Higher National Project-based Graded Unit Specification

General Information

This Graded Unit has been validated as part of the HND Chemical Process Technology. Centres are required to develop a project-based assessment in accordance with this validated specification.

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Graded Unit code: HF0L 35

Type of Project: Practical Assignment

Publication date: August 2018

Source: Scottish Qualifications Authority

Version: 03

Graded Unit purpose

This Graded Unit is designed to provide evidence that the learner has achieved the following principal aims of the HND Chemical Process Technology:

- Prepare learners for an appropriate level of employment.
- Develop a range of contemporary vocational skills including investigative skills, developing health and safety skills in a practical environment or as part of a design project and enhancing risk assessment skills.
- Prepare learners for progression to further studies.
- Provide learners with a wider range of practical laboratory skills or process equipment/plant design skills.
- Develop study and research skills.
- Develop Core Skills such as *Working with Others* in a team environment.

Credit points and level

2 Higher National Unit credits at SCQF level 8: (16 SCQF credit points at SCQF level 8)

Higher National Project-based Graded Unit Specification: (General Information (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Recommended entry to the Graded Unit

It is recommended that the learner should have completed or be in the process of completing the following HN Units relating to the above principal aims prior to undertaking this Graded Unit:

H92X 34 *Fundamental Chemistry: Theory and Laboratory Skills*
H933 34 *Organic Chemistry: Theory and Laboratory Skills*
H936 34 *Physical Chemistry: Theory and Laboratory Skills*
HF0K 34 *Chemical Process Technology: Graded Unit 1*
H97N 34 *Chemical Engineering: Principles*
H92N 35 *Aromatic Chemistry: Theory and Laboratory Skills*
HE3J 35 *Process Operations: Heat Exchange, Drying and Evaporation*
HE3E 34 *Fluid Mechanics: Theory and Laboratory Skills*
H930 35 *Instrumental Techniques 1*
HE3G 34 *Industrial Chemicals: Processes and Products*
HE3F 34 *Process Safety Engineering*
H97R 35 *Process Operations: Distillation*
H938 35 *Thermodynamics and Kinetics: Theory and Laboratory Skills*
H97T 34 *Heat Transfer Theory and Practical Skills*
H935 35 *Phase Equilibrium and Surface Chemistry*
H92P 35 *Base-Catalysed and Organometallic Chemistry: Theory and Laboratory Skills*
H92Y 34 *Inorganic Chemistry: Theory and Laboratory Skills*

And

Two of the Units below:

H7K0 33 *Engineering Mathematics 1*
H7K1 34 *Engineering Mathematics 2*
H7K2 34 *Engineering Mathematics 3*

Higher National Project-based Graded Unit Specification: (General Information (cont)

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Core Skills

Achievement of this Unit gives automatic certification of the following:

Complete Core Skill *Problem Solving* at SCQF level 6

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes of this Unit specification.

Assessment Support Pack

The Assessment Support Pack for this Unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable instrument of assessment. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard. Assessment Support Packs are available on SQA's secure website.

Equality and inclusion

This Graded Unit has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on SQA's website:
www.sqa.org.uk/assessmentarrangements

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Assessment

This Graded Unit will be assessed by the use of a project-based practical assignment developed by centres. The project should provide the learner with the opportunity to produce evidence that demonstrates they have met the aims of this Graded Unit.

The project undertaken by the learner must be a complex task which involves:

- variables which are complex or unfamiliar
- relationships which need to be clarified
- a context which may be unfamiliar to the learner

The project must require the learner to:

- analyse the task and decide on a course of action for undertaking the project
- plan and organise work and carry it through to completion
- reflect on what has been done and draw conclusions for the future
- produce evidence of meeting the aims which this Graded Unit has been designed to cover

Learners must carry out the investigation individually, and learners should not produce joint evidence. Assessors must be satisfied that the work has been completed by the individual learner.

Conditions of assessment

The learner should be given a date for completion of the project. However, the instructions for the project should be distributed to allow the learner sufficient time to assimilate the details and carry out the project. During the time between the distribution of the project instructions and the completion date, assessors may answer questions, provide clarification, guidance and reasonable assistance.

Reasonable assistance is the term used by SQA to describe the difference between providing learners with some direction to generate the required evidence for assessment and providing too much support which would compromise the integrity of the assessment. Reasonable assistance is part of all learning and teaching processes. In relation to the assessment of Higher National Project-based Graded Units, assessors may provide advice, clarification, and guidance during the time between the distribution of the project instructions and the completion date, ie at each stage of the project.

Remediation allows an assessor to clarify learner responses, either by requiring a written amendment or by oral questioning, where there is a minor shortfall or omission in evidence requirements. In either case, such instances must be formally noted by the assessor, either in writing or recording, and be made available to the internal and external verifier. In relation to Higher National Project-based Graded Units, learners must be given the opportunity for remediation at each stage of the project.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners

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The evidence for a Higher National Project-based Graded Unit is generated over time and involves three distinct stages, each of which has to be achieved before the next is undertaken. This means that any re-assessment of stages must be undertaken before proceeding to the next stage. The overall grade is derived from the total number of marks *across all* sections, and should reflect the ability of the learner to work autonomously and the amount of support required. In relation to Higher National Project-based Graded Units, learners who have failed any stage of the project and have been unable to provide the necessary evidence through remediation must be given the opportunity for re-assessment of that stage.

At SCQF level 8 learners should work independently. It is the responsibility of the centre to take reasonable steps to ensure that the project is the work of the learner. For example, centres may wish to informally question learners at various stages on their knowledge and understanding of the project on which they have embarked. Centres should ensure, where research, etc is carried out in other establishments or under the supervision of others, that the learner does not receive undue assistance.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Evidence Requirements for this Graded Unit

The project undertaken by learners will consist of three stages: Planning; Developing; and Evaluating. The following table specifies the minimum evidence required to pass each stage.

Project stage	Minimum Evidence Requirements	% Mark Allocation
Stage 1 — Planning	♦ The learner's development of the project brief. (1.1) ♦ A summary of background theory and principles. (1.2) ♦ A set of project aims/objectives. (1.3) ♦ Identification of materials and resources required and how they will be accessed. (1.4) ♦ Identification of the steps involved in the practical or design activities and write up phases of the development stage and the timescales for completion of each stage. (1.5) ♦ Identification of appropriate Health and Safety procedures and requirements. (1.6)	20%
	*The learner **must** achieve all of the minimum evidence specified above in order to pass the Planning stage.*	
Stage 2 — Developing	♦ Practical or design activities to produce collated scientific data. (2.1) ♦ Output (scientific report) of the practical or design activities. (2.2) ♦ Record of the processes underpinning the activities, ie logbook/diary. (2.3)	60%
	*The learner **must** achieve all of the minimum evidence specified above in order to pass the Developing stage.*	
Stage 3 — Evaluating	Evaluation report which: ♦ Contains an abstract. (3.1) ♦ Evaluates the output of the investigation. (3.2) ♦ Evaluates the processes involved in producing the output of the investigation. (3.3) ♦ Suggests potential development themes for the project. (3.4)	20%
	*The learner **must** achieve all of the minimum evidence specified above in order to pass the Evaluating stage.*	

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Important Note: Centres **must** complete the Grading Checklist on pages 12−17 for each Chemical Process Technology project. Completed checklists will be used as part of the external verification process to ensure the accuracy and consistency of grading between learners in the centre and across the centres.

Assessing and grading learners

The overall project will be marked out of **100**. Only whole marks should be used.

The percentage of marks allocated to each stage of the project is outlined in the **Evidence Requirements**.

It is a requirement that learners must meet the minimum Evidence Requirements for the Planning stage before progressing to the Developing stage before progressing to the Evaluating stage. Assessors should use the Grade Related Criteria outlined below to judge learner performance.

Learners are required to work independently to meet the Evidence Requirements of the Graded Unit. At the same time, learners need appropriate support. SQA uses the term reasonable assistance to describe the balance between supporting learners in their project and not providing too much assistance.

At the end of each stage there should be opportunities for remediation and re-assessment of learners for that particular stage. This includes the final Evaluation stage. Any re-assessment should be carried out in line with the centre's own assessment policy.

To pass the Graded Unit learners must achieve:

Planning stage:

- A minimum of 50% of the total marks (10 marks) **and** all of the minimum Evidence Requirements.

Developing stage:

- A minimum of 50% of the total marks (30 marks) **and** all of the minimum Evidence Requirements.

Evaluating stage:

- A minimum of 50% of the total marks (10 marks) **and** all of the minimum Evidence Requirements.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

The Grade Related Criteria to be used to judge learner performance for this Graded Unit is specified in the following table.

Grade Related Criteria	
Grade A	**Grade C**
Is a seamless, coherent piece of work: ♦ The project brief accurately specifies the project in both technical and non-technical terms and is prepared in a clear and concise manner. ♦ The project objectives accurately and fully reflect the long term project targets. ♦ The initial project plan contains a comprehensive list of project activities and timings. The information in the initial plan is used to assess if the project can be completed within timescales. ♦ The learner develops a substantial knowledge base to support the demands of the project. ♦ The project demonstrates the learner's ability to work autonomously. ♦ The learner identifies all known project risks, categorises them in terms of their likely level of occurrence and identifies actions for minimising such risks. ♦ The learner undertakes all practical or design activities according to current Health and Safety requirements and applies good laboratory practice to a high standard.	Is a co-ordinated piece of work: ♦ The project brief includes accurate information about the main technical and non-technical requirements of the project. ♦ The project objectives identify the key long term project targets. ♦ The initial project plan shows all essential project activities and timings. Evidence that the plan has been monitored on a number of occasions during the life of the project to inform on-going project planning and development should be available. ♦ The learner develops a sound knowledge base to support the demands of the project. ♦ The learner demonstrates independent learning with minimum support and revision during project ♦ The learner identifies main risks that are likely to occur during the progress of the project and identifies main actions for minimising such risks. ♦ The learner undertakes all practical or design activities according to current Health and Safety requirements and applies good laboratory practice to a standard regarded as acceptable in a scientific setting.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Grade Related Criteria	
Grade A	**Grade C**
♦ Demonstrates appropriate use of a range of types of instrumentation/equipment to a complex level and a high standard (eg using the more advanced features of the equipment competently).	♦ Demonstrates appropriate use of a range of types of instrumentation/equipment to a standard that is acceptable within a scientific setting.
♦ Analysis of results is accurate and comprehensive, takes account of all known sources of error and is either substantiated in terms of known theory and/or identifies limitations in theory.	♦ Analysis of results is sufficiently accurate and detailed and takes account of main sources of error and establishes key relationships between results and theory.
♦ The diary is regularly maintained and provides a detailed record of results, calculations and conclusions.	♦ The diary contains a sufficient level of details about project ideas, results and progress and there is evidence that entries have been made on a number of occasions during the life of the project.
♦ The project report is well structured, contains only relevant information, is technically accurate, uses clear and correct English and has clear and accurate conclusions and recommendations.	♦ The project report meets acceptable standards in terms of structure, technical accuracy, use of English and has accurate conclusions and recommendations.
♦ The project report includes a full analysis of results, and a comprehensive evaluation of the project against project objectives.	♦ The project includes an analysis of results and an evaluation of the project against the project objectives.
♦ The learner identifies clear and full details of the new knowledge and skills they have developed as a result of doing the project such as project management skills, keeping to deadlines, recognising limitations of knowledge — approaching expert sources.	♦ The learner provides a number of examples of new knowledge and skills they have developed as a result of doing the project.
♦ The learner demonstrates a high level of self-motivation throughout the project.	♦ The learner demonstrates an acceptable level of motivation throughout the project.
♦ The learner undertakes additional research beyond that demanded by the project.	♦ The learner undertakes research demanded by the project.

Higher National Project-based Graded Unit Specification: Designing the project and assessing learners (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

The marks allocated to each stage will then be aggregated to arrive at an overall mark for the project. Assessors will then assign an overall grade to the learner for this Graded Unit based on the following grade boundaries.

A = 70%−100%
B = 60%−69%
C = 50%−59%

These grade boundaries are fixed and should **not** be amended.

Any learner who has failed their graded unit or wishes to upgrade their award must be given a re-assessment opportunity, or in exceptional circumstances, two re-assessment opportunities. In the case of project-based graded units, this must be done using a substantially different project.

The final grading given must reflect the quality of the learner's evidence at the time of the completion of the graded unit. Learners must be awarded the highest grade achieved — whether through first submission or through any re-assessment, remediation, and/or reasonable assistance provided.

Higher National Project-based Graded Unit Support Notes

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Guidance on approaches to delivery and assessment of this Graded Unit

In order to pass the Graded Unit a learner must pass each one of the three stages (Planning, Developing, Evaluating) ie they must achieve a minimum of 50% of the total marks for each stage, and achieve all of the minimum Evidence Requirements on at least one occasion for each stage. Centres should note that the grading checklist should be applied holistically and it is not a requirement that learners address all of the bullet points in the checklist.

Grading Checklist

A grading checklist is presented below to facilitate the allocation of marks.

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Chemical Process Technology: Graded Unit 2

Grading Unit Checklist

Centre Name: ……

Centre Number: ……

Learner Name: ……..

Learner Number: ……..

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Stage 1: Planning Stage

Grading Criteria		Maximum mark	Mark
1.1 (a)	Evidence of analysing and interpreting what is involved in the practical or design project brief and presenting it in a clear and concise manner.	3	
1.1 (b)	The identification of the key factors influencing the project and their interrelationships.	2	
1.2	A summary of background theory and principles clarifying and exemplifying the brief, with identification of information sources.	3	
1.3	Set of project aims/objectives that accurately and fully reflect the long term project targets.	2	
1.4	Evidence that the learner has identified the material/resources required to complete the project, and where they can be accessed.	3	
1.5 (a)	Identification of the steps involved in the practical or design project and write-up phases of the development stage.	2	
1.5 (b)	The initial project plan contains a comprehensive list of project activities and timings. The information in the initial plan is used to assess if the project can be completed within timescales.	2	
1.6	Identification of appropriate Health and Safety procedures and requirements. Identifies all known project risks, categorises them in terms of their likely level of occurrence and identifies actions for minimising such risks. Alternatively, identification of the potential Health and Safety requirements in the process equipment or plant designed.	3	
Total		20	

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Stage 2: Developing Stage

Grading Criteria		Maximum mark	Mark
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.	4	
2.1 (b)	Performs a range of laboratory or field work and methods commensurate with 40 hours of lab/field time.	8	
2.1 (c)	Collection of data and appropriate quality.	6	
2.2 (a)	Title, contents page.	1	
2.2 (b)	Introduction, including underpinning theory, aims and objectives of the practical or design project. The aims and objectives should be developed and enhanced from those in the original plan in light of experience.	4	
2.2 (c)	Laboratory/ design methods are accurately and fully described in report.	4	
2.2 (d)	Presentation of data is clear and well structured.	2	
2.2 (e)	Contains a full analysis/interpretation of results that is accurate and comprehensive.	8	
2.2 (f)	Takes account of all known sources of error and is either substantiated in terms of known theory and/or identifies limitations in theory.	2	
2.2 (g)	The report has clear and accurate conclusions, discussions and recommendations.	5	

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Grading Criteria		Maximum mark	Mark
2.2 (h)	Appropriate bibliography/referencing of sources and references including full and appropriate referencing within the report through use of an established system (eg Vancouver or Harvard).	4	
2.2 (i)	The report is clear and well structured, contains only relevant information, is technically accurate and uses clear and correct English.	2	
2.3	Record of the processes underpinning the practical or design activity, eg logbook, diary, progress report. The diary is regularly maintained and provides a detailed record of results, calculations and conclusions.	4	
2.4	Appropriate Health and Safety Assessments (eg risk, COSHH, Manual Handling) are produced and undertakes all practical activities according to Health and Safety requirements. Alternatively, appropriate Health and Safety assessments are produced for the process equipment or plant designed.	2	
2.5	Demonstrates a high level of self-motivation/initiative throughout the project, as evidenced by: ♦ consistently demonstrating initiative. ♦ sourcing extra information. ♦ willingness to learn new techniques. The learner undertakes additional research well beyond that demanded by the project.	2	

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Grading Criteria		Maximum mark	Mark
2.6	The learner undertakes the project with the minimum of supervision. Where the learner feeds back to their supervisor it is on a proactive basis, updating the supervisor on progress made and actions for the next stage of the project.	2	
Total		60	

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Stage 3: Evaluation Stage

Grading Criteria		Maximum mark	Mark
3.1	Contain an abstract (outline of the assignment).	4	
3.2 (a)	Assess the strengths and weaknesses of the output of the practical or design assignment.	2	
3.2 (b)	Determine and justify to what extent the assignment met the aims and objectives.	4	
3.3 (a)	Summary of any difficulties encountered and how they were handled.	2	
3.3 (b)	Identify knowledge and skills which have been gained and/or developed.	4	
3.4	Suggest potential development of the project/recommendations for the future.	4	
Total		20	

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

Centres are strongly advised to give learners adequate time to choose their topic and carry out the planning stage. Careful planning enables the learner to complete the following tasks of developing and of evaluating more effectively.

The briefing task sheet for the learners should include clear indications of how the Unit is being assessed so that the learner can provide all the evidence required to complete the Unit. It is strongly advised that learners are provided with a detailed description of the requirements of the planning stage to enable them to carry out the task prior to proceeding to the development stage. It is advisable that the planning stage should be assessed prior to the learner progressing to the developing stage.

However if the development stage does not progress as anticipated the learners may return to their plans and modify them. If changes to plans are needed during the developing stage this can be reflected on during the evaluation.

The evaluation stage develops the reflective skills of the learners.

Opportunities for developing Core and other essential skills

This Unit has the Core Skill of *Problem Solving* embedded in it. This means that when learners achieve the Unit, their Core Skills profile will also be updated to show they have achieved *Problem Solving* at SCQF level 6.

The delivery and assessment of this Unit may also provide learners with the opportunity to develop the Core Skills of *Communication, Numeracy* and *Information and Communication Technology (ICT).*

The precise nature and level of these will vary depending on the nature of the project topic, however some indicative examples are given below.

***Communication* — Writing at SCQF level 6**

Learners will produce a written communication which presents, analyses, and evaluates a substantial body of information, and develop interpretations and conclusions in relation to an issue which is explored in depth.

***Communication* — Writing at SCQF level 6**

Learners will be required to extract, summarise, and provide a full explanation of the relationships between substantive information drawn from a range of different sources.

***Numeracy* — Using Graphical Information at SCQF level 6**

Learners may use an appropriate form of complex table, chart, diagram, or qualitative form, to communicate complex information.

Higher National Project-based Graded Unit Support Notes (cont)

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

***Information and Communication Technology (ICT)* — Providing Information at SCQF level 5**

Learners will select appropriate websites/data sources to research an issue and present findings in an appropriate format including referencing.

It is also to be expected that certain of the analytical instruments used will be operated via computer, and that databases may be deployed.

This Unit has the Core Skill of Problem Solving embedded in it, so when learners achieve this Unit their Core Skills profile will be updated to show that they have achieved Problem Solving at SCQF level 6.

History of changes to Graded Unit

Version	Description of change	Date
02	Core Skill Problem Solving at SCQF level 6 embedded.	19/08/16
03	Update of Conditions of Assessment.	06/08/18

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

General information for learners

Graded Unit title: Chemical Process Technology: Graded Unit 2 (SCQF level 8)

This is a 2 credit Unit at SCQF level 8. This Unit is project-based and will require you to undertake a laboratory and/or field investigation using a variety of research methods and techniques. You will be assessed both on the laboratory/field work undertaken, and on the report of that work. The topic of research will be left to your choice with advice from your lecturer. This enables you to find out more about an area that interests you particularly and may reflect some developing fields or an interest at your employment.

The project will be marked out of 100. To pass the Graded Unit you must achieve 50% of the total marks and all of the minimum Evidence Requirements for each of the three sections. The three sections are:

The Planning Stage: Where you will produce a plan outlining the nature of the project and the requirements to proceed.

The Developing Stage: Where you will undertake the practical or design project, keep a laboratory diary or log book, and produce a comprehensive written report.

The Evaluating Stage: Where you will summarise the output of the developing stage (ie the report), and evaluate the project and the processes evolved in undertaking the project.

The HND Chemical Process Technology covers diverse areas and a variety of chemical industries (eg oil and gas, pharmaceutical, environmental, dyes, inks, biotechnology). Suggested projects are given below. However, please note that this list is intended as a guide and is not exhaustive.

- A complex organic synthesis of a product, with analysis of the product
- Investigation of reaction kinetics
- A work based yield optimisation project
- Development of a process plant
- Commissioning and calibration of suitable laboratory equipment
- A chemical engineering design project
- A chemical engineering practical project
- An analytical chemistry based project.

Core Skills

This Unit has the Core Skill of *Problem Solving* at SCQF level 6 embedded in it. You may also have opportunities to develop the Core Skills of *Communication, Numeracy* and *Information and Communication Technology (ICT).*

This Unit has the Core Skill of Problem Solving embedded in it, so when you achieve this Unit your Core Skills profile will be updated to show that you have achieved Problem Solving at SCQF level 6.