SCQF level 5
Unit Specification

Chemistry in Society

SCQF: level 5 (6 SCQF credit points)

Unit code: J23D 75

Unit outline

The general aim of this Unit is to develop skills of scientific inquiry, investigation, analytical thinking and knowledge and understanding of chemistry in society. Learners will apply these skills when considering the applications of chemistry in society on our lives, as well as the implications on society/the environment. This can be done using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of metals, properties of plastics, fertilisers, nuclear chemistry and chemical analysis. Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Learners who complete this Unit will be able to:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Unit Support Notes*, which provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in *Unit Assessment Support*.

Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- National 4 Chemistry Course or relevant Units
- National 4 Science Course or relevant Units

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. For further information, please refer to the *Unit Support Notes.*

Standards

Outcomes and Assessment Standards

Outcome 1

The learner will:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment by:

1.1 Planning an experiment
1.2 Following procedures safely
1.3 Making and recording observations/measurements correctly
1.4 Presenting results in an appropriate format
1.5 Drawing valid conclusions
1.6 Evaluating experimental procedures

Outcome 2

The learner will:

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills by:

2.1 Making accurate statements
2.2 Solving problems

Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used. The key areas covered in this Unit are:

- **metals**
- **properties of plastics**
- **fertilisers**
- **nuclear chemistry**
- **chemical analysis**

Evidence can be drawn from a variety of sources and presented in a variety of formats. The table below describes the evidence for the Assessment Standards which require exemplification. Evidence may be presented for individual Outcomes, or gathered for the Unit. If the latter approach is used, it must be clear how the evidence covers each Outcome.

Assessment Standard	**National 5**
Planning an experiment	The plan should include: ♦ an aim ♦ a dependent and independent variable ♦ key variables to be kept constant ♦ measurements/observations to be made ♦ the resources ♦ the method including safety considerations
Presenting results in an appropriate format	One format from: table, line graph, chart, key, diagram, flow chart, summaries or other appropriate formats
Draw a valid conclusion	Include reference to the aim
Evaluating experimental procedures	Suggest an improvement with justification
Accurate statements	At least half of the statements should be correct across the key areas of this Unit.
Solving problems	One of each: ♦ make generalisation/predictions ♦ selecting information ♦ processing information including calculations as appropriate ♦ analyse information

Transfer of evidence

Evidence for the achievement of Outcome 1 and Assessment Standard 2.2 for this Unit can be used as evidence of the achievement of Outcome 1 and Assessment Standard 2.2 in the freestanding SCQF level 5 *Nature's Chemistry* and *Chemical Changes and Structure* Units.

Exemplification of assessment is provided in *Unit Assessment Support*. Advice and guidance on possible approaches to assessment is provided in the *Unit Support Notes.*

Assessment Standard Thresholds

Outcome 1:

Candidates are not required to show full mastery of the Assessment Standards to achieve Outcome 1. Instead, five out of the six Assessment Standards for Outcome 1 must be met to achieve a pass. There is still the requirement for candidates to be given the opportunity to meet all Assessment Standards. The above threshold is in place to reduce the volume of re-assessment where that is required.

Candidates have the opportunity to re-draft their original Outcome 1 report or to carry out a new experiment/practical investigation.

Outcome 2:

Assessment Standards 2.1 (making accurate statements) and 2.2 (solving problems) are not required to be passed independently. Assessment Standards 2.1 and 2.2 can be assessed by means of a single assessment for each Unit.

Outcome 2 assessment

Centres have two options when assessing Outcome 2 (AS 2.1 and 2.2).

Option 1: Single Assessment
Candidates are assessed by means of a single test that contains marks and a cut-off score. A suitable Unit assessment will cover all of the key areas (AS 2.1) and assess each of the problem solving skills (AS 2.2). Where a candidate achieves 50% or more of the total marks available in a single Unit assessment they will pass Outcome 2 for that Unit. Existing Unit assessment support packs can be used.

Option 2:
If this option is chosen, 50% or more of the KU statements (AS 2.1) made by candidates must be correct in the Unit assessment and at least one correct response for each problem solving skill (AS 2.2) is required to pass Outcome 2. However, if a candidate is given more than one opportunity in a Unit assessment to provide a response for a problem solving skill, then they must answer 50% or more correctly.

Centres can use the Unit assessment support packs from SQA's secure site or centre devised assessments.

Guidance on Outcome 2 (Option 1) Assessment

Unit assessment support pack 1 (Unit-by-Unit approach)
As these packages contain questions on all of the key areas (AS 2.1) and questions covering each of the problem solving skills (AS 2.2), Unit assessment support pack 1 is suitable for use as a single assessment for its associated Unit. The number of marks available for each question should be combined to give the total number of marks available. A cut-off score of 50% should be applied to each of these Unit assessments.

Unit assessment support pack 2 (combined approach)

As this package contains questions covering Assessment Standard 2.1 for each Unit and a set of questions assessing the problem solving skills, they may be suitable for use as a single assessment for their associated Units. If a centre wishes to use Unit assessment support pack 2 as a single Unit assessment, the existing problem solving questions could be used for one of the Units and different questions, covering each of the four problem solving skills, would need to be added to the tests for the other Units. A minimum of 1 mark per problem solving skill per unit would be acceptable.

These marks should be combined with the marks added to assess the problem solving skills (AS 2.2) before the 50% cut-off score is applied.

The problem solving questions included in package 2 would be allocated a total of 5 marks. As with the Unit-by-Unit approach, centres may wish to supplement the existing questions in the Unit assessment support packs with additional questions, so that the sampling of each Unit is increased, the tests are out of the same total mark and that total is an even number so that the cut-off is actually 50%. Where centres are adding additional questions, care should be taken that these questions are of an appropriate standard for Unit assessment and are not 'A grade' type questions that would appear in an exam.

Unit assessment support pack 3 (portfolio approach)
It is still acceptable for centres to use this method of assessment. Candidates should be given the opportunity to make accurate statements for all of the key areas of each Unit (AS 2.1). They must also be given opportunities throughout the session to answer questions on each of the four problem solving skills (AS 2.2). Evidence should be collected as candidates progress through the session. For Assessment Standard 2.1, candidates must achieve 50% or more of the total KU marks available for each Unit. For Assessment Standard 2.2, candidates must achieve 50% or more of the total marks available for all four problem solving skills.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

2 Numeracy

2.1 Number processes
2.2 Money, time and measurement
2.3 Information handling

4 Employability, enterprise and citizenship

4.6 Citizenship

5 Thinking skills

5.3 Applying
5.4 Analysing and evaluating

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work.* The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the *Unit Support Notes.*

Appendix: Unit support notes

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing this Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Specification*
- the *Unit Assessment Support packs*

Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Approaches to learning and teaching

Mandatory key areas	Exemplification of key areas
Metals Metallic bonding can be used to explain the conductivity of metals in terms of delocalised electrons.	
Balanced equations, involving ionic formulae, can be written to show the reaction of metals with water, oxygen and acids.	Candidates should be familiar with the reactivity series.
Redox including oxidation reactions, reduction reactions and redox reactions.	Define and identify the following types of reaction; oxidation, reduction and redox, given, for example a balanced chemical equation or an ion-electron equation.
Extraction of metals.	Changing metal ions to metal atoms is a reduction reaction that occurs during the extraction of metals. Balanced equations, involving ionic formulae, can be written to show extraction of metals. The reducing agent can be identified from a balanced equation for the extraction of a metal. Ion-electron equations, including those involving non-metals, can be:

Mandatory key areas	Exemplification of key areas
The percentage of a particular metal in an ore can be calculated from the formula. Write ion-electron equations, including those involving non-metals. The direction of electron flow can be determined for redox reactions including those occurring in electrochemical cells. Fuel cells and rechargeable batteries are two examples of technologies which utilise redox reactions.	♦ written for oxidation reactions ♦ written for reduction reactions ♦ combined to give equations for redox reactions ♦ written for electrochemical cells including those with a non-metal electrode Direction of electron flow in electrochemical cells includes those involving non-metal electrodes. **Specific details of fuel cells and rechargeable batteries are not required.**
Properties of plastics Plastics can be made by the processes of addition or condensation polymerisation.	Addition polymerisation – a chemical reaction in which a number of small unsaturated molecules join together to form a long chain molecule. No other product is formed. Condensation polymerisation – a chemical reaction in which a number of small molecules react together to form a long chain molecule by eliminating a small stable molecule. There are a number of small stable molecules that could be produced during condensation polymerisation eg water, hydrogen chloride etc

Mandatory key areas	Exemplification of key areas
Polythene is made by addition polymerisation and polyesters are made by condensation polymerisation The structure of a polymer can be drawn given either the structure of the monomer(s) or the repeating unit and vice versa. The type of polymer, addition or condensation, can be identified from the structure of the polymer.	
Fertilisers Candidates should be familiar with the use of fertilisers to provide the essential elements, nitrogen, phosphorus and potassium, for healthy plant growth The Haber process: to include the balanced equation and catalyst used. Ammonia is the starting material for the commercial production of nitric acid.	The Haber process is one of the most important reactions in the production of fertilisers and is an example of a reversible reaction. Ammonia is the starting material for the commercial production of nitric acid, which is used to produce fertilisers, eg ammonium nitrate. Candidates should know the starting materials and the end product for the commercial production of nitric acid. Details of the Ostwald process are not required.

Mandatory key areas	Exemplification of key areas
Percentage mass compositions of fertilisers from a formula.	
Nuclear chemistry Radioactive decay.	Radioactive elements can become more stable by giving out alpha, beta or gamma radiation.
Properties of alpha, beta and gamma radiation.	Properties of alpha, beta and gamma radiation including their mass, charge and ability to penetrate different materials.
Nuclear equations can be written to describe nuclear reactions.	Identify the type of radiation emitted, starting isotope or product of a nuclear reaction given relevant information.
Half-life of radioisotopes.	Half-life is the time for half of the nuclei of a particular isotope to decay. Half-life, for a particular isotope, is a constant so radioactive isotopes can be used to date materials.
Calculations involving half-life.	Calculations involving half-life including: ♦ Determining half-life from a graph ♦ finding the number of half-lives that have passed or the time that has passed ♦ finding the proportion of a radioactive sample that has decayed or remains
Uses of radioisotopes.	Uses of radioisotopes: ♦ in medicine ♦ in industry

Mandatory key areas	Exemplification of key areas
	♦ to date materials
Chemical analysis A variety of methods exist which enable chemists to monitor the environment both qualitatively and quantitatively, including: ♦ acid/base titration ♦ precipitation (the formation of an insoluble solid from two aqueous solutions) ♦ flame testing	Chemists play an important role in society by monitoring our environment to ensure that it remains healthy, safe and that pollution is tackled as it arises. Examples of monitoring methods include: ♦ acidity in water or soil can be tackled by addition of a suitable alkali or base such as lime (calcium oxide). Titration is used to identify the extent of acidic pollution and titration calculations to determine the quantity of neutraliser required ♦ precipitation can be used to identify substances present in water or soil, eg silver nitrate can be used to monitor pollution by halogens, barium chloride can be used to monitor sulfate pollution. ♦ Flame testing can be used to identify metals present in compounds that have polluted the environment. Use of the data booklet to identify the metal present or flame colour.

Combining assessment within Units

Assessment could be combined in this Unit by holistically assessing all the Outcomes of the Unit in a single assessment. When assessment within the Unit is holistic, teachers and lecturers should take particular care to track the evidence for each individual Outcome. Centres should adhere to the conditions of assessment, outlined within the unit assessment support packs available via SQA secure.

Re-assessment

SQA's guidance on re-assessment is that there should be one or, in exceptional circumstances, two re-assessment opportunities. Re-assessment should be carried out under the same conditions as the original assessment. It is at a centre's discretion as to how they re-assess their candidates. Candidates may be given a full re-assessment opportunity, or be re-assessed on individual key areas and/or problem solving skills. Regardless of which option is chosen, candidates must achieve 50% or more of each re-assessment opportunity.

Administrative information

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Superclass: RD

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
1.1	Assessment standard thresholds added Unit support notes added	Qualifications Manager	September 2018
2.0	Unit code updated	Qualifications Manager	July 2019