Higher
Course Assessment
Specification

Higher Chemistry Course Assessment Specification (C713 76)

Valid from August 2014

This edition: April 2015, version 3.0

Please refer to the note of changes at the end of this Course Assessment Specification for details of changes from previous version (where applicable).

Course outline

Course title: Higher Chemistry

SCQF level: 6 (24 SCQF credit points)

Course code: C713 76

Course assessment code: X713 76

The purpose of the Course Assessment Specification is to ensure consistent and transparent assessment year on year. It describes the structure of the Course assessment and the mandatory skills, knowledge and understanding that will be assessed.

Course assessment structure

Component 1 — question paper	100 marks
Component 2 — assignment	20 marks
Total marks	**120 marks**

This Course includes six SCQF credit points to allow additional time for preparation for Course assessment. The Course assessment covers the added value of the Course.

Equality and inclusion

This Course Assessment Specification has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled learners and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: www.sqa.org.uk/sqa/14977.html.

Guidance on inclusive approaches to delivery and assessment of this Course is provided in the *Course Support Notes*.

Assessment

To gain the award of the Course, the learner must pass all of the Units as well as the Course assessment. Course assessment will provide the basis for grading attainment in the Course award.

Course assessment

SQA will produce and give instructions for the production and conduct of Course assessments based on the information provided in this document.

Added value

The purpose of the Course assessment is to assess added value of the Course as well as confirming attainment in the Course and providing a grade. The added value for the Course will address the key purposes and aims of the Course, as defined in the Course rationale. It will do this by addressing one or more of breadth, challenge, or application.

In this Course assessment, added value will focus on the following:

- breadth — drawing on knowledge and skills from across the Course
- challenge — requiring greater depth or extension of knowledge and/or skills
- application — requiring application of knowledge and/or skills in practical or theoretical contexts as appropriate

This added value consists of:

- a question paper, which requires learners to demonstrate aspects of breadth, challenge and application; learners will apply breadth and depth of skills, knowledge and understanding from across the Course to answer questions in chemistry
- an assignment, which requires learners to demonstrate aspects of challenge and application; learners will apply skills of scientific inquiry, using related knowledge, to carry out a meaningful and appropriately challenging task in chemistry and communicate findings

Grading

Course assessment will provide the basis for grading attainment in the Course award.

The Course assessment is graded A–D. The grade is determined on the basis of the total mark for all Course assessments together.

A learner's overall grade will be determined by their performance across the Course assessment.

Grade description for C
For the award of Grade C, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated successful performance in relation to the mandatory skills, knowledge and understanding for the Course.

Grade description for A
For the award of Grade A, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated a consistently high level of performance in relation to the mandatory skills, knowledge and understanding for the Course.

In addition, learners achieving a Grade A will have demonstrated a high overall level of performance by:

- retaining knowledge and understanding over a long period of time
- showing a deeper level of knowledge and understanding
- integrating and applying skills, knowledge and understanding across the four component Units of the Course
- displaying problem solving skills in less familiar and more complex contexts
- applying skills of scientific inquiry and analytical thinking in complex contexts that involve more complex data

Credit
To take account of the extended range of learning and teaching approaches, remediation, consolidation of learning and integration needed for preparation for external assessment, six SCQF credit points are available in Courses at National 5 and Higher, and eight SCQF credit points in Courses at Advanced Higher. These points will be awarded when a grade D or better is achieved.

Structure and coverage of the Course assessment

The Course assessment will consist of two Components: a question paper and an assignment. The question paper will have two Sections. The assignment will have one Section.

Component 1 — question paper
The purpose of the question paper is to assess breadth and depth of knowledge and understanding from across the Units.

The paper will assess scientific inquiry skills, analytical thinking skills and the impact of applications on society and the environment.

The question paper will give learners an opportunity to demonstrate the following skills, knowledge and understanding by:

- demonstrating knowledge and understanding of chemistry by making statements, describing information, providing explanations and integrating knowledge
- applying chemistry knowledge to new situations, analysing information and solving problems
- planning and designing experiments/practical investigations to test given hypotheses or to illustrate particular effects including safety measures
- selecting information and presenting information appropriately in a variety of forms
- processing information (using calculations and units, where appropriate)
- making predictions and generalisations from evidence/information
- drawing valid conclusions and giving explanations supported by evidence/justification
- evaluating experiments/practical investigations and suggesting improvements

The mandatory skills and knowledge are specified in the 'Further mandatory information on Course coverage' section at the end of this Course Assessment Specification.

The question paper will have 100 marks

The question paper will have two Sections.

Section 1 (Objective Test) will have 20 marks.

Section 2 will contain restricted and extended response questions and will have 80 marks.

Marks will be distributed approximately proportionately across the Units.

The majority of the marks will be awarded for applying knowledge and understanding. The other marks will be awarded for applying scientific inquiry, scientific analytical thinking and problem solving skills.

A data booklet containing relevant data and formulae will be provided.

Component 2 — assignment
This assignment requires learners to apply skills, knowledge and understanding to investigate a relevant topic in chemistry. The topic should draw on one or more of the key areas of the Course, and should be chosen with guidance from the assessor.

The assignment will assess the application of skills of scientific inquiry and related chemistry knowledge and understanding.

The assignment will give learners an opportunity to demonstrate the following skills, knowledge and understanding by:

- applying chemistry knowledge to new situations, analysing information and solving problems
- selecting information and presenting information appropriately in a variety of forms
- processing the information (using calculations and units, where appropriate)
- drawing valid conclusions and giving explanations supported by evidence/justification
- communicating findings/information effectively

The assignment will have 20 marks out of a total of 120 marks.

The majority of the marks will be awarded for applying scientific inquiry and analytical thinking skills. The other marks will be awarded for applying knowledge and understanding related to the topic chosen.

The assignment offers challenge by requiring skills, knowledge and understanding to be applied in a context that is one or more of the following:

- unfamiliar
- familiar but investigated in greater depth
- integrates a number of familiar contexts

This assignment has two stages:

- a research stage
- a communication stage

In the course of their assignment, learners are required to:

- choose a relevant topic in chemistry (the assessor must review the appropriateness of the topic chosen)
- state appropriate aim(s)
- research the topic by selecting relevant data/information
- risk assessment of procedure
- process and present relevant data/information
- analyse data/information
- state conclusions
- evaluate their investigation
- explain the underlying chemistry of the topic researched
- present the findings of the research in a report

Setting, conducting and marking of assessment

Question paper

This question paper will be set and marked by SQA, and conducted in centres under conditions specified for external examinations by SQA. Learners will complete this in 2 hours and 30 minutes.

Controlled assessment — assignment

This assignment is:

- set by centres within SQA guidelines
- conducted under a high degree of supervision and control

Evidence will be submitted to SQA for external marking.

All marking will be quality assured by SQA.

Setting the assessment

Set by centres within SQA guidelines.

Conducting the assessment

The **research** stage will be conducted under some supervision and control.

The **communication** stage will be conducted under a high degree of supervision.

SQA will provide Assignment General assessment information and Assignment Assessment task documents. SQA will specify the material to be taken into the communication stage of the assignment.

The production of the report will be carried out:

- in time to meet a submission date set by SQA
- independently by the learner

Further mandatory information on Course coverage

The following gives details of mandatory skills, knowledge and understanding for the Higher Chemistry Course. Course assessment will involve sampling the skills, knowledge and understanding. This list of skills, knowledge and understanding also provides the basis for the assessment of Units of the Course.

The following gives details of the skills:

- demonstrating knowledge and understanding of chemistry by making statements, describing information, providing explanations and integrating knowledge
- applying chemistry knowledge to new situations, analysing information and solving problems
- planning and designing experiments/practical investigations to test given hypotheses or to illustrate particular effects including safety measures
- carrying out experiments/practical investigation safely ,recording detailed observations and collecting data
- selecting information and presenting information appropriately in a variety of forms
- processing information (using calculations and units, where appropriate)
- making predictions and generalisations from evidence/information
- drawing valid conclusions and giving explanations supported by evidence/justification
- evaluating experiments/practical investigations and suggesting improvements
- communicating findings/information effectively

These skills will be assessed, across the Course, in the context of the mandatory knowledge. The following table provides further detail of the mandatory knowledge for the Higher Chemistry Course.

Chemical Changes and Structure
Controlling the rate Importance of controlling reaction rate. Collision theory can be used to explain the effects of concentration, pressure, surface area, temperature and collision geometry on reaction rates. Calculations involving relative rate. Reaction profiles can be shown using potential energy diagrams. Interpretation of and calculations from potential energy diagrams for both forward and reverse reactions. Enthalpy changes for exothermic and endothermic reactions. Activation energy and activated complexes. A catalyst provides an alternative reaction pathway with a lower activation energy. A potential energy diagram can be used to show the effect of a catalyst on activation energy. Temperature is a measure of the average kinetic energy of the particles of a substance. The activation energy is the minimum kinetic energy required by colliding particles before a reaction may occur. Energy distribution diagrams can be used to explain the effect of changing temperature on the kinetic energy of particles and reaction rate. **Periodicity** The first 20 elements in the Periodic Table are categorised according to bonding and structure. The trends in covalent radius across periods and down groups.

The trends in ionisation energies across periods and down groups.
The trends in electronegativity across periods and down groups.

Structure and bonding
Covalent bonding.
Polar covalent bonding.
The bonding continuum.
The larger the difference in electronegativities between bonded atoms, the more polar the bond will be.
The evidence for attractive forces between the molecules or discrete atoms.
Intermolecular forces acting between molecules are known as van der Waals' forces and there are several different types of these.
London dispersion forces are forces of attraction that can operate between all atoms and molecules.
The strength of London dispersion forces is related to the number of electrons within an atom or molecule.
A molecule is described as polar if it has a permanent dipole.
Permanent dipole-permanent dipole interactions are additional electrostatic forces of attraction between polar molecules.
Hydrogen bonding.
Physical properties can be rationalised in terms of the nature and strength of the intermolecular forces which exist between molecules.
Solubility of ionic compounds, polar molecules and non-polar molecules.

Nature's Chemistry

Esters, fats and oils
An ester can be identified from the ester group and by the name containing the '–yl–oate' endings.
Naming esters.
Structural formulae for esters.
Characteristics and uses of esters.
Making esters by condensation reactions.
Hydrolysis of esters.
Fats and oils are esters formed glycerol and three carboxylic acid molecules.
The melting points of fats and oils.
Oils can be converted to fats by hydrogenation.
The importance of fats and oils.

Proteins
Proteins are the major structural materials of animal tissue and are also involved in the maintenance and regulation of life processes.
The formation of proteins from amino acids.
The link which forms between two amino acids can be recognised as a peptide link (CONH) also known as an amide link.
Essential amino acids.
Enzyme hydrolysis of dietary proteins to produce amino acids.
Enzymes are proteins which act as biological catalysts.

Chemistry of cooking
Shapes of protein molecules.
Denaturing of proteins.
Many flavour and aroma molecules are aldehydes.
Aldehydes and ketones both contain the carbonyl functional group.

Aldehydes and ketones can be identified from the '-al' and '-one' name endings respectively.
Naming and formulae for straight-chain and branched-chain aldehydes and ketones, with no more than eight carbon atoms in their longest chain.
Isomers of straight and branch chain aldehydes and ketones.
Tests to differentiate between an aldehyde and a ketone.
Explain the influence of functional groups on physical properties.

Oxidation of food
Naming and formulae for branched-chain alcohols, with no more than eight carbon atoms in their longest chain.
Alcohols can be classified as primary, secondary or tertiary.
Structural formulae and names of isomeric alcohols.
Hydrogen bonding can be used to explain the properties of alcohols.
Structure and properties of diols and triols.
Oxidation of alcohols.
Naming and formulae for branched-chain carboxylic acids, with no more than eight carbon atoms in their longest chain.
Reactions of carboxylic acids.
Antioxidants in foods.
From an ion-electron equation recognise that a substance is acting as an antioxidant.

Soaps, detergents and emulsions
Production of soaps.
Structure of soap ions.
How soaps work.
How detergents work.
Detergents are particularly useful in hard water areas because they do not form scum.
An emulsion contains small droplets of one liquid dispersed in another liquid.
Structure and use of emulsifiers.

Fragrances
Essential oils are concentrated extracts from plants, and are mixtures of organic compounds.
Terpenes are key components in most essential oils.
Terpenes are unsaturated compounds formed by joining together isoprene (2-methylbuta-1,3-diene) units.

Skin care
The damaging effect of ultraviolet radiation (UV) in sunlight on skin and the action of sun-block.
Free radical formation, structure and chain reactions.
Free radical scavengers.

Chemistry in Society

Getting the most from reactants

The factors influencing industrial process design.
Environmental factors influencing industrial process design.
Balanced equations show the mole ratio(s) of reactants and products.
The molar volume is the same for all gases at the same temperature and pressure. Calculations involving molar volume.
Determination of quantities of reactants and/or products using balanced equations and moles.
The efficiency with which reactants are converted into the desired product is measured in terms of the percentage yield and atom economy.
Calculations involving percentage yield.
The atom economy measures the proportion of the total mass of all starting materials successfully converted into the desired product.
Calculations involving atom economy.
By considering a balanced equation, the limiting reactant and the reactant(s) in excess can be identified by calculation.
The need for an economic/environmental balance in industrial processes.

Equilibria

In a closed system, reversible reactions attain a state of dynamic equilibrium when the rates of forward and reverse reactions are equal.
Changes in concentration, pressure and temperature can alter the position of equilibrium.
A catalyst increases the rate of attainment of equilibrium but does not affect the position of equilibrium.
The effect of changing conditions can be explained using changes in rates of forward and reverse reactions and the position of the equilibrium.

Chemical energies

Chemical energy is also known as enthalpy.
Enthalpy calculations for industrial processes including the reasons they are necessary.
Calculate the enthalpy change for a reaction using $E_h = cm\Delta T$. The quantities c, m and ΔT can be calculated given relevant data.
Enthalpy of combustion.
Hess's law.
Calculation of enthalpy changes by application of Hess's law.
Molar bond enthalpy.
Mean molar bond enthalpy.
Enthalpy changes for gas phase reactions can be calculated using bond enthalpies.

Oxidising or reducing agents

Oxidising and reducing agents can be identified in redox reactions.
The strongest reducing agents are found in group 1 whilst the strongest oxidising agents come from group 7.
Compounds, group ions and molecules can also act as oxidising or reducing agents.
The electrochemical series can be used to indicate the effectiveness of oxidising

and reducing agents.
Oxidation and reduction reactions can be represented by ion-electron equations, including those involving molecules or group ions.
Ion-electron equations can be combined to produce redox equations.
Uses of oxidising agents.

Chemical analysis
In chromatography, differences in the polarity and/or size of molecules are exploited to separate the components present within a mixture.
Interpretation of the results of chromatography.
Volumetric analysis.
A solution of accurately known concentration is known as a standard solution.
Titrations including redox titrations.
The concentration of a substance can be calculated from experimental results by use of a balanced equation.

Researching Unit

Candidates should have knowledge of the following pieces of general laboratory apparatus:

- Conical flask
- Beaker
- Measuring cylinder
- Delivery tubes
- Dropper
- Test tubes/Boiling tubes
- Evaporating basin
- Pipette with safety filler
- Burette
- Volumetric flask
- Funnel
- Thermometer

Candidates should be familiar with the following techniques:

- Filtration
- Distillation
- Use of a balance
- Titration
- Methods for the collection of a gas: over water, using a gas syringe
- Safe Methods for heating: Bunsen burners, water baths or heating mantles

Administrative information

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History of changes to Course Assessment Specification

Course details	Version	Description of change	Authorised by	Date
	2.0	The number of marks awarded for the assignment has changed. The descriptions of the skills to be assessed have been rewritten to better explain what is required. Conducting the assessment: this has been rewritten to clarify how stages will be assessed. Suggested timings for each stage have been removed. The details of the skills to be assessed have been rewritten for clarity Further mandatory knowledge: these tables have been substantially revised to aid understanding	Qualifications Development Manager	April 2014
	3.0	Number of Components updated to four in 'Grade description for A' section. Significant changes to clarify mandatory knowledge — table revised in 'Further mandatory information on Course coverage' section.	Qualifications Manager	April 2015