Course Support Notes

National 4 Chemistry Course Support Notes

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

Contents

Introduction

These support notes are not mandatory. They provide advice on approaches to delivering and assessing the National 4 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 *Added Value Unit Specification* and the *Unit Specifications* for the Standard 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 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 problem solving skills in a chemistry context
- use and understand scientific literacy, in everyday contexts, to communicate ideas and issues
- develop the knowledge and skills for more advanced learning in chemistry

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 3 Chemistry Course

There may also be progression from National 3 Biology, National 3 Environmental Science, National 3 Physics, and National 3 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:

Organisers	**Lines of development**	
Planet Earth	Biodiversity and Interdependence	SCN 03
	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.

Skills, knowledge and understanding covered in this Course

Note: teachers and lecturers should refer to the *Added Value Unit 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 for the learner to:

- National 5 Chemistry Course
- National 4 or 5 Course in another science subject
- Skills for Work Courses (SCQF levels 4 or 5)
- National Certificate Group Awards
- National Progression Awards (SCQF levels 4 or 5)
- 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 Chemistry Added Value Unit.

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, 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.

Bonding 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 balanced equations throughout the Course. By revisiting chemical equations at different points of the Course, learners consolidate earlier learning and may progressively develop a more in-depth and secure understanding through applying their knowledge in different contexts.

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 should allow learners 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. 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. Appropriate risk assessment must be undertaken.

Learners should also 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:	Learners should be able to process experimental results by:
♦ filtration ♦ evaporation ♦ use of a balance ♦ measuring pH ♦ tests for starch sugars and unsaturation ♦ methods for the collection and testing of gases ♦ safe methods of heating ♦ methods for following rates of reactions ♦ salt preparation ♦ electrical conductivity and cells ♦ simple distillation ♦ flame testing ♦ drawing diagrams of apparatus	♦ using tables to present data ♦ representing experimental data using a bar or line graph ♦ sketching lines or curves of best fit ♦ calculation of averages (means) for experiments ♦ suggesting improvements

Learners would be expected to contribute their own time in addition to programmed learning time.

Effective partnership working can enhance the science experience. Where possible, locally relevant contexts should be studied, with visits where this is 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 **key areas** are from the Added Value Unit 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. The contexts for key areas are open to personalisation and choice, so centres are likely to 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/lecturers prior to doing any of the experiments and demonstrations listed in the table.

Chemical Changes and Structure		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
Rates of reaction Factors affecting rate of reaction	Learners will carry out a series of experiments that involve production of a gas, for example acid with metal carbonate or metal. Alternatively, an effervescent tablet can be added to water.	A working knowledge of the factors affecting rates of reaction including temperature, concentration, surface area/particle size and the presence of a catalyst
Monitoring reactions in terms of rate of reaction	Learners can collect data manually or by using data-logging technology.	To compare rates of chemical reactions, changes in mass, volume and other quantities can be measured. Graphs can then be drawn to help this comparison.
Interpreting rate of reaction graphs	Learners can be given a pre-drawn graph and asked to add lines to it to show differences in the rate and the end-point of a reaction when conditions have been changed.	Change in mass, volume etc vs time graphs can be interpreted in terms of: ♦ rate (qualitative only) ♦ end-point of a reaction ♦ quantity of product ♦ quantity of reactant used ♦ effect of changing conditions (qualitative only)

Atomic structure and bonding related to properties of materials Learners should be familiar with the structure of the periodic table.		Learners should have a working knowledge of the structure of the periodic table in terms of groups and periods.
Elements		All matter is made of atoms. When a substance contains only one kind of atom it is known as an element.
Structure of the atom Atomic number Mass Number Why atoms are neutral	Learners can be introduced to the three subatomic particles in a variety of ways. Learners can take part in an activity to 'build an atom'. Using small beads/sweets or even their classmates, they can build a model of the positions of the particles in an atom. It may be useful to show the electrons in shells as a simple target diagram. Simple card sorts can be used for the sub-atomic particles and the elements, allowing the learners to generate their own general rules from the patterns that they observe. The learners can produce lists of similarities and differences in the cards. Interactive alternatives are available online from the University of Colorado, Education — the build-an-atom simulation and K Science — atom animation. The idea of mass and charge can be discussed allowing learners to link the properties of the three particles to the mass number and charge.	Atoms contain protons, neutrons and electrons each with a specific charge, mass and position within the atom. The mass of an electron is negligible. The number of protons defines an element and is known as the atomic number. The mass number of an atom is the number of protons plus neutrons. Atoms do not have an electric charge and are said to be neutral.

Structure of the periodic table		Elements are arranged in the periodic table in order of increasing atomic number. Elements in the group have similar chemical properties.
Classifying elements as metals and non-metals		The position of metals and non-metals in the periodic table.
Compounds and how they are named	Learners can carry out simple chemical reactions that form two-element compounds (eg magnesium + oxygen, hydrogen and oxygen, and burning iron filings). They could be shown some reactions more suited to teacher demonstration (aluminium + iodine and the combustion of iron wool — details available at the Royal Society of Chemistry's Practical Chemistry website).	Compounds are substances formed when atoms of two or more elements join together. The name of a compound is derived from the names of the elements from which it is formed with a suffix of -ide, -ite, or -ate.
Chemical formulae	Learners learn to write formulae from named compounds and chemical equations from word equations. Learners can then practise this through card sorts and games.	The ratio in which elements combine to form two element compounds can be determined using valency rules and hence a formula can be written. The chemical formula can also be determined from names with prefixes, models or structures.
Calculation of formula mass	Learners will explore the link between the formula mass and the mass of the individual atoms within it. Small beads, sweets or learners themselves can be used to demonstrate this principle as can the animation available from Sunflower Learning.	From the formula of a substance, its formula mass can be calculated using the Relative Formula Mass of the elements.

Word equations and chemical equations including state symbols		A chemical reaction which can be described using word equations can also be described using chemical symbol equations. Use of state symbols in equations.
The two types of compound, covalent and ionic, in terms of their elements, sharing/transfer of electrons and their structure		There are two types of compound. Covalent compounds form when non-metal atoms form covalent bonds by sharing their outer electrons. Covalent compounds exist as molecules. Ionic compounds form when metal atoms join to non-metal atoms by transferring electron(s) from the metal to the non-metal. The resulting charged particles are called ions and an ionic bond is the attraction of the oppositely charged ions.
Properties of covalent and ionic compounds including, melting point, boiling point, state at room temperature and conductivity.	Learners will test the electrical conductivity of various compounds as solids, liquids, gases and solutions. Teachers can demonstrate the electrical conductivity of molten and solid wax and lead bromide.	Covalent compounds, made of molecules, have low melting and boiling points. As a result, they can be found in any state at room temperature. Ionic compounds have high melting and boiling points. As a result, they are found in the solid state at room temperature. Only ionic compounds can conduct electricity, they can only do this when molten or in solution.
Determining the type of bonding present in a compound.		To be sure of the bonding present in a substance the conductivity must be tested.

Energy changes of chemical reactions Exothermic and endothermic reactions	Explore examples of exothermic reaction which could include combustion and neutralisation. Reactions of metals in water or acid. Adding water to anhydrous copper sulphate. Explore examples of endothermic reactions which could include solubility of ammonium nitrate and reaction of barium hydroxide with ammonium nitrate. RSC has resources available to investigate handwarmers and the exothermic/endothermic changes involved.	Reactions can be defined as exothermic or endothermic depending on the overall energy change that takes place. Reactions that give out heat/energy are exothermic and those that take in heat/energy are endothermic

Acids and bases		Learners should be familiar with: ♦ pH ♦ acids and bases in ♦ neutralisation reactions ♦ salt formation
pH of oxides	Learners could investigate the effect on pH of various oxides to establish a pattern. A description of one such investigation is given at the Royal Society of Chemistry's Practical Chemistry website.	The pH of water can only be affected by the addition of soluble substances: ♦ Soluble metal oxides produce alkaline solutions ♦ Soluble non-metal oxides produce acidic solutions ♦ Insoluble oxides will not affect the pH of water
Sources of carbon dioxide in the atmosphere	Learners will investigate sources of CO_2 in the atmosphere including the burning of fossil fuels and cement manufacture. Carbon/global footprints may be discussed at this point. A good resource for this is Education Scotland's 'Schools Global Footprint'. Online resources are available on LTS schools global footprint index.	Candidates may have an appreciation that CO_2 is a by-product of burning fossil fuels but another large contribution is made by cement manufacturing for use in new buildings.
Sources of non-metal oxides, particularly carbon dioxide, sulfur dioxide and	Learners can study the effect of CO_2 on global warming by charting the temperature of plastic bottles filled with air, water vapour, CO_2 (and possibly methane)	Non-metal oxides play a large role in the environment.

oxides of nitrogen, and their effects on the environment.	exposed to a heat source over time. The effect of increased temperature on the ability of the oceans to absorb extra CO_2 as well as the effect of reduced pH on shells could also be investigated. A suitable resource can be found at the Royal Society of Chemistry website called 'Sea Change'. Learners can be introduced to other non-metal oxide pollutants and can investigate the effects of lower pH on cress seed growth, limestone or marble. These investigations can be accessed on the Education Scotland website.	Carbon dioxide, sulfur dioxide and oxides of nitrogen are produced as a result of our continued use of fossil fuels. Although these oxides are produced in nature the increased production of these oxides is linked to environmental problems including acid rain, global warming and ocean acidification.
Acids in food and drink and the effect these have on human health.	Learners could investigate the effect of low pH drinks on teeth (using pieces of bone) as described in the Sip Smart BC Tooth Experiment website. Learners should also investigate the positive uses of acids, eg acidity regulators in foodstuffs such as ethanoic acid (E260) and citric acid (E330). Benzoic acid (E210) is a preservative. HCl is used by the body for digestion. Lightning storms supply much needed nitrates to the soil of rain forests. Another positive use can be found at the apple-browning demonstrations, experiments at 'about.com'.	Acids play an important role in the food and drink industry eg as preservatives. These acids have an impact on human health eg tooth erosion, indigestion, etc.
Neutralisation reactions and salt formation.	The role of neutralisation can be investigated in the prevention of acid damage. Various practical	

Bases Following the course of a neutralisation reaction Word equations for neutralisation reactions and naming the salt produced.	experiments could be carried out here such as the investigation into changing the pH of soil in agriculture. A suitable resource can be found at the Royal Society of Chemistry's Practical Chemistry website: 'Curing Acidity'. Copper carbonate and sulfuric acid could be used to investigate a neutralisation reaction that does not need an indicator. Learners could also make indicators from natural resources to follow the course of a neutralisation reaction. Suitable resources can be found out at the Planet Science: Cabbage-chemistry website or the Woodrow Wilson Foundation's website: Say pH with Flowers. Website available at woodrow.org/teachers/1986/exp23	A neutralisation reaction is one in which an acid reacts with a base to form water. A salt is also formed in this reaction. Bases are metal oxides, metal carbonates and metal hydroxides. The course of a neutralisation reaction can be followed using a pH indicator; if the base is insoluble an indicator is not required. Neutralisation reactions can be described through the use of word equations and should include the correct name for the salt.

Nature's Chemistry		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
Fuels Fuels store energy in chemical bonds.	More information on which wood burns best and which wood contains the most energy can be found at the website juliantrubin.com. Information on how charcoal can be made can be found on the MIT Open Courseware site: http://ocw.mit.edu. Information on how to make charcoal in the classroom can be found on http://chemistry.about.com/ under 'blacksnakes'. Further information and activities on fuels can be found through the Royal Society of Chemistry website and on the European Union's Popularity and Relevance of Science Education for Scientific Literacy (Parsel) site.	A fuel is any compound that has stored energy. Energy is captured in chemical bonds through processes such as photosynthesis. Wood, petrol, coal, peat and a number of other fuels have energy-rich chemical bonds created using the energy from the Sun
Fossil fuels	Video clips on the formation of fossil fuels and fractional distillation can be found on the website. A methane explosion can be demonstrated using the ratio of 1 part methane to 2 parts oxygen. This can also be shown by an 'exploding can' demonstration as detailed in the book *101 Classic Chemistry Demonstrations* published by the RSC.	Fossil fuels are a useful reserve of fuels and are therefore used extensively to satisfy the demands of an energy-dependent world. Fossil fuels are principally hydrocarbons with minor impurities. They are so named because they originate from the decayed and fossilised remains of plants and animals that lived millions of years ago. They are a finite resource.

Some reactions release energy from fuels	Demonstration of fractional distillation using synthetic crude oil. Further details on this can be found through the SSERC website.	Crude oil is a mixture of hydrocarbons. Energy is released during burning/oxidation and respiration. The most common form of oxidation is the direct reaction of a fuel with oxygen through combustion. Combustion is the reaction of burning a fuel in oxygen.
Fire triangle		Controlling fires can be explained through the fire triangle.
Complete and incomplete combustion	The products of combustion can be shown through a demonstration of burning a hydrocarbon and drawing the products of combustion through a test tube with cobalt chloride paper surrounded by an ice bath and through another test tube with lime water. The products of incomplete combustion can be shown by heating a beaker of water using the safety flame of a Bunsen burner.	Hydrocarbons burn in a plentiful supply of oxygen to produce carbon dioxide and water. Carbon monoxide, a poisonous gas, and carbon are produced when hydrocarbons burn in a limited supply of oxygen.
Use of catalytic converters to reduce carbon monoxide emissions		In engines, catalytic converters can be used to minimise the output of carbon monoxide
Reducing carbon emissions		Ways to reduce carbon dioxide emissions are explored (including methods of carbon capture).

Conservation of mass during chemical reactions		The concept of conservation of mass will be introduced through equations relating to combustion of hydrocarbons.
Impact on the environment of burning fossil fuels including the effect on the carbon cycle		Combustion of fossil fuels impacts on the environment and contributes to the carbon cycle.
Exothermic and endothermic reactions	Reacting solid potassium permanganate and adding a few drops of glycerol can show an exothermic chemical reaction. A demonstration of the flammability of alcohols 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 dramatic are the 'alcohol gun' experiment, or the 'flaming pumpkin'. Centres should carry out risk assessments before carrying out these experiments. A more mysterious element can be introduced with the 'non-burning £5 note' experiment.	Exothermic chemical reactions give out energy and endothermic chemical reactions take in energy. Combustion is an example of an exothermic reaction.

Finite energy sources and biofuels. Benefit and risks of different energy sources Biomass	 Practical experiments on making biofuels can be found on the parsel and science buddies' websites. Learners can also take part in a debate about the pros and cons of using biofuels and whether or not they should be used to replace fossil fuels. Further examples on topical science debates can be obtained from Dundee Science Centre. Education Scotland has a website called STEM central through which additional information can be accessed.	Finite energy sources will be investigated in conjunction with the development of biofuels as alternative sources of energy to support society's energy needs. The benefits and risks of different energy sources and their impact on the carbon cycle can be researched. Energy sources could include: ♦ wind power ♦ wave and tidal power ♦ geothermal ♦ biomass and biofuels ♦ solar power ♦ nuclear Biomass, a source of biofuels, is plant-based material which can be burned to release energy. Biomass can also be converted to other usable forms of fuel. These include methane gas or fuels used for transportation such as ethanol and biodiesel.
Hydrocarbons Fractional distillation		Hydrocarbon molecules contain carbon and hydrogen only. Fractional distillation is the process used for separating crude oil into fractions. The properties, including melting point, boiling point, flammability and viscosity, and the use of the fractions

		can be compared. A fraction is a group of hydrocarbons with boiling points within a given range.
Hydrocarbon chains		There are many different hydrocarbon molecules as carbon and hydrogen can form chain molecules of different lengths.
Alkanes	Animations on the naming of alkanes, alkenes and fractional distillation can be found through the Scholar website (in the higher world of carbon unit) and the e-chalk website. Chemsketch can be used to draw and show the geometry of alkanes and alkenes. Chemsketch is available free of charge for schools.	The alkanes are a subset of hydrocarbons and are identified from the '-ane' ending. Straight-chain alkanes can be named and identified from full structural formulae and molecular formulae up to C_8.
Alkenes	A demonstration can be used to show learners how to distinguish between an alkane and an alkene. During the demonstration bromine water is added to an alkene and an alkane. The bromine water will decolourise immediately in the alkene and stay yellow in the alkane.	The alkenes are also a subset of hydrocarbons. An alkene can be identified from the carbon-to-carbon double bond and '-ene' ending. Straight-chain alkenes can be named and identified from full structural formulae and molecular formulae up to C_8.

Cracking	Cracking can be carried out in the classroom using an aluminium oxide catalyst. To do this, soak some ceramic wool in paraffin and place in a boiling tube. Place some aluminium oxide powder in a beaker and add some ceramic wool and cover it in aluminium oxide. Place the ceramic wool containing aluminium oxide in the boiling tube about 3 cm away from the paraffin ceramic wool. Attach a delivery tube to the boiling tube and place into a tub of water. Heat the boiling tube at the ceramic wool covered in aluminium oxide. Collect the gas given off over water. Remove the delivery tube from the water before stopping heating to prevent 'suck back'. To prove the gas is an alkene, bromine water can be added and will decolourise in the test tube with the gas.	Cracking is a process used to meet the demand for shorter chain alkanes and alkenes.
Everyday consumer products Use of carbohydrates and oils from plants Carbohydrates including glucose and starch	The 'Screaming Jelly babies' demonstration can be used to show the energy content of carbohydrates. This involves warming potassium chlorate until it melts and adding the jelly baby. This will combust and release the stored energy. Centres should carry out their own risk assessment before undertaking this experiment. To show the elements present in a carbohydrate, learners can watch a demonstration of a few drops of concentrated sulfuric acid being added to a few grams of solid sucrose. This will remove the hydrogen and oxygen from the carbohydrate through steam. Solid carbon is left behind.	Plants are a source of carbohydrates and oils which can be used for food or fuel. Carbohydrates are compounds which contain carbon, hydrogen and oxygen with the hydrogen and oxygen in the ratio of two to one.

		Glucose is a simple carbohydrate with the formula $C_6H_{12}O_6$. Starch is a complex carbohydrate formed by joining many glucose molecules. Plants store energy by converting glucose into starch..
Testing for starch and glucose	Practical tasks should be carried out to demonstrate the differences between glucose and starch and how starch can be hydrolysed into glucose. This can be confirmed through chemical tests.	Chemical tests can carried out to distinguish between glucose and starch using Benedict's solution and iodine respectively.
Digestion of starch and respiration		Starch is broken down into glucose in the body, during digestion. Glucose, due to its small molecular size, can pass through the gut wall into the bloodstream to be used in cells, throughout the body, during respiration.
Fermentation	To form ethanol, learners can add yeast to fruit juice in a conical flask. A balloon can be placed over the neck of the conical flask to collect the gas given off. The resulting ethanol/fruit juice mixture can then be distilled to produce a higher concentration of ethanol.	Enzymes present in yeast can convert glucose into ethanol. This process is called fermentation. Different plants are used to produce different alcoholic beverages. As the fermentation process continues the concentration of ethanol causes the enzyme to stop working. This limits the ethanol concentration achievable by fermentation. Enzymes operate under optimal conditions of temperature and pH.
Distillation		To achieve higher concentrations of ethanol for production of spirits, distillation must be carried out.
Units of alcohol	To achieve an understanding of units of alcohol, learners can look at different alcoholic beverage labels that show the number of units in the drink.	The alcohol content of drinks is measured in units.

Plants to products Plants are used to make a wide variety of products. How products are made from plants.	Approximately 30% of medicines used today are derived from plants. The label on a medicine or pharmaceutical product describes the contents of the product and what is can be used for. There are a variety of medicines which are legal. While alcohol is also a legal drug there are other drugs which are illegal and may be harmful. Plants such as foxglove, willow, meadowsweet, poppies and chinchona were commonly used in earlier times for the treatment of diseases such as heart disease, inflammatory diseases and malaria. Scottish scientists were instrumental in the development of willow, poppies and chinchona in the treatment of disease. Aspirin is a medicine that is derived from meadowsweet and willow. Morphine, used to treat pain, is derived from poppies.	Many plants are used by chemists in the design and manufacture of many everyday products such as pharmaceuticals soaps, cosmetics, dyes, medicines, foods or food colourings. Learners will research and investigate how plants are used to make products. For each plant they should cover: ♦ where they are found and grown ♦ the identification of the active ingredient ♦ the role of the chemists in extracting the useful chemicals ♦ the variety of uses and applications of plant-based products ♦ how the plant-based products have enhanced everyday life

Chemistry in Society		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
Metals and alloys The chemical and physical properties of materials are linked to their use.	The practical chemistry branch of the RSC website has examples of practical activities related to metals, polymers, and analysis.	Materials are all substances and include metals, ceramics and plastics as well as natural and novel substances. Chemical and physical properties of materials are linked to their uses.
Reactions of metals with oxygen, water and dilute acid.	Reactions of metals (Cu, Zn, Mg) with air, water and dilute acid. Testing hydrogen. Suggested demo using Arculus method.	Observation of the reaction of metals with: oxygen, water and dilute acid.
Reactivity series	TES website now contains the Teachers' TV videos. *The Periodic Table — Ferocious Elements* could be used. BBC Learning Zone has a video clip on alkali metals. The Open University has a clip on the reaction of rubidium and caesium with water.	Learners should be able to use the reactions of metals with oxygen, water and dilute acid to deduce a reactivity series.
The method of extracting a metal is related to the reactivity series	Extraction of metals: ♦ heat alone — silver oxide ♦ copper from copper oxide using carbon ♦ electrolysis	Methods used to extract metals from their ores are dependent on the position of the metal in the reactivity series. Methods include: ♦ heating alone ♦ heating with carbon ♦ electrolysis
Corrosion of metals		Metals corrode by their reaction with oxygen and water. Different metals corrode at different rates.

Rusting and methods of preventing iron from rusting		Rusting is the corrosion of iron. It occurs when iron is exposed to oxygen and water. Various methods can be used to prevent iron form rusting including: ♦ painting ♦ coating with oil or grease ♦ electroplating ♦ chrome plating ♦ plastic coating ♦ sacrificial protection ♦ attaching to the negative terminal of a power source Ferroxyl indicator can be used to show rusting occurring.
Sacrificial protection of iron to prevent rusting		The use of certain metals to protect iron from rusting is related to their relative position to iron in the electrochemical series.
Chemical cells and the electrochemical series	Pairs of metals to determine electrochemical series. 'Fruity' batteries using different metal pairs. Simple cells.	When different metals are connected by an electrolyte, an electric current flows from one metal to the other through connecting wires. By comparing pairs of metals the electrochemical series can be constructed. The electrochemical series is used to predict the size of voltage and direction of current in chemical cells. This forms the basis for batteries.

Alloys	'Turning copper coins gold'. The RSC website has guidance and risk assessments for this experiment. Possible scope to investigate carbon in steel.	An alloy is a mixture of two or more elements, at least one of which is a metal. Alloys have different physical properties in comparison to the pure elements.
Materials Polymers and polymerisation Thermosoftening and thermosetting plastics Burning plastics Biodegradable plastics	The National STEM centre E-Library contains all the resources produced by the Gatsby Science Enhancement Programme. These include resource booklets and suggested experiments on: Fantastic Plastic, fibres and fabrics, 'bouncy fluids', novel materials and SMART applications. Mindsets is an organisation sponsored by Middlesex University. Resources and chemicals can be purchased from its website. Fantastic Plastic is a website sponsored by the University of Reading. It has a variety of resources available. Investigate polymers and their properties. Types of plastic — thermosoftening and thermosetting. Burning of plastics related to poisonous gases released and consequences on the environment.	Plastics are a group of important materials. They are long-chain molecules called polymers and can be made by a process called polymerisation. Plastics are made from small units called monomers. The name of the polymer can be deduced from the name of the monomer. Polymers can be engineered to be used in a variety of environments. Plastics can be grouped in different ways: thermosoftening and thermosetting plastics. Thermosoftening plastics or thermoplastics can be reshaped once heated whereas thermosetting polymers cannot. Plastics burn to release harmful gases. Plastics have been developed which can biodegrade.

Novel materials		Properties of materials are constantly updated and adapted and new materials developed to meet the demands of society. These tend to have special and unique properties.
Ceramics	Investigate types of ceramics and properties of ceramics including strength and heat resistance. Activities might include making glass, investigating clay vs. fired clay and porosity. Other suggested activities are available from Education Scotland.	The properties of ceramic materials have made them vital components for many modern applications.
Fertilisers Importance of fertilisers		The chemist has an important role in helping to make sure plants have the correct nutrients to ensure sufficient food production.
Three essential elements and percentage composition	Percentage composition calculations can be related to the packaging of fertilisers. Design and prepare fertilisers using neutralisation reactions. Possible investigation into effectiveness of fertilisers: Different school-made fertilisers could be compared by growing suitable plants.	There are three key elements which provide the nutrients required for plant growth: nitrogen, phosphorus and potassium. The % composition of an element in the fertiliser can be calculated. They are usually shown as percentage amounts on the side of fertiliser packaging.
Natural and manmade fertilisers		Fertilisers can be produced naturally or in laboratories by chemists using neutralisation reactions.
Environmental impact of fertilisers	Investigate the solubility of fertilisers and the potential environmental consequences associated with fertiliser use.	The use of fertilisers may have an environmental impact. This should include the effect of fertilisers leeching into water courses.

Nuclear chemistry Formation of elements in stars	Internet search: 'teachers domain nova science formation of elements'. Carry out research into formation of elements.	Heavier elements are formed from lighter elements in stars.
Background radiation	Use a gieger-muller tube to measure background radiation and that of various everyday objects such as bananas.	Background radiation is a natural phenomenon and is caused by various factors including: ♦ rocks ♦ cosmic rays ♦ medical uses
Chemical analysis Importance of chemical analysis to our everyday life.		Chemical analysis permeates all aspects of chemistry. It is important that learners understand the significance of analysis in terms of: ♦ testing purity of eg water ♦ identifying pollutants
Simple analytical techniques	Learners carry out simple chemical analysis which can build on knowledge and skills from across any of the National 4 Chemistry Units. Possible activities could include: ♦ analysis of rock salt to determine % of sodium chloride ♦ crime scene scenario — poison-pen letter — using paper chromatography to separate and identify ink samples ♦ soil or water analysis using pH testing	Learners should carry out simple analytical techniques. These could include: ♦ chromatography ♦ flame tests ♦ pH measurement using indicators / pH meters ♦ separation techniques including filtration, evaporation and distillation

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 numerous formats including tabular and graphical. Practical work will provide opportunities to develop time and measurement skills.

2.1 Number processes
Number processes means solving problems arising in everyday life.
Learners have the opportunity to develop numeracy skills by carrying out and understanding calculations, when working out formulae and balanced equations, and using whole numbers, decimal fractions, and percentages in composition of fertilisers and crude oil.
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.

2.2 Money, time and measurement
Using time and measurement in practical work during rates of reaction; the reactions of acids, bases, metals, alkanes, alkenes, fuels; and chemical analysis.

2.3 Information handling
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.

Thinking skills

This is the ability to develop the cognitive skills of remembering and identifying, understanding, 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 a different contexts,

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

When researching topics learners should identify and weigh-up the features of a situation or issue in chemistry and use judgement in coming to a conclusion. It includes reviewing and considering any potential solutions.

In addition, leaners 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/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
Through learning in Chemistry learners can demonstrate creativity. In particular, when planning and designing experiments/investigations, learners have the opportunity to be innovative in their approach. Learners 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 the environment.

Approaches to assessment

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 4, the added value will be assessed in the Added Value Unit.

Information given in the *Course Specification* and the *Added Value Unit Specification* about the assessment of added value is mandatory.

The Chemistry Added Value Unit is assessed by an Assignment. Prior to doing this Unit, learners would benefit from having covered key areas from at least one of:

- Chemical Changes and Structure (National 4)
- Nature's Chemistry (National 4)
- Chemistry in Society (National 4)

It is intended that the majority of this time be spent in learning and teaching activities which develop the skills necessary to conduct investigative/practical work in chemistry. In addition to ensuring that learners are suitably prepared to conduct simple background research using the internet, learners should also have the opportunity to become familiar with a range of apparatus and practical techniques.

If the Added Value Unit is delivered as part of a Course, then centres can deliver this Unit at an appropriate point during the Course.
Learners will use the skills, knowledge and understanding necessary to undertake an investigation into a topical issue in Chemistry. The teacher/lecturer may provide guidance to learners on topics for study taking into account the needs of their learners and the relevance to everyday issues. While the learner should choose the topic to be investigated, it would be reasonable for the choice the learner makes to be one where the teacher/lecturer has some expertise and has resources available to enable the learner to successfully meet the Assessment Standards.

The Assignment offers opportunities for learners to work in partnership and in teams, though it must be clear, at each stage, that the learner has produced evidence of their contribution to any group work carried out.

Suggested investigations

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

Key area	Topic	Investigation	Practical activity
Metals and alloys	Alloys and metals	Uses of alloys compared to metals Impact of extraction of metals on surrounding land	Physical and chemical properties of metals and alloys
Fertilisers and Chemical Analysis	Fertilisers	Pollution of rivers Comparison between natural and synthetic fertilisers Solubility of fertilisers (natural & synthetic) and there effect on the environment	Solubility of fertilisers Comparison between natural and synthetic fertilisers
Materials, Atomic Structure and Bonding related to properties	Materials	Relate the use to the properties of materials	Properties of polymers
Chemical Analysis and Acids and Alkalis	Testing Sea water/ water samples	Acidity of Sea Water Impact of acidity of sea water	Flame tests pH tests
Energy Changes, Fuels and Everyday Consumer Products	Food or fuel	Impact of burning fossil fuels for energy Converting fossil fuels into products…. Is it worth it? Impact of burning alcohols as fuels Impact of the use of biofuels	Energy from food Energy from fuels
Bonding and properties, Acids and Alkalis, Chemical Analysis and Metals and Alloys	Ice	Why do councils use a mixture of rock salt and other materials? Do de-icing compounds increase corrosion? How do they keep the Forth Road Bridge free of ice? What is different about the de-icers used for aircraft? What is the impact of using rock salt on roadside plants	Choice of anti-icer Choice of de-icer Salt analysis — flame testing Corrosion

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

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 of Evidence

Evidence for the achievement of Outcome 1 and Assessment Standards 2.2, 2.3 and 2.4 for a standard Unit can be used as evidence of the achievement of Outcome 1 and Assessment Standards 2.2, 2.3 and 2.4 in the other Standard Units of this Course. The Added Value Unit is not a standard unit.

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 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.

Assessment Standard	Evidence required	Evidence produced
1.1 Planning an experiment/ practical investigation	Aim of experiment	Aim relates to experiment and variable
	Variable to be kept constant	'Volume of acid to kept the same' mentioned in procedure
	Measurements/ observations to be made	Colour change recorded. Measurements recorded
	Resources	Apparatus used included in diagram and mentioned in procedure.
	Method including safety	Sequence of steps given. Safety listed.
1.2 Following procedures safely	Procedures have been followed safely	Goggles worn at all times. Glassware and liquids were handled carefully
1.3 Making and recording observations/ measurements accurately	Observations/measurements taken are correct	Results recorded correctly.
1.4 Presenting results in an appropriate format	Results have been presented in an appropriate format	Table of results with correct averages recorded. Average results presented in bar graph. All labels and units are present and correct.
1.5 Drawing valid conclusions	What the experiment shows, with reference to the aim	Conclusion relates to the aim and is correct for the results
1.6 Evaluating experimental procedures	The suggestion given will improve the experiment	Appropriate suggestion given

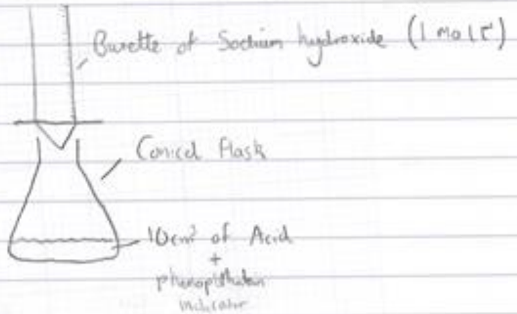
Candidate 1

Acids

Aim: To see how the Concentration of acid has an effect on the volume of alkali required to neutralise the acid.

Hypothesis: I assume that the higher Concentrated the alkali the lower the quantity of it will be needed to neutralise the acid.

Procedure:



1. 10cm³ of Hydrochloric Acid (0·1 mol l⁻¹) was added to a conical flask using a measuring cylinder
2. Alkali was added to a burette until it was filled up to 0cm³
3. The alkali was added to the conical flask using a burette until the pink colour observed
4. This was repeated and the results recorded.
5. Steps 1→4 were repeated again with an acid of a higher concentration but keeping the volume of acid constant.

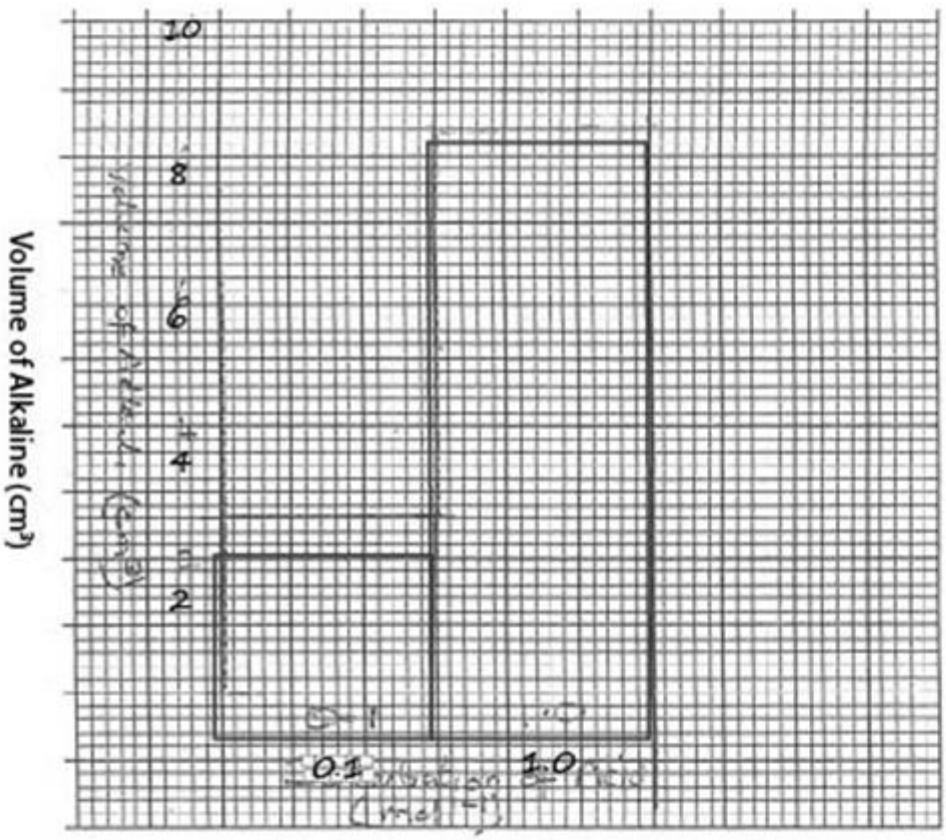
Safety: Goggles must be worn at all times
Hands must be washed after the experiment
All Spillages must be cleaned up
All apparatus must be washed before and after the experiment

Attempt	0·1 mol l⁻¹ acid Volume of alkali (cm³)	1.0 mol l⁻¹ acid Volume of alkali (cm³)
1	2·5	8·6
2	2·8	8·2
mean	2·65	8·4

Conclusion: The more Concentrated the acid the higher the volume of alkali is needed to neutralise it.

Evaluation:
To make the experiment better I could have used a better way of measuring the alkali as measuring cylinders are not very accurate

Candidate 1 (contd)



Concentration of acid (mol l^{-1})

Candidate 2

Assessment Standards 2.2 and 2.3 can be achieved using one or two pieces of evidence covering work done on different occasions.

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

Nylon Nylon is a plastic which is a thermoplastic (thermoplastics is polymers which becomes mouldable after it has reached a specific temperature) it was invented in February 5th 1935 by a chemist who is called Wallace Hume Carothers. It first made an effect on society in 1938, the first nylon bristled toothbrush and shortly after that women's stockings were introduced into society in 1939. Nylon is light weight, has a high tensile strength and is very durable; it was the first commercially successful synthetic polymers. Some environmental disadvantages of nylon would be the lack of being biodegradable and general pollution.

Assessment standard	Evidence required	Evidence produced
2.2 Describe an application	The application is linked to a key area of the Course	Materials
	Application stated	Tooth brush and stockings
	Appropriate chemistry knowledge is used to describe the application	Thermoplastic identified and definition given, properties of plastic given
2.3 Describe a chemistry issue in terms of the effect on the environment/ society	The chemistry issue is linked to a key area of the Course	Materials
	A relevant issue is stated	Pollution
	Appropriate chemistry knowledge is used to describe its effect	Nylon not biodegradable

Equality and inclusion

The following should be taken into consideration:

Situation	Reasonable Adjustment
Carrying out practical activities	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.
Reading, writing and presenting text, symbolic representation, tables, graphs and diagrams.	Use could be made of ICT, enlarged text, alternative paper and/or print colour and/or practical helpers for learners with visual impairment, specific learning difficulties and physical disabilities.
Process information using calculations	Use could be made of practical helpers for learners with specific cognitive difficulties (eg dyscalculia).
Draw a valid conclusion, giving explanations and making predictions or generalisations	Use could be made of practical helpers for learners with specific cognitive difficulties or autism.

As far as possible, reasonable adjustments should be made for the Assignment, where necessary. 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.

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)
- *SCQF Handbook: User Guide* (published 2009) and
  SCQF level descriptors (to be reviewed during 2011 to 2012):
  www.sqa.org.uk/sqa/4595.html
- *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: Resource pack

National 4 Chemistry: Added Value Unit

Resource pack: Ice

The following key areas are used in this pack:

Atomic Structure and Bonding related to properties of materials
Physical properties of chemicals linked to the bonding

The properties of Metals and Alloys
Corrosion, physical and chemical protection of metals

Neutralisation reactions
Selection of chemicals for salt formation

Chemical Analysis
Flame testing

Background

Scotland has a history of extreme weather conditions — especially snow and ice, but it now seems that the rest of the UK is starting to see similar conditions far more often.

Local councils use two main methods to try to keep the roads open to traffic.

1. **De-icing —** removal of existing, snow, ice, etc. from the roads, followed by application of salt or other ice-melting chemicals to the surface.
2. **Anti-icing** — treatment of a road, pavement, etc. with ice-melting chemicals **before** it snows/freezes, to prevent or delay the formation of ice and to stop snow from lying.

There are, however, problems using these chemicals as they can cause**:**

- **corrosion** of iron and steel structures like car bodies and bridges
- **pollution** of the river system as chemicals are washed off the roads by rain

1. Cost

'Over a third of the UK's small businesses had to close during the last extreme weather conditions at an estimated cost of £2·1bn, according to a survey of 397 SME owners conducted by small business telecom and broadband specialist XLN Telecom.'

There are also many other costs: increased heating, costs due to businesses closing, costs of accidents etc. Plus the costs of the preventative measures taken by local authorities all over the UK.

2. Injuries

Figures recently published for the 'big freeze' winter of 2009–10 show that hospitalisations increased dramatically putting operational stress on the NHS and considerably increasing costs:

- *18,565 patients hospitalised as a direct result of slipping on ice and snow*
- *resulting in 70,674 bed days*
- *estimate cost to the NHS and taxpayer between £7·5–15·0 million per annum*

www.icegripper.co.uk/slips-and-falls-on-ice

3. Road damage

Potholes are formed by water penetrating the asphalt surface of a road through cracks caused by traffic. When temperatures plunge, the water freezes, expands and causes the surface to rupture. When the ice melts, it leaves a void below the surface, which caves in under the stress of vehicles and eventually forms a pothole.

'Snow and ice are the worst weather conditions for exacerbating existing road defects, due to the repetition of the freeze-thaw process', says Geoff French, vice president of the Institute of Civil Engineers.

4. Shortages

If transport is disrupted, deliveries of all sorts of other commodities suffer, particularly, fuel and food.

5. Corrosion

Many chloride salts increase the rate of corrosion of vehicles and metal structures.

Anti-icing and de-icing

There are several factors that will affect the choice of chemical to be used for putting on the roads.

1. **Cost** — sodium chloride (as rock salt) is much cheaper than any of the others and is used for about 98% of road gritting in the UK.
2. **Efficacy** — sodium chloride is effective down to about –7 °C, magnesium chloride to –55 °C.
3. **Ease of application** — and likelihood of being washed off.
4. **Corrosion** — many chlorides will cause corrosion of steel — a problem for cars and more seriously bridges. They can also cause corrosion of aluminium so should not be used in airports.
5. **Pollution** — when the salts get washed off the roads, they can impact on the local environment. A build-up of salt is harmful to many plants. Ethylene glycol can be toxic to animals. Other compounds such as acetates can damage watercourses.

In order to try to keep the roads free and fit for travel, councils use two main approaches.

Anti-icing and de-icing chemicals

Chemicals used for anti-icing and de-icing fall into the following categories:

- Chloride based: sodium chloride (NaCl), magnesium chloride ($MgCl_2$) and calcium chloride ($CaCl_2$). These de-icers can also be mixed with corrosion inhibitors and anti-caking agents such as sodium ferrocyanide.
- Glycol based: ethylene glycol, propylene glycol, diethylene glycol.
- Additives: agricultural-based additives, eg molasses, corrosion inhibitors and anti-caking agents.
- Acetate based: calcium magnesium acetate, potassium acetate and sodium acetate.
- Formate based: Potassium formate and sodium formate.
- Urea based: urea (also called carbamide).

They all work in more or less the same way, by lowering the freezing point of water — hopefully to lower than the temperature expected that night so that any meltwater will not freeze on the roads.

Useful additional reading

a. Overview of de-icing. Info is available on Wikipedia.
b. Article on aircraft de-icers. SKYbray — AEA Recommendations for De-icing /anti-Icing website and BBC news magazine — How do you de-ice a plane
c. Articles on the effect of de-icing chemicals on roads are available from local authority websites, especially Aberdeenshire, Wiltshire and Croydon. Safecote website gives information on agricultural-based additives.

Investigations

This resource pack contains four different possible investigations. These investigations may be used unaltered or adapted to suit individual centre needs. Centres may also replace them with suitable alternatives of a similar standard.

Investigation	Research area
Choice of anti-icer	Why do councils tend to use salt mixtures on the roads instead of simply sodium chloride? What are the positive and negative impacts on the environment and/ or society?
Choice of de-icer (could also be used for National 5 due to OH group in diols)	What is different about the de-icers used for aircraft? Why are different ones used? Are they more or less effective than those used on roads? What are the positive and negative impacts on the environment and/or society? One problem with some de-icing salts is that they can increase corrosion of road vehicles. Which de-icing salt would be best to use to minimise this problem? What are the positive and negative impacts on the environment and/or society? How do they keep the Forth Road Bridge free of ice? What are the positive and negative impacts on the environment and/or society?
Salt analysis — flame testing	Why do councils tend to use salt mixtures on the roads instead of simply sodium chloride? What are the positive and negative impacts on the environment and/or society?
Corrosion rates	How do they keep the Forth Road Bridge free of ice? What are the positive and negative impacts on the environment and/or society? One problem with some de-icing salts is that they can increase corrosion. Which de-icing salt would be best to use to minimise this problem? What are the positive and negative impacts on the environment and/or society?

Teaching notes

Ice has to absorb energy in order to melt, changing the phase of water from a solid to a liquid.

When you add salt to the ice, it lowers the freezing point of the ice. This makes the ice colder than it was before.

Compounds that separate into two particles on dissolving like NaCl (which breaks into Na^+ and Cl^-) are better at lowering the freezing point than substances that don't separate into particles. This is because the added particles disrupt the ability of the water to form crystalline ice. The more particles there are, the greater the disruption and the greater the impact on particle-dependent properties (colligative properties) like freezing point depression.

Some councils are now using mixtures of rock salt with agricultural by-products such as liquid molasses (a derivative of the sugar production process). This mixture has the advantage that it spreads better than pure rock salt, and is more effective in dealing with ice, whilst also reducing the amount of salt deposited in our surface water drainage systems.

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 be adapted to suit individual centre needs. Centres may also replace them with suitable alternatives of a similar standard.

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

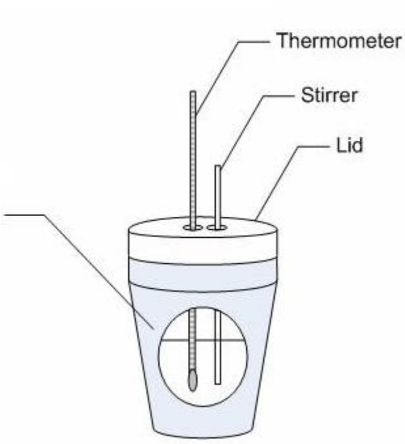
Choice of anti-icer

Chemicals	Apparatus
10 g Table salt/sodium chloride	two polystyrene cups
10 g calcium chloride	thermometer
10 g magnesium chloride	stirrer
sugar	1 × 100 cm^3 measuring cylinder
ice	funnel
	timer
	access to an accurate balance

Making the calorimeter

This is very simple. Some things to watch out for are:

If you use two cups (one inside the other) the insulation will be better.



Make sure the thermometer is positioned so the bulb is in the middle of the mixture and held in place (rubber bands wrapped round above and below the lid will hold it quite firmly).

If you can put some extra insulation on the lid, that will also improve the device.

Give some thought to the stirrer — ideally you want to be able to stir the mixture effectively without taking the lid off.

Using the calorimeter to measure the depression of freezing point

1. Weigh out 100 g of ice and transfer it to the polystyrene cup.
2. Place the lid on the calorimeter, and set the calorimeter on the base of a clamp stand. Additional support can be given to the thermometer by attaching a clamp. Leave enough room to swirl the cup without bumping the thermometer.
3. Record the temperature of the ice before adding anything.
4. Lift the lid, keeping the thermometer in the ice, and add 10 g of one of the compounds
5. Shut the lid and gently stir the contents. Record the temperature from your thermometer. Keep on recording the temperature at intervals and stirring from time to time until the temperature stops falling.
6. The change in the temperature is a measure of the heat absorbed.
7. Repeat for other substances.

Choice of de-icer

Chemicals	Apparatus
samples of de-icers A–D	1 × 250 cm^3 beaker
crushed ice	thermometer
	stirring rod
	1 × 100 cm^3 measuring cylinder
	funnel
	timer
	access to balance

1. Weigh out 10 g of your first de-icer.*
2. Weigh out 100 g of crushed ice in the beaker. Put the thermometer in the beaker.
3. Take the temperature and record it.
4. Add the first de-icer, stir and start the timer.
5. Record the temperature every minute for 5 minutes.
6. Stir from time to time.
7. At the end of 5 minutes, place the funnel in the measuring cylinder and pour the contents of the beaker into it.
8. Record the volume of water that collects in the measuring cylinder.*
9. Empty the cylinder and beaker and repeat the process for each of the other de-icing chemicals.
10. Repeat for other de-icers

    * Ethane-1, 2-diol is a liquid. You are being given 10 cm^3 of it, so subtract 10 from the volume of water you get.

Salt analysis — flame testing

For candidate instructions see RSC experiment — Flame testing CFNS Experiment 79.

Chemicals	Apparatus
sodium chloride	wooden splint
calcium chloride	Bunsen burner
magnesium chloride	
unknown samples of road salt	

Corrosion rates

Chemicals	Apparatus
ferroxyl indicator solution	spotting tile
sodium chloride	4 x $1cm^3$ Pasteur pipettes
calcium chloride	marker pen
magnesium sulphate	clean nails or tacks or fresh iron filings
sugar	
ethandiol	

1. Collect a spotting tile.
2. Place a sample of clean iron in each dimple.
3. Use the marker pen to label the dimples with the chemicals you are going to use.
4. Place 0·01 g of each chemical in each labelled dimple (a small spatula tip).
5. Add 10 drops of ferroxyl indicator solution to each chemical in the dimple.
6. Time how long it takes for a blue colour to appear in each.

Learner information

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.

Using the internet for background research

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.

Administrative information

Published: May 2015 (version 2.0)

History of changes to Course Support Notes

Course details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013
	2.0	Minor amendments throughout the document to increase clarity. Amendments to the 'key areas' and 'exemplification of key areas' columns to increase clarity in terms of depth/breadth of study.	Qualifications Manager	May 2015

Note: You are advised to check SQA's website (**www.sqa.org.uk)** to ensure you are using the most up-to-date version.

Unit
Support
Notes

Unit Support Notes — Chemical Changes and Structure (National 4)

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 Chemical Changes and Structure (National 4) 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 *Added Value Unit 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, 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 by 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
- Energy changes of chemical reactions
- 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 3 Chemistry

There may also be progression from National 3 Biology, National 3 Environmental Science, National 3 Physics, and National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 Chemistry *Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the 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 or related areas
- 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 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 balanced equations.

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. Outcome 1 provides an opportunity for learners to identify risks and plan the safety steps required.

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
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 the learners' 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)
- *SCQF Handbook: User Guide* (published 2009) and
  SCQF level descriptors (to be reviewed during 2011 to 2012):
  www.sqa.org.uk/sqa/4595.html
- *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

Unit details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013

Note: You are advised to check SQA's website (**www.sqa.org.uk)** to ensure you are using the most up-to-date version.

Unit Support Notes

Unit Support Notes — Nature's Chemistry (National 4)

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 Nature's Chemistry (National 4) 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 *Added Value Unit 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, 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 by using a variety of approaches, including investigation and problem solving. The Unit covers the key areas of:

- fuels
- hydrocarbons
- everyday consumer products
- plants to products

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 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 3 Chemistry Course

There may also be progression from National 3 Biology, National 3 Environmental Science, National 3 Physics, and National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 Chemistry *Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the 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, or related areas
- 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 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 balanced equations throughout the Unit.

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. Outcome 1 provides an opportunity for learners to identify risks and plan the safety steps required.

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
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 the Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in this document 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 approach to assessment will 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*
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- Course Specifications
- Design Principles for National Courses
- *Guide to Assessment* (June 2008)
- Overview of Qualification Reports
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- Science: A Portrait of current practice in Scottish Schools (2008)
- *SCQF Handbook: User Guide* (published 2009) and
  SCQF level descriptors (to be reviewed during 2011 to 2012):
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Administrative information

Published: June 2013 (version 1.1)

Superclass: RD

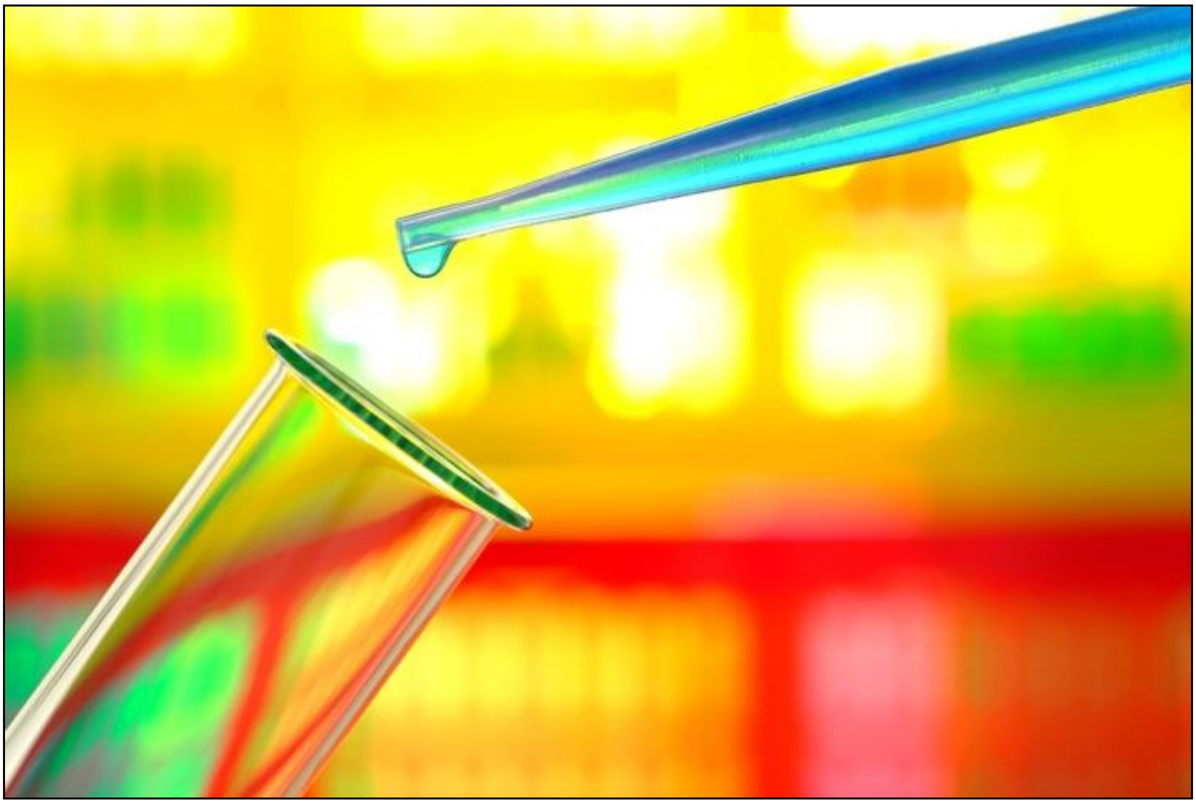
History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013

Note: You are advised to check SQA's website (**www.sqa.org.uk)** to ensure you are using the most up-to-date version.

Unit Support Notes

Unit Support Notes — Chemistry in Society (National 4)



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 Chemistry in Society (National 4) 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 *Added Value Unit 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 and alloys
- Materials
- 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 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 3 Chemistry Course

There may also be progression from National 3 Biology, National 3 Environmental Science, National 3 Physics and National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 Chemistry *Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the 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 or related areas
- 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 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 balanced equations throughout the Unit.

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. Outcome 1 provides an opportunity for learners to identify risks and plan the safety steps required.

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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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 this document 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 approach to assessment will generate the necessary evidence of achievement.

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  SCQF level descriptors (to be reviewed during 2011 to 2012):
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- *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

Unit details	Version	Description of change	Authorised by	Date
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