



## National Unit Specification: general information

**UNIT** Process Chemistry: An Introduction (SCQF level 6)

**CODE** F6X9 12

### SUMMARY

This Unit may be delivered as part of the National Certificate in Engineering Systems or as a free standing Unit. The Unit is suitable for candidates who wish to develop knowledge and understanding of process chemistry. Candidates will be expected to gain an understanding of the naming process of selected hydrocarbons, how selected hydrocarbons are processed in industry. Candidates will investigate the production, source, cost demand and environmental impact of a selected organic compound. Candidates will also be expected to develop a knowledge and understanding of corrosion, the factors affecting corrosion and methods of corrosion prevention.

### OUTCOMES

- 1 Describe and use the nomenclature and reactions of selected hydrocarbons.
- 2 Describe the industrial production, economic demands, and environmental impact of a selected organic product.
- 3 Describe the factors affecting the corrosion and degradation of metals and other selected materials.
- 4 Describe methods for the prevention of corrosion of metals and other selected materials.

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- ◆ a Standard Grade science at Credit level, preferably chemistry
- ◆ an Intermediate 2 science qualification, preferably chemistry

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#### Administrative Information

**Superclass:** RD

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## **National Unit Specification: general information (cont)**

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### **CREDIT VALUE**

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6\*).

*\*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.*

### **CORE SKILLS**

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of this Unit Specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

## National Unit Specification: statement of standards

### UNIT Process Chemistry: An Introduction

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

#### OUTCOME 1

Describe and use the nomenclature and reactions of selected hydrocarbons.

##### Performance Criteria

- Accurately draw the full structural formula of given organic compounds from its correct IUPAC name.
- Accurately name given organic compounds, using the correct IUPAC nomenclature, from a given full structure.
- Describe the main chemical reactions of a range of hydrocarbons.

#### OUTCOME 2

Describe the industrial production, economic demands, and environmental impact of a selected organic product

##### Performance Criteria

- Describe clearly the industrial synthesis of a selected organic product in terms of starting materials and conditions.
- Describe the main use(s) of the selected organic compound as an intermediate or final product.
- Describe clearly the demand, origins, availability, cost and environmental impact of the selected organic product.

#### OUTCOME 3

Describe the factors affecting the corrosion and degradation of metals and other selected materials.

##### Performance Criteria

- Describe the main factors affecting corrosion.
- Describe accurately electrochemistry of corrosion.
- Describe the basic patterns of corrosion.
- Describe the basic degradation of selected ceramic and polymeric materials.

## National Unit Specification: statement of standards (cont)

### UNIT Process Chemistry: An Introduction

#### OUTCOME 4

Describe methods for the prevention of corrosion of metals and other selected materials.

#### Performance Criteria

- Describe clearly the use of chemical inhibitors in corrosion prevention.
- Describe clearly use of physical boundaries in corrosion prevention.
- Describe clearly sacrificial anodes and cathodic protection in corrosion prevention.

#### EVIDENCE REQUIREMENTS FOR THIS UNIT

Written and or recorded oral evidence is required which demonstrates that the candidate has achieved all Outcomes to the standard specified in the Outcome and Performance Criteria. For Outcome 1, evidence will be generated under supervised closed book conditions. The candidates will name organic compounds, draw full structural formula. Candidates will describe the main reactions of the hydrocarbons suggested below. The organic compounds should contain no more than ten carbon atoms in the main chain. The suggested compounds to be studied are: alkanes, alkenes, alkanols, alkanals, alkanones, alkanolic acids, and esters.

For Outcome 2 a study on an appropriate organic compound is recommended. The evidence should cover the production conditions, starting material(s), demands for the product, cost/environmental considerations, source of the product and availability of starting materials.

For Outcomes 3 and 4, evidence will be generated under supervised closed-book conditions. It is envisaged that Outcomes 3 and 4 will be assessed holistically and the evidence will cover:

- ◆ Factors affecting corrosion, predicting corrosion rates
- ◆ The electrochemistry of metallic corrosion
- ◆ Patterns of metallic corrosion
- ◆ Degradation of ceramic and polymeric materials
- ◆ Cathodic protection and sacrificial anodes
- ◆ Chemical inhibitors and physical boundaries
- ◆ Oxidation passivation

It is envisaged that the assessment for Outcome 1 will be of 45 minutes duration, with the assessments for Outcomes 3 and 4 being no more than 90 minutes duration.

The Assessment Support Pack (ASP) for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard.

## National Unit Specification: support notes

### UNIT Process Chemistry: An Introduction

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

The Unit is designed for candidates who wish to develop knowledge and understanding of process chemistry.

##### Outcome 1

Outcome 1 covers IUPAC nomenclature of organic compounds. The candidates will learn to name organic compounds, draw full structural formula. The organic compounds should contain no more than ten carbon atoms in the main chain. The suggested compounds to be studied are: alkanes, alkenes, alkanols, alkanals, alkanones, alkanolic acids, and esters. Once nomenclature has been developed candidates should be introduced to the main chemical reactions of a range of organic compounds.

##### Outcome 2

In this Outcome candidates should select an organic product. This product could be from a range of suitable products, the product may be a familiar product to the candidate or it may be a new product. The candidate may produce a case study report that covers the production conditions, starting material(s), demands for the product, cost/environmental considerations, source of the product, availability of starting materials. This case study could be on any organic product, for example a fine chemical, pharmaceutical, refinery product, agrochemical or polymer. Examples include, but are not limited to, methanol manufacture, cracking and reforming, benzene production, natural gas and its use as a fuel, petrol/diesel, and pharmaceutical compounds.

##### Outcome 3

This outcome will develop the candidate's knowledge and understanding of factors affecting corrosion:

- ◆ factors affecting corrosion, predicting corrosion rates
  - effects of temperature and concentration
  - activation polarisation
  - concentration polarisation
  - passivation
  
- ◆ the electrochemistry of metallic corrosion
  - standard electrode potentials and galvanic coupling
  - the electrochemical series

## National Unit Specification: support notes (cont)

### UNIT Process Chemistry: An Introduction

- ◆ patterns of metallic corrosion
  - uniform and galvanic corrosion
  - crevice and pitting corrosion
  - intergranular corrosion and leaching
  - stress corrosion and erosion
  - dry corrosion and hydrogen embrittlement
  
- ◆ degradation of ceramic and polymeric materials
  - swelling and dissolution
  - bond rupture
  - weathering

#### Outcome 4

This outcome will develop the candidate's knowledge and understanding of methods for the prevention of corrosion.

- ◆ cathodic protection and sacrificial anodes
- ◆ chemical inhibitors and physical boundaries
- ◆ oxidation passivation

#### GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

While the use of case study material is particularly recommended for both the learning and teaching components of this Unit, other suggested teaching and learning methods for this Unit could include: the use of visual aids, Information Communication Technology (ICT), group lectures and discussion, practical demonstrations, question and answer sessions, directed study, and industrial/site visits.

The learning and teaching approaches should be appropriate to the needs of the candidates. The Unit Outcomes can be delivered in the same sequence the Outcomes are presented in the National Unit Specification or Outcome 3 and 4 could be delivered before Outcome 1 & 2. The Unit may be delivered by a combination of lectures, tutorial, practical work and research based learning.

For Outcome 2 of this Unit, investigative methods will be used to produce individual projects relating to a selected industrial organic synthesis. It is important that the industrial organic compound selected for study has appropriate and accessible resources for the candidate. This could include internet access, journals, textbooks and potentially workbased resources.

#### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

There is no automatic certification of Core Skills in this Unit. However, there are opportunities to develop aspects of Core Skills in *Communication* (Written and/or Oral) and *Problem Solving* (Critical Thinking). Candidates will develop their *Communication* skills during Outcome 2 as they prepare a report on their chosen organic compound. *Problem Solving* will be developed throughout the Unit.

## National Unit Specification: support notes (cont)

### UNIT Process Chemistry: An Introduction

#### GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

It is recommended that Outcome 1 is assessed as a single assessment, which could be an assessment paper with multiple choice and short response questions. The assessment could cover names and structures of key organic compounds. Outcome 2 could be a report based around the Performance Criteria for the Outcome. This report could take the form of a case study into the selected organic compound. The report will cover all aspects of the Performance Criteria for the Outcome. A checklist could be used to ensure all Performance Criteria have been met. It is not envisaged that the report will be investigated under supervised conditions, rather it will be a piece of work that is monitored during contact time but may be worked on by the candidate out with the classroom environment. Outcomes 3 and 4 could be assessed as a single holistic assessment or separately. The assessment(s) could contain multiple choice and/or short response questions.

Preparation for assessment could include formative work with opportunities for feedback to the candidate before the candidates attempt the summative assessment.

Where candidates require re-assessment there should be a different set of questions available for that re-assessment.

#### Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

#### DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website

[www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements)