



Higher National Unit Specification

General information for centres

Unit title: Chemical Engineering Principles

Unit code: F3X8 34

Unit purpose: This Unit will provide candidates with knowledge and understanding of the principles of mass and energy balances, to process engineering systems.

On completion of the Unit the candidate should be able to:

- 1 Apply the principles of mass balances.
- 2 Apply the principles of energy balances.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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.*

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the centre. Candidates should have some prior skills in mathematics at and chemistry at SCQF level 5 or 6, or equivalent.

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

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: This Unit could be assessed by a single, holistic end of Unit assessment under supervised conditions.

Higher National Unit specification: statement of standards

Unit title: Chemical Engineering Principles

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The sections of the Unit stating the Outcomes, Knowledge and/or Skills and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed. On each assessment occasion a different items should be sampled.

Outcome 1

Apply the principles of mass balances

Knowledge and/or Skills

- ◆ Mass balance calculations
- ◆ Mass balance techniques
- ◆ Mass balance in an industrial context
- ◆ Data sources

Evidence Requirements

Evidence for this Outcome will be provided on a sample basis, with candidates required to answer questions on three of the four Knowledge and/or Skills items. Assessment must be conducted under supervised conditions.

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ use data sources to solve mass balance calculations (to include mass fractions, volume fractions, mole fraction, dry and wet basis analysis and the interconversion of these terms)
- ◆ apply mass balance techniques to tie component; individual component; and mixing balances as applied to steady state processes stoichiometry in simple processes and recycle operations

Where calculations are performed the candidate must:

- ◆ apply appropriate formulae
- ◆ apply the principles of the calculation
- ◆ show all working through a calculation
- ◆ provide reasonable answers to the questions asked. The answer should derive from the application of the formulae and correct application of the principles of the calculation

Assessment Guidelines

This Outcome could be assessed as single holistic assessment with Outcome 2.

Higher National Unit specification: statement of standards (cont)

Unit title: Chemical Engineering Principles

Outcome 2

Apply the principles of energy balances

Knowledge and/or Skills

- ◆ Data sources
- ◆ Energy balance techniques
- ◆ Energy balances in an industrial process
- ◆ Steam quality/consumption
- ◆ Single phase system
- ◆ Two phase systems

Evidence Requirements

Evidence for this Outcome will be provided on a sample basis, with candidates required to answer questions from four of the six Knowledge and/or Skills items. Assessment must be conducted under supervised conditions.

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing they can:

- ◆ apply data sources to energy balance calculations
- ◆ apply energy balances techniques to single phase and two phase systems
- ◆ apply energy balances in an industrial process
- ◆ solve calculations on steam quality and consumption

Where calculations are performed the candidate must:

- ◆ apply appropriate formulae
- ◆ apply the principles of the calculation
- ◆ show all working through a calculation
- ◆ provide reasonable answers to the questions asked. The answer should derive from the application of the formulae and correct application of the principles of the calculation

Assessment Guidelines for the Unit

This Unit could be assessed by a single, holistic end of Unit assessment.

Administrative Information

Unit code: F3X8 34

Unit title: Chemical Engineering Principles

Superclass category: YC

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History of Changes:

Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Chemical Engineering Principles

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

Outcome 1 is designed to introduce and then apply the principles of mass balance. Candidates should therefore be able to calculate mass fractions, volume fractions, mole fraction, dry and wet basis analysis and the interconversion of these terms. The use of tie component and individual component balances should then be introduced and candidates should be able to apply these to steady state processes. Mixing streams, multiple Unit processes and recycling operations should then be introduced. In order to solve these problems, candidates should use appropriate data tables. Candidates should be able to solve mass balances based on industrial processes.

Outcome 2 is designed to introduce and then apply the principles of energy balances. Candidates should be able to apply the first law of thermodynamics, they should understand enthalpy, be able to calculate dryness fraction, flash steam and steam consumption, then apply heats of reaction in preparing energy balances as reactive processes. Candidates should be able to solve energy balances based on industrial processes.

Guidance on the delivery and assessment of this Unit

This Unit is designed to introduce candidates to the principles of mass and energy balances and their applications to industrial processes. Therefore, reference should be made to relevant industrial processes, where possible. Assessment for Outcomes 1 and 2 is likely to comprise a single holistic assessment, on a sampling basis.

A note on the Evidence Requirements

The Evidence Requirements state that candidates must ‘provide reasonable answers’ derived ‘from the application of the formulae and correct application of the principles of the calculation’. This allows for acknowledgement of the correct working and application of formulae, even where candidates’ final answer may be inaccurate.

The statement allows for the eventuality where a single error at one stage in an extended calculation sequence has a cumulative effect on the final answer, even though working/formulae are otherwise correctly applied. Acknowledgement of the correct working should be given in such cases.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of *Numeracy* at SCQF level 6 and the component of Critical Thinking in the Core Skill of *Problem Solving* at SCQF level 6, although there is no automatic certification of Core Skills

Higher National Unit specification: support notes (cont)

Unit title: Chemical Engineering Principles

Throughout this Unit candidates are required to perform calculations, manage formula and equations that provide the opportunity to develop the Core Skill of *Numeracy* at SCQF level 6. In Outcome 2, candidates will also be required to interpret and plot graphs which again provide the opportunity to develop *Numeracy* at SCQF level 6.

The presentation of problems in assessments which candidates are required to interpret and work through will develop the Critical Thinking component of *Problem Solving* at SCQF level 6.

Open learning

If this Unit is delivered by open or distance learning methods, additional planning resources may be required for candidate support, assessment and quality assurance.

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 Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Chemical Engineering Principles

Whilst this Unit may be studied on a standalone basis, it has been designed as a single-credit HN Unit at SCQF level 7, intended for candidates undertaking HNC Chemical Engineering and HNC/HND Chemical Process Technology. It is designed to provide you with understanding and knowledge of the principles of mass and energy balances.

On completion of this Unit you should be able to solve problems mass balances and energy balances. In order to do this you will need to be able to interpret data given to you, use data sources to collect data and then solve the problems presented to you, many of which will be based on industrial processes.

The two Outcomes are likely to be assessed in the one assignment, under supervised conditions.

There are opportunities for you to develop the Core Skills of *Numeracy* at SCQF level 6 and the component of Critical Thinking in the Core Skill of *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills.

Throughout the Unit you will also have the opportunity to develop Core Skills in *Numeracy*, and *Problem Solving* at SCQF level 6. You will perform calculations, manage formulae and equations that may develop the Core Skill of *Numeracy* at SCQF level 6. You will also be required to interpret and plot graphs, which again provides the opportunity to develop the Core Skill of *Numeracy* at SCQF level 6.

The presentation of problems throughout the delivery and assessment of the course will require you to interpret situations, apply the learned principles, and develop appropriate solutions, thus providing opportunities to develop the component Critical Thinking of the Core Skill of *Problem Solving*.