Institute for Apprenticeships and Technical Education

Royal Society of Chemistry's response to the consultation on the outline content for the Science T-level

March 2019

Responses to questions relating to occupational specialisms were answered with regard to the Laboratory Science specialism.

(Rate on a 5-point scale:) The knowledge and skills in the core content will enable someone to develop a broad understanding relevant to the sector.

Rating: 4

Comment

The content is broadly appropriate and the relevance to the occupational sector is clear.

As a general point, we advise reviewing the content bearing in mind the intended assessment methods, to ensure that it is clear what is expected in terms of depth of knowledge and how students should be able to apply the knowledge. As it is, some sections are open to interpretation in such a way that would skew the learning away from what is intended, and may lead to an assessment approach that is inappropriately academic. We further advise that employers, and professional bodies such as the Royal Society of Chemistry, be asked to review the Awarding Organisation specifications once they have been produced, to ensure that the interpretation at that stage remains appropriate.

An important example is the list of policies, regulations and practices that students will be expected to have an awareness of. We agree with the principle of including this content, but students must not be asked to learn policy and regulation documents off by heart and answer detailed questions about them in an examination. We do not suggest that this is the panel's intention, but it has already been decided that the Core knowledge and understanding will be assessed by exam; understanding of regulations and practices would be better assessed through the employer-set project, where students could demonstrate an awareness relevant policies in how they meet the brief.

The core science concepts (page 10) include 'structure of materials and the relationship with physical and chemical properties', with the detail singling out the properties of metals. While relevant, it is unclear why metals are given this prominence above other types of structure, e.g. polymers and ceramics. Additionally, we advocate including the relationship between structure and properties of composite materials.

A scientific concept missing in the Core, which would be relevant to all Health and Science occupations, is an understanding of toxicity and its relationship to the type of substance, the dose and individual sensitivity.

Use of SI units would be relevant to include in Health and Science route Core, rather than confined to the Science pathway Core. In a broad range of medical occupations an understanding of a range of units and a sense of scale is essential; for example in understanding appropriate ranges for concentrations and dosage.

In the section on the Science sector (page 11), it is good to see reference to the diversity of the sectors, as well as application to non-science sectors. Additionally, we would be keen to see reference to the fact that science inherently involves innovation and the development of new ideas, and how the sector contributes to that.

We take this opportunity to signal that, among the people we spoke to in preparing this response there was some confusion about the structure of the T level programmes as presented in the consultation document:

- The existence of two sets of ‘Core’ content caused confusion about whether the T level qualification would cover Health and Science or Science only; this will need to be made very clear in tendering, but also in communications to stakeholder groups. It would also be advisable to review the heading ‘Core Scientific knowledge’ in the Laboratory Science Occupational Specialism (page 18).
- Several people interpreted the employer-set project as being related to the industry placement. Again, it will need to be made clear in all communications that these are two separate entities.

(Rate on a 5-point scale:) The content for the occupational specialism(s) contain the right knowledge and skills to allow someone to gain employment within that specialism.

Rating: 4

Comment

It is appropriate that this contains both scientific tasks and skills, and scientific knowledge, and the content included is broadly appropriate.

Here again we express concern about how some sections may be translated into a specification and assessments. There may be a temptation for the core scientific knowledge to be incorporated as a distinct module and covered in a similar depth and manner as in an A level; this would not be appropriate to this type of qualification. The wording of the core scientific knowledge section could more clearly demonstrate how the knowledge can be linked to the occupationally specific tasks, skills and techniques, and how this might be integrated in the qualification specification and in teaching. This would also provide a better steer on how this content can be assessed through the intended practical assessments. The Royal Society of Chemistry will be keen to review the specifications once created by Awarding Organisations, to ensure that the Science qualification has an appropriate focus on being practically challenging.

It is excellent that the laboratory science specialism leads with a section on safety, health and environmental practices, which is central to the work of laboratory technicians. This could be expanded to refer to the role laboratory technicians often play in acting as local experts in health and safety, keeping others safe as well as themselves; for instance, by sharing health and safety information in appropriate ways.

Is there anything missing from the content for the occupational specialism(s)? If you response ‘Yes’, please provide details in the comment section.

Answer: Yes

Comment

We recommend including the following:

- Content relating to organic chemistry and chemical synthesis. This would support students who progress into chemical manufacturing and synthesis environments. At least, this should cover: competence in techniques for purifying and testing compounds; some basic synthesis techniques; a basic understanding that one can plan a route to synthesise a desired compound using chemical knowledge. We do not advocate the level of coverage of different reaction types that would be seen in an A level.
- The basic principles of organic and inorganic systematic nomenclature, as well as awareness of common trivial names for substances used in laboratories.
- A more detailed coverage of spectroscopy, for example expecting students to gain awareness of a range of techniques and their applications. Spectroscopic techniques are among those that technicians are most likely to encounter.
- Reference to the importance of collaboration and the types of other people laboratory technicians work with; for example: laboratory managers, those who supply and service equipment, and wider scientific teams. It may be desirable for one or more of the assessments in the occupational specialism to include a collaborative aspect.

- Reference to the increased use of computer modelling and simulation used in laboratory environments to progress both scientific understanding and technological applications. While we do not recommend in-depth study at this level of how simulations are constructed, students would benefit from some familiarity of their use and awareness of key areas of application, as they would be likely to encounter them in a technician role.

Is there anything in the content for the occupational specialism(s) that is unnecessary?

It is unnecessary in the context of this qualification to ask students to perform calculations using Born–Haber cycles. An appreciation of quantitative aspects of enthalpy can be covered through simpler means, for example Hess cycles and bond enthalpies.

Do the occupational specialisms cover everything a person needs to learn to be able to start work in that specialism? (If you answer 'No', please provide reasons for your answer.)

Answer: No

[Our response repeated our answer to the above question, whether anything was missing from the content for the occupational specialism.]

Overall, is the outline content appropriate for a Level 3 qualification?

In general, the content appears to be at the appropriate level. However, many sections are open to interpretation in terms of the depth at which they should be covered. When the content is translated into a specification, care must be taken that the overall amount of content is manageable within the expected teaching time. We would expect the focus for this type of qualification to be on technical and other workplace skills, supported by relevant knowledge; therefore theoretical concepts would not necessarily be covered to the same level of depth as in an A level.

There are some areas where we are concerned the outline content is open to interpretation at too high a level, and where clarification would be helpful. Specifically:

- Occupational specialism; laboratory science, Performance outcome 1: complying with relevant legislation and regulations in handling and disposal of a range of materials. We would not expect a level 3 student in a provider setting to handle e.g. explosives, compressed gases or pyrophorics. An awareness of considerations involved in handling such materials is appropriate and sufficient.
- Occupational specialism; laboratory science, Performance outcome 2: use of information from scientific papers to plan scientific tasks. An indication of the level required, and how this skill may be scaffolded, would be useful here. For example, that students should have an awareness of the usual sections in a scientific paper and be able to extract relevant experimental detail. Reading full scientific papers is a high level skill and would not generally be required at level 3.

Overall, is the outline content suitable for teaching in a classroom-based setting?

In general, the content appears to be suitable for teaching in a classroom-based setting. As in other areas, however, some of the content is open to inappropriate interpretation.

A number of techniques and scientific tasks are mentioned for the laboratory science occupational specialism, for which providers are unlikely to already possess suitable equipment. For example, pages 20–21 describe a range of equipment in the knowledge column, with the skills column requiring use and calibration of equipment, and competence in the use of equipment, in general terms. This section could be interpreted as requiring all students to develop practical competence in all the techniques listed, which would place a significant burden on providers to invest in appropriate equipment; providers are unlikely to already have access to e.g. mass spectrometers, NMR instruments and cryogenic equipment. For the avoidance of doubt, the content should state clearly in which techniques students should have hands-on experience or gain practical competence, and for which techniques an awareness of the principles and uses will suffice. We would expect funding to be made available to support providers in acquiring any equipment that is not already routinely required for level 3 technical qualifications.