T Level Technical Qualification in Science

Occupational specialism assessment (OSA)

Laboratory Sciences

Assignment 2

Provider guide

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Contents

Introduction

This occupational specialism is assessed by a synoptic assessment consisting of a package of 3 assignments. The assignments require the student to independently apply an appropriate selection of knowledge, understanding, skills and techniques developed throughout the full course of study, in response to briefs or tasks. This will allow the student to demonstrate that they have met a level of threshold competence in the performance outcomes of the occupational specialism.

The synoptic assessment for this occupational specialism is graded by pass, merit or distinction, and the final grade will contribute 60% of the overall technical qualification grade. Therefore, it is important that students have the opportunity to produce work of the highest standard they can. The assignments within this synoptic assessment are designed to allow the student to do this in a way that is as occupationally realistic as possible.

What is threshold competence?

Threshold competence is defined as a level of competence that:

- signifies that a student is well-placed to develop full occupational competence with further support and development, once in employment
- is as close to full occupational competence as can be reasonably expected of a student studying the technical qualification in a provider-based setting with a substantial industry placement
- signifies that a student has achieved the level for a pass in relation to the relevant occupational specialism component

This level is reflected in the grading descriptors of the occupational specialism and successful completion of the assignments will ensure that students are well-placed to develop full occupational competence once in employment. Grading descriptors can be found in the technical qualification specification document.

What is synoptic assessment?

Synoptic assessment is a form of assessment in which students are required to demonstrate that they can identify and use, in an integrated way, an appropriate selection of skills, techniques, concepts, theories and knowledge from across the technical area, relevant to the tasks.

Synoptic assessment is integral to high-quality technical qualifications to allow students to demonstrate a holistic understanding of the sector, making effective connections between different aspects of the subject content.

The assignments and tasks in this assessment are designed to be synoptic in a way that is as occupationally realistic as possible.

How will students be assessed?

Students will be assessed against the following set of performance outcomes (POs) that describe what the student should be able to do.

Laboratory Sciences POs	
PO1	Perform a range of appropriate scientific techniques to collect experimental data in a laboratory setting, complying with regulations and requirements
PO2	Plan, review, implement and suggest improvements to scientific tasks relevant to a laboratory setting
PO3	Identify and resolve issues with scientific equipment or data errors

The synoptic assessment consists of 3 assignments:

Assignment 1

Perform a literature review surrounding a given problem that is relevant to an occupational setting. Carry out a literature review to determine suitable methods, and how to interpret results.

Students will be provided with an online information package of literature sources. They should search only these sources to find relevant material and to carry out the review.

Students should write a literature review which demonstrates how they have evaluated which literature to select for the task, including justifications for the literature selected.

Use this knowledge to design a scientific standard operating procedure (SOP) and related risk assessment (RA) that could be used to determine whether the new technique would offer an improvement over current process.

Select key information that will be needed to write the SOP and to interpret the results, for example:

- information that would help to inform the methods, techniques and equipment used
- how results are determined
- the results expected
- safety considerations

Comment on the quality and reliability of the information used.

Reference any sources of information.

Assignment 2

Perform 2 experimental techniques relevant to an occupational setting that will be assessed in terms of the student's ability to competently, accurately and safely perform the technical task to acquire the necessary data.

Assignment 3

Review a given set of experimental data/records to identify potential errors in either samples/equipment or usage of equipment by an operator. Identify the factors that could be contributing to any errors and suggest process improvements to rectify and prevent any errors identified.

Assignments are broken down into tasks where necessary. The assignments, tasks and associated guidance for students and tutors show how the assignments are expected to be delivered.

Evidence produced by students for the assignments will be sent to NCFE for marking. Assessment judgements, including overall judgement of the performance required at each of the grade boundaries, will be made by NCFE and results released to the provider at the appropriate time.

Assignment coverage

See the table at the end of this provider guide document which shows how the PO content is covered by the assignments and tasks.

Controls

There is a requirement for work completed under supervised conditions to be collected and securely stored, for controls in place to ensure that providers do not release materials to their students until the appropriate time (and that when they do release materials, they are retrieved as appropriate), and for tasks designed in ways that minimise any advantage students might gain by having prior knowledge of what they entail.

Where the occupational specialism assessments allow for research requiring the use of the internet, students must reference the sources in their work.

Marks available

Marks available for each assignment are detailed below.

Assignment		**Raw marks**	**% weighting**
1	Perform a literature review and develop a new SOP and RA to investigate a possible process improvement	102 marks	47.9%
2	Perform an experimental task relevant to an occupational setting	70 marks	32.9%
3	Assess a given set of scientific data to identify potential sources of error in the data and suggest improvements to rectify these errors	41 marks	19.2%
	Total	**213 marks**	**100%**

Assignment timings

Assignment 1 consists of 3 tasks:

- task 1 involves a literature review in which students will be assessed on their ability to extract relevant information from literature within a searchable database given to providers - task 1 is allocated 3 hours
- the literature review will then be used by the student to support their development of task 2, designing a scientific task in an unfamiliar context and selecting appropriate equipment to complete a theoretical scientific practical - task 2 is allocated 3 hours
- task 3 will involve developing a risk assessment that would be followed alongside the student's scientific practical - task 3 is allocated 1 hour

To allow providers to plan for this, and to allow NCFE to arrange moderation visits, assignment 1 will be available to the provider from the start of delivery. A submission deadline for the evidence for assignment 2 will be set for

each academic year to allow NCFE to carry out moderation and awarding before the release of results in the August of that year.

Assignment 2 consists of 2 practical tasks in which students will be assessed on their ability to safely and effectively carry out a given technique. Assignment 2 is allocated 6 hours in total, split across a part A and part B, 3 hours for each. It will be assessed by direct observation and through the student's written record from the practical activity. Assessors will be required to observe each student while completing their practical task.

This assignment will be released on a particular date each year for delivery over a set window. These dates will be set to allow providers time to plan the delivery of the assignments.

For assignment 3, providers and students will be provided with a dataset and scenario in which the student is expected to identify potential sources of error in the dataset and suggest the origins of any errors, as well as suggesting methods for rectifying and preventing these errors in the future. Assignment 3 is allocated 3 hours.

Assignment 3 will be assessed via the student's written records and will be released on a particular date each year for delivery across a defined assessment window (for example, 1 week). These dates will be set to allow providers time to plan the delivery of the assignments.

All evidence created, generated and recorded for these assignments is subject to data protection rules, and information should be anonymised to protect the rights of individuals, where relevant.

Assignment specific guidance

Required material

The provided material (including a searchable database of literature) will be sent to providers ahead of the assessment window. Providers must issue the provided material to their students upon commencement of task 1.

Students are not allowed to bring outside research or any other unauthorised materials into the supervised environment.

Assignment 2: experimental practical assessments, part A and part B

Each part of this assignment must be completed under supervised conditions with an assessment window by NCFE. Providers will be given preliminary materials and details of the assignment ahead of the assessment window, these can be found below. The tasks will be something that will be achievable using standard laboratory equipment that should be available to providers as part of their delivery of the qualification.

Providers must ensure that their entire cohort of students complete the 3 hours for Part A of this assignment on the same day.

Providers must ensure that their entire cohort of students complete the 3 hours for Part B of this assignment on the same day.

Providers may schedule supervised rest breaks during the 3 hours. Any rest breaks must be supervised, and students must not have access to any resources during this time. In addition, assessment materials must be kept securely and must not be removed from the supervised environment.

Providers must ensure that during the supervised assessment, students have access to the required personal protective equipment, laboratory equipment and reagents necessary to complete the tasks. Access to a LIMS system (for example, an excel document) is also required for part A 1(b) and part B 1(b).

Students must not have access to the internet and must not bring anything into the supervised environment.

Students are required to sign declarations of authenticity to confirm that all the work they complete during the supervised assessment is their own. Students must be made aware of the importance of this declaration and the impact this could have on their overall grade if malpractice was to be identified. Providers must also ensure that the students' work is authenticated by the tutor before it is submitted for marking. The declaration forms are available on the NCFE website.

The assignment is a formal external assessment and must be conducted with reference to the instructions on the front of the assignment booklet, as well as the regulations for the conduct of external assessment and qualification specific instructions for delivery (QSID) documents, which should be accessed from the NCFE website to ensure they are the most up-to-date versions.

Providers are not allowed to give any support or guidance to students during the supervised time, unless the students are operating in a manner which may endanger themselves or others. If this is required, this aspect of performance will be reflected in the mark scheme.

Students must ensure that all materials can be identified as their own work.

Space the students out evenly at a distance where it is not feasible for them to see other students' work in detail. Exam conditions should be followed during the assignment, and students should turn over their paper when leaving the workstation.

Part A

Each student will need one standard bench space area in order to carry out the experiment. The students will need to be distributed around the lab without any issues.

Around 15 students will be able to be assessed at one time. The observation checklist provided will aid the assessor in assigning marks, with many of the observations being able to be performed at any point or continuously across the room. However, an assessment of the student's ability to perform the technique correctly will be able to be observed by the assessor, and students will not be required to be observed throughout the whole procedure.

Additionally, there are multiple repeated steps, that the protocol requires repeating in the same manner with different samples and to ensure reliability of results. Only one of the repeated steps would need to be observed by the assessor to be confident that the whole procedure has been performed correctly.

Equipment for task 1 (a)	Quantity per student	Special considerations
Samples of rice (3 different samples from 2020, 2021 and 2022)	30g of each sample.	Rice can be bought from the supermarket. Split into 3 samples in containers with lids and labelled 2020, 2021 and 2022. Students are expected to decide the mass of each sample they will test.
Balance	1	Allow sharing if resource is limited. All balances should be calibrated prior to assessment. Students will check they are calibrated but should not find errors.
Calibration masses for balance	Range of masses for students to choose from	Allow sharing if resource is limited. Masses ranging from 1g to 30g would be suitable.
Aluminium foil tray with lid	1	Any variation of a foil tray with a lid would be suitable.
Geiger counter	1	This can be a newer handheld or more traditional version. Allow sharing if resource is limited..
Retort stand and clamp	1	
30cm ruler or metre rule	1	
Personal protective equipment	1 set per student	

All students will need access to a LIMS system for part 1(b), this can be in a separate, supervised, computer lab or with laptops provided within the laboratory they are working in. Students should not access the internet for this task. Students should save their LIMS work using the following format:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Assignment 2 Part A

Part B

Each student will need one standard bench space area in order to carry out the experiment. As such, the students will be distributed around the lab without any issues. Around 15 students will be able to be assessed at one time. The observation checklist provided will aid the assessor in assigning marks, with the majority of the observations being able to be performed at any point or continuously across the room. Additionally, students are required to carry out the procedure for the control and the sample, this means that the protocol requires repeating in the same techniques, so only one of these would need to be observed by the assessor to be confident that the whole procedure has been performed correctly.

Equipment for task 1 (b)	Quantity	Special considerations
70% ethanol and paper towels	Small volume for cleaning workbench and access to paper towels	Could be in a spray bottle. Paper towels or suitable alternative needed for wiping bench.
2x prepared and sterile agar plates	2 plates each	Prepared as per manufacturer's instructions
Mechanical pipette and sterile 1ml pipette tips	1 pipette and at least 2 tips each (plus spare tips in case of mistakes / contamination)	Allow sharing of pipettes if limited in number. Pipette should be able to hold 1ml of sample.
Inoculating loop	1	
Control sample in suitable tube stoppered with cotton wool	About 2ml per student to allow them to measure out 1ml	This is just distilled or tap water in a test tube / boiling tube that can be used with the pipette. Label as ‘C’.
Test sample in suitable tube stoppered with cotton wool	About 2ml per student to allow them to measure out 1ml	This is just distilled or tap water in a test tube / boiling tube that can be used with the pipette. Label as ‘T’.
Rack to hold samples in tubes	1	
Bunsen burner and heatproof mat	1	Provide splints / matches to light Bunsen burner
Tape and marker pen	1	To seal and label agar plates
250ml beaker with disinfectant solution	200ml	Waste beaker to dispose of used pipette tips and any other contaminated equipment.

Personal protective equipment	1 set per student	

All students will need access to a LIMS system for part 1(b), this can be a separate, supervised, computer lab or laptops provided within the laboratory they are working in. Students should not access the internet for this task. Students should save their LIMS work using the following format:

(Provider_number)_(Student registration number)_(Surname)_(First name)_Assignment 2 Part B

Information for assessors

Setting up the assessment

Before the task

The assessor must:

- read through the safety checklist below to remind students that all health and safety procedures must be followed during the assessment
- ask the student to locate all relevant safety equipment and emergency procedures specific to the laboratory where the task is taking place.

Safety checklist

The student:

☐	can locate all relevant safety equipment and emergency procedures specific to the individual laboratory
☐	used appropriate personal protective equipment (PPE) correctly and effectively throughout the practical procedure (for example, laboratory coat fastened, splash proof eye protection and gloves worn correctly at all times)
☐	followed all appropriate safety guidelines and procedures when handling materials, disposing of waste materials and during clean-up of any spills
☐	cleaned up the bench and work surfaces satisfactorily at the end of the task

After the task

The assessor must complete an observation checklist, given in the mark scheme, to show the allocation of marks against student practice.

In the event that a student performs a task in an unsafe manner, the assessor may stop the assessment, and the student will not be able to complete the assessment at this time.

Please note that in the event of one minor incident where the assessor can see that there is no immediate safety concern, and where the assessor can intervene, the assessor may provide a prompt to the student.

An example of this would be if a student lifts their goggles onto their forehead in order to see a pipette reading more clearly, and then forgets momentarily to place the goggles back over their eyes. The assessor should not stop the assessment in this instance and may remind the student to put their goggles back over their eyes. They should inform the student that if they make the same error again, that they would need to stop the assessment.

Assignment coverage

Assignment 2: experimental practical assessment

K1.1: How health, safety and environmental practices apply to laboratory settings:

- safely performing the technique
- completing the scientific technique

K1.47: When scientific and mathematical skills are applied when performing a range of scientific techniques:

- measuring
- manual dexterity
- observing
- analysing
    - calculations

K1.52: When it is appropriate to use the following laboratory techniques:

- microbiology techniques: aseptic culturing

K1.55: How physics laboratory techniques are applied in different fields

K1.61: The purpose of the following physics laboratory equipment:

- Geiger counter: used to detect ionising radiation

K1.63: The principles of producing reliable and verifiable results:

- recording in a clear and unambiguous way (for example the use of tables, indelible ink, not using sticky notes or loose papers, ensuring that writing is legible)
- using appropriate units, notation, and correct number of significant figures

K1.67: The purpose and importance of SOPs within a laboratory environment

K2.6: How the following considerations inform data processing and subsequent analysis of the results in a laboratory environment:

- regulatory requirements (for example, validation, conformity to known analytical standards)
- relevant calculations (for example, magnification and Rf values)
- conversion of units (for example, consistent use of units across different data sets)
- appropriate statistical techniques to determine the validity or significance of the results (for example, standard deviation, p value, uncertainty values)
- customer requirements for the presentation of data (for example, graphs)
- using complementary experimental methodologies from existing peer-reviewed studies to confirm results (for example, by the use of online databases)
- using laboratory control charts and trend charts (for example, to confirm equipment and/or protocols are within tolerance)

S1.68: Work safely in a laboratory when performing specific scientific techniques

S1.69: Comply with relevant health and safety legislation and regulations, including COSHH and biosafety containment levels, when handling and disposing of solids, liquids, and gases relevant for the scientific technique being performed

S1.71: Use appropriate PPE when performing scientific tasks (for example, suitable eye protection and gloves)

S1.73 Apply scientific knowledge when undertaking scientific techniques by:

- choosing and justifying appropriate scientific techniques: aseptic techniques

S1.75: Apply a range of science and mathematical skills when performing practical scientific techniques

S1.76: Use the following practical scientific techniques to measure a range of physical properties:

- radioactive count rate using Geiger counter:
  - measuring the background count rate

S1.78: Use the following practical scientific techniques to analyse environments and identify microorganisms within biological environments:

- aseptic culturing

S1.81: Use appropriate international system of units (SI) and be able to work with a range of appropriate scales when conducting scientific tasks

S1.82: Convert between SI and non-SI measurement units when conducting scientific tasks

S1.84: Select appropriate equipment to complete practical scientific techniques:

- Geiger counter

S1.85: Demonstrate practical technical competence in the use of equipment:

- taking accurate measurements
- correctly manipulating the equipment
- using equipment safely and for intended purpose

S1.86 Calibrate scientific equipment and check it is fit for use

- balances

S1.87 Produce data from scientific techniques, which are reliable and verifiable, by:

- recording data and records in a clear and unambiguous way:
  - using appropriate units, notation, and correct number of significant figures
  - organising ideas logically and coherently
- selecting and using appropriate digital technology (for example, PC-connected data logger, multimeter):
  - to gather data evidence efficiently (for example, using a temperature data logger instead of multiple manual recordings)
  - demonstrating a secure level of competence and confidence in configuring and using digital devices
- critically reviewing data obtained and repeating investigations where appropriate

S2.20: Select appropriate statistical techniques to analyse and interpret results from scientific tasks:

- mean
- standard deviation

- Chi-square test
- T-test

S2.22: Use the results of calculations and statistical analysis to interpret and evaluate data from scientific tasks to:

- determine trends
- assess statistical validity
- support technical arguments
- draw conclusions
- communicate effectively to a range of stakeholders

Performance outcome grids

Assignment 2A

Task	PO1	PO2	PO3	Total
1 (a)	23	0	0	23
1 (b)	7	5	0	12
Total marks	30	5	0	35
% weighting	86%	14%	0%	100%

Assignment 2B

Task	PO1	PO2	PO3	Total
1 (a)	23	0	0	23
1 (b)	7	5	0	12
Total marks	30	5	0	35
% Weighting	86%	14%	0%	100%

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