Subject guidance for internally assessed qualifications in 2020-21

Please read this document in conjunction with guidance for the assessment of internally assessed qualifications issued to centres in August 2020.

Group Award title(s):	HND in Chemical Process Technology at SCQF level 8
Group Award code(s):	GL6C 16

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

Centres can change the conditions of assessment from closed book to open book for all units. However, please note that when an assessment is open book, centres must not use SQA ASPs and centre-devised assessment must be used instead.

Centres can gather evidence for learning outcomes under open book conditions if this is more practicable for 2020-21. Examples of alternative assessment could be questions which have been answered and submitted by learners in a given time period, an electronic presentation with questions and answers, case studies, professional discussions, viva voce examinations or a report. Centres must ensure that the revised assessment task(s) is of the same level of demand for the learner as required by the original assessment requirements.

Adaptations to evidence requirements to help manage assessment

The minimum number of practical experiments will be:

Year 1

- Four experiments at SCQF level 7

Learners must complete two laboratory reports from the four experiments.

Year 2

- Three experiments and associated laboratory reports at SCQF level 8
- Process Operations: Distillation (H97R 35)
  – Reduced to 1 simple distillation or 1 plate distillation
- Instrumental Techniques 1 (H930 35)
  –1 experiment using an analytical instrument

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

- Instrumental Techniques 2 (H931 35)
  –1 experiment using an analytical technique

Chemical Process Technology: Graded Unit 2

Suggested strategies for the successful delivery and assessment of the Chemical Process Technology: Graded Unit 2 is provided at the end of this document..

Rationale

The practical requirements have been reduced to ensure manageability of assessment while social distancing remains in place.

Additional guidance and information

If your centre would like to move to a combined assessment approach or adapt the conditions of assessment, we would recommend you contact operationshnvq@sqa.org.uk. Our subject experts can then provide virtual guidance and support at the planning stage.

Guidance on strategies for the successful delivery of HN science graded units 2 in 2020-21

This section contains 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)

The document can also be applied to the graded units listed below:

- Chemical Process Technology: Graded Unit 2 (HF0L 35)

Science practical work is essential for learners to achieve any of these graded units. However, with restrictions in place because of Covid-19 it is to be anticipated that many centres will have difficulties in providing the usual number of hours of laboratory time for their learners. As a result, they may also find it difficult to provide practical projects of the level of complexity that is normally involved.

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

- 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.

Exemplification of how these grading criteria could be met under normal circumstances can be found in the Understanding Standards in HN Science document. This guidance contains information for centres on approaches they can use to meet these grading criteria when operating under the current restrictions imposed by Covid-19. In summary approaches could involve:

- allowing projects of shorter duration (ca. 20 hours of laboratory time)
- using projects which may be partly or fully undertaken outside the centre. This could be further facilitated by awarding marks for grading criteria 2.1 (a) holistically for the project design rather than for individual techniques

Further examples of how these approaches could be applied are given in the following sections.

Projects of shortened duration

There are several approaches which could be taken to allow learners to complete a project of shorter duration which will still allow them to develop and display skills and achievements that are comparable to those they would have developed and displayed under normal circumstances. Examples of possible approaches are:

- for some commonly used projects it will be possible to reduce the duration of the project by reducing sampling. For example, in some common analytical projects (e.g. chemical analysis of foods or beverages, 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 criteria 2.1 (a).
- for other projects it may be possible to reduce the duration of the project by removing lower level preparatory work. This would allowing an amount of work which would be commensurate with the work undertaken in normal circumstances at SCQF level 8. An example of a project where this could be an appropriate approach 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 centres collaborative working between learners may be possible. An example of a project where this could apply 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 amount of time a learner spends on lower level preparatory work and still allow them to complete a project of comparable complexity to what they would do under normal circumstances. If such an approach is undertaken then it is essential that each learner, as an individual, still undertakes sufficiently complex tasks to meet the grading criteria.
- it will be possible to reduce their duration of some projects by reducing the number of replicates for example, the number of duplicate plates in a microbiological project, the number of concordant titrations in an analytical chemistry project. However, if this approach is taken it will have an impact on the potential reliability of results and learners would be expected to discuss this in their evaluation of experimental errors.
- It may also be possible to use practical experiments that learners have already completed 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'*.

The Understanding Standards in HN Science documentation explains the allocation of marks for grading criteria 2.1 (b): learners are required to produce a body of work commensurate with fully efficient deployment of 40 hours of lab time to be eligible for full marks. Where the approaches above, or other suitable approaches, are used to allow learners to achieve the graded unit through a shortened project, then the guidelines on mark allocation for grading criteria 2.1 (b) should be adjusted from that presented in the Understanding Standards in HN Science documentation 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

It is recognised that leaners may complete practical activities which, through no fault of their own, do not 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. Examples of project titles which could be shortened using the approaches outlined above are given in the appendix.

Undertaking projects outside the centre

There is a large range of possible projects that could either partly or fully be undertaken outside the centre. This would reduce the number of learners who need to attend laboratory sessions.

An example of a project that could be partially undertaken outside a centre would be '*lichens as biomonitors'.* Field work involving population mapping in different environments could be combined with laboratory work on lead and fluoride analysis.

Alternatively, there are a range of projects including, but not restricted to, those of an ecological or environmental chemistry nature, which may be fully undertaken outside a centre. A common concern with such projects is that they may not incorporate suitable or sufficient techniques commensurate with SCQF level 8 to allow leaners to achieve good marks for grading criteria 2.1 (a). However, the assessor can award marks on the basis of the overall complexity of the project rather than the complexity of the individual techniques.

An example of such a project could be '*water analysis'*. A range of parameters may be measured readily in the field with simple equipment and test strips for example, pH, nitrate, chloride, microbial, turbidity and dissolved oxygen. In such a case, a learner could design a suitable project where the complexity arises from the project design in terms of sampling protocols by, for example, considering the locations of sampling, number of samples, depths samples are taken at and environmental conditions. If this approach is used a suitably complex project may not be able to be completed in the shortened timescales and a project equal to or closer to the standard duration (40 hours) may be required. In such a case the assessor should apply their professional discretion when allocating marks for grading criteria 2.1 (b).

Examples of project titles that could be completed outside a centre are given in the appendix

Appendix

The lists of projects in this appendix are not prescriptive. Other projects of similar complexity may be used by centres.

Projects of shortened duration

The following are examples of projects that could be completed in a shortened timescale using the strategies outlined in the guidance.

- Extraction of essential oils from various sources, analysis of composition, and study of anti-bacterial properties
- Food analysis e.g. complete nutritional breakdown (protein, fat, moisture, carbohydrate, fibre, salt) of meals and comparison to RDA's
- Analgesics: comparison of effectiveness of different analytical methods e.g. 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 antibacterial (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 e.g. nitrogen, pollen, diastase, sugars, HMF, anti-microbial activity
- End product analysis of fermentation under different conditions e.g. methanol/ethanol content, yeast activity – effect of nutrients, pH, temperature, 'Turbo-yeasts', pectolase etc.

Projects that may be partially undertaken outside a centre

The following are examples of projects that may be partially undertaken outside a centre.

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

Projects that may be wholly undertaken outside a centre

The following are examples of projects which may be undertaken outside college.

- How ants respond to different environmental stimuli – observe and map foraging paters induced by different food e.g. sugary/savoury/bitter, different household chemicals such as antibacterial sprays, change of behavioural responses to temperature and light etc.
- Investigation (in-situ) of the occurrence of cellulose degrading microbiota in different soil environments (e.g. 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 e.g. calculation of diversity index, identification and zonation of different types of seaweed, male and female carapace shape differences etc
- 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 (e.g. pH, nitrate, chloride, microbial, turbidity, dissolved oxygen etc).