March 2022

Subject guidance for internally assessed qualifications in 2021–22

Please read this document in conjunction with guidance for the assessment of internally assessed qualifications issued to centres in August 2021.

Group Award title:	HND in Industrial Biotechnology at SCQF level 8
Group Award code:	GK70 16

Units and/or outcomes where conditions of assessment can or cannot be altered

There must be a minimum of three supervised or closed-book assessments at SCQF level 8. The supervised or closed-book assessment may be a single outcome, two or more outcomes together or a holistic assessment.

Centres can alter the conditions of assessment from closed-book to open-book for all of the remaining assessments. However, if an open-book approach is adopted, you cannot use SQA Assessment Support Packs (ASPs) and centre-devised assessments will need to be used instead. Centres must ensure that revised assessment task(s) have the same level of demand as the original assessment.

Adaptations to evidence requirements to help manage assessment

The minimum number of practical experiments for the standard science units is:

Year 1:

- The Laboratory Skills for Science Industries (H91V 34)

Year 2:

If learners are completing Graded Unit 2:

- three practical experiments and associated laboratory reports at SCQF level 8
- Instrumental Techniques 1 (H930 35):
  - one experiment using an analytical instrument

If learners are **not** completing Graded Unit 2:

- six practical experiments and associated laboratory reports at SCQF level 8
- Instrumental Techniques 1 (H930 35):
  - one experiment using an analytical instrument

In addition to the above, learners must complete additional experiments if the following optional unit is selected. The minimum number of experiments for the optional unit will be:

- Instrumental Techniques 2 (H931 35):
  - one experiment using an advanced analytical technique

The requirement to produce and deliver an oral presentation/take part in a group discussion has been removed from all units.

Industrial Biotechnology: Graded Unit 2

Suggested strategies for the successful delivery and assessment of Industrial Biotechnology: Graded Unit 2 are provided at the end of this form.

Rationale

We have reduced the practical requirements to ensure manageability of assessment due to ongoing physical distancing.

Additional guidance and information

For centres who would like to move to a combined assessment approach or adapt the conditions of assessment, we recommend you notify operationshnvq@sqa.org.uk so that our subject experts can provide virtual guidance and support at the planning stage.

HN Science Graded Unit 2 — session 2021–22

This document outlines suggested strategies for the successful delivery and assessment of the graded units listed below:

- Applied Biological Sciences: Graded Unit 2 (H91Y 35)
- Applied Chemical Sciences: Graded Unit 2 (H92L 35)
- Applied Sciences: Graded Unit 2 (H91X 35)
- Industrial Biotechnology: Graded Unit 2 (H996 35)

Science practical work is essential to achieving these graded units. However, due to their current COVID-19 restrictions, it may be difficult for many centres to provide learners with the usual number of hours of laboratory time, and this will limit the complexity of the practical projects that learners can undertake.

These difficulties are highlighted by the following two grading criteria from the graded unit specification:

- 2.1 (a) Resources/materials and methods. Demonstrates appropriate use of a range of types of instrumentation/equipment and/or techniques to a complex level and a high standard.
- 2.1 (b) Performs a range of laboratory or field work and methods commensurate with 40 hours of lab/field time.

The Understanding Standards in HN Science documentation gives further examples of how to meet these grading criteria under normal circumstances. This document provides guidance to centres on how these grading criteria can be met when operating under the restrictions imposed by COVID-19. In summary, approaches could:

- allow projects of shorter duration (about 20 hours of laboratory time)
- use projects which may be partly or fully undertaken outwith college
- award marks for grading criterion 2.1 (a) holistically for the project design rather than for individual techniques

Further examples of how to apply these approaches are given below.

Projects of shortened duration

There are several approaches which could allow learners to undertake a shorter project while still developing and displaying skills and achievement comparable to what they would have done under normal circumstances:

- For some commonly used projects it will be possible to reduce the duration of the project by reducing sampling. For example, in a number of common analytical projects (such as chemical analysis of foods or beverages, or microbiological analysis of cleaning products) the number of samples analysed could be reduced. Learners would still be applying the same materials and methods, so would still meet in full the requirements of grading criterion 2.1 (a).

- It may be possible to shorten other projects by removing lower-level preparatory work, thereby allowing an amount of work at SCQF level 8 similar to that undertaken in normal circumstances. A project where this approach could be appropriate is the 'synthesis and analysis of biodiesels'. The synthesis stage of this project is of low skill level and time consuming, and learners could therefore be supplied with pre-prepared biodiesels, allowing them to progress directly to the more complex analysis stage of the project.
- In some projects collaborative working between learners may be possible. An example would be the 'extraction of essential oils and analysis of their chemical and microbiological properties'. Rather than each learner extracting a series of oils, a group of learners could perform one extraction each and share their extracts. As with the previous approach, this would reduce the time spent on lower-level preparatory work, and allow learners to undertake a project comparable in complexity to what they would do under normal circumstances. If such an approach is undertaken, each learner must individually undertake sufficiently complex project tasks to meet the grading criteria.
- It will be possible to shorten some projects somewhat by reducing the number of replicates (such as the number of duplicate plates in a microbiological project, or the number of concordant titrations in an analytical chemistry project). However, if this approach is undertaken, it could potentially affect the reliability of results, and learners would be expected to discuss this in their evaluation of experimental errors.
- Learners may also be able to include practical experiments they have undertaken in other science units as part of their graded unit. An example might be the project 'evaluation of methods of analysis of analgesics', where project work could be supplemented by practical experiments undertaken elsewhere in the group award, for example by the commonly used practical 'back titration of aspirin'.

Examples of project titles which could be shortened via the approaches outlined above are given in the appendix to this document.

The Understanding Standards in HN Science documentation explains the allocation of marks for grading criteria 2.1 (b). To be eligible for full marks, learners must produce a body of work which uses the full 40 hours of lab time efficiently. Where the approaches above, or other suitable approaches, are used to allow learners to undertake a shortened project, the guidelines on mark allocation for grading criterion 2.1 (b) should be adjusted as follows:

Marks	Hours allocation in Understanding Standards	Hours allocation for amended (shortened) project
8	40	20
6	35	17
4	30	15
3	25	12
2	20	10

That said, it is recognised that a learner may undertake practical activities which, through no fault of theirs, fail to produce usable results. If this is the case, they should write up these activities in their final report, and they will still be eligible for marks allocated against the hours spent.

Undertaking projects outwith the centre

Many different projects could be undertaken partly or fully outwith the centre, thus reducing the number of learners required to attend laboratory sessions.

An example of a project which could be partially undertaken outwith a centre would be ‘lichens as biomonitors’, with fieldwork involving population mapping in different environments, combined with laboratory work on lead and fluoride analysis.

Other projects, including but not restricted to those of an ecological or environmental chemistry nature, can be fully undertaken outwith a centre.

A common concern with such projects is that they may not involve suitable or sufficient techniques at SCQF level 8 to allow learners to achieve good marks for grading criterion 2.1 (a). However, in such a case the assessor could award marks on the basis of overall project complexity rather than complexity of the individual techniques used. An example of such a project could be water analysis, where a range of measurements could be made in the field with simple equipment and test strips (pH, nitrate, chloride, microbial, turbidity, dissolved oxygen etc). In such a case a learner could design a suitable project where the complexity arises from the sampling protocols, for example by consideration of locations of sampling, number of samples, depths samples are taken at, or environmental conditions. If this approach is adopted it may be that a project of suitable complexity cannot be completed within the shortened timescales outlined above, and a project equal or closer to the standard duration (40 hours) would be required. In such a case the assessor should apply professional discretion when allocating marks for grading criterion 2.1 (b).

Examples of project titles which could be undertaken outwith a centre are given in the appendix to this document.

Appendix

Projects of shortened duration

The following are examples of projects which would lend themselves to being completed in a shortened timescale using the strategies outlined above. This list is not prescriptive, and other projects of similar complexity may be used by the centre.

- Extraction of essential oils from various sources, analysis of composition, and study of antibacterial properties
- Food analysis, eg complete nutritional breakdown of meals (protein, fat, moisture, carbohydrate, fibre, salt) and comparison to RDAs
- Analgesics: comparison of effectiveness of different analytical methods, eg HPLC, UV, Fe-salicylate complex, titrimetric
- Aspirin from Wintergreen plant — extraction, purification and quantitation of natural product (methyl salicylate), conversion to aspirin (ester hydrolysis / acylation + final product purification and analysis)
- Vitamin C: analysis of in foods. Effect of cooking, copper, pH, comparison of UV/Vis vs titrimetric analysis
- Fuel chemistry: comparison of biodiesels to petroleum diesel: viscosity, calorimetry, cloud point etc
- Analysis and classification of fish by protein analysis, Bradford assay etc
- Investigation of the effects of antibacterials (antibiotics, disinfectants, antiseptics, skin care products, toothpaste/mouthwash) on bacterial growth
- Determination of K_m and V_{max} for an alkaline phosphatase with 4-nitrophenyl phosphate as substrate (spectrophotometry)
- Analysis of honey, eg nitrogen, pollen, diastase, sugars, HMF, antimicrobial activity
- End product analysis of fermentation under different conditions, eg methanol/ethanol content, yeast activity — effect of nutrients, pH, temperature, ‘Turbo-yeasts’, pectolase etc

Projects which may be suitable to be partially undertaken outwith college

The following are examples of projects which may be suitable to be partially undertaken outwith college. This list is not prescriptive, and other projects of similar complexity may be used by the centre.

- Pollution biomonitors — study and collection of species, eg lichens, mushrooms from different locations to monitor environmental pollutant levels, eg lead. Population mapping of lichens.
- Investigation of harmonic motion
- Water analysis — combination of field work with more advanced analysis being undertaken in college

Projects which may be undertaken outwith college

The following are examples of projects which may be undertaken outwith college. This list is not prescriptive, and other projects of similar complexity may be used by the centre.

- How ants respond to different environmental stimuli — observe and map foraging patterns induced by different food, eg sugary/savoury/bitter, different household chemicals such as antibacterial sprays, change of behavioural responses to temperature and light
- Investigation (in-situ) of the occurrence of cellulose degrading microbiota in different soil environments (eg polluted areas, farmlands, forest area, back garden). GFC filter papers can be used as a cellulose source. Also collect data re: rainfall, temperature variation, soil pH, moisture etc, soil profiles for correlation.
- Bioindicators: Using organisms to measure environmental impacts. Investigate impact of human activities on the shift in the community composition of aquatic macroinvertebrates as water pollution indicators over a range of river/stream profiles. Correlate change in species richness to water temperature, pH, DO, BOD (if possible), pollutants etc.
- The distribution in habitats of alien invasive plants in the UK in relation to the development of the biological and manual control strategies. This could also look at the impacts on the slower growing herbaceous species in terms of abundance.
- Study of a rocky seashore, eg calculation of diversity index, identification and zonation of different types of seaweed, male and female carapace shape differences.
- Identification and distribution study of coloniser plant and animal species on a piece of waste ground. Alternatively, a similar project could be undertaken on arable farmland.
- Exercise physiology measurements such as effect of exercise on heart rate, breathing rate, recovery times. A portable spirometer could be used to measure lung volumes.
- A comparison of duration or intensity/type of exercise could also be made for the above.
- Water analysis. A range of parameters may be readily measured in the field with simple equipment and test strips (eg pH, nitrate, chloride, microbial, turbidity, dissolved oxygen).