to the NCCA Leaving Certificate Chemistry

and publication.

Unanswered questions are omitted for clarity.

Clarity and coherence in the specification

There are three design features of the specification, which aim to support curricular coherence and clarity; namely the overview of each strand, the students learn about column and the learning outcomes themselves. Considered along with the other sections of the document [the Rationale, Aims, Key Competencies, Teaching and Learning and Assessment], the students learn about column builds on the overview and indicates what students will be learning. The learning outcomes state what students should know, understand and be able to do at the end of the course.

Please provide specific feedback / observations / comments on the extent to which the strand overview and students learn about column bring clarity to the learning outcomes in an appropriate way.

There is room for further clarification, especially in relation to the timing required considering the number of learning outcomes and 160 hours of class time (minus 20 for project). It is unclear which experiments are expected to be completed in these 160 hours of class time. For example, all of the

The knowledge about science; continuity from junior cycle and the unifying strand

To ensure continuity from junior cycle, the knowledge about science in the unifying strand is the same as that set out in the Nature of Science strand in junior cycle. Progression from junior cycle is signposted through the strand overview and the provision of the extra detail in the students learn about column.

This strand builds on the unifying strand from Junior Cycle Science and continues to bring to life the practices and norms underpinning the facts, concepts, laws, and theories of science. Building on existing knowledge students develop an appreciation of science as a process; a way of knowing and doing and an awareness that the discipline of science includes the nature of scientific knowledge as well as how this knowledge is generated, established and communicated. In senior cycle it is expected that students will be able to meet these learning outcomes with a greater degree of independence. (page 16)

The Unifying Strand: The Nature of Science (pages 16-18)

In this strand, students learn about

U1. Understanding about Chemistry (page 16)

U2. Investigating in Chemistry (page 17)

U3. Communicating in Chemistry (page 17)

U4. Chemistry in Society (page 18)

U5. Abstraction to Representation (page 18)

Please provide specific feedback / observations / comments on the knowledge about science specified in the unifying strand.

Our curriculum framework proposes three core components of a chemistry curriculum at 16-18; the way in which chemistry operates as a science; the body of knowledge that constitutes chemical

Cross-cutting themes and the knowledge from Chemistry

Health, Sustainability and Technology have been chosen as cross-cutting themes. These themes have been specifically chosen to show the relevance of Chemistry to students' lives coherent with the Rationale and Aims set out on pages 2 and 3.

The themes act as lenses through which students explore the application of the knowledge from Chemistry. (Page 13)

Please provide specific feedback / observations / comments on the cross-cutting themes sustainability, health and technology.

We are pleased to see sustainability as one of the core themes of this proposed qualification. Our 'Green Shoots' report, which included educators from Ireland and the UK, highlighted that young people wanted sustainability and climate change to be a priority in a chemistry curriculum. Additionally, 69% of surveyed educators felt that there was currently too little content in the chemistry curriculum at 16-19 that directly relates to these topics.

Alongside the specific chemistry content that explores climate change and sustainability, we would want to see content across the qualification exemplified and contextualised around sustainability where appropriate.

The knowledge of Chemistry; the four contextual strands. (pages 18 - 43)

- Further topics that could be omitted to make room for this suggested content include radioactivity (NM2), parts of the periodic table content e.g. its development and properties of specific groups (NM3, level 2 content), allotropy (BM1, level 2 content), combustion (IM1, level 2 content), and identifying organic compounds (MW2, recall - something teachers have asked for less of).

Strand 4 mainly focuses on the bulk of the organic chemistry content, the applications of this chemistry, and the chemical environment. The organic chemistry content broadly aligns with our curriculum framework and includes key concepts such as functional group interconversions and the use of curly arrows. In the final MW3 section, we noted that the content doesn't cover decision making (chemistry being affected by different decisions, requiring weighting of evidence and constructing arguments) which is something our curriculum experts strongly recommended to include. We feel this would complement the topics you have proposed and illustrate the difficult balancing act scientists are often faced with.

The knowledge of Chemistry; the four contextual strands. (pages 18 - 43)

The learning outcomes in the four contextual strands are common apart from those specified for Higher Level only, which are emboldened.

Please provide specific feedback / observations / comments on the appropriateness of the learning outcomes specified as common and those that are emboldened as Higher Level only. If mentioning specific topics / learning outcomes please use appropriate coding.

In NM2, by limiting the more advanced electronic structure model (s, p, d) to Higher Level only, the opportunity to build on ideas developed in level 2 is limited and understanding remains at a basic level. We believe this should be content for all.

The nature of metallic bonding in BM1 seems a basic concept to limit to Higher Level only; the proposed learning objective also doesn't seem to build on/add to level 2 understanding.

We also noted that much of the quantitative content in strands 3 and 4 have been marked as Higher Level only. These include using bond enthalpy data and calculating enthalpy changes using Hess's law (IM1 e & f), using the mathematical model of Kc and solving prob, [illegible]

Additional Assessment Component (AAC)

The Additional Assessment Component of LC Chemistry provides an opportunity for students to display evidence of their learning throughout the course, in particular, the learning set out as outcomes in the unifying strand. It involves students completing a piece of work in a specified time period towards the end of the course as evidence of their ability to conduct scientific research on a particular issue and to use appropriate primary data to investigate aspects of that issue. It has been designed, to exploit its potential to be motivating and relevant for students, to draw together the learning outcomes and cross-cutting themes of the course and to spotlight potential career paths by highlighting the relevance of learning in Chemistry to their lives. (Page 45)

Please provide specific feedback / observations / comments on the challenges associated with introducing an AAC.

We would like more clarification about this. If the AAC requires all students to conduct individual practical lab projects, it may also disadvantage schools without a technician. Some teachers have commented to us that individual lab projects will involve significant lab time that isn't always available in schools as it currently stands. This is especially the case when all the lab science subjects will be conducting their projects at the same time.

Widening the appeal of Chemistry

In addition to its potential to support the development of scientific literacy necessary for twenty-first century citizenship, it is hoped therefore, that this specification will appeal to a broad range of learners with a diverse range of post-school aspirations.

Please provide specific feedback / observations / comments on the likelihood of the draft specification to appeal to a broader range of students with a diverse range of post-school aspirations.

Our 'Chemistry for all' outreach study explored the impact of five years of outreach activities to widen participation in chemistry. It showed that targeting students from less advantaged backgrounds can draw them into the chemistry pipeline and strengthen their identity with chemistry. Student perceptions of chemistry and the existing dominant representations of chemistry were found to have an effect on student aspiration in the subject.

The Aspires research project led by Professor Louise Archer at UCL also concluded that identifying and challenging dominant representations of STEM is one of the key ways to improve STEM aspirations in young people.

We want to see awarding and regulatory bodies provide examples in curricula of successful people in chemistry who have 'worked hard' rather than rely on 'natural cleverness'. We also want to see a diversity of people (including across age, ethnicity, gender and other aspects of people's identities, characteristics, and circumstances) portrayed as contributing to chemistry and working in it and with it. We would hope that during the development of this qualification, careful consideration is made to the exemplification and contextualisation of the content.

Our 'Green Shoots' report, which included educators from Ireland and the UK, surveyed young people and their educators on the state of climate and sustainability education in chemistry. It revealed that