



## National Unit specification

### General information

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

**Unit code:** HT6V 46

**Superclass:** RD

**Publication date:** October 2018

**Source:** Scottish Qualifications Authority

**Version:** 03

### Unit purpose

This unit is designed to provide learners with an introduction to the basic concepts of chemistry, both theoretical and practical. The unit is suitable for learners undertaking the Foundation Apprenticeship in Scientific Technologies, and will provide the necessary underpinning knowledge and skills to enable progression to further study of chemistry at Higher National level.

### Outcomes

On successful completion of the unit the learner will be able to:

- 1 Describe and use the basic chemical principles associated with atomic structure, chemical formulae, acids and bases, the periodic table, and organic chemistry.
- 2 Perform practical experiments related to fundamental chemistry.

### Credit points and level

1 National Unit credit at SCQF level 6: (6 SCQF credit points at SCQF level 6)

### Recommended entry to the unit

Entry is at the discretion of the centre. There are no specific entry requirements. This unit is suitable for learners with no prior chemistry knowledge.

## National Unit specification: General information (cont)

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

### Core Skills

Achievement of this unit gives automatic certification of the following Core Skills component:

Complete Core Skill	None
Core Skill component	Critical Thinking at SCQF level 4 Using Number at SCQF level 5

There are also opportunities to develop aspects of Core Skills which are highlighted in the support notes of this unit specification.

### 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.

The Assessment Support Pack (ASP) for this unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

### Equality and inclusion

This unit specification 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 our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## National Unit specification: Statement of standards

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

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 basic chemical principles associated with atomic structure, chemical formulae, acids and bases, the periodic table, and organic chemistry.

#### Performance criteria

- (a) Describes the structure of an atom, identifies types of bonding in common compounds, and determines the chemical formula of compounds which contain up to three elements.
- (b) Writes and balances chemical equations derived from written descriptions.
- (c) Explains the general trends in the periodic table.
- (d) Explains the properties of the groups in the periodic table.
- (e) Carries out calculations involving the relationship between the number of moles and quantity of a compound.
- (f) Calculates volumes, concentrations of solutions.
- (g) Explains the basic concepts of acidity and alkalinity.
- (h) Identifies organic functional groups and describes their main reaction types.
- (i) Explains the concepts of isomers and homologous series.

### Outcome 2

Perform practical experiments related to fundamental chemistry.

#### Performance criteria

- (a) Follows instructions to perform experiments related to fundamental chemistry.
- (b) Works in a safe manner regarding current health and safety regulations.
- (c) Achieves consistent and accurate results.
- (d) Records experimental observations and results clearly and accurately.
- (e) Evaluates validity of results in terms of experimental errors.
- (f) Analyses results correctly and states valid conclusions.

#### Evidence requirements for this unit

Evidence is required to demonstrate that learners have achieved all outcomes and performance criteria.

Written and/or oral recorded evidence for Outcome 1 should be assessed using a holistic, closed-book assessment under supervised conditions. It is recommended that the assessment be completed within 90 minutes. Learners can only have access to the SQA Data Booklet for Higher and Advanced Higher Chemistry or any suitable replacement when sitting the assessment.

Written and/or oral recorded evidence for Outcome 2 should be assessed by production of a full laboratory report, completion of an appropriate pro forma, a laboratory diary entry or a checklist.

## National Unit specification: Statement of standards (cont)

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

Learners will perform a minimum of two practical experiments, the content of which will be related to Outcome 1.

An assessor observation checklist will be used to record the learner's performance of the practical work in line with given instructions and health and safety requirements.

Learners must report one of the two practical experiments by production of a full laboratory report. Learners may report the remaining practical experiment by production of a full laboratory report, completion of an appropriate pro forma, a laboratory diary entry or a checklist. Where a pro forma approach is deployed, the pro forma will not present information or assistance to the learners on how to correctly perform calculations, analyse experimental results or experimental errors. Learners will be expected to perform such activities independently on the basis of the experimental data. Where a laboratory diary approach is deployed, the laboratory diary must meet all of the requirements of a pro forma (in particular an evaluation of experimental errors), as set out in the Understanding Standards materials.

Where a learner does not perform an assessed practical experiment to the required standard, they will be given the chance to either reattempt the same practical experiment, or to undertake a different practical experiment of similar complexity. Where a laboratory report, pro forma or laboratory diary does not meet the required standard, then the learner will be given a single opportunity to re-draft. If the required standard is still not attained, then an alternative practical experiment will be set.

## National Unit support notes

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

Unit support notes are offered as guidance and 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

This unit is intended as part of the framework for the Foundation Apprenticeship in Scientific Technologies. It is designed to provide learners with the underpinning theoretical and practical knowledge required for a basic understanding of chemistry.

**Outcome 1 — Describe and use the basic chemical principles associated with atomic structure, chemical formulae, acids and bases, the periodic table, and organic chemistry.**

Learners should be able to write balanced equations from written descriptions, and determine the chemical formula for simple compounds containing up to three elements. Learners should understand basic atomic structure, the difference between elements, compounds and mixtures, and have an understanding of the layout of the periodic table, the symbols for common elements and the trends associated with groups and periods in the table. Learners should also be able to perform calculations involving the mole, concentrations and volumes. The concepts of acidity and alkalinity should be taught, this should include strong, weak acids and bases.

In the organic chemistry section learners should be introduced to IUPAC nomenclature for alkanes, alkenes, alcohols, and carboxylic acids. The concept of isomers and homologous series should be introduced. The common reactions and tests for these compounds should also be taught.

**Outcome 2 — Perform practical experiments related to fundamental chemistry.**

Guidance on suitable practical experiments for assessment purposes is given elsewhere in this document. However, it is envisaged that learners will also participate in a range of other practical experiments which will both develop their laboratory skills and support the theory covered in Outcome 1.

In carrying out such activities, learners should follow Good Laboratory Practice (GLP) and carry out or be familiar with the risk and Control of Substances Hazardous to Health (COSHH) assessments on all procedures undertaken. Opportunities should be taken to develop awareness of the sources of experimental error and of the accuracy of measurements.

## National Unit support notes (cont)

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

### Guidance on approaches to delivery of this unit

There is no particular order in which Outcome 1 would be best delivered. However, it is suggested that Outcome 1 be delivered in the order as written as this would lend itself to a coherent approach. It is envisaged that laboratory work and demonstrations will feature across the delivery of Outcome 1, and that the assessed practical experiments for Outcome 2 will be undertaken in similar timeframe to the underpinning theory.

Outcome 1 could commence with coverage of atomic structure and chemical reactions relating to the differences between elements, compounds and mixtures. Simple demonstrations of chemical vs physical processes could be used to exemplify the concepts. This could lead onto an understanding of how different types of bonds are formed from which the determination of chemical formulae for simple compounds could be introduced followed by exercises in balancing of chemical equations. The periodic table could then be introduced through looking at the history of its development and the discovery of key elements. The properties of elements would lend itself both to learning via literature research exercises and to practical activities (eg on melting point, conductivity, reactivity). The concept of the mole and calculations involving it could then be introduced and reinforced using a range of tutorial based activities. The use of appropriate practical activities (eg making of standard solutions) could be used to further reinforce the concept.

The key concepts of acids and alkalis, including pH, neutralisation and strong and weak acids and bases, etc lend themselves particularly well to a blended approach to learning with theoretical aspects of delivery being underpinned and reinforced with practical activities (eg titrations, natural indicators, comparison of strong vs weak acids).

The subject of organic chemistry could be introduced by a discussion on the pre-eminence of carbon based chemicals and of them being the basis of life. The petroleum industry as the source of feed stocks could be reviewed, leading onto organic functional groups, homologous series and isomers. It is envisaged that model building activities could be used to further embed key understandings. The main reaction types of classes of organic compounds could be covered by tutorial exercises and also reinforced by practical activities (eg bromine water test).

It is envisaged that Outcome 2 will be delivered alongside the theoretical based Outcome 1. A range of practical experiments could be utilised to both support understanding of the underlying theory and to prepare learners for undertaking the assessed practical experiments. Aspects suitable for experimental investigation might include properties of elements, titrations, organic reactions, etc.

### Guidance on approaches to assessment of this unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

## National Unit support notes (cont)

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

Outcome 1 could be assessed by a single holistic closed-book assessment with an appropriate cut-off score. Assessment should be carried out in supervised conditions, and it is recommended that the assessment be completed within 90 minutes. The assessment could be worth 60 marks with the marks split 20 on organic chemistry and 40 on the remainder of the outcome. The questions set in the assessment should cover a representative sample of the topics covered in the support notes. Learners can only have access to the SQA Data Booklet for Higher and Advanced Higher Chemistry or any suitable replacement when sitting the assessment.

In Outcome 2 learners are required to undertake two assessed practical experiments, the content of which will be related to Outcome 1. Examples of suitable experiments are given below. However, this list is not prescriptive, and other practical experiments of similar complexity may be used by the centre.

Suitable practical experiments could include:

- ◆ making standard solutions
- ◆ titrations
- ◆ testing for simple organic compounds
- ◆ reactions of organic acids and alcohols
- ◆ effect of concentration on reaction rate
- ◆ effect of temperature on reaction rate
- ◆ simple distillation

Assessed practical experiments will usually be performed individually. However, there may be some experiments that are suitable to be undertaken in pairs or small groups. If this is the case then the assessor should ensure that all participants are actively involved and are able to adequately demonstrate the required skills.

An exemplar instrument of assessment with marking guidelines has been produced to indicate the national standard of achievement at SCQF level 6.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

## Opportunities for 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 social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

## National Unit support notes (cont)

**Unit title:** Fundamental Chemistry: An Introduction (SCQF level 6)

### Opportunities for developing Core and other essential skills

This unit has the *Critical Thinking* component of *Problem Solving* and the *Using Number* component of *Numeracy* embedded in it. This means that when learners achieve the unit, their Core Skills profile will also be updated to show they have achieved Critical Thinking at SCQF level 4 and Using Number at SCQF level 5.

The delivery and assessment of this unit will also provide learners with the opportunity to develop the Core Skills of *Problem Solving* at SCQF level 5, and *Information and Communication Technology (ICT)* at SCQF level 4.

#### ***Problem Solving* — Reviewing and Evaluating at SCQF level 5**

Following assessed practical experiments learners will be required to review and evaluate the effectiveness of the exercise with a thorough analysis of the sources of error. They will be required to reach sound conclusions on the basis of the data collected and the inherent errors.

#### ***Information and Communication Technology (ICT)* — Providing/Creating Information at SCQF level 4**

Learners will make effective and appropriate use of *ICT* packages to produce laboratory reports or pro formas in an appropriate format. Packages used will likely include word processing, spreadsheets, and specialist chemical structure software.

#### **Sustainability**

Sustainability can be embedded in delivery of the unit in a variety of ways. For example, by encouraging minimum usage, correct disposal procedures and possibly recycling (eg of solvents) during practical experiments.



## History of changes to unit

Version	Description of change	Date
03	The number of practical experiments for Outcome 2 reduced from three to two.  One of the experiments must be reported by production of a full laboratory report. The remaining experiment can be reported by production of a full laboratory report, completion of an appropriate pro forma, a laboratory diary entry or a checklist.	03/10/2018
02	Core Skills component Critical Thinking at SCQF level 4 and Using Number at SCQF level 5 embedded.	24/11/2017

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## General information for learners

### Unit title: Fundamental Chemistry: An Introduction (SCQF level 6)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

This is a 1 credit unit at SCQF level 6, which you are likely to be studying as part of the Foundation Apprenticeship in Scientific Technologies. This unit is designed to provide you with the underpinning theoretical and practical knowledge required for a basic understanding of chemistry.

On completion of this unit you should be able to:

- 1 Describe and use the basic chemical principles associated with atomic structure, chemical formulae, acids and bases, the periodic table, and organic chemistry.
- 2 Perform practical experiments related to fundamental chemistry.

#### Outcome 1

In this outcome you will be introduced to the periodic table, the simple structure of an atom and chemical bonding. This will give you the knowledge to work out chemical formula of compounds containing up to three elements. You will also learn how to write a balanced chemical equation from a written description.

You will learn about the concept of the mole and how it can be used in calculations, and you will study the concept of acidity and alkalinity.

You will also study some basic organic chemistry and learn how to name the compounds you are studying and how they react.

#### Outcome 2

In this outcome you will carry out a range of practical techniques which are related to the theory you will learn in Outcome 1.

#### Assessment

Outcome 1 you will take a closed-book, end of unit assessment.

Outcome 2 will be assessed after you have learned the necessary practical skills, and will take the form of two practical experiments, for which you will report your results either in full laboratory reports, completion of a pro forma report, a laboratory diary entry or a checklist.

#### Core Skills

This unit has the *Critical Thinking* component of *Problem Solving* and the *Using Number* component of *Numeracy* embedded in it. You may also have the opportunity to develop the Core Skills of *Problem Solving* at SCQF level 5, and *Information and Communication Technology (ICT)* at SCQF level 4.