



Higher National Graded Unit specification

General information for centres

This Graded Unit has been validated as part of the Chemical Process Technology HND. Centres are required to develop the assessment instrument in accordance with this validated specification. Centres wishing to use another type of Graded Unit or assessment instrument are required to submit proposals detailing the justification for change for validation.

Graded Unit title: Chemical Process Technology: Graded Unit 2

Graded Unit code: F4CJ 35

Type of Graded Unit: Project

Assessment Instrument: Practical Assignment

Credit points and level: 2 HN credits at SCQF level 8: (16 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

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

- ◆ develop candidates' knowledge and skills such as planning, developing and evaluating.
- ◆ develop transferable skills including Core Skills.
- ◆ develop a range of vocational skills relating to the use, support and development of systems appropriate to employment at technician level. This may include operating process equipment, synthesising chemicals, analysing chemicals and completing technical reports.
- ◆ develop options to permit an element of vocational specialisation in a variety of areas such as: distillation, fermentation, water and steam services, refinery operations, CAD and environmental sampling.
- ◆ enable progression within the SCQF framework to chemistry or chemical engineering as candidates are undertaking a wide range of transferable skills and underpinning knowledge. These include process operations, analytical chemistry, organic and physical chemistry.
- ◆ provide candidates with a deeper underpinning knowledge by providing a wide range of theoretical and practical knowledge in chemistry and chemical engineering. These skills include heat transfer, fluid mechanics, thermodynamics, and organic synthesis.
- ◆ prepare candidates for an appropriate level of employment in the chemicals industry such as a process technician, analytical laboratory technician or industrial laboratory technician within the wide variety of areas that are encompassed by the chemical and life science industries.

General information for centres (cont)

Recommended prior knowledge and skills: It is recommended that the candidate should have completed or be in the process of completing the following Units relating to the above specific aims prior to undertaking this Graded Unit:

DP54 35	<i>Aromatic Chemistry</i>
DP4N 35	<i>Thermodynamics and Kinetics</i>
F3XC 34	<i>Heat Transfer: Theory and Practice</i>
F3XB 34	<i>Fluid Mechanics: Theory and Practice</i>
F3XG 35	<i>Process Operations: Heat Exchange Drying, and Evaporation</i>
F3XF 35	<i>Process Operations: Distillation</i>

Core Skills: There are opportunities to develop the Core Skills of *Communication, Information Technology, Numeracy* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Assessment: This Graded Unit will be assessed by the use of a Practical Assignment which includes a scientific report. The developed Practical Assignment should provide the candidate with the opportunity to produce evidence that demonstrates s/he has met the aims of the Graded Unit that it covers.

Administrative Information

Graded Unit code: F4CJ 35

Graded Unit title: Chemical Process Technology: Graded Unit 2

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History of changes:

Version	Description of change	Date
02	Correcting typographical errors.	02/02/09

Source: SQA

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Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates

Graded Unit title: Chemical Process Technology: Graded Unit 2

Conditions of assessment

The candidate should be given a date for completion of the project. However, the instructions for the assessment task should be distributed to allow the candidate sufficient time to assimilate the details and carry out the assessment task. During the time between the distribution of the assessment task instructions and the completion date, assessors may answer questions, provide clarification, guidance and reasonable assistance. The assessment task should be marked as soon as possible after the completion date. The final grading given should reflect the quality of the candidate's evidence at the time of the completion date.

The evidence for the project is generated over time and involves three distinct stages, where each stage has to be achieved before the next is undertaken. Thus any re-assessment of stages must be undertaken before proceeding to the next stage.

If a candidate fails the project overall or wishes to upgrade, then this must be done using a *substantially different* project, ie all stages are undertaken using a new project, assignment, case study, etc. In this case, a candidate's grade will be based on the achievement in the re-assessment, if this results in a higher grade.

At this level candidates should work independently, ie without undue assistance from the assessor. It is up to centres to take reasonable steps to ensure that the project is the work of the candidate. For example, centres may wish to informally question candidates 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 candidates do not receive undue assistance.

Instructions for designing the assessment task

The assessment task is a project. This will take the form of a practical assignment on a topic relevant to the subject areas covered by the Units forming the Chemical Process Technology HND, and provide the opportunity to apply and integrate knowledge and skills. However, it is not anticipated that candidates will cover all Units from the HND within their assignment.

Assessment tasks could require candidates to investigate a chosen chemical or process technology situation. These situations will be varied and different Units from within the HND will support the project. Candidates are expected within their project evaluation to reflect on the knowledge and skills developed within the project.

The range of project topics will be diverse due to the range of subjects covered within the HND, the variety of chemical industries (eg oil and gas, pharmaceutical, environmental, dyes, inks to name a few). Some examples of practical assignment topics are given in the support notes. Candidates are expected to draw upon the taught theories in the key Units of the Chemical Process Technology HND and demonstrate through their research how understanding of these theories contributes to their understanding of the chemical process industry.

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

The brief presented must ensure that the three stages of planning, development and evaluation are clearly identified. The use of logbooks or equivalent must be highlighted, and the need for appropriate health and safety measures to be in place and complied with, must be stated.

The assessment task is a practical assignment. The assignment undertaken by the candidate must be a complex task which involves:

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

The assessment task must require the candidate 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

Guidance on grading candidates

Candidates who meet the minimum Evidence Requirements will have their achievement graded as C — competent, or A — highly competent or B somewhere between A and C. The grade related criteria to be used to judge candidate performance for this Graded Unit is specified in the following table.

Grade A	Grade C
<p>Is a seamless, coherent piece of work which:</p> <ul style="list-style-type: none">◆ includes a project brief that accurately specifies the project in both technical and non-technical terms. The brief is prepared in a clear and concise manner.◆ includes project objectives which accurately and fully reflect the long term project aims.◆ includes an initial project plan. The 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 schedule is monitored on a regular basis to inform ongoing project planning and development.	<p>Is a co-ordinated piece of work which:</p> <ul style="list-style-type: none">◆ includes a project brief that has accurate information about the main technical and non technical requirements of the project.◆ includes project objectives that identify the key long term project aims.◆ includes an initial project plan which 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 ongoing project planning and development should be available.

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

Grade A	Grade C
<ul style="list-style-type: none"> ◆ is undertaken with minimum supervision. Where the candidate feeds back to their supervisor, it is on a proactive basis, updating them on progress made and actions for the next stage of the project. ◆ indicates development of a substantial knowledge base to support the demands of the project. ◆ identifies all known project risks, categorises them in terms of their likely occurrence and identifies actions for minimising such risks. ◆ incorporates any practical activities according to current Health and Safety requirements, with practical work to a high standard. ◆ demonstrates a high standard of competency on any equipment/methods or software used as part of the project/practical assignment. ◆ includes results or investigation data that is accurate, takes account of all known sources of error and is either substantiated in terms of known theory and/or identifies limitations in theory. ◆ includes a diary or logbook of progress, regularly maintained and including a detailed, informal record of results, and evidence of candidates' thinking as the project had developed, including reflective comments. ◆ includes a well structured project report, which contains only relevant information, is technically accurate, uses clear and correct English and has clear and accurate conclusions and recommendations. ◆ includes a project report which has a full analysis of results, and a comprehensive evaluation of the project against project objectives. ◆ provides clear and full details of new knowledge and skills developed as a result of carrying out the project such as project management skills, meeting deadlines, recognising limitations of knowledge and using expert sources. ◆ indicates a high level of self motivation throughout. ◆ includes additional research undertaken, beyond that demanded by the project. 	<ul style="list-style-type: none"> ◆ is undertaken with interventions from the supervisor, which ensure the project remains on track. ◆ indicates development of a sound knowledge base to support the demands of the project. ◆ identifies main risks that are likely to occur, and identifies main actions for minimising such risks. ◆ incorporates any practical activities according to current Health and Safety requirements, with practical work to an acceptable standard. ◆ demonstrates an acceptable level of competency on any equipment/methods or software used as part of the project/practical assignment. ◆ includes results or investigation data that is sufficiently accurate and detailed and takes account of main sources of error, and establishes key relationships between results and theory. ◆ includes a diary or logbook of progress, including a sufficient level of details about project ideas, results and progress. There is evidence that entries have been made on a number of occasions during the duration of the project. ◆ includes a project report which meets acceptable standards in terms of structure, technical accuracy, use of English and has accurate conclusions and recommendations. ◆ includes a project report which has an analysis of results, an evaluation of the project against the project objectives. ◆ provides a number of examples of new knowledge and skills developed as a result of carrying out the project. ◆ indicates an acceptable level of motivation throughout. ◆ includes research demanded by the project.

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

The project should be marked using the checklist shown later. For each item shown in the checklist an assessor should award a mark which most closely reflects the candidate's performance against the item. All the marks will then be added together to give an aggregated mark out of 200. This score will then be converted into a percentage. Assessors will then assign an overall grade to the candidate for this Graded Unit based on the following grade boundaries.

- A = 70% — 100%
- B = 60% — 69%
- C = 50% — 59%

Note: the candidate must achieve all of the minimum evidence specified below for each stage of the project in order to achieve the Graded Unit.

Evidence Requirements

The project consists of three stages: planning; developing; and evaluating. The following table specifies the minimum evidence required to pass each stage.

Note: The candidate must achieve **all of the minimum evidence** specified below for each stage of the project in order to pass the Graded Unit.

Project stage	Minimum Evidence Requirements
Stage 1 — Planning 20%	<p>An action plan which includes:</p> <ol style="list-style-type: none">1 Details of the task undertaken by the candidate, which must be unfamiliar and complex.2 Description of the project brief, which accurately specifies the project in both technical and non-technical terms and is prepared in a clear and concise manner.3 Development of the brief and the identification of the key factors influencing the project and their interrelationships.4 A set of project objectives that accurately and fully reflect the long term aims of the project.5 Aims of the Project.6 Identification of materials and resources required and how they will be accessed.7 Identification of the stages involved and the timescales for completion of each stage (project plan).8 Identification of appropriate Health and Safety procedures. <p><i>The candidate must achieve all of the minimum evidence specified above in order to pass the Planning stage.</i></p>

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

Project stage	Minimum Evidence Requirements
Stage 2 — Developing 55%	<ol style="list-style-type: none"> 1 Outputs from the project in the form of a scientific report that includes: <ul style="list-style-type: none"> ◆ title, contents page ◆ aims and objectives ◆ analysis and interpretation of data collected ◆ sources of error ◆ conclusion and discussion ◆ references 2 Records of processes underpinning the activity of the project: <ul style="list-style-type: none"> ◆ logbook/diary ◆ progress reports ◆ practical results or project findings ◆ collection of data 3 Compliance with Health and Safety requirements. 4 Relevant health and safety assessments. 5 Relevant risk assessments. 6 Resources/materials and methods including any equipment/methods or software used. 7 Analysis and Interpretation of data that includes a full analysis of results. 8 Sources of error — takes account of all known sources of error and is either substantiated in terms of known theory and/or identifies limitations in theory. <p>A diary or logbook of progress must be maintained including an informal record of results and candidates' thinking as the project develops, and reflective comments.</p> <p><i>The candidate must achieve all of the minimum evidence specified above in order to pass the Developing stage.</i></p>
Stage 3 — Evaluating 25%	<p>An evaluation report which should:</p> <ol style="list-style-type: none"> 1 Contain an outline of the assignment. 2 Review and update the action plan in light of experience. 3 Summarise any unforeseen events and how they were handled. 4 Identify knowledge and skills which have been gained and/or developed. 5 Assess the strengths and weaknesses of the project. 6 Determine to what extent the assignment met the project brief. 7 Suggest any future potential development themes for the project. <p><i>The candidate must achieve all of the minimum evidence specified above in order to pass the Evaluating stage.</i></p>

To pass the Graded Unit candidates must achieve 50% of the total marks and all the minimum Evidence Requirements for each of the three sections.

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

Support notes

Grading Checklist

Centres may provide additional comments to support their grading decisions. A candidate may be awarded less than the mark allocation for a grade C in appropriate circumstances.

Stage 1: Planning stage — The Action Plan

Project Stage	Evidence Requirements	Maximum mark	Mark Grade C	Mark Awarded
Planning	the project brief: Accurately specifies the project in both technical and non-technical terms and is prepared in a clear and concise manner			
	♦ the candidate's development of the brief: — includes evidence of analysing and interpreting what is involved in the project brief and presents it in a clear and concise manner — identifies the key factors influencing the project and their interrelationships	4	2	
	♦ any information gathered to clarify the brief — evidence of information gathered eg references/articles/appropriate websites — identification of information sources to be used	4	2	
	♦ aims of project	4	2	
	♦ project objectives — accurately and fully reflect the long term aims of the project	4	2	
	♦ identification of materials and resources required and how they will be accessed — evidence the candidate has identified materials/resources required to complete the project and where they can be accessed	6	3	
	♦ identification of the stages involved	4	2	

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

Project Stage	Evidence Requirements	Maximum mark	Mark Grade C	Mark Awarded
Planning (cont)	<ul style="list-style-type: none"> ◆ the timescales for completion of each stage (project plan) <ul style="list-style-type: none"> — the initial project plan contains a comprehensive list of project activities and timings. The information in the initial plan is used to assess whether the project can be completed within timescales. The schedule is monitored on a regular basis to inform ongoing project planning and development. 	4	2	
	<ul style="list-style-type: none"> ◆ identification of appropriate Health and Safety procedures <ul style="list-style-type: none"> — identifies all known project risks, categorises them in terms of their likely occurrence and identifies actions for minimising such risks 	6	3	
	The candidate must achieve the minimum evidence specified in order to pass the planning stage. This will account for 20% of the overall mark. If the assessor forms the view that the work finally submitted by the candidate is not acceptable to progress to the next stage, the candidate may receive additional assistance (over and above the norm). In this event, this extra assistance must be recorded by the assessor and the candidate can not receive any more than 20 marks for this section.	Total 40	Minimum 20	

Project Stage	Evidence Requirements	Maximum mark	Mark Grade C	Mark Awarded
Developing	Output (scientific report of 3,000–5,000 words or equivalent) of project			
	◆ title, contents page	2	2	
	◆ introduction, aims and objectives	6	3	
	<ul style="list-style-type: none"> ◆ resources/materials and methods <ul style="list-style-type: none"> — the candidate will demonstrate competency on any equipment/methods or software used 	8	4	
	◆ collection of appropriate data	20	10	
	◆ presentation of data	4	2	
	<ul style="list-style-type: none"> ◆ analysis and interpretation of data <ul style="list-style-type: none"> — full analysis of results, and a comprehensive evaluation of the project against project objectives 	20	10	

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

Project Stage	Evidence Requirements	Maximum mark	Mark Grade C	Mark Awarded
Developing (cont)	<p>◆ sources of error — takes into account of all known sources of error and is either substantiated in terms of known theory and/or identifies limitations in theory.</p>	4	2	
	<p>◆ conclusion and discussions — report has clear and accurate conclusions and recommendations.</p>	14	7	
	<p>◆ Bibliography/References — the candidate develops their knowledge base in the subject to support the assignment by using a range of information sources.</p>	6	2	
	<p>◆ Health and Safety requirements — the candidate should have all appropriate Health and Safety assessments (COSHH, risk, manual handling etc), they should show evidence of following these.</p>	4	2	
	<p>◆ level of motivation and initiative — the candidate demonstrates a high level of self motivation throughout the project. This should include consistently demonstrating initiative, sourcing extra information as required, developing new skills to complete assignment.</p>	4	2	
	<p>◆ presentation — the project report is well structured, contains only relevant information, is technically accurate, uses clear and correct English.</p>	4	2	
	<p>◆ level of supervision — the candidate undertakes the project with minimum supervision. Where the candidate 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.</p>	6	3	
	<p>◆ records of the processes underpinning the assignment eg logbook, diary, progress report — the candidate keeps a diary or logbook of progress, this diary or logbook is regularly maintained and provides a detailed, informal record of results, the candidate's thinking as the project develops including reflective comments.</p>	8	4	

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

Project Stage	Evidence Requirements	Maximum mark	Mark Grade C	Mark Awarded
Developing (cont)	The candidate must achieve the minimum evidence specified in order to pass the developing stage. This will account for 55% of the overall mark. If the assessor feels that the work finally submitted by the candidate is not acceptable to progress to the next stage, the candidate may receive additional assistance (over and above the norm). In this event, this extra assistance must be recorded by the assessor and the candidate cannot receive any more than 55 marks for this section.	Total 110	Minimum 55	

Project Stage	Evidence Requirements	Maximum mark	Mark Grade C	Mark Awarded
Evaluating	Evaluation Report which should:			
	◆ contain an outline of the assignment	3	1	
	◆ review and update, as required, the project brief	6	3	
	◆ summarise any unforeseen events and how they were handled — if there were no unforeseen events candidates should refer to this in the evaluation report	8	4	
	◆ identify knowledge and skills which have been gained and/or developed — this includes a self evaluation with clear and full details of the new knowledge and skills the candidate has developed as a result of doing the project	15	8	
	◆ assess the strengths and weaknesses of the output of the project/practical assignment	8	4	
	◆ determine to what extent the assignment met the original brief	4	2	
	◆ suggest potential development of the project/recommendations for the future	6	3	
	The candidate must achieve the minimum evidence specified in order to pass the developing stage. This will account for 25% of the overall mark.	Total: 50	Minimum: 25	

Higher National Graded Unit specification: instructions for designing the assessment task and assessing candidates (cont)

The range of projects topics will be diverse due to the range of subjects covered within the HND, the variety of chemical industries (eg oil and gas, pharmaceutical, environmental, dyes, inks, etc.) and potential articulation routes. The project may consist of one of the following:

- ◆ an organic chemistry synthesis of a product, with analysis of the product
- ◆ investigation of reaction kinetics
- ◆ a work based yield optimisation project
- ◆ development of a pilot plant process
- ◆ chemical engineering design eg heat exchanger or distillation column
- ◆ chemical engineering practical project
- ◆ an analytical chemistry based project

At the level of the candidate, work based projects will most likely be part of a team project. However the candidate could have a subproject that is part of a team project, to meet the requirements of the Graded Unit.

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative assessment arrangements. For information on these, please refer to the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on SQA's website: www.sqa.org.uk.

General information for candidates

As part of the 2nd year of your Chemical Process Technology HND programme of study, you will have to complete a two credit Graded Unit project. The project will be graded A, B or C.

This Graded Unit gives you the opportunity to pursue an area of interest from the programme and further develop your skills and knowledge in that area. The area of choice may be chemical engineering, process chemistry, analytical chemistry, physical chemistry, organic chemistry or the project may cover more than one of these areas. The range of project topics will be diverse due to the range of subjects covered within the HND, the variety of chemical industries (eg oil and gas, pharmaceutical, environmental, dyes, inks to name a few) and potential articulation routes.

However, your choice of project must be agreed with your project tutor. Examples of projects could include:

- ◆ an organic chemistry synthesis of a product, with analysis of the product
- ◆ investigation of reaction kinetics
- ◆ a work based yield optimisation project
- ◆ development of a pilot plant process
- ◆ chemical engineering design eg heat exchanger or distillation column
- ◆ chemical engineering practical project
- ◆ an analytical chemistry based project

In conducting your project you will have the opportunity to develop skills in planning, identifying the project aims and objectives, working to a deadline (time management), evaluating the project as you carry out the work and after you have completed the task, being innovative and motivated, communicating effectively with your project supervisor.

The project will be broken down into three stages: planning, development and evaluation. These stages will be explained to you by your project supervisor. You will be required to keep a logbook or diary, a project brief, and complete a project report.

A = 70% — 100%
B = 60% — 69%
C = 50% — 59%