledge and understanding and 50% allocated to handling information and solving problems. The practical test assesses students' experimental investigative skills.

Section Summary

- Many of the jurisdictions explored provide flexible pathways throughout their upper secondary school science programme, supporting students to make choices in their science learning that reflects their interest and post-school aspirations.
- The general science courses seem to be most aligned with LC Physics and Chemistry (Phys-Chem), however, they have a broader focus that goes beyond the physical sciences.
- Many jurisdictions provide learning opportunities that provide learning in science connected to industry and the workplace, earth and space and environmental science.
- There is a consistent focus on the development of students' attitudes towards science and scientific practices. In addition, may jurisdictions focus on the application of learning and making connections to the real world.
- Opportunities to engage with and develop both experimental and research investigative skills are embedded within each of the science courses explored, with a focus on experimental or research design and the collection and integration of data, supporting students in their ability to draw and justify appropriate conclusions.
- Assessment is multi-faceted with a focus on a range of assessment modes with a balance in many cases between school-based and external assessment.

5.Issues for consideration

This section sets out a number of issues for consideration in the redevelopment of Leaving Certificate Physics and Chemistry (Phys-Chem). These arise from considerations relating to the nature of the subject itself and draw on themes that emerge from previous sections of this background paper.

Careful consideration of the following issues will be required from an early stage of the deliberations of the redevelopment of this subject.

Viability and rationale for a redeveloped specification

A unique culture has developed around the enactment of LC Physics and Chemistry (Phys-Chem). The dated syllabus is providing access to learning in the physical sciences to students in small to medium sized schools that tend to be either mixed or single-sex girls with limited laboratory provision and, at times, no specialised teaching staff. Classroom teaching and learning has been established through custom and practice over many years, which appears to have been significantly influenced by past examination papers and marking schemes. The subject does not enjoy parity of esteem with other science subjects (LC Physics, LC Chemistry, LC Biology, LC Agricultural Science) for recognition as entry to some Higher Education courses, and, with participation rates remaining consistent at 0.7% of the total Leaving Certificate cohort, there are questions around its viability.

Yet, evidence from school visits is clear. LC Physics and Chemistry (Phys-Chem) is providing a highly valued route through the physical sciences in senior cycle. Students, teachers and school leaders are unanimous in their perception that the syllabus offers a valuable experience for a cohort of students who otherwise would not experience the physical sciences in senior cycle. In redeveloping this subject, it will be important to consider its purpose and how to reflect this in the rationale and aim of the redeveloped specification. Deliberations will need to consider the unique culture surrounding this subject, where teachers have carefully selected topics to build a foundation in the physical sciences to support a cohort of students to experience success in senior cycle and in their post-school futures, whilst at the same time ensuring continuity and progression from junior cycle and beyond senior cycle.

The implications of widening the appeal of the subject

Consideration will need to be given as to how the redeveloped specification will encourage interest in and engagement with the physical sciences, leading to improved participation rates and better outcomes. Maintaining a balance between theory and practice, applying learning, industry visits and case studies and appropriate scaffolding of scientific practices throughout the learning process are suggested by schools as a means by which to widen the appeal.

Whilst widening the appeal will directly address the viability question it may also give way to unintended consequences such as, the redeveloped subject may have an increased uptake across the entire cohort of students, but it could decline in the schools where it is currently offered.

It will be necessary to give careful consideration to the rationale for this subject and the extent to which it is aligned to the redeveloped LC Physics and LC Chemistry specifications. Questions to consider include:

- to what extent should the subject align with the redeveloped LC Physics and LC Chemistry specifications?
- what will be the impact of aligning the subject in a hybrid manner have on a). uptake within the schools that currently offer the subject, and b). Uptake within schools that don't currently offer the subject?

Appropriate continuity and progression

Continuity and progression from junior cycle science is essential and whilst this can be achieved in many ways, consideration will need to be given to how best to rebalance knowledge and skill development, the approach to investigative work and how to include the values and dispositions associated with scientific practices and habit of mind whilst remaining cognisant of the cohort of students currently availing of the syllabus and the viability question.

Policy alignment

The redevelopment of LC Physics and Chemistry (Phys-Chem) presents an opportunity to consider a route through the physical sciences in senior cycle that has the potential to address some of the issues that currently exist within education such as:

- the low uptake of the physical sciences
- diversifying the profile of students choosing STEM subjects in post-primary school (STEM Education Policy 2017 – 2026)
- empowering students to meet the challenges of the 21st century (Equity and Excellence for All

Section Summary

- The redevelopment of LC Physics and Chemistry (Phys-Chem) presents an opportunity to address some of the issues associated with uptake that currently exist within the physical sciences.
- Consideration must be given to the rationale of the subject within a redeveloped senior cycle and its aim and relationship to the recently redeveloped LC Physics and LC Chemistry specifications.
- A unique culture has developed around the enactment of LC Physics and Chemistry (Phys-Chem) prompting questions related to viability of the subject.
- Whilst addressing the viability question, widening the appeal may have unforeseen consequences.
- Consideration should be given to rebalancing knowledge and skills, the approach to investigate work and the development of the values and dispositions associated with scientific practices and habit of mind.

6. Brief for the redevelopment of the Leaving Certificate Physics and Chemistry (Phys-Chem)

NCCA has established a development group to undertake the task of redeveloping the curriculum specification for LC Physics and Chemistry (Phys-Chem). The work of the Development Group is, in general terms, agreed by the NCCA Board for Senior Cycle and approved by the Council in the form of the brief set out below.

This brief is designed to provide the basis for redeveloping LC Physics and Chemistry (Phys-Chem). While the brief is derived from the key insights and issues for consideration identified in the previous sections of this paper, it is also guided by the parameters for the design of assessment arrangements in the development of specifications for all Tranche 3 subjects (Appendix 1).

The redevelopment of the new specification for LC Physics and Chemistry (Phys-Chem) will take account of current research and developments in the field. It will remain student-centred and outcomes-based, and in general terms, the specification should be aligned with levels 4 and 5 of the National Framework of Qualifications.

The specification will align to the template, agreed by Council, for curriculum specifications as set out in the *Technical form of curriculum specifications for subjects and modules in a redeveloped senior cycle* (NCCA, 2023).

The Senior Cycle Key Competencies will be embedded in the learning outcomes. LC Physics and Chemistry (Phys-Chem) will be available at both Higher and Ordinary level and will be designed to be taught and assessed in a minimum of 180 hours. The development will be completed in Q2, 2026.

More specifically, the development of the new specification will consider and address the following:

- How the specification aligns with the guiding principles of senior cycle and the vision for senior cycle education.
- How the specification can support continuity and progression, including how to connect with and build on related learning at junior cycle and in other senior cycle subjects and modules including Transition Year, in addition to a variety of post-school pathways including future learning in life, study, further education and training, higher education, apprenticeships, traineeships, and the world of work.
- The rationale for LC Physics and Chemistry (Phys-Chem), making it transparent and evident to students, teachers, and parents, its role in a redeveloped senior cycle and its relationship to the recently developed LC Chemistry and LC Physics specifications.

- How the student learning set out in the specification can be coherently linked and developed across the physical sciences.
- How the specification can support the development of a range of student key competencies.
- How the specification, in its presentation and language register, can be strongly student-centred and have a clear focus on how students develop and demonstrate their knowledge, skills, values and dispositions.
- The assessment of LC Physics and Chemistry (Phys-Chem) aligned to the parameters for the design of assessment arrangements in the development of specifications for all Tranche 3 subjects and modules (Appendix 1).
- How the specification, in its presentation, can support teachers in planning for teaching, learning and assessment, and can support students in developing links and enhanced engagement with real life applications and industry.
- How to embrace and embed technology in teaching, learning and assessment.
- How to provide multiple, diverse, and appropriate opportunities for students to achieve and demonstrate their learning across the LC Physics and Chemistry (Phys-Chem).
- How to name the subject to better reflect it's redeveloped focus.

The work of the LC Physics and Chemistry (Phys-Chem) Development Group will be based, in the first instance, on this Brief. In the course of the work and deliberations of the Development Group, elaborations of some of these points and additional points may be added to the brief.

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Appendix 1: Overarching parameters for the design of assessment arrangements in the development of specifications for all Tranche 3 subjects.

1. **Executive summary**
    - The Minister for Education announced an update on September 20, 2023, on the approach to be taken to the introduction of new and revised subject specifications including how assessment would be addressed in those specifications. Specifically, each subject shall have an assessment component in addition to the final written examination.
    - This assessment component (an AAC) will be worth at least 40% of the total available marks.
    - Each subject is to have one written examination; typically marks for the written examination will be 60%,
    - Typically, there should be two assessment components: One written examination and one other assessment component (an AAC).

    - More than one AAC or written examination may be justified in exceptional circumstances and after extensive consideration of the overall assessment load on students. Such exception, however, would be based on strong, clear evidence that a second AAC or a second written paper in the final examination is essential to assess student learning which cannot be achieved through a single AAC and a single written examination paper.

2. **Introduction**

This document outlines the overarching assessment arrangements and parameters to guide the design of specifications for all Tranche 3 subjects which include:

- Agricultural Science
- Computer Science
- Design and Communication Graphics
- History
- Home Economics
- Mathematics
- Music
- Physics and Chemistry.

This advice is informed by ongoing work with Tranche 1 and 2 subjects and will be amended, as appropriate, for future tranches which may take account of their subject areas and existing assessment arrangements.

The arrangements as detailed here reflect the policy direction issued by the Minister of Education that all subjects will have an assessment component, to be in a form that is not a traditional written examination, for those components to be set and assessed by the SEC and thereby lead to a reduced emphasis on final examinations in June of 6th year.

Specifically, the arrangements for all assessment components as outlined in this document are framed by the Minister's announcement(s) on March 29, 2022, and subsequently on September 20 2023. Underpinned by the following understandings, the assessment components:

- will not take the form of traditional written examinations.
- will be set and marked by the SEC.

- will be subject to SEC arrangements for their completion, authentication, and submission.

In developing the arrangements outlined below, the following rationale for moving towards all subjects having another assessment component is central. This rationale is informed by deliberations on research commissioned by the NCCA and the SEC, and on the assessment literature more generally. From this work, it is evident that these components have the potential to:

- **Reduce dependence** on written summative examinations and therefore provide for a **broader assessment system**; written examinations have an important role but can be seen as a 'snapshot' of learning and can lead to teaching and learning having an excessive focus on examination preparation; other forms of assessment can mitigate the potential for this narrowing of learning by assessing aspects of student learning better and/or more comprehensively than written examinations alone can do; or assess learning that is not readily assessable through written examinations.
- Support and enhance teachers' understanding and assessment of **key competencies** by contributing to a greater understanding of how students' knowledge, skills, values, and dispositions are assessed.
- Provide opportunities for students and teachers to **reflect on student learning,** boost students' motivation to learn and enhance opportunities for formative feedback practices.
- Extend the range and diversity of assessment opportunities; including **spreading the assessment load** over the course of the last two years of senior cycle and thus contribute to a reduction in or spreading of pressure on students.
- Build and develop **teachers' assessment skills and assessment literacy** as teachers support students in working through the assessment activities as detailed within assessment briefs or guidelines.
- Generate student assessment data which can help reduce the vulnerability of the system to future unprecedented or unexpected system shocks such as COVID.
- Allow for assessment opportunities that are more **authentic** than a system relying on terminal written examinations solely.

It is also important to note that a review of the assessment literature more generally also indicates that when introducing other assessment components, it is necessary to consider how to mitigate risks, for example, of:

- over-assessment of students
- over-rehearsal of assessments
- the assessments becoming overly structured, compartmentalised, repetitive, and routine.

As is already the case where other forms of assessment apply, the new assessment arrangements will be guided by the overarching principles of equity, fairness, and integrity.

In addition, at a programme wide level (i.e. taking account of all subjects and modules implemented across schools), it is necessary to have regard to the overall assessment load on students primarily as well as on schools more generally. Whilst it can be expected that SDGs might focus on the approach to assessment in their own subject initially, they are encouraged to be mindful of the overall assessment load across all subjects and modules. Such programme level considerations will also include the methods of assessment being undertaken. As stated above more than one AAC or written examination may be justified in exceptional circumstances and the following section outlines the process for such cases.

3. Process

This section sets out the process through which a variation to the parameters defined in this document will be considered and decided upon; for example, an additional AAC or a second final written examination.

1. Following extensive discussion by the SDG and after exploration of a range of options for a single suitable AAC/single written examination for the subject, the NCCA Executive generates a written note setting out the strong, clear case being made by the Development Group.

2. The written case is agreed and signed off by the Development Group.

3. The written case is discussed with the Board for Senior Cycle.

4. The written case is discussed with the Council. On foot of this discussion, the Council decides whether or not to send the case forward to the Department.

   a) Having considered the importance of managing and spreading the assessment load for students, if the Council decides that the case isn't sufficiently strong to merit consideration by the Department, the Council requests the Development Group to work on the basis of one AAC and one written examination.

   OR

   b) Having considered the importance of managing and spreading the assessment load for students, if the Council decides that the case is sufficiently strong to merit consideration by the Department, the Council agrees to send the case forward to the Department of Education.

5. In the case of 4b, the written case is sent to the Senior Cycle Redevelopment Programme Management Office (SCRPMO) in the Department of Education for consideration and response.

6. The Department may convene the Senior Cycle Redevelopment Implementation Group (SCRIG) to support its consideration of the request for a variation. The SCRIG is a Department-led structure established to provide oversight and support the co-ordination of work across the key agencies/organisations contributing to the redevelopment of senior cycle. Its members include senior officials from the Department (Curriculum and Assessment Policy Unit, Inspectorate, Teacher Professional Learning [TPL]), NCCA, SEC and Oide.

7. The Department decides to support or decline the request for the variation sought and communicates its decision in writing to the NCCA in a timely manner.

8. The Subject Development Group progresses its work in line with the Council's response (arising from 4a) or the Department's response (arising from 4b and 7).

4. Timelines

The process outlined above will require time. Such time, if involving a number of weeks, could have significant implications for the timeline for specific stages of work on the subject specification and/or the overall completion of the specification ahead of sending it to the Department for consideration. This time factor may necessitate NCCA organising additional online meetings of the Board for Senior Cycle and the Council in order to ensure the development work remains within the overall timelines.

Table 1 below sets out the general parameters and processes to guide the work of the subject development groups (SDG) as they consider the most appropriate assessment for each subject. The specific parameters for each of the Tranche 3 subjects are set out in Table 2.

Table 1: Assessment parameters and processes – general application to tranche 3 subjects

Considerations	Parameters to guide the work of the development group.
Nature	The purpose and nature of the assessment component will be clearly outlined in the subject specification and accompanying guidelines to support the completion of the assessment. Details will be provided on the nature of the component. Existing examples include: • research project/extended essay • oral assessment • performance assessment • portfolio assessment • creation of an artefact • field study • experiment/ proof of concept/ practical investigation. The subject specification and the accompanying guidelines will articulate clearly what the students are required to do, the form(s) in which it can be carried out and submitted, and the workload expectations associated with the assessment. The alignment of the assessment component to a particular set of learning outcomes from the subject specification will be provided, as well as details on which key competencies and associated learning outcomes will be assessed. This does not preclude the same LOs from being assessed in the final examination.
Weighting	The assessment component in each subject will be worth at least 40% of the total available marks.
Timing	The SDG will advise on the time required for the carrying out of the assessment component across the course of study.
Completion and Submission	While the SDG may suggest when this may occur (as referenced above having regard to the assessment load on students in particular), a final decision will be made by the SEC following consideration of the overall schedule of completion dates for all assessments across all subjects. This will be finalised by the SEC following engagement with the NCCA and DE. The dates for final completion and\or submission of the assessment component by the student will be published by the SEC and this detail will not be included in the subject specification. (See table 1 below in relation to Mathematics also)
Design	The majority of assessment components will result in a completed item that is materially different to a traditional written examination and which tests different competencies being transmitted to the SEC and assessed by the SEC. In some instances, the design of the assessment may require examiners to visit schools to conduct the assessment but manageability at school and system level will need to be considered.

Guidance	Guidelines to support the assessment components will be specific to each subject. These guidelines will be developed collaboratively by the NCCA and SEC. They will be informed by the deliberations of the SDG during the development of the specification and will detail: • the purpose of the component concerned i.e., what it is intended to assess. • the nature of the assessment component/activity. • descriptors of quality in the form of a graduated rubric and details on assessment standards at higher and ordinary levels if deemed necessary by the assessment method. • details on the timing of the assessment (its duration and when it could happen). • guidance on the processes that may be used for the administration of the assessment.

Table 2: Parameters for assessment arrangements for each Tranche 3 subject

Subject	Current arrangements	Parameters for new assessment arrangements
Agricultural Science	Written examination is 2.5 hours duration for higher level and ordinary level students and is awarded 300 of the 400 marks available (75%). Coursework is an Individual Investigative Study, which is done in response to a common brief from SEC and is worth 100 marks (25%).	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher and ordinary levels. Assessment component would be based on one submission to SEC in response to a common brief.
Computer Science	The final examination is worth 70% and is 2.5 hours duration on one day towards the end of May. There is a paper-based element (1.5 hrs.; 130 marks) followed by a computer-based element (I hr.; 80 marks). The coursework is worth 30% of the final marks. The common brief is released in December of 6th year and a report and summary video (90 marks) is typically submitted in March of 6th year. This is completed over a 10-week period. Coursework and practical are set at a common level but are graded in line with the standards that apply to the level at which the candidate sits the written examination.	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher and ordinary levels. Assessment component would be based on one submission to SEC in response to a common brief.

	Written examination is examined at higher and ordinary levels.	
Design and Communication Graphics	Written examination has 1 paper worth 240 marks which is 60% of the marks available. This paper is 3 hours in duration. Written examination is examined at higher and ordinary levels. Student assignment is worth 160 marks which is 40% of the marks available. The student assignment at higher level differs from the student assignment at ordinary level with a different brief set for HL and OL students. There are 9 outputs required in a portfolio for both levels with the HL page limit set at 14 pages and OL page limit 12 pages.	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher and ordinary levels. Assessment component would be based on one submission to SEC in response to a common brief.
History	Written examination is worth 80% of the total marks available, and the exam is 2 hour 50 minutes in duration. Coursework is a Research Study Report (RSR) and is allocated the remaining 20%. There is a different word count for HL and OL students, with the OL word count set at 800 words and the HL word count set at 1600.	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher and ordinary levels. Assessment component would be based on one submission to SEC in response to a common brief.
Home Economics	Written examination is 2 hr 30 minutes duration and worth 280 or 320 marks (out of 400) depending on the elective chosen. For students who choose the **Home Design and Management** or **Social Studies** electives, the written examination is worth 80% and the **Food Studies Coursework** is worth 20%. For those who choose the **Textile Fashion and Design** elective, the written exam is worth 70%; the **Food Studies Coursework** is worth 20% and the **TFD Coursework** is allocated 10%. **Food Studies Coursework** is based on 4 assignments completed by the	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher and ordinary levels. Assessment component would be based on one submission to SEC in response to a common brief.

	beginning of November of 6th year and submitted to the SEC.	
Mathematics	There are 2 written papers that are worth the full allocation of marks. Paper 1: HL OL and FL is 2.5 hrs duration. Paper 2: Hl and OL 2.5 hrs duration.	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher ordinary and foundation levels and it would be expected to take the form of a single paper Assessment component would be based on one submission to SEC in response to a common brief. Assessment component to be completed in Year 1 of the two-year programme.
Music	There are 3 areas for assessment: Composing element is worth 25% and assessed by a written paper of 1.5 hours duration. Performing element is worth 25% and is assessed by a performance of 3 or 4 pieces depending on the selection of one performance format or 2. Listening element is worth 25% and is assessed by an aural exam and written paper of 1.5 hours duration. HL Elective: Higher level students select one of the 3 areas above and choose to increase mark allocation to 50% by including an additional assessment activity. For ordinary level students, their best mark in one out of the three areas is doubled to reach 100%-mark allocation.	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher and ordinary levels. Assessment component will be based on a brief issued by the SEC.
Physics and Chemistry	Written paper at HL and OL worth full mark allocation of 400 marks. 3-hour paper. Section 1 Physics worth 200 marks. Section 2 Chemistry worth 200 marks.	Written examination: typically, 60% weighting. Assessment component: minimum 40% weighting. Written examination will be set at higher and ordinary levels. Assessment component would be based on one submission to SEC in response to a common brief.

Whilst an AAC in each subject must have a minimum weighting of 40%; an SDG may propose a weighting of 50%. In these circumstances, the process outlined at Section 3 above will apply to determine if such a weighting receives further consideration as to whether it shall be applied or not. It would not be anticipated that an SDG would seek to apply a weighting to the AAC above this level.

NCCA

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