T-LEVELS | Institute for Apprenticeships & Technical Education

Chief examiner's report

T Level Technical Qualification in Science (Level 3) (603/6989/9)

Summer 2023 – Core A and B

NCFE CACHE

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Summer 2023 – Core A and B

Assessment dates: **Core A 19 June 2023**

Core B 23 June 2023

Paper number: **P001926**

P001932

This report contains information in relation to the externally assessed core sub-component provided by the chief examiner, with an emphasis on the standard of student work within this assessment.

The report is written for providers, with the aim of highlighting how students have performed generally, as well as any areas where further development or guidance may be required to support preparation for future opportunities.

Key points:

- grade boundaries
- standard of student work
- responses to the external assessment questions
- administering the external assessment

It is important to note that students should not sit the core exam until they have received the relevant teaching of the qualification in relation to this sub-component, and that both papers must be taken in any given series that a student sits the core exam.

Grade boundaries

Raw mark grade boundaries for the series are:

	Overall		Notional boundaries	
			Paper A P001926	Paper B P001932
Max	231		112	119
A*	193		93	99
A	168		81	87
B	143		69	74
C	119		57	61
D	95		45	49
E	71		34	37

Grade boundaries are the lowest mark with which a grade is achieved.

Students receive a grade for the core exam sub-component as whole, and although there are no official grades for the individual assessments in the core exam, it can be useful for students and teachers to see how the core exam grade was achieved. The grade boundaries given for each assessment are known as 'notional grade boundaries', as they are for illustrative purposes only. For further information on notional grade boundaries, please see our guide T Levels: Notional boundaries for the core exam assessments available on the qualification page of our website.

For further detail on how raw marks are converted to uniform marks (UMS), and the aggregation of the core component, please refer to the qualification specification.

Standard of student work

In this series there was a notable improvement in the standard of student responses to both papers in general. In particular there were significantly fewer blank responses, indicating that providers have been supporting students in developing exam technique and building confidence in attempting all questions, including those that are more challenging to them.

Across the papers students achieved well on the AO1 (demonstrating knowledge and understanding) questions, showing that in many cases fundamental scientific concepts were well understood. AO2 (application of knowledge and understanding) and AO3 (analysis and evaluation of information) provided a greater level of challenge for many students, and this continues to be an area for development from other series.

In some questions students were unable to gain marks as they had simply re-stated the question text. In questions with a multiple mark tariff students often gained one mark for a response that gives some basic information but does not go on to develop the response and achieve the maximum marks available for the question.

In the extended-response questions students are giving longer and more detailed responses, however, these are often limited in that they only demonstrate knowledge and understanding for AO1 marks, giving little or no application and analysis to provide access to the higher marks for these questions. In addition there was a trend of students using connective language such as “furthermore” and “nevertheless” in an attempt to develop the language in these responses, however these often led to poorly structured sentences where meaning was lost. Quality of written communication overall however was reasonable, and students were able to gain credit for responses written in coherent paragraphs with an appropriate level of technical language used correctly.

Responses to the external assessment questions

Core paper A

Section A: working within the science sector

In this section students provided a reasonable demonstration of their level of understanding of the fundamental concepts relating to scientific workplaces. Most students were able to provide good reasons for the importance of standard operating procedures and demonstrated good understanding of safe storage and handling of different types of chemicals.

In question 2(b) students struggled to explain how the SOPs ensured that the laboratory was working to the required standard. Many students simply repeated their responses to 2(a), providing no additional detail, or giving a very superficial answer regarding safety, which was insufficient for any additional marks.

Question 4 proved an interesting challenge for students. Many students correctly discussed the lower overall cost leading to better commercial success for the company. Few, however, identified that the surplus product left over at the end of each month would incur additional cost for the company, meaning that the cheaper initial cost may be outweighed by this. Also, a small number of students correctly suggested that the disposal of the surplus product could have environmental impacts.

The extended-response question in this section required students to evaluate a proposal for safe storage and disposal of chemicals in a research company. Many students provided some good examples of storage conditions for different types of chemical, however, some of these were rather superficial, stating thing like ‘the chemicals will explode’ without any additional context. Very few students made any relevant comments

about safe disposal methods. A small number of students were able to refer to COSHH, however, very few provided any additional application or evaluation of the information provided, with very little reference to the potential impacts of the manager's plan.

Section B: ethics, data and managing personal information in the science sector

This section required students to use their knowledge and understanding of data and ethics in a range of contexts. In question 7(a) some students managed to score one mark by identifying that the T-test compares the means of 2 groups of data, however, very few students obtained the second mark here for either stating that this matches the data presented that is measuring the same variable twice or the converse with regards to Chi-squared.

In question 7(b) many students managed to obtain one mark by identifying that in each case the training improved the scores of the employees, however, few students developed their answers further to include additional detail or analysis of the data presented, limiting achievement in this question. Similarly in question 8, many students were able to state one way in which the mice should be handled to avoid harm, however, few advanced their responses to include the explanation required to achieve the higher marks.

The extended-response question in this section proved challenging to many students. Most responses included an attempt to consider the principles of animal testing, however, the level of depth and detail in these was generally superficial and was only able to achieve marks in the lower bands. Many responses did not attempt to evaluate the statement made by the scientist, making it very difficult for marks to be awarded for AO3.

Section C: health and safety in the science sector

This section was generally the best answered in this paper. Health and safety practices are critical in the science industry, and students' ability to apply their understanding of this is important. The vast majority of students were able to correctly identify the definition of a category 3 biohazard, and questions 12 and 13 where students were required to provide suggestions of how dangerous activities could be made safer were generally answered well.

Question 14(b) required students to discuss the potential efficacy of a set of protocols proposed by a laboratory manager. In this question students' responses were generally poor, repeating information provided in the question without providing any additional detail. For example, the protocol states that gloves and lab coats should be worn at all times, and students frequently just repeated this statement. Few went on to acknowledge that this provides a minimal level of protection or to specify additional precautions such as face masks and goggles should be used.

In the extended-response question in this section students were asked to evaluate the response to an incident. A small number of students recognised that the H&S officer's response was not comprehensive in that it only dealt with the clearing up of the spillage, rather than the incident itself, which caused the injury. Most students recognised that the failure of the employee to use appropriate PPE was a significant contributory factor in the injury, however, again there were very limited examples of application of knowledge and evaluative work meaning access to higher levels of marks was restricted.

Section D: scientific methodology, equipment and techniques

In section D students were required to provide a demonstration of their understanding of practical scientific techniques. Surprisingly few students could identify the correct example of a negative control, and similarly few students could articulate how an autoclave sterilises materials with many simply repeating the stem of the question.

In 17(b) students were required to identify a piece of equipment precise enough to measure accurate volumes of culture medium. Many students responded with ‘pipette’, which does not give sufficient distinction between a simple dropping pipette and other more suitable types of pipette.

Question 19 asked students to discuss how a technician could investigate an issue with equipment they were using by testing and calibrating it. Some students seemed to struggle with this, giving confused responses about using other types of equipment or simply by repeating the preparation of the solution, whereas those students who scored more highly were able to discuss the calibration and steps necessary for checking the equipment.

Very few students were able to achieve marks in question 20. It appears that the majority of students have little or no experience of the use of oil immersion lenses. Many gave responses that were just incorrect, such as making sure the oil doesn’t touch the lens and making sure a coverslip is used over the oil.

The final extended-response question asked students to evaluate a project plan proposed by a pharmaceutical company. Some students were able to identify some basic strengths and weaknesses of the plan, however, again the level of application of knowledge and evaluation was weak. Students needed to consider the impact of the different steps of the plan and any improvements that could be made in order to achieve these higher marks.

Core paper B

Section A: biology

In this section students’ achievement varied greatly between questions. Very few students, for instance, could correctly identify a purpose of the Giesma stain (specification reference B1.23) whereas approximately twice as many recognised that the scanning electron microscope was most appropriate for examining the outer surface of a virus.

Question 3(a) proved surprisingly difficult for students. Many students simply repeated the information given in the question, and very few actually used the term ‘surface area to volume ratio’ or any abbreviation of this. Many students simply stated that this was because the volume was greater, and a significant number of responses incorrectly referred to SA:Vol being bigger.

In question 3(c) students were asked to interpret a simple graph showing rate of uptake against concentration. Many students misinterpreted this and attempted to respond in terms of concentration gradient. Other students assumed the scientist’s conclusion in the question was correct, arguing that the rate of simple diffusion would level off at a certain point, suggesting a fundamental misunderstanding of the concept of diffusion.

Many students struggled with the discussion required for question 5(d). A relatively small number gained one mark by recalling that lipids have a higher amount of energy per gram than carbohydrates, and even fewer went on to develop this response in terms of the need for lipids to be digested before use in respiration or difficulty transporting the insoluble molecules.

The questions relating to meiosis form another area for development for many students. In 6(c) very few students identified that the doubling of the mass of DNA was because the cell was about to begin the first meiotic division.

Question 8 was the first extended-response question in this paper. Many students were able to give a reasonable account of protein structure and amino acids, however, some led themselves down an incorrect path by referring to active sites and enzyme denaturation. Some students had a reasonable attempt at applying some of this knowledge for AO2, however, few were able to provide any coherent evaluation that was required for the highest marks.

Section B: chemistry

Pleasingly, most students were able to balance the chemical equations provided in questions 10(a) and 10(b). Similarly in 10(c) many students understood that caesium, whilst more reactive than potassium, would be too reactive to be able to be used safely in the context provided. Unfortunately many students then went on to try and justify this in terms of electron configuration by demonstrating a misconception about electron arrangements, stating variously that caesium has 3, 4 or 5 electrons in the outer shell. This suggests a very basic GCSE-level of understanding of electron configuration rather than the level of detail of orbitals and sub-orbitals required by the specification. Also, a number of students stated that caesium is highly reactive because of the position is occupies on the periodic table, which is not accurate.

Interpreting graphs was an issue once again here in question 11(d). Many students stated that the rate of reaction was decreasing above 80°C, and several students assumed that this graph was representing an enzyme-controlled reaction and referred to reagent B as being denatured. A large number of responses to this question also incorrectly referred to the activation energy changing at different points in the graph, suggesting that changing temperature changes the activation energy of a reaction.

In question 13 the main issue again is the lack of application and evaluation of the information presented to gain the higher marks Another problem appearing very frequently here was students stating that the spots on the chromatogram indicate that the solvents themselves are pure or not, rather than the substances being tested, indicating a fundamental lack of understanding of the mechanisms associated with chromatography. A small number of students were able to suggest that other investigation should be carried out, naming other processes such as HPLC and GC-MS as potential alternatives.

Section C: physics

Questions 15(a) and 15(b) were poorly answered, with most students showing a fundamental misunderstanding of basic concepts relating to mains electricity and electromagnetic induction. Many responses to 15(a) referred to ‘more electricity’ without any contextualisation of what this means, and very few in 15(b) were able to identify that this plan would not be suitable and may be dangerous. A small number of students did recognise that a step-down transformer would be needed in this context.

Calculation questions were generally reasonably well answered, however. some students lost marks here by failing to provide the correct units or providing incorrect units, where this was required.

Section D: scientific concepts

Questions 19(a) and 19(c) were also more challenging than expected. In 19(a) students responded with a wide range of types of flow, however the question asked them to explain the type of flow rate shown in the graph. In 19(c) very few students were able to provide the definition of turbulent flow (B2.39 in the specification), and fewer still attempted to evaluate the statement made by the student.

In the final extended-response question students were asked to evaluate a provided method and conclusion. Relatively few students were able to apply their knowledge of enzyme action to infer that the immobilisation of the invertase was the most likely cause of the decrease in enzyme activity. Many students suggested that this might be because the enzyme was denatured at 40°C, however, whilst technically possible this is highly unlikely, and in this context it is impossible to conclude this as the other technique does not specify the temperature used. Some students were able to make some generic statements about experimental design, for example, referring to the change in substrate concentration introducing an additional uncontrolled variable.

Administering the external assessment

The external assessment is invigilated and must be conducted in line with our Regulations for the Conduct of External Assessment.

Students must be given the resources to complete the assessment, and these are highlighted within the Qualification Specific Instructions for Delivery (QSID).