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Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the National 5 Chemistry Course. They are intended for teachers and lecturers who are delivering the Course and its Units. They should be read in conjunction with the *Course Specification*, the *Course Assessment Specification* and the Unit Specifications for the Units in the Course.
General guidance on the Course

Aims

As stated in the Course Specification, the aims of the Course are to enable learners to:

♦ develop and apply knowledge and understanding of chemistry
♦ develop an understanding of chemistry’s role in scientific issues and relevant applications of chemistry, including the impact these could make in society and the environment
♦ develop scientific inquiry and investigative skills
♦ develop scientific analytical thinking skills in a chemistry context
♦ develop the use of technology, equipment and materials, safely, in practical scientific activities
♦ develop planning skills
♦ develop problem solving skills in a chemistry context
♦ use and understand scientific literacy, in everyday contexts, to communicate ideas and issues and to make scientifically informed choices
♦ develop the knowledge and skills for more advanced learning in chemistry
♦ develop skills of independent working

Progression into this Course

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

♦ National 4 Chemistry Course

There may also be progression from National 4 Biology, National 4 Environmental Science, National 4 Physics, and National 4 Science Courses.

Experiences and Outcomes

National Courses have been designed to draw on and build on the curriculum experiences and outcomes as appropriate. Qualifications developed for the senior phase of secondary education are benchmarked against SCQF levels. SCQF level 4 and the curriculum level 4 are broadly equivalent in terms of level of demand although qualifications at SCQF level 4 will be more specific to allow for more specialist study of subjects.

Learners who have completed relevant Curriculum for Excellence experiences and outcomes will find these an appropriate basis for doing the Course.

In this Course, learners would benefit from having experience of the following:
Organiser | Lines of development | SCN
---|---|---
Planet Earth | Biodiversity and interdependence | SCN 03, 04, 05
| Energy sources and sustainability | SCN 04
| Processes of the planet | SCN 05
| Space | SCN 06
Forces, Electricity and Waves | Electricity | SCN 10
Materials | Properties and uses of substances | SCN 15, SCN 16
| Earth’s materials | SCN 17
| Chemical changes | SCN 18, SCN 19

More detail is contained in the [Chemistry Progression Framework](#). The Chemistry Progression Framework shows the development of the key areas throughout the suite of Courses.

Note: teachers and lecturers should refer to the [Course Assessment Specification](#) for mandatory information about the skills, knowledge and understanding to be covered in this Course.

**Skills, knowledge and understanding covered in the Course**

Note: teachers and lecturers should refer to the [Course Assessment Specification](#) for mandatory information about the skills, knowledge and understanding to be covered in this Course.

**Progression from this Course**

This Course or its components may provide progression to:

- Higher Chemistry Course
- National 5 Course in another science subject
- Skills for Work Courses (SCQF levels 5 or 6)
- National Certificate Group Awards
- National Progression Awards (SCQF levels 5 or 6)
- Employment and/or training

**Hierarchies**

*Hierarchy* is the term used to describe Courses and Units which form a structured sequence involving two or more SCQF levels.
It is important that any content in a Course and/or Unit at one particular SCQF level is not repeated if a learner progresses to the next level of the hierarchy. The skills and knowledge should be able to be applied to new content and contexts to enrich the learning experience. This is for centres to manage.

- Chemistry Courses from National 3 to Advanced Higher are hierarchical
- Courses from National 3 to National 5 have Units with the same title
Approaches to learning and teaching

The purpose of this section is to provide advice and guidance on learning and teaching. It is essential that you are familiar with the mandatory information within the National 5 Chemistry Course Assessment Specification.

Teaching should involve an appropriate range of approaches to develop knowledge and understanding and skills for learning, life and work. This can be integrated into a related sequence of activities, centred on an idea, theme or application of chemistry, based on appropriate contexts, and need not be restricted to the Unit structure. Learning should be experiential, active, challenging and enjoyable, and include appropriate practical experiments/activities and could be learner-led. The use of a variety of active learning approaches is encouraged, including peer teaching and assessment, individual and group presentations, role-playing and game-based learning, with learner-generated questions.

When developing your Chemistry Course there should be opportunities for learners to take responsibility for their learning. Learning and teaching should build on learners' prior knowledge, skills and experiences. The Units and the concepts identified within them may be approached in any appropriate sequence, at the centre's discretion. The distribution of time between the various Units is a matter for professional judgement and is entirely at the discretion of the centre. Each Unit is likely to require an approximately equal time allocation, although this may depend on the learners' prior learning in the different key areas.

Learning and teaching, within a class, can be organised, in a flexible way, to allow a range of learners' needs to be met, including learners achieving at different levels. The hierarchical nature of the new Chemistry qualifications provides improved continuity between the levels. Centres can, therefore, organise learning and teaching strategies in ways appropriate for their learners.

Within a class, there may be learners capable of achieving at a higher level in some aspects of the Course. Where possible, they should be given the opportunity to do so. There may also be learners who are struggling to achieve in all aspects of the Course, and may only achieve at the lower level in some areas.

Teachers/lecturers need to consider the Course and Unit Specifications, and Course Assessment Specifications to identify the differences between Course levels. It may also be useful to refer to the Chemistry Progression Framework.

When delivering this Course to a group of learners, with some working towards different levels, it may be useful for teachers to identify activities covering common concepts and skills for all learners, and additional activities required for some learners. In some aspects of the Course, the difference between levels is defined in terms of a higher level of skill.

Learners should be given the opportunity to practise solving problems relating to the mole and balanced equations throughout the Course. By revisiting the mole and chemical equations at different points of the Course, learners consolidate earlier learning and may progressively develop a more in-depth and secure
understanding of the mole concept through applying their knowledge in different contexts.

The key areas which could be helpful to be covered before doing this Course are: atomic structure, elements and the periodic table, chemical equations, alkanes and alkenes, formation of acids, alkalis and salts, and the reactivity series.

An investigatory approach is encouraged in Chemistry, with learners actively involved in developing their skills, knowledge and understanding by investigating a range of relevant chemistry applications and issues. A holistic approach should be adopted to encourage simultaneous development of learners’ conceptual understanding and skills.

Where appropriate, investigative work/experiments, in Chemistry, should allow candidates the opportunity to select activities and/or carry out extended study. Investigative and experimental work is part of the scientific method of working and can fulfil a number of educational purposes.

All learning and teaching should offer opportunities for learners to work collaboratively. Practical activities and investigative work can offer opportunities for group work, which should be encouraged.

Group work approaches can be used within Units and across Courses where it is helpful to simulate real-life situations, share tasks and promote team working skills. However there must be clear evidence for each learner to show that the learner has met the required assessment standards for the Unit or Course.

Laboratory work should include the use of technology and equipment that reflects current scientific use in Chemistry. Appropriate risk assessment must be undertaken.

Learners should have the opportunity to become familiar with the apparatus, practical techniques and data analysis strategies indicated below. The list builds on the skills from the experience and outcomes and is not exhaustive.

| Learners would benefit from being familiar with the following apparatus, practical techniques and activities: |
| ♦ filtration |
| ♦ use of a balance |
| ♦ titration |
| ♦ preparation of a standard solution |
| ♦ methods for the collection and testing of gases |
| ♦ safe methods of heating |
| ♦ methods for following rates of reactions |
| ♦ salt preparation |
| ♦ electrical conductivity and cells |
| ♦ Determining \( E_{\text{th}} \) for fuels |
| ♦ Simple distillation |
| Learners should be able to process experimental results by: |
| ♦ draw diagrams of apparatus |
| ♦ using tables to present data |
| ♦ representing experimental data using a bar chart or line graph |
| ♦ sketching lines or curves of best fit |
| ♦ mole calculation for experiments |
| ♦ suggesting improvements with reasoning |
Learners would be expected to contribute their own time in addition to programmed learning time.

Effective partnership working can enhance the science experience. Where appropriate, locally relevant contexts should be studied, with visits if possible. Guest speakers from industry, further education and higher education could be used to bring the world of chemistry into the classroom.

Information and Communications Technology (ICT) makes a significant contribution to the Chemistry Course. In addition to the use of computers as a learning tool, computer animations can be used to demonstrate microscopic particles, reactions and processes. Computer interfacing equipment can detect and record small changes in variables allowing experimental results to be recorded over short or long periods of time. Results can also be displayed in real-time helping to improve understanding. Data logging equipment, cameras and video cameras can be set up to record data and make observations which can then be subsequently downloaded and viewed for analysis.

Learning about Scotland and Scottish culture will enrich the learners' learning experience and help them to develop the skills for learning, life and work they will need to prepare them for taking their place in a diverse, inclusive and participative Scotland and beyond. Where there are opportunities to contextualise approaches to learning and teaching to Scottish contexts, teachers and lecturers should consider this.

Assessment should be integral to, and improve, learning and teaching. The approach should involve learners and provide supportive feedback. Self- and peer-assessment techniques should be encouraged, wherever appropriate. Assessment information should be used to set learning targets and next steps.

Suggestions for possible contexts and learning activities to support and enrich learning and teaching are detailed in the table below.
The **Mandatory Course key areas** are from the *Course Assessment Specification*. **Suggested learning activities** are not mandatory. This offers examples of suggested activities, from which you could select a range. It is not expected that all will be covered. Centres may also devise their own learning activities. **Exemplification of key areas** provides an outline of the level of demand and detail of the key areas.

Risk assessment should always be carried out by teachers/lectures prior to doing any of the experiments and demonstrations listed in the table.

<table>
<thead>
<tr>
<th>Chemical Changes and Structure</th>
<th>Suggested learning activities</th>
<th>Exemplification of key areas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mandatory Course key areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rates of reaction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learners should be familiar with the factors affecting rates of reaction.</td>
<td>Various videos are available commercially from TWIG website in both the ‘Atoms and bonding’ and ‘Reactions’ sections.</td>
<td>Factors affecting rate of reaction that learners should be familiar with are; temperature, concentration, surface area and the presence of a catalyst.</td>
</tr>
<tr>
<td>Calculations of the average rate of a chemical reaction from data.</td>
<td>Learners can carry out a series of experiments that involve production of a gas, eg acid with metal carbonate or metal. Alternatively, an effervescent tablet can be added to water.</td>
<td>Calculations of the average rate of a chemical reaction from data eg a graph of the change in mass or volume against time, or a table of data or a passage containing relevant information.</td>
</tr>
<tr>
<td>Average rate of reaction to show the change in rate of reaction as a reaction progresses.</td>
<td>Learners can collect data manually or by using data-logging technology. The learners can construct graphs and calculate the average rate of reaction. Alternative variables such as colour and pH can be investigated where equipment is available.</td>
<td>Awareness of appropriate units eg cm³ s⁻¹ or g s⁻¹.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average rates of reaction over various time intervals during the reaction can be used to show that as a reaction progresses the rate of reaction decreases.</td>
</tr>
</tbody>
</table>
### Atomic structure and bonding related to properties of materials

<table>
<thead>
<tr>
<th>Learners should have knowledge of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ sub-atomic particles, their charge, mass and position within the atom</td>
</tr>
<tr>
<td>♦ the structure of the periodic table, groups, periods and atomic number</td>
</tr>
<tr>
<td>♦ the seven diatomic elements</td>
</tr>
</tbody>
</table>

#### Learners should have knowledge of:

<table>
<thead>
<tr>
<th>Learners should have knowledge of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ sub-atomic particles, the periodic table, and diatomic elements.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electron configuration for the first 20 elements in the periodic table.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various interactive periodic tables can be found online on the Royal Society of Chemistry website. They can be used to show the properties of elements that are not available.</td>
</tr>
<tr>
<td>A discussion of the noble gases’ lack of reactivity and possible reasons why — relating to outer electron number — can be used to introduce the Octet Rule of Thumb.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative atomic mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isotopes</td>
</tr>
<tr>
<td>Elements in the periodic table are arranged in order of increasing atomic number. Groups are columns in the periodic table containing elements with similar chemical properties, owing to their electron configuration.</td>
</tr>
<tr>
<td>Awareness of the electron configuration of the first 20 elements as shown on page 6 of the data booklet.</td>
</tr>
<tr>
<td>Isotopes are atoms with the same atomic number but different mass numbers. They can also be defined as having the same number of protons but different numbers of neutrons.</td>
</tr>
<tr>
<td>Relative atomic mass is the average mass of the isotopes present, taking into account their relative proportions.</td>
</tr>
<tr>
<td>Given data, identifying the most or least...</td>
</tr>
<tr>
<td>Formation of ions</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
</tbody>
</table>

Determining the number of sub-atomic particles in atoms and ions from nuclide notation. Write nuclide notation for both atoms and ions.

Ionic bonds are the electrostatic attraction between positive and negative ions.

Ionic compounds form lattice structures of oppositely charged ions.

Use of structure and bonding to explain the following physical properties of ionic compounds:

- melting point and boiling point
- solubility (water molecules surround ions)
- electrical conductivity

- abundant isotope or calculating relative atomic mass using a given formula.

When there is an imbalance in the number of protons and electrons the particle is known as an ion. Ions are formed by loss or gain of electrons which achieves a stable electron configuration.

Nuclide notation is used to show the numbers of sub-atomic particles in an atom or ion. Determine numbers of protons, neutrons and electrons from nuclide notation for both atoms and ions.

A lattice is a regular arrangement of ions where each positive ion is surrounded by negative ions and each negative ion is surrounded by positive ions.

Ionic compounds have high melting and boiling points because strong ionic bonds must be broken in order to break down the lattice. Dissolving also breaks down the lattice structure. Ionic compounds conduct electricity only when molten or in solution, due to the breakdown of the lattice resulting in the ions.
In a covalent bond, the shared pair of electrons is attracted to the nuclei of the two bonded atoms. Draw diagrams to show how outer electrons are shared to form the covalent bond(s) in a molecule.

Covalent substances can form either discrete molecular or giant network structures.

Shapes of simple two-element compounds.

Use of structure and bonding to explain the following physical properties of covalent compounds:

- melting point and boiling point
- solubility (covalent molecular substances dissolve in covalent solvents)
- electrical conductivity

Experimental procedures are required to confirm the type of bonding present in a substance.

Balloons can be used to demonstrate the shape of electron orbitals.

A wide variety of models can be made and used to demonstrate molecular shape.

Learners can engage in practical activities on electrical conductivity, melting point and boiling point to explore the effects of bonding.

being free to move.

More than one bond can be formed between atoms leading to double and triple covalent bonds.

Shapes should include linear, angular, trigonal pyramidal and tetrahedral.

Covalent molecular substances have low melting and boiling points as only weak forces of attraction between molecules are being broken. Giant covalent network structures have very high melting and boiling points because the network of strong covalent bonds must be broken. Measurement of melting point and boiling point can be used to indicate the type of bonding. Measurement of electrical conductivity can be used to confirm the type of bonding.
**Formulae and reaction quantities**
Write chemical and ionic formulae for compounds including those containing group ions.

Balanced equations, including state symbols.

Calculations to determine the gram formula mass, concentration, volume, mass of a substance and the number of moles present.

Learners could prepare standard solutions to reinforce use of calculations.

The chemical formula of a covalent molecular substance gives the number of atoms present in the molecule. The formula of a covalent network or ionic compound gives the simplest ratio of atoms/ions in the substance.

Calculations using the following formulae:

- \( n = \frac{CV}{m} \)
- \( n = \frac{GFM}{GFM} \)

includes calculating moles, masses, volumes and concentrations from given data using either one or both of these formulae.

The concentration of solutions in moles per litre (mol l\(^{-1}\)).
### Acids and bases
Learners should have knowledge of pH including the pH scale, acids and bases, neutralisation reactions and salt formation.

### Dissociation of water.
The pH is a measure of the hydrogen ion concentration.

<table>
<thead>
<tr>
<th><strong>Knowledge includes:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ names and formulae of acids and bases</td>
</tr>
<tr>
<td>♦ common household examples</td>
</tr>
<tr>
<td>♦ pH values</td>
</tr>
<tr>
<td>♦ definition of neutralisation</td>
</tr>
<tr>
<td>♦ examples of neutralisation reactions including those with metals, hydroxides, oxides and carbonates</td>
</tr>
<tr>
<td>♦ definition and recognition of a salt</td>
</tr>
<tr>
<td>♦ reactions that form salts</td>
</tr>
</tbody>
</table>

Learners can investigate the comparative conductivity of saline solution, tap water and distilled water. These measurements can be linked to ion concentration to develop an understanding of the dissociation of water molecules.

A very small proportion of water molecules will dissociate into an equal number of hydrogen and hydroxide ions.

A neutral solution has an equal concentration of hydrogen and hydroxide ions.

A solution with a greater concentration of hydrogen ions than hydroxide ions is an acid. When the reverse is true the solution is known as an alkali.

The effect of dilution of an acid or alkali on the:

- concentration of hydrogen/hydroxide ions
- pH
| The effect of dilution of an acid or alkali with water is related to the concentrations of hydrogen and hydroxide ions. | Learners can use sequential ten-fold dilution and full-scale pH indicator or a pH meter to study the effect of dilution on pH. | ♦ acidity/alkalinity
♦ conductivity |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The effect of adding soluble oxides to water.</td>
<td>Practical tasks could be carried out to demonstrate the formation of acids and alkalis from oxides.</td>
<td>When added to water, soluble metal oxides produce metal hydroxide solutions, which increases the hydroxide ion concentration. Soluble non-metal oxides increase the hydrogen ion concentration.</td>
</tr>
<tr>
<td>Neutralisation reactions</td>
<td>For these neutralisation reactions:</td>
<td>For these neutralisation reactions:</td>
</tr>
</tbody>
</table>
| Identifying the products and writing balanced equations for the reaction of acids with metals, oxides, hydroxides and carbonates. | ♦ identify spectator ions
♦ determine the reacting species by omission of spectator ions | ♦ identify spectator ions
♦ determine the reacting species by omission of spectator ions |
<p>| Titration as an analytical technique, including calculations. | Learners can carry out acid-base titrations to acquire skills of accurate measurement. Accurate and precise end-point detection should be emphasised. | Titration is an analytical technique used to determine the accurate volumes involved in chemical reactions such as neutralisation. An indicator is normally used to show the end-point of the reaction. Using data from concordant titres to calculate an average volume used and the concentration of a solution. Volumes within 0·2 cm³ are considered to be concordant at National 5. |</p>
<table>
<thead>
<tr>
<th>Nature’s Chemistry</th>
<th>Suggested learning activities</th>
<th>Exemplification of key areas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mandatory Course key areas</strong></td>
<td>rsc-oilstrike.org — RSC website Scholar animations (including naming animations) ChemSketch (can get 3D models of hydrocarbons) ChemSketch is available for schools free of charge</td>
<td>Hydrocarbon is a compound containing hydrogen and carbon only.</td>
</tr>
<tr>
<td>Learners should be familiar with systematic naming, molecular formulae and full structural formulae for straight chain alkanes and alkenes containing up to eight carbons. They should also be familiar with the term hydrocarbon</td>
<td></td>
<td>A homologous series is a family of compounds with the same general formula and similar chemical properties.</td>
</tr>
<tr>
<td><strong>Homologous series</strong></td>
<td>Hydration of alkenes: Website at practicalchemistry.org/experiments formulae identified and drawn.</td>
<td>The carbon to carbon bonds in saturated hydrocarbons are all single bonds.</td>
</tr>
<tr>
<td>Definition of a homologous series.</td>
<td></td>
<td>Unsaturated hydrocarbons contain at least one double or triple carbon to carbon bond.</td>
</tr>
<tr>
<td>General formulae and shortened structural formulae for alkanes and alkenes.</td>
<td></td>
<td>Alkenes undergo addition reactions with hydrogen that convert them into alkanes. Alkenes also undergo addition reactions with halogens. Balanced chemical equations and structures of reactants/products for addition reactions of alkenes. The test for unsaturation is addition of a few drops of bromine water which will quickly be</td>
</tr>
<tr>
<td>Alkanes are described as saturated.</td>
<td></td>
<td>colored.</td>
</tr>
<tr>
<td>Naming straight chain alkenes to show the position of the double bond.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alkenes are described as unsaturated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addition reactions of alkenes with hydrogen and halogens.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The test for unsaturation.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| The cycloalkane homologous series. | Decolourised  
The cycloalkane family is a homologous series of hydrocarbons and is identified from the name and the general formula.  

For branched chain alkanes, branched chain alkenes and cycloalkanes containing up to eight carbons in their longest chain:  
- structural formulae can be drawn from systematic names  
- molecular formulae can be written from systematic names  
- systematic names, including the position of any double bond, can be written from structural formulae .  

Structural formulae can be shortened or full.  
Identifying products and writing balanced equations for combustion of hydrocarbons.  
Isomers have the same molecular formula but different structural formulae. |
| Cycloalkanes, with no more than eight carbon atoms in their longest chain, can be named from their full structural formulae, shortened structural formulae and molecular formulae.  

Naming and formulae for branched chain alkanes, branched chain alkenes and cycloalkanes containing up to eight carbons in their longest chain. |
| Combustion reactions for hydrocarbons.  

Learners can investigate the structure of isomers by using molecular models. |
<p>| Definition of isomers. |</p>
<table>
<thead>
<tr>
<th>Isomers of alkanes, alkenes and cycloalkanes.</th>
<th>Names, full structural formulae, and shortened structural formulae for isomers of:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isomers have different physical properties.</td>
<td>♦ alkanes&lt;br&gt;♦ branched alkanes&lt;br&gt;♦ alkenes&lt;br&gt;♦ branched alkenes&lt;br&gt;♦ cycloalkanes.</td>
</tr>
<tr>
<td>Physical properties of the following homologous series: cycloalkanes, alkanes and alkenes containing up to eight carbons in their longest chain.</td>
<td>Isomers have different physical properties including melting point and boiling point.</td>
</tr>
<tr>
<td>Uses of cycloalkanes, branched chain alkanes and branched chain alkenes containing up to eight carbons in their longest chain.</td>
<td>Physical properties to include melting point and boiling point. Explaining trends in melting or boiling point in terms of intermolecular forces.</td>
</tr>
<tr>
<td></td>
<td>Uses of branched chain alkanes should include fuels and uses of branched chain alkenes should include making plastics.</td>
</tr>
</tbody>
</table>
**Everyday consumer products**

**Alcohols**
An alcohol is identified from the hydroxyl group, the –OH group and the ending ‘-ol’.

Naming and formulae for straight chain alcohols containing up to eight carbons in their longest chain.

| Explain the physical properties of alcohols in terms of the intermolecular forces of attraction. | A number of alcohols can be examined to establish common properties. The miscibility of alcohol in water and the pH of the resultant solutions could be tested. |
| Chemical properties of alcohols. | The flammability of meths in camping stoves can be demonstrated whilst methanol can be discussed as a fuel in drag racing and speedway. |
| Uses of alcohols as solvents and fuels. | Examine a number of products such as screen wipes, disinfectant wipes and hand gels which contain isopropyl alcohol (propan-2-ol). |

For straight chain alcohols (C1 to C8) determine the:
- systematic name from the structural formulae including the position of the hydroxyl group
- full structural formulae, shortened structural formulae and molecular formulae from the systematic name
- general formula

Physical properties of alcohols including melting point, boiling point and solubility in water. Explain these properties in terms of the intermolecular forces of attraction.

Chemical properties of alcohols to include that they are flammable and they react with carboxylic acids to form esters.

Alcohols are used as fuels as they are highly flammable, and burn with very clean flames.
<table>
<thead>
<tr>
<th><strong>Carboxylic acids</strong></th>
<th>Many carboxylic acids have unpleasant smells. (Great care must be taken in handling undiluted carboxylic acids as they are highly corrosive.) Many learners may describe their smell as ‘like vomit’. It can be worthwhile commenting on the accuracy of their description as vomit contains carboxylic acids known as ‘fatty acids’ released from fats and oils during digestion. Vinegar offers learners an introduction to carboxylic acids using a familiar example. To obtain a qualitative measure of the concentration of ethanoic acid in different vinegars. A marble chip is attached to the inside of the lids of a number of 35 mm film canisters using a small piece of reusable poster tack. Equal volumes of a variety of vinegars are poured into the film cans until they are one third full. The lids are placed onto the cans and the cans inverted at the same time. Ethanoic acid reacts with the marble liberating carbon dioxide gas which builds up until the lid seal breaks and the can shoots into the air like a rocket. The order in which the vinegar ‘rockets’ take off is a measure of the concentration of ethanoic acid in each.</th>
<th>For straight-chained carboxylic acids, C1 to C8, determine the: ♦ systematic name from the structural formulae ♦ full structural formulae, shortened structural formulae and molecular formulae from the systematic name. ♦ general formula Physical properties of carboxylic acids including melting point, boiling point and solubility in water. Explain these properties in terms of the intermolecular forces of attraction. Chemical properties of carboxylic acids to include ♦ pH ♦ Reactions with metals, oxides, hydroxides and carbonates ♦ reaction with alcohols to form esters Naming and structures of esters from their parent alcohol and acid is not required.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carboxylic acids can be identified by the carboxyl functional group, –COOH functional group, and the ‘-oic’ name ending.</td>
<td>Naming and formulae for straight chain carboxylic acids containing up to eight carbons in their longest chain.</td>
<td></td>
</tr>
</tbody>
</table>
| Vinegar and its uses. | The concentration of ethanoic acid in vinegars can be determined quantitatively by measuring the volume of carbon dioxide liberated when excess carbonate salt is added to vinegar. To demonstrate both the acidic nature of ethanoic acid and its use as a food preservative, pickled eggs can be produced by placing boiled eggs (still in their shells) into jars containing vinegar. The acid will dissolve the shell to leave a pickled egg in vinegar. Pickles (food preserved in vinegar) can be stored for a long time because the low pH prevents the growth of harmful bacteria and fungi. Esters can be quickly synthesised on a test-tube scale by learners. Learners work in pairs to synthesise different esters and identify their properties. Websites provide extensive lists of the esters found in fruit. A 'smelling' session is one way of reinforcing the use of the 'fruity' type of scent/flavour associated with esters. Foam-fruit-type sweets, pear drops and other fruit flavoured sweets often have distinctive ester scents. Examples of esters responsible for fruit smells include: | Vinegar is a solution of ethanoic acid. Vinegar is used in household cleaning products designed to remove lime scale (a build-up of insoluble carbonates on plumbing fixtures) and as a preservative in the food industry. |}

**Esters**

Esters can be identified by the, −COO− functional group in a structural formula and from the 'oate' name ending.

An ester can be made by reacting a carboxylic acid and an alcohol.

**Uses of esters.**

|  |  | Naming and structures of esters from their parent alcohol and acid is not required. | Uses of esters including food flavouring, industrial solvents, fragrances and materials. |
| Energy from fuels | 3-methyl-1-butyl ethanoate = banana  
methyl butanoate = apple  
propyl ethanoate = pear  
Learners could research the uses of esters. | The flammability of meths in camping stoves can be demonstrated whilst methanol can be discussed as a fuel in drag racing and speedway.  
When a substance is combusted the reaction can be represented using a balanced equation. |
|---|---|---|
| Combustion reactions are exothermic reactions. The opposite of this is an endothermic reaction. | A demonstration of the flammability of alcohol is provided by the ‘whoosh bottle’ demonstration. A mixture of alcohol and air in a large polycarbonate bottle is ignited. The resulting rapid combustion reaction, often accompanied by a dramatic ‘whoosh’ sound and flames, demonstrates the large amount of chemical energy released in the combustion of alcohols.  
Equally, the ‘alcohol gun’ experiment or the ‘flaming pumpkin’ could be demonstrated.  
Risk assessments should be carried out before doing any of these experiments. A more mysterious element can be introduced with the ‘non-burning £5 note’ experiment.  
The heat energy released when alcohol burn can be measured.  
Different fuels provide different quantities of energy and this can be determined experimentally and calculated using  
\[ E_h = cm\Delta T \]  
(There is no requirement to calculate enthalpy per mole.)  
Awareness of appropriate units eg kJ or kJ kg\(^{-1}\)°C\(^{-1}\), etc.  
Candidates can be asked to determine specific heat capacity for substances other than water.  
These calculations can be based on any balanced equation eg displacement, combustion, oxidation, reduction, etc. | Energy from fuels can be determined experimentally and calculated using  
\[ E_h = cm\Delta T \]  
The quantities \( c, m \) and \( \Delta T \) can be calculated given relevant data. |
<table>
<thead>
<tr>
<th><strong>National 5 — Chemistry in Society</strong></th>
<th><strong>Suggested learning activities</strong></th>
<th><strong>Exemplification of key areas</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mandatory Course key areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Metals</strong></td>
<td>Internet search 'metallic bonding'. This will provide numerous websites to illustrate the bonding and what happens when a voltage is applied to a metal.</td>
<td>Candidates should be familiar with the reactivity series.</td>
</tr>
<tr>
<td>Metallic bonding can be used to explain the conductivity of metals in terms of delocalised electrons.</td>
<td>This should provide many short video clips covering various chemical reactions including those involving metals.</td>
<td>Define and identify the following types of reaction; oxidation, reduction and redox, given, for example a balanced chemical equation or an ion-electron equation.</td>
</tr>
<tr>
<td>Balanced equations, involving ionic formulae, can be written to show the reaction of metals with water, oxygen and acids.</td>
<td>The following internet site should provide details of various experiments to reduce metal compounds - Internet search: 'rsc.org/Education Learn Chemistry'</td>
<td>Changing metal ions to metal atoms is a reduction reaction that occurs during the extraction of metals.</td>
</tr>
<tr>
<td>Redox including oxidation reactions, reduction reactions and redox reactions.</td>
<td>Carryout electrolysis of molten lead bromide Internet search: 'bbc.co.uk learning zone clips secondary chemistry'</td>
<td>Balanced equations, involving ionic formulae, can be written to show extraction of metals.</td>
</tr>
<tr>
<td>Extraction of metals.</td>
<td>Aluminium extraction — Internet search: ♦ ‘rsc.org/Education Alchemy’ ♦ Iron and steel - Internet search: ‘rsc.org/Education Alchemy’ ♦ ‘bbc.co.uk learning zone clips secondary chemistry’</td>
<td>The reducing agent can be identified from a balanced equation for the extraction of a metal.</td>
</tr>
</tbody>
</table>
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. | Internet search ‘Stem Central’ this should bring up a website with resources and video clips related to fuel cells and a whole lot more. Make a lead/acid cell to demonstrate a rechargeable battery. | Ion-electron equations, including those involving non-metals, can be:
- 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

**Properties of plastics**
Plastics can be made by the processes of addition or condensation polymerisation.

| Polymers
Identifying polymers — Internet search: ‘rsc.org/Education/polymer’
For addition polymers: Identify monomer, polymer, repeating unit and naming polymers. | 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. |
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.

Novel materials could be investigated for the following properties eg: conductivity, solubility, colour changing, water absorption. Smart materials.

There are a number of small stable molecules that could be produced during condensation polymerisation eg water, hydrogen chloride etc.

Ammonia and or nitric acid — Internet search:

- `rsc.org/Education Alchemy`

Could discuss the history of the Haber process and Fritz Haber himself.

Produce ammonia via heating an ammonium salt and a solid base such as soda lime and

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
| Percentage mass compositions of fertilisers from a formula. | testing pH via damp litmus paper.  
Ammonia fountain experiment | used to produce fertilisers, e.g., 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. |
| Nuclear chemistry  
Radioactive decay. | Find out about the uses of radioisotopes.  
Find out about the benefits and problems associated with radioisotopes, e.g., carbon dating.  
Analyse such information in terms of the nature of the radiation emitted and its consequent properties, the intensity of the radiation emitted and the half-life of the radioisotope(s) present.  
Internet search for: ‘Institute of Physics teaching radioactivity’. | Radioactive elements can become more stable by giving out alpha, beta or gamma radiation.  
Properties of alpha, beta and gamma radiation including their mass, charge and ability to penetrate different materials.  
Identify the type of radiation emitted, starting isotope or product of a nuclear reaction given relevant information.  
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 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
| Uses of radioisotopes. | Internet search for: ‘uses of isotope ratios’ These are used extensively in analysis across science disciplines. | sample that has decayed or remains

Uses of radioisotopes:
- in medicine
- in industry
- to date materials

| Chemical analysis | Water analysis, soil analysis. These could be modified with various salts if necessary. Chemical ion tests with silver nitrate for halide ions or carrying out other precipitation reactions to determine other ions. | 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.

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
Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad, generic skills as an integral part of their learning experience. The Course Specification lists the skills for learning, skills for life and skills for work that learners should develop through this Course. These are based on SQA’s Skills Framework: Skills for Learning, Skills for Life and Skills for Work and must be built into the Course where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Course.

For this Course, it is expected that the following skills for learning, skills for life and skills for work will be significantly developed:

Numeracy
This is the ability to use numbers in order to solve problems by counting, doing calculations, measuring, and understanding graphs and charts. This is also the ability to understand the results. Learners will have opportunities to extract, process and interpret information presented in various formats including tabular and graphical. Practical work will provide opportunities to develop time and measurement skills.

<table>
<thead>
<tr>
<th>2.1 Number processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number processes means solving problems arising in everyday life.</td>
</tr>
<tr>
<td>Learners have the opportunity to develop numeracy skills by carrying out and understanding calculations when working out formulae, balanced equations, mole calculations, chemical energy calculations and percentages in composition of ores and chemicals.</td>
</tr>
<tr>
<td>Learners should deal with data and results from experiments/investigations and everyday class work, making informed decisions based on the results of these calculations and understanding these results.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.2 Money, time and measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using time and measurement in practical work during rates of reaction, titrations chemical energy and chemical cells practicals.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.3 Information handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners will experience information handling opportunities when dealing with data in tables, charts and other graphical displays to draw sensible conclusions throughout the Course. It involves interpreting the data and considering its reliability in making reasoned deductions and informed decisions.</td>
</tr>
</tbody>
</table>

Thinking skills
This is the ability to develop the cognitive skills of remembering and identifying, understanding, and applying. The Course will allow learners to develop skills of applying, analysing and evaluating. Learners can analyse and evaluate practical work and data by reviewing the process, identifying issues and forming valid conclusions. They can demonstrate understanding and application of concepts and explain and interpret information and data.
### 5.3 Applying
Learners should be given opportunities to plan experiments throughout the Course and to use existing information to solve problems in different contexts.

### 5.4 Analysing and evaluating
During practical work, learners should be given the opportunity to identify and review the experimental procedure and to identify improvements. Learners will use their judgement when drawing conclusions from experiments.

Analysis is the ability to solve problems in chemistry and make decisions that are based on available information. It may involve the review and evaluation of relevant information and/or prior knowledge to provide an explanation.

It may build on selecting and/or processing information, so is a higher skill.

In addition, learners will also have opportunities to develop literacy skills, creating, working with others and citizenship.

#### Literacy
Learners develop the skills to effectively communicate key chemical concepts and to clearly describe chemical issues in various media forms. Learners will have opportunities to communicate knowledge and understanding with an emphasis on applications and environmental and/or social impacts. Learners will have opportunities to develop listening and reading skills when gathering and processing information.

#### Working with Others
Learning activities provide many opportunities in all areas of the Course for learners to work with others. Practical activities and investigations offer opportunities for group work, which is an important aspect of science and should be encouraged.

#### Creating
Learners can demonstrate creativity through learning in Chemistry. In particular, when planning and designing experiments/investigations, learners have the opportunity to be innovative in their approach. They also have opportunities to make, write, say or do something new.

#### Citizenship
This Course has an extensive range of practical activities which provide many opportunities for learners to work co-operatively with others.

Learners will develop citizenship skills when considering the applications of chemistry on society and/or the environmental.
Approaches to assessment

Assessment should cover the mandatory skills, knowledge and understanding of the Course. Assessment is integral to improve learning and teaching. The approach should involve learners and provide supportive feedback. Self- and peer-assessment techniques should be used whenever appropriate.

See the Unit Support Notes for guidance on approaches to assessment of the Units of the Course.

Added value
Courses from National 4 to Advanced Higher include assessment of added value. At National 5, the added value will be assessed in the Course assessment.

Information given in the Course Specification and the Course Assessment Specification about the assessment of added value is mandatory.

Some investigations are listed below which are likely to be familiar to assessor. Centres are free to select other appropriate investigations.

<table>
<thead>
<tr>
<th>Key area</th>
<th>Topic</th>
<th>Investigation</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Properties of plastics Everyday Consumer products Atomic structure and bonding related to properties of materials</td>
<td>Polymers</td>
<td>Absorbency of hydrogels: in nappies (or hair gel). Supported using the RSC materials from above. Uses of hydrogels in soils: for water retention, and other uses. Uses of hydrogels in medicine</td>
<td>Look at the effect of salt in hydrogels (RSC materials) Measure rate of water absorbency in hydrogels. Relative absorbance of other liquids, eg alcohols, vegetable oil. Weight loss against time of hydrogels in different hair gels. Look at water absorbency of hydrogel with different concentrations of fertilisers, or with different fertilisers.</td>
</tr>
<tr>
<td>Conduction polymers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atomic structure and bonding related to properties of materials</td>
<td>Materials used in sport</td>
<td>Materials used in cycling Blades used by athletes Newly developed materials</td>
<td>RSC website learn chemistry sport</td>
</tr>
<tr>
<td>Energy Changes Fuels Everyday Consumer products Metals</td>
<td>Chemistry and Energy</td>
<td>New developments in battery technology New developments in fuel cell technology</td>
<td></td>
</tr>
<tr>
<td>Atomic structure and bonding related to properties of materials</td>
<td>Ice</td>
<td>What is different about the de-icers used for aircraft? How do they keep the Forth Road Bridge free of ice?</td>
<td>Choice of de-icer</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>-----</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
</tbody>
</table>

A resource pack has been developed for one of these investigations and can be found in Appendix 2. This is not mandatory and centres are free to develop their own investigations.

**Preparation for Course assessment**

Each Course has additional time which may be used at the discretion of the teacher or lecturer to enable learners to prepare for Course assessment. This time may be used near the start of the Course and at various points throughout the Course for consolidation and support. It may also be used for preparation for Unit assessment, and towards the end of the Course, for further integration, revision and preparation and/or gathering evidence for Course assessment.

During delivery of the Course, opportunities should be found:

- for identification of particular aspects of work requiring reinforcement and support
- to practise skills of scientific inquiry and investigation in preparation for the Assignment
- to practise question paper techniques

**Open Ended Questions**

In an open ended question, the candidate is required to draw on his/her understanding of key chemical principles in order to solve a problem or challenge. The 'open-ended' nature of these questions is such that there is no unique correct answer. In addition to testing the extent of a student's chemical insight, these questions promote and reward creativity and analytical thinking. The less prescriptive marking instructions focus on rewarding students for their understanding of chemistry.

Open-ended questions give candidates the opportunity to demonstrate their understanding of underpinning chemical concepts and their ability to apply these ideas creatively in unfamiliar contexts. These questions are signposted for candidates by the use of the phrase, 'using your knowledge of chemistry' printed in bold text within the question stem. As there is no one answer candidates could draw on a number of ways of answering the question, ie they could:

- Describe an aspect of chemistry
- Explain the underlying chemistry principles
- Explain the chemistry relationship(s) in a given scenario or context
- Outline the evidence that supports a chemical reaction
Manipulate chemistry information/data provided in a question to fit a situation or context
Identify variables, which may be known, unknown or require an estimation to be made, and solve a chemistry problem.
Evaluate/analyse the process/outcome of a chemistry investigation, experiment or other such work

**Combining assessment across Units**

If an integrated approach to Course delivery is chosen then there may be opportunities for combining assessment across Units. If this approach is used then it is necessary to be able to track evidence for individual Outcomes and Assessment Standards.

Transfer for evidence: Outcome 1 in a Unit may be used as evidence of the achievement of Outcome 1 in other Units of this Course.

**Exemplification**

Assessment Standards can be achieved using one or more pieces of evidence covering work done on different occasions.

Assessors should record evidence of achievement of Outcomes and Assessment Standards. The recording evidence table on the next page shows one way of recording evidence. This table is not mandatory.

This candidate has passed all six Assessment Standards for Outcome 1.

**Combustion**

<table>
<thead>
<tr>
<th>Assessment Standard</th>
<th>Evidence required</th>
<th>Evidence produced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Planning an experiment/practical investigation</td>
<td>Aim of experiment</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Dependent and independent variable</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Key variables to be kept constant</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Measurements/observations to be made</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Equipment/materials</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Method including safety</td>
<td>✓</td>
</tr>
<tr>
<td>1.2 Following procedures safely</td>
<td>Procedures have been followed safely.</td>
<td>Goggles worn at all times. The steps in the method were followed in the correct order. Handled apparatus and chemicals safely</td>
</tr>
<tr>
<td>1.3 Making and recording observations/measurements correctly</td>
<td>Observations/measurements taken are recorded correctly and repeated where appropriate. Correct SI units or standard abbreviations where appropriate.</td>
<td>✓</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1.4 Presenting results in an appropriate format</td>
<td>Results have been processed and presented in an appropriate format. Averages have been calculated for repeated measurements. Correct SI units or standard abbreviations where appropriate.</td>
<td>✓</td>
</tr>
<tr>
<td>1.5 Drawing valid conclusions</td>
<td>What the experiment shows, with reference to the aim.</td>
<td>Conclusion correct for the results</td>
</tr>
<tr>
<td>1.6 Evaluating experimental procedures</td>
<td>Procedure correctly evaluated with supporting justification or one improvement suggested with a valid justification.</td>
<td>✓</td>
</tr>
</tbody>
</table>
Candidate 1
For 1.5 The conclusion is correct for the candidate’s results.

Combustion

Aim: The aim of the experiment is to see how changing the number of carbons in an alcohol affects the enthalpy produced per gram of fuel.

1. (a) The independent variable in this experiment is the number of carbons in the chain, and the dependent variable is temperature change.

1. (b) Method: The equipment below was set up as shown making sure that the distance of the wick from the copper pot was 20mm and the volume of water used was 50cm³ and measured using a measuring cylinder.

1. (c) [Diagram of equipment]

1. (e) • The burner filled with methanol is weighed
• The initial temperature of the water is taken
• The burner cap is removed and the burner placed under the copper pot
• The burner is immediately lit and the
11(a)

- The thermometer used to stir the water
- The burner is recapped when the thermometer reads about 20°C higher than the original temperature
- The thermometer is kept in the water and the highest temperature reached is noted.
- The burner is reweighed.
- The experiment is repeated with a fresh volume of water and making sure the copper pot is cooled back to room temperature.
- The whole process is repeated using the different alcohols (methanol, ethanol, and propanol).

11(b)

- It is important to ensure that only burners that were lit had their caps off as unlit one could allow the alcohol in them to evaporate affecting the mass recorded and possibly making a "vapour trail" that could ignite.
### Candidate 1 (contd)

#### Results

**Experiment 1**

<table>
<thead>
<tr>
<th>Alcohol</th>
<th>Methanol</th>
<th>Ethanol</th>
<th>Propanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of C in chain</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mass at start (g)</td>
<td>2.296</td>
<td>2.247</td>
<td>2.068</td>
</tr>
<tr>
<td>Mass at end (g)</td>
<td>2.290</td>
<td>2.237</td>
<td>2.060</td>
</tr>
<tr>
<td>Change in mass (g)</td>
<td>0.6</td>
<td>1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Water temp at start (°C)</td>
<td>21</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Water temp at end (°C)</td>
<td>45</td>
<td>46</td>
<td>44</td>
</tr>
<tr>
<td>Change in temp (°C)</td>
<td>24</td>
<td>27</td>
<td>26</td>
</tr>
<tr>
<td>Enthalpy per gram (kJ g⁻¹)</td>
<td>8.36</td>
<td>5.64</td>
<td>9.75</td>
</tr>
</tbody>
</table>

**Experiment 2**

<table>
<thead>
<tr>
<th>Alcohol</th>
<th>Methanol</th>
<th>Ethanol</th>
<th>Propanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of C in chain</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mass at start (g)</td>
<td>2.290</td>
<td>2.237</td>
<td>2.054</td>
</tr>
<tr>
<td>Mass at end (g)</td>
<td>2.285</td>
<td>2.227</td>
<td>2.080</td>
</tr>
<tr>
<td>Change in mass (g)</td>
<td>0.5</td>
<td>1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>Water temp at start (°C)</td>
<td>18</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>Water temp at end (°C)</td>
<td>43</td>
<td>59</td>
<td>41</td>
</tr>
<tr>
<td>Change in temp (°C)</td>
<td>25</td>
<td>35</td>
<td>26</td>
</tr>
<tr>
<td>Enthalpy per gram (kJ g⁻¹)</td>
<td>10.45</td>
<td>7.38</td>
<td>9.06</td>
</tr>
</tbody>
</table>

1.3

1.4

**The enthalpy was calculated using**

\[ E = -cm\Delta T \]

- \( c = \text{specific heat capacity of water} = 4.18 \, \text{J kg}^{-1} \, \text{°C}^{-1} \)
- \( m = \text{mass of water} = 50 \, \text{cm}^3 = 0.05 \, \text{kg} \)
Example of a calculation

\[ E = c \Delta T \]
\[ = 4.18 \times 0.05 \times 25 = 5.225 \text{kJ} \]
\[ 0.5 \text{g} \rightarrow 5.225 \text{kJ} \]
\[ 1 \text{g} \rightarrow 1 \times 5.225 = 10.45 \text{kJ g}^{-1} \]

Conclusion. As the number of carbon atoms in the alcohol increases the enthalpy per gram does not change.

**Evaluation**
The experimental result for ethanol seems lower than the other two alcohols. This may be because it seemed to burn with a larger flame and a smokier flame. It might have been better to use the same burner and wick for each alcohol but this would mean drying out wick and burner before putting in new alcohol. It would also improve the experiment to repeat it another two times with each alcohol to get a more reliable result. The experiment could also be improved by increasing the number of alcohols used.
Equality and inclusion
The following should been taken into consideration:

<table>
<thead>
<tr>
<th>Situation</th>
<th>Reasonable Adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrying out practical activities</td>
<td>Use could be made of practical helpers if learners with physical disabilities, especially manual dexterity, need assistance to carry out practical techniques. Practical helpers may also assist learners who have visual impairment and have difficulty in distinguishing colour changes or other visual information.</td>
</tr>
<tr>
<td>Reading, writing and presenting text, symbolic representation, tables, graphs and diagrams</td>
<td>Use could be made of ICT, enlarged text, paper and/or print colour and/or practical helpers for learners with visual impairment, specific learning difficulties and physical disabilities.</td>
</tr>
<tr>
<td>Process information using calculations</td>
<td>Use could be made of practical helpers for learners with specific cognitive difficulties (e.g. dyscalculia).</td>
</tr>
<tr>
<td>Draw a valid conclusion, giving explanations and making generalisation/predictions</td>
<td>Use could be made of practical helpers for learners with specific cognitive difficulties or autism.</td>
</tr>
</tbody>
</table>

As far as possible, reasonable adjustments should be made for the Question Paper and/or Assignment, where necessary. All current adjustments currently available for the Question Paper would be available for Component 1. Learners will have a choice of Assignment topic for Component 2 for which reasonable adjustments can be made. This includes the use of ‘practical helpers’, readers, scribes, adapted equipment or assistive technologies.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Course Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Course.

It is important that centres are aware of and understand SQA’s assessment arrangements for disabled learners, and those with additional support needs, when making requests for adjustments to published assessment arrangements. Centres will find more guidance on this in the series of publications on Assessment Arrangements on SQA’s website: [www.sqa.org.uk/sqa/14977.html](http://www.sqa.org.uk/sqa/14977.html).
Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications are available on SQA’s website at: www.sqa.org.uk/sqa/14977.html.
- Building the Curriculum 3: A framework for Learning and Teaching
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- Science: A portrait of current practice in Scottish Schools (2008)
- SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work
- Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool
Appendix 2: Support pack

Resource pack: Hydrogels

This pack provides support and background information for the Coursework assessment of the Course. It should be used in conjunction with the N5 Chemistry Assignment General Assessment Information published on SQA’s website and the N5 Chemistry Assignment Assessment Task published on SQA’s secure website.

The support pack contains a list of suggested investigative practical work related to the theme of ‘polymers’/‘hydrogels’. **This is not a mandatory topic.**

It is at the discretion of the centre how these resources are deployed but many schools are likely to organise the learners into groups for investigative work, issuing a different brief with each group.

SQA would like to thank SERCC for their help and support in the production of this document.

The following key areas are supported by this pack:

**Atomic structure and bonding related to properties of materials**
- Physical properties of chemicals explained through bonding

**Everyday consumer products**
- Functional groups in alcohols, carboxylic acids

**Properties of plastics**
- Addition and condensation polymerisation including polythene and polyesters
- Representation of the structure of monomers and polymers, natural polymers
Hydrogels

In this assessment, the learners will be asked to research/investigate the uses and/or properties of hydrogels. Hydrogels are presently used in many products available in High Street shops for medical, horticultural and cosmetic uses (search ‘hydrogel’ or ‘aqua gel’ on the internet.) They are also used to make artificial snow for special effects in films and TV (search ‘snowbusiness’).

Hydrogels are a group of polymeric materials where the major constituent is water. They can be made from variety of substances, as described in the Wikipedia extract (search ‘hydrogels’).

Should you choose to give the option of practical work, an instruction sheet must be given. The practical work is not assessed and the data collected will count as one of the reference sources. The following practicals may be used unaltered or by adapting them to suit individual centre needs. Centres may also replace them with suitable alternatives of a similar standard.

Starter materials

Many are available, here are a few.

- There was also a demo of using the hydrogel from a nappy for snow making in the Christmas 2012 episode of QI.
- Search 'weirdsciencekids<http://weirdsciencekids.com/OilspillexperimentPolymer>
- http://weirdsciencekids.com/OilspillexperimentPolymer.html> OilspillexperimentPolymer”: hydrogel experiment for clearing up oil spills.
- Search — ‘Weirdsciencekids and watergel’: absorbency of hydrogel.

Useful search terms

- Hydrogel — Wikipedia has a full article on this.
- Aquagel.
- Snowbusiness – a company specialising in snow effects for TV and film.
- Weirdsciencekids – website aimed at pupil level.
- Newspaper report: ScienceDaily (Mar. 5, 2012) — University of California, San Diego bioengineers have developed a self-healing hydrogel that binds in seconds, as easily as Velcro, and forms a bond strong enough to withstand repeated stretching. The material has numerous potential applications, including medical sutures, targeted drug delivery, industrial sealants and self-healing plastics, a team of UC San Diego Jacobs School of Engineering researchers reported March 5 in the online Early Edition of the Proceedings of the National Academy of Sciences. Visited July 2012.
- RSC, New TalkChemistry and LearnChemistry
A few examples of possible investigations are given below. The list is not exhaustive and other areas may be investigated.

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Research</th>
<th>Experimental activities</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbency of hydrogels: in nappies (or hair gel).</td>
<td>Investigate the benefits of using hydrogel rather than traditional liners in nappies. Nappies can be recycled. Research why this is important. Research the properties of hydrogels in relation to their structure and bonding.</td>
<td>Look at the effect of salt in hydrogels (RSC materials) Measure rate of water absorbency in hydrogels. Relative absorbance of other liquids e.g. alcohols, vegetable oil Weight loss against time of hydrogels in different hair gels.</td>
<td>These investigations can be used to enhance the teaching of ionic and covalent bonding, or hydrogels can be considered as an interesting polymer as well as an example of a smart material. Hydrogels are smart materials because they change shape when there is a change in their environment – in this case it is the change in the concentration of ions. Students need to have some knowledge and understanding of ionic and covalent bonding, reversible reactions, and acids and bases to understand what is happening.</td>
</tr>
<tr>
<td>Uses of hydrogels in soils: for water retention, and other uses.</td>
<td>Can hydrogels be used to absorb nutrient-enriched water?</td>
<td>Look at water absorbency of a hydrogel with different concentrations of fertilisers, or with different fertilisers.</td>
<td></td>
</tr>
<tr>
<td>Uses of hydrogels in medicine for water retention, and other uses.</td>
<td>Research the use of hydrogels in any medical area, e.g. contact lenses, burns dressings, wound closures.</td>
<td>Look at water absorbency of hydrogel with different dressings</td>
<td></td>
</tr>
</tbody>
</table>
Practical investigations

The following experimental activities (and other support) are available on the RSC, New TalkChemistry and LearnChemistry websites.

To open the following PDF files, right click on the PDF icon, choose Acrobat Document Object then Open.

♦ Experiments with hydrogels — hair gel and disposable nappies
  
  ![PDF](Hydrogel nappy)

♦ Experiments with a smart material — hydrogels
  
  ![PDF](Hydrogels 1)

♦ Hydrogels — how they work
  
  ![PDF](Hydrogels 1a)

♦ Drug delivery and smart materials
  
  ![PDF](hydrogels 1b)

♦ Experiments with hydrogels — plant water storage crystals
  
  ![PDF](hydrogels water store)

♦ Green plastics
  
  ![PDF](RSC Green polymers)
Before chemists start planning experimental work, they will always check to find out what is already known about a topic by reviewing the current literature.

The web allows you to access a huge amount of information.

Make sure that you remain focused as you carry out your research. It is very easy to get side-tracked. Keep reminding yourself what you are trying to find out as you research.

Interesting, but not relevant, sites can be visited later. Sites that seem to be promising can be bookmarked so that they can be returned to later.

Tables, graphs and pictures can be copied into a folder. It is likely that some will be used and some will not.

It is worthwhile spending a few moments considering what keywords may best be entered into your search engine.

The web contains many sites with reliable information — but inevitably some data is unreliable. How can we know what is reliable? As a general rule, information that is not attributed to a source is likely to be unreliable. Professional and government sites are useful, however other online sources may be less reliable. Often it is quite easy to access the same data from a number of sites. This doesn’t guarantee the reliability of the information, but it does help.
Appendix 3: Copyright acknowledgements

Page 39: copyright shutterstock

Pink orchid flower ID: 26281333
Administrative information

Published: May 2015 (version 2.0)

History of changes to Course Support Notes

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<td>Qualifications Development Manager</td>
<td>June 2013</td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>Extensive changes in the tables showing key areas and learning activities. ‘Mandatory Course key areas’ column has been populated using material from the ‘exemplification of key areas’ column to give more detail. In some areas, detail has been added to increase clarity. Examples of natural polymers has been removed from the mandatory course key areas. Additional information included about open ended questions in the ‘Preparation for Course assessment section’.</td>
<td>Qualifications Manager</td>
<td>May 2015</td>
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Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).
Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the National 5 Chemistry: Chemical Changes and Structure Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

♦ the Unit Specification
♦ the Course Specification
♦ the Course Assessment Specification
♦ the Course Support Notes
♦ appropriate assessment support materials
General guidance on the Unit

Aims
The general aim of this Unit is to develop skills of scientific inquiry, investigation, analytical thinking and knowledge and understanding of chemical changes and structure.

Learners will apply these skills when considering the applications of chemical changes and structure on our lives, as well as the implications on society and/or the environment. This can be done using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of:

✦ Rates of reaction
✦ Atomic structure and bonding related to properties of materials
✦ Formulae and reaction quantities
✦ Acids and bases

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit
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 the following or equivalent qualifications and/or experience:

✦ National 4 Chemistry Course

There may also be progression from National 4 Biology, National 4 Environmental Science, National 4 Physics, and National 4 Science Courses.

Skills, knowledge and understanding covered in this Unit
Information about skills, knowledge and understanding is given in the Chemistry National 5 Course Support Notes.

If this Unit is being delivered on a free-standing basis, teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Progression from this Unit
This Unit may provide progression to:

✦ Other qualifications in Chemistry eg Higher
✦ Further study, employment and/or training
Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are covered in the Course Support Notes.

Bonding and calculations based on the mole and chemical equations are central to chemistry and are visited in Chemical Changes and Structure, Nature's Chemistry, and Chemistry in Society.

Throughout the Unit, learners should be given the opportunity to practise solving problems relating to the mole and balanced equations. Through applying their knowledge in different contexts, learners will consolidate their learning.

Safety is integral to all practical work and learners should be encouraged to see risk assessment as a natural part of the planning process for any practical activity. Whilst candidates would not be expected to produce a full written risk assessment themselves, Outcome 1 provides an opportunity to assess risks and take informed decisions regarding the use of appropriate control measures during the planning stage of the practical experiment or investigation.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant Course Support Notes.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice on approaches to assessment for the Unit. There will be other documents produced for centres to provide exemplification of assessments and guidance on how to write them.

Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Assessments must be valid, reliable and fit for purpose for the subject and level, and should fit in with learning and teaching approaches.

Unit assessment should support learning and teaching and, where possible, enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching.
The table below gives guidance and advice on possible approaches to assessment and gathering evidence.

### Strategies for gathering evidence

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<td>Approaches to assessment might cover the whole Unit or be combined across Outcomes. A holistic approach can enrich the assessment process for the learner by bringing together different Outcomes and/or Assessment Standards. If a holistic approach is used, then it is necessary to be able to track individual Assessment Standard evidence.</td>
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<td>Strategies for gathering evidence and ensuring that a learner’s work is their own, could include:</td>
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<td>Evidence can be gathered from classwork, experiment, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods which could include a test of knowledge, understanding and skills.</td>
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Equality and inclusion

The *Course Support Notes* provide full information on equality and inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment, to take account of the specific needs of learners, can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approaches to assessment will, in fact, generate the necessary evidence of achievement.
Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications are available on SQA’s website at: www.sqa.org.uk/sqa//14977.html.
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Administrative information

Published: June 2013 (version 1.1)
Superclass: RD

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Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Chemistry: Nature’s Chemistry (National 5) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

♦ the Unit Specification
♦ the Course Specification
♦ the Course Assessment Specification
♦ the Course Support Notes
♦ appropriate assessment support materials
General guidance on the Unit

Aims
The general aim of this Unit is to develop skills of scientific inquiry, investigation, analytical thinking and knowledge and understanding of nature’s chemistry.

Learners will apply these skills when considering the applications of nature’s chemistry on our lives, as well as the implications on society and/or the environment. This can be done using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of:

♦ Homologous series
♦ Everyday consumer products
♦ Energy of fuels

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit
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 the following or equivalent qualifications and/or experience:

♦ National 4 Chemistry Course

There may also be progression from National 4 Biology, National 4 Environmental Science, National 4 Physics, and National 4 Science Courses.

Skills, knowledge and understanding covered in this Unit
Information about skills, knowledge and understanding is given in the National 5 Chemistry Course Support Notes.

If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the mandatory skills and key areas in ways which are most appropriate for delivery in their centres.

Progression from this Unit
This Unit may provide progression to:

♦ Other qualifications in Chemistry eg Higher
♦ Further study, employment and/or training
Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are covered in the Course Support Notes.

Bonding and calculations based on the mole and chemical equations are central to chemistry and are visited in Chemical Changes and Structure, Nature's Chemistry and Chemistry in Society.

Learners should be given the opportunity to practise solving problems relating to the mole and balanced equations throughout the Unit. Through applying their knowledge in different contexts, learners will consolidate their learning.

Safety is integral to all practical work and learners should be encouraged to see risk assessment as a natural part of the planning process for any practical activity. Whilst candidates would not be expected to produce a full written risk assessment themselves, Outcome 1 provides an opportunity to assess risks and take informed decisions regarding the use of appropriate control measures during the planning stage of the practical experiment or investigation.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant Course Support Notes.

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Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

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Unit assessment should support learning and teaching and, where possible, enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

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Alternative approaches to Unit assessment, to take account of the specific needs of learners, can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approaches to assessment will, in fact, generate the necessary evidence of achievement.
Appendix 1: Reference documents

The following reference documents will provide useful information and background.

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Introduction

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♦ the Unit Specification
♦ the Course Specification
♦ the Course Assessment Specification
♦ the Course Support Notes
♦ appropriate assessment support materials
General guidance on the Unit

Aims

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 and/or 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
- Chemical analysis

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit

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 the following or equivalent qualifications and/or experience:

- National 4 Chemistry Course

There may also be progression from National 4 Biology, National 4 Environmental Science, National 4 Physics, and National 4 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 5 Chemistry Course Support Notes.

If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the mandatory skills and key areas in ways which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- Other qualifications in Chemistry eg Higher
- Further study, employment and/or training
Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are covered in the Course Support Notes.

Bonding and calculations based on the mole and chemical equations are central to chemistry and are visited in Chemical Changes and Structure, Nature's Chemistry and Chemistry in Society.

Learners should be given the opportunity to practise solving problems relating to the mole and balanced equations throughout the Course. Through applying their knowledge in different contexts, learners will consolidate their learning.

Learning through applications highlights the relevance of chemistry for the learner.

The following gives ideas for themes for teaching which could link the key areas in this Unit and other Units.

♦ The Car
  — What will the car be made of?
  — How will it be powered?

♦ Mission to Mars
  — Many of Earth’s resources are being depleted and scientists need to find new ways to produce materials. Could a mission to Mars help?

Safety is integral to all practical work and learners should be encouraged to see risk assessment as a natural part of the planning process for any practical activity. Whilst candidates would not be expected to produce a full written risk assessment themselves, Outcome 1 provides an opportunity to assess risks and take informed decisions regarding the use of appropriate control measures during the planning stage of the practical experiment or investigation.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant Course Support Notes.

Approaches on assessment and gathering evidence

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There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching. The table that follows gives guidance and advice on possible approaches to assessment and gathering evidence.
**Strategies for gathering evidence**

There may be opportunities in the day-to-day delivery of the Units in a Course to observe learners providing evidence, which satisfies completely, or partially, a Unit or Units. This is naturally occurring evidence and can be recorded as evidence for an Outcome or parts of an Outcome. In some cases, additional evidence may also be required to supplement and confirm the naturally occurring evidence.

Approaches to assessment might cover the whole Unit or be combined across Outcomes. A holistic approach can enrich the assessment process for the learner by bringing together different Outcomes and/or Assessment Standards. If a holistic approach is used, then it is necessary to be able to track individual Assessment Standard evidence.

Strategies for gathering evidence and ensuring that a learner’s work is their own, could include:

- personal interviews during which the teacher or lecturer can ask additional questions about completed work
- oral presentations on their work
- written reports
- checklists to record authenticity
- supplementary sources of evidence, such as witness testimony, film or audio clips

Evidence can be gathered from classwork, experiment, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods which could include a test of knowledge, understanding and skills.
Equality and inclusion

The Course Support Notes provide full information on equality and inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these Unit Support Notes is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment, to take account of the specific needs of learners, can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approaches to assessment will, in fact, generate the necessary evidence of achievement.
Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications are available on SQA’s website at: www.sqa.org.uk/sqa//14977.html.
- Building the Curriculum 3: A framework for Learning and Teaching
- Building the Curriculum 4: Skills for learning, skills for life and skills for work
- Building the Curriculum 5: A framework for assessment
- Course Specifications
- Design Principles for National Courses
- Guide to Assessment (June 2008)
- Overview of Qualification Reports
- Principles and practice papers for the sciences curriculum areas
- Science: A portrait of current practice in Scottish Schools (2008)
- SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work
- Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool
Administrative information

Published: June 2013 (version 1.1)
Superclass: RD

History of changes to Unit Support Notes

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<td></td>
<td>1.1</td>
<td>Exemplar materials and resource pack added.</td>
<td>Qualifications Development Manager</td>
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