SCOTTISH QUALIFICATIONS AUTHORITY

CHEMISTRY
Intermediate 2

Fifth edition – published March 2004

NOTE OF CHANGES TO ARRANGEMENTS
FITH EDITION PUBLISHED MARCH 2004

COURSE TITLE: Chemistry (Intermediate 2)

COURSE NUMBER: C012 11

National Course Specification

Course Details: Clarification to depth of treatment of content throughout

National Unit Specification

All Units: No change

National Course Specification

CHEMISTRY (INTERMEDIATE 2)

COURSE NUMBER C012 11

COURSE STRUCTURE

The course has three mandatory units:

D066 11	***Building Blocks (Int 2)***	***1 credit (40 hours)***
D067 11	***Carbon Compounds (Int 2)***	***1 credit (40 hours)***
D068 11	***Acids, Bases and Metals (Int 2)***	***1 credit (40 hours)***

In common with all courses, this course includes a further 40 hours over and above the 120 hours for component units. This is for induction, extending the range of learning and teaching approaches, support, consolidation, integration of learning and preparation for external assessment. This time is an important element of the course and advice on its use is included in the course details.

It is recommended that the *Building Blocks* unit be studied first. It should also be noted that the Higher and Intermediate 2 courses have been designed so that there is overlap of content areas and the *Building Blocks* (Int 2) unit ties in with the *Energy Matters* (H) unit.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following awards or its equivalent:

- Standard Grade Chemistry at grades 3 and 4
- Standard Grade Biology, Physics or Science at grades 1 to 3
- the Intermediate 1 Chemistry course or its component units
- the Intermediate 2 Biology or Physics course

together with

- Standard Grade Mathematics at grades 3 and 4 or Intermediate 1 Mathematics.

The preferred entry from Standard Grade is based on achievement in the Knowledge and Understanding and Problem Solving elements.

Administrative Information

Publication date: March 2004

Source: Scottish Qualifications Authority

Version: 05

National Course Specification (cont)

COURSE Chemistry (Intermediate 2)

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, publication code BA0906).

CREDIT VALUE

SCQF points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification is allocated a number of SCQF Credit Points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.

COURSE	SCQF LEVEL	SCQF CREDIT POINTS
Intermediate 2	5	24

National Course Specification: course details

COURSE Chemistry (Intermediate 2)

RATIONALE

The study of chemistry at Intermediate 2 introduces the candidates to a knowledge and understanding of the physical and natural environments at the atomic level and continues the development of the problem solving and practical skills associated with scientific enquiry. A grounding for further study at Higher is provided for candidates with previous achievement in knowledge and understanding and problem solving at Intermediate 1, or for those who wish to study chemistry for the first time.

As such, the course is designed to provide opportunities in appropriate contexts for the candidates to acquire:

- knowledge and understanding of chemical facts, theories and symbols
- the ability to solve chemical problems
- the ability to carry out chemical techniques and investigations
- positive attitudes, by helping candidates to be open-minded and willing to recognise alternative points of view, and to be interested in science and aware that they can take decisions which affect the well-being of themselves and others and the quality of their environment.

In problem solving, the candidates will be expected to:

- select and present information
- carry out calculations
- plan, design and evaluate experimental procedures
- draw conclusions and give explanations
- make generalisations and predictions.

As a result of engaging in practical work candidates will be expected to**:**

- describe experimental procedures
- record relevant measurements and observations
- analyse experimental information
- draw valid conclusions
- evaluate experimental procedures with supporting argument.

In addition, the learning experiences make an important contribution to the candidates' general education by:

- emphasising the relevance of chemistry to everyday living
- developing core skills
- raising awareness of the links between the subject and the world of work in general and the chemical industry in particular
- providing opportunities for independent and cooperative learning.

National Course Specification: course details (cont)

COURSE Chemistry (Intermediate 2)

COURSE CONTENT

The Content Statements given in the left-hand column of the tables on the following pages describe in detail the knowledge and understanding associated with the three units of the course, all of which will be subject to sampling in the external assessment. Achievement will require to be shown in a variety of ways, that is, candidates will be expected to 'state', 'describe', 'explain', 'identify' etc as appropriate. The right-hand column gives Suggested Activities related to the Content Statements. Opportunities to make use of information technology are indicated by (ITO).

It should be noted that the content has been arranged to tie in with the performance criteria and evidence requirements for each of the units. Teachers and lecturers may wish to reorder for learning and teaching purposes.

It should also be noted that, while the units are valuable in their own right, candidates will gain considerable additional benefit from completing this course, since there will be opportunities for the integration of skills across the units and for tackling problem solving of a more complex nature than that required for attainment of the units.

All candidates will be expected to carry out the prescribed practical activities listed below. These are highlighted in italics under Suggested Activities.

ACTIVITY	UNIT
The Effect of Concentration Changes on Reaction Rate	1
The Effect of Temperature Changes on Reaction Rate	1
Electrolysis	1
Testing for Unsaturation	2
Cracking	2
Hydrolysis of Starch	2
Preparation of a Salt	3
Factors which Affect Voltage	3
Reaction of Metals with Oxygen	3

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
a) Substances		
(i) Elements		
Everything in the world is made from about 100 elements. Each element has a name and a symbol. Elements are classified in different ways, including naturally-occurring/made by scientists, solid/liquid/gas, metal/non-metal. Chemists have classified elements by arranging them in the Periodic Table.	Candidates would be expected to use the data booklet if asked to give specific examples of elements in particular classifications.	Refer to different versions of Periodic Tables. Examine as many samples of elements as possible. Use a database to obtain information (ITO). Set up a simplified database (ITO). Find out about how the discovery of the elements was related to social and industrial factors. Find out about the names of some elements which have been made by scientists. Make a collection of elements in everyday use and record uses in a table. Find out about the uses of elements.
A group is a column of elements in the Periodic Table. A period is a row of elements in the Periodic Table. The groups include the halogens, the alkali metals and the noble gases. Elements in any one group of the Periodic Table show similar chemical properties. The noble gases are a family of very unreactive elements. The alkali metals are a family of very reactive metals. The halogens are a family of very reactive non-metals. The transition metals are found between Groups 2 and 3 in the Periodic Table.		Demonstrate reactions of the Group 1 metals. React metals with chlorine. Find out the meanings of the names of the noble gases. Use a database to obtain information (ITO).

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(ii) Compounds and mixtures Most compounds with a name in '-ide' contain the two elements indicated; the ending 'ite' or '-ate' indicates the additional element oxygen. Compounds are formed when elements react together.		React pairs of elements and compare compounds formed with the elements. Classify substances as element or compound from names and formulae and record information in a table. Use models.
All chemical reactions involve the formation of one or more new substances. Chemical reactions can be identified by changes in appearance of substance, including colour change, gas evolved, precipitate formed. Chemical reactions can be identified by energy changes.		Carry out/demonstrate a selection of experiments. Make a list of everyday chemical reactions. View a videotape.
Exothermic reactions release energy to the surroundings and the products have less chemical energy than the reactants. Endothermic reactions take in energy from the surroundings and the products have more chemical energy than the reactants.	The use of reaction profiles should be restricted to the identification of exothermic and endothermic reactions.	Demonstrate/carry out a selection of exothermic and endothermic reactions.
Mixtures occur when two or more substances come together without reacting.		Make some mixtures and compare with the elements in the compound. Make a list of everyday mixtures. Separate mixtures by chromatography. Use models.
Air is a mixture of gases.	Candidates would be expected to know the approximate composition of air and that the gases in air include nitrogen, oxygen, carbon dioxide and noble gases.	
The test for oxygen is that it relights a glowing splint. There is not enough oxygen in the air for the test to be positive.		Find out, by experiment, the test for oxygen.

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
A solution is a mixture formed when a solute dissolves in a solvent. A substance which dissolves in a liquid is soluble; a substance which does not dissolve is insoluble. A saturated solution is one in which no more substance can be dissolved.		Dissolve a solid in water and recover by the evaporation of the water.
A dilute solution has a lower concentration of dissolved substance than a concentrated solution. A solution is diluted by adding more solvent.		Dissolve copper sulphate in water to make solutions of different concentrations, Add water to a concentrated solution and observe the change. Dilute concentrated fruit juice. Draw diagrams.
State symbols are used to show the state of species.		
b) Reaction rates		
(i) Following the course of a reaction Reactions can be followed by measuring changes in concentration, mass and volume of reactants and products.		Carry out a selection of experiments. Present and analyse experimental information in the form of tables and graphs (ITO).
The average rate of a reaction, or stage in a reaction, can be calculated from initial and final quantities and the time interval.		
The rate of a reaction, or stage in a reaction, is proportional to the reciprocal of the time taken, ie if the rate is high the time taken will be small, and vice versa.	Candidates would be expected to calculate the time taken for a reaction from rate information.	

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(ii) Factors affecting rate The rates of reactions are affected by changes in concentration, particle size and temperature.		*Investigate the effect of concentration, particle size and temperature on the rate of reaction (ITO).* Make a list of everyday reactions which are affected by changes in concentration, particle size and temperature.
The collision theory can be used to explain the effects of concentration and surface area on reaction rates.	The use of collision theory to explain the effect of temperature on reaction rate is not required.	Use a computer program. Use models.
(iii) Catalysts Catalysts are substances which speed up some reactions and are not used up by the reactions. Catalysts can be classified as either heterogeneous or homogeneous.		Demonstrate/carry out a selection of reactions involving heterogeneous and homogeneous catalysts (ITO). View a videotape
There are many everyday examples of uses of catalysts. Catalysts are used in many industrial processes.		Find out about everyday uses of catalysts and catalysts used in industry.
Heterogeneous catalysts work by the adsorption of reactant molecules.	Reference to activation energy, collision geometry or bond weakening is not required.	
The surface activity of a catalyst can be reduced by poisoning. Impurities in the reactants result in industrial catalysts having to be regenerated or renewed.	Candidates would be expected to have some understanding of active sites and that catalyst poisoning involves blocking of these sites.	
Catalytic convertors are fitted to cars to catalyse the conversion of poisonous carbon monoxide and oxides of nitrogen to carbon dioxide and nitrogen.		Find out why costly rhodium, platinum and palladium are used for the converters, rather than cheaper copper and nickel.

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Enzymes catalyse the chemical reactions which take place in the living cells of plants and animals. There are many everyday examples of uses of enzymes. Enzymes are used in many industrial processes.	Knowledge of specific enzymes is not required. Candidates would be expected to give an example of the use of an enzyme. Examples to include use in biological washing powders and in fermentation.	Investigate enzyme activity. Find out about everyday uses of enzymes and enzymes used in industry.
c) The structure of the atom		
(i) Sub-atomic particles Every element is made up of very small particles called atoms. The atom has a nucleus, which contains protons and neutrons, with electrons moving around outside the nucleus. Protons have a charge of one-positive, neutrons are neutral and electrons have a charge of one-negative. An atom is neutral because the numbers of protons and electrons are equal. Protons and neutrons have an approximate mass of one atomic mass unit and electrons, in comparison, have virtually no mass.		Demonstrate diffusion experiments. Find out about Rutherford's scattering experiment. Draw and label a diagram of an atom showing the location, charge and mass of the sub-atomic particles.
(ii) Important numbers Atoms of different elements have a different number of protons, called the atomic number. The electrons in an atom are arranged in energy levels. The elements of the Periodic Table are arranged in terms of their atomic number and chemical properties. Elements with the same number of outer electrons have similar chemical properties. An atom has a mass number which equals the number of protons plus neutrons.		Use a computer program.

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
The number of protons, neutrons and electrons can be found from the atomic number and mass number, and vice versa.		
Atoms can be represented by nuclide notation, eg $^{37}_{17}Cl$.		
(iii) Isotopes		
Isotopes are atoms with the same atomic number but different mass numbers.		Carry out an analogy experiment.
Most elements exist as a mixture of isotopes.		
The relative atomic mass of an element is rarely a whole number.	Candidates should be able to deduce the most abundant isotope given the mass numbers of the isotopes and the relative atomic mass of the element.	
d) Bonding, structure and properties		
(i) Bonding		
Atoms can be held together by bonds.		Use models.
In forming bonds, atoms can achieve a stable electron arrangement.		Use a computer program.
In a covalent bond atoms share pairs of electrons.		
The covalent bond is a result of two positive nuclei being held together by their common attraction for the shared pair of electrons.		
Covalent bonds are strong forces of attraction		
Polar covalent bonds are formed when the attraction of the atoms for the bonded electrons is different.	No understanding of electronegativity or use of electronegativity values is required.	
The covalent bonds in water are highly polar.		Find out about the unusual properties of water.

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Ionic compounds are usually formed when metals combine with non-metals. Positive ions are formed by metal atoms losing electrons and negative ions are formed by non-metal atoms gaining electrons. Ionic bonding is the electrostatic force of attraction between oppositely charged ions.	Candidates should be able to extend the use of nuclide notation to ions.	Use models. Use a computer program.
Metallic bonding is the electrostatic force of attraction between positively charged ions and delocalised electrons.		Use models. Use a computer program.
(ii) Structure		
A molecule is a group of atoms held together by covalent bonds. A diatomic molecule is made up of two atoms. Hydrogen, nitrogen, oxygen, the halogens and carbon monoxide exist as diatomic molecules.		Use models. Use a computer program.
Diagrams can be drawn to show how the outer electrons are shared to form the covalent bond(s) in a molecule. Diagrams can be drawn to show the shape of simple two-element molecules.	Candidates should be able to draw the shapes of linear, bent, pyramidal and tetrahedral two-element molecules.	
Covalent substances can consist of discrete molecules. The bonds between the molecules are weaker than the covalent bonds within molecules.		

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
The formula for a discrete covalent substance gives the actual number of atoms in each molecule. Formulae can be written from models or given molecular pictures. A covalent network structure consists of a giant lattice of covalently bonded atoms. The formula for a covalent network substance gives the simplest ratio of atoms of each element. An ionic structure consists of a giant lattice of oppositely charged ions. The formula for an ionic compound gives the simplest ratio of positive ions to negative ions. A metallic structure consists of a giant lattice of positively charged ions and delocalised outer electrons. **(iii) Properties** Metal elements (solids, liquids) and carbon (graphite) are conductors of electricity because they contain free electrons. Covalent substances (solids, liquids, solutions) do not conduct electricity since they are made up of molecules which are uncharged. Ionic compounds do not conduct electricity in the solid state since the ions are not free to move, but these compounds do conduct electricity when dissolved in water or when molten as the ions are now free to move.		Investigate the electrical conductivity of metals and non-metals. Investigate the electrical conductivity of ionic and covalent compounds (solids, liquids, solutions).

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Metals, ionic compounds and covalent network substances have high melting and boiling points due to the strong forces of attraction which need to be overcome. Discrete covalent substances have low melting and boiling points due to the weak forces of attraction that need to be overcome.		Compare the melting and boiling points of selected substances. Use a database to obtain information (ITO). Heat/melt solids.
Ionic compounds are usually soluble in water. Covalent substances which are insoluble in water may dissolve in other solvents.	Knowledge of lattice breaking versus hydration (solvation) energies is not required.	Investigate the solubility of ionic and covalent compounds in water and other solvents.
(iv) Electrolysis An electric current is a flow of charged particles.		
Electrolysis is the flow of ions through solutions and molten compounds (electrolytes). Electrolysis chemically changes the electrolyte and may lead to the break up of the compound. A dc supply must be used if the products of electrolysis are to be identified. Positive metal ions gain electrons at the negative electrode and negative non-metal ions lose electrons at the positive electrode. The results of electrolysis experiments can be illustrated by the migration of coloured ions.		*Electrolyse solutions.* Demonstrate the electrolysis of an ionic melt.

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
e) Chemical symbolism **(i) Formulae: two-element compounds and group ions** Formulae can be written for names using prefixes, including mono-, di-, tri-, tetra-. Formulae for two-element compounds are written using the data booklet. Formulae can be written for compounds involving group ions but not requiring brackets, eg Na_2SO_4. **(ii) Formulae: using Roman numerals and brackets** Formulae can be written for compounds which include Roman numerals in their names, eg iron(III) chloride. Formulae requiring brackets can be written for compounds, eg $Mg(OH)_2$. **(iii) Balanced equations** Formulae equations can be balanced to show the relative number of moles of reactant(s) and product(s). ***f) The mole*** **(i) Number of moles** The relative formula mass of a substance can be calculated from the relative atomic masses. The gram formula mass of any substance is known as one mole. The number of moles can be calculated from the mass of a substance and vice versa.	Candidates should be able to extend the use of brackets to writing formulae for compounds which include Roman numerals in their names, eg iron(III) hydroxide, $Fe(OH)_3$.	

National Course Specification: course details (cont)

Unit 1: Building Blocks (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(ii) Using balanced equations The mass of a reactant or product can be calculated using a balanced equation.		

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
a) Fuels		
(i) Combustion A fuel is a chemical which is burned to produce energy. Combustion is another word for burning. When a substance burns it reacts with oxygen.		Demonstrate a selection of experiments. Use models.
The chemical compounds which are found in oil and natural gas are mainly hydrocarbons.		Use audio-visual media. Find out about the formation of fossil fuels and fuel conservation.
A hydrocarbon is a compound which contains hydrogen and carbon only. Hydrocarbons burn in a plentiful supply of air to produce carbon dioxide and water. The test for carbon dioxide is that it turns lime water milky.		Find out, by experiment, the test for carbon dioxide. Burn a hydrocarbon and test products for carbon dioxide and water. Find out about condensation problems.
Carbon, and carbon monoxide, a poisonous gas, are produced when the hydrocarbons burn in a supply of oxygen which is insufficient for complete combustion.		Refer to newspaper articles.
Nitrogen and oxygen from the air react inside a petrol engine to form nitrogen oxides which are poisonous gases. The burning of some fuels releases sulphur dioxide, a poisonous gas, into the atmosphere.		Demonstrate the sparking of air. Find out about attempts to reduce pollution due to exhaust gases of the internal combustion engine. Use audio-visual material.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Soot particles produced by the incomplete combustion of diesel are harmful. Air pollution from the combustion of hydrocarbons can be reduced by the use of catalytic converters which speed up the conversion of pollutant gases to harmless gases.	Candidates would be expected to know that catalytic converters reduce emissions of nitrogen oxides, carbon monoxide and unburnt hydrocarbons.	
(ii) Fractional distillation Crude oil is a mixture of chemical compounds, mainly hydrocarbons. Fractional distillation is the process used to separate crude oil into fractions according to the boiling points of the components of the fractions. A fraction is a group of hydrocarbons with boiling points within a given range. Ease of evaporation, viscosity, flammability and boiling point range of the fractions are properties related to molecular sizes of the molecules within the fractions. The uses of the fractions are related to the ease of evaporation, viscosity, flammability and boiling point range of the fractions.		Use audio-visual material. Demonstrate fractional distillation of simulated crude oil and compare evaporation rate, viscosity and flammability of fractions.
b) Nomenclature and structural formulae **(i) Hydrocarbons** The alkanes are a subset of the set of hydrocarbons. The general formula for the alkanes is C_nH_{2n+2}. An alkane can be identified from the '-ane' ending. Straight-chain alkanes can be named from molecular formulae, shortened and full structural formulae (only C_1 to C_8). Molecular formulae can be written and shortened and full structural formulae can be drawn, given the names of straight-chain alkanes (only C_1 to C_8).		Use models.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Branched-chain alkanes can be systematically named from shortened and full structural formulae (only C_4 to C_8). Molecular formulae can be written and shortened and full structural formulae can be drawn, given the systematic names of branched-chain alkanes (only C_4 to C_8).		Use models.
The alkenes are a subset of the set of hydrocarbons. The general formula for the alkenes is C_nH_{2n}. An alkene can be identified from the carbon to carbon double bond and the '-ene' ending. Straight-chain alkenes can be named, incorporating the position of the double bond, from shortened and full structural formulae (only C_2 to C_8). Molecular formulae can be written and shortened and full structural formulae can be drawn, given the names of alkenes (only C_2 to C_8).		Use models.
The cycloalkanes are a subset of the set of hydrocarbons. The general formula for the cycloalkanes is C_nH_{2n}. A cycloalkane can be identified from the name. Cycloalkanes can be named from molecular formulae, shortened and full structural formulae (only C_3 to C_8; isomers are not required, eg only cyclohexane is expected, not methylcyclopentane). Molecular formulae can be written and shortened and full structural formulae can be drawn, given the names of cycloalkanes (only C_3 to C_8).		Use models.
A homologous series is a set of compounds with the same general formula and similar chemical properties.		

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(ii) Isomers Isomers are compounds with the same molecular formula but different structural formulae. Isomers can be drawn for given molecular formulae, shortened and full structural formulae.		Use models.
(iii) Alkanols and alkanoic acids An alkanol can be identified from the hydroxyl group and the '-ol' name ending. Straight-chain alkanols can be named, incorporating the position of the hydroxyl group, from shortened and full structural formulae (only C_1 to C_8). Molecular formulae can be written and shortened and full structural formulae can be drawn, given the names of straight-chain alkanols (only C_1 to C_8).	The classification of alkanols as primary or secondary is not required.	Use models.
An alkanoic acid can be identified from the carboxyl group and the '-oic' name ending. Straight-chain alkanoic acids can be named from shortened and full structural formulae (only C_1 to C_8). Molecular formulae can be written and shortened and full structural formulae can be drawn, given the name of straight-chain alkanoic acids (only C_1 to C_8).		Use models.
(iv) Esters An ester can be identified from the ester group and the '-oate' ending. An ester can be named given the names of the parent alkanol and alkanoic acid or from shortened and full structural formulae.		Use models.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Shortened and full structural formulae for esters can be drawn given the names of the parent alkanol and alkanoic acid or the names of esters. The products of the breakdown of an ester can be named, or shortened and full structural formulae can be drawn, given the name of the ester or from the shortened or full structural formulae of the ester. ***c) Reactions of carbon compounds*** **(i) Addition reactions** The alkanes and the cycloalkanes are saturated hydrocarbons. Saturated hydrocarbons contain only carbon to carbon single covalent bonds. The alkenes are unsaturated hydrocarbons. Unsaturated hydrocarbons contain at least one carbon to carbon double covalent bond. It is possible to distinguish an unsaturated hydrocarbon from a saturated hydrocarbon using bromine solution. An alkene reacts with hydrogen to form the corresponding alkane. The reactions of an alkene with bromine, hydrogen and water are addition reactions. **(ii) Cracking** Fractional distillation of crude oil yields more long-chain hydrocarbons than are useful for present-day industrial purposes. Cracking is an industrial method for producing a mixture of smaller, more useful molecules, some of which are unsaturated.	Candidates would be expected to name and draw the full structural formula of the alkane product. Candidates should be able to draw full structural formulae for possible products of the addition of bromine or water to an alkene.	*Test hydrocarbons for unsaturation.* Use models. *Carry out the cracking of liquid paraffin.* Use models. View a videotape.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
The catalyst allows the reaction to take place at a lower temperature. Cracking can be carried out in the laboratory using an aluminium oxide or silicate catalyst.		
(iii) Ethanol Fermentation is the breakdown of glucose to form ethanol and carbon dioxide. An enzyme in yeast acts as a catalyst for the reaction. Ethanol, for alcoholic drinks, can be made by fermentation of glucose derived from any fruit or vegetable.		Carry out the fermentation of a glucose solution or fruit juice.
There is a limit to the ethanol concentration of fermentation products.	Candidates would be expected to know why there is a limit to the ethanol concentration of fermentation products.	
Distillation is a method of increasing the ethanol concentration of fermentation products in the manufacture of 'spirit' drinks.		Distill a water/alcohol mixture. Find out about the whisky industry.
Alcoholic drinks, if taken in excess, can have damaging affects to health and mind.		Refer to public information booklets to find out about the affect of alcohol on the body and the links between the use of alcohol and road accidents. Demonstrate the breathalyser reaction.
To meet market demand ethanol is made by means other than fermentation. Industrial ethanol is manufactured by the catalytic hydration of ethene.		
Ethanol can be converted to ethene by dehydration.		View a videotape. Carry out the dehydration of ethanol.
Ethanol, mixed with petrol, can be used as a fuel for cars. The ethanol is obtained from sugar cane, a renewable source of energy.		Find out about the use of ethanol as a fuel.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(iv) Making and breaking esters Esters are formed by the condensation reaction between a carboxylic acid and an alcohol. In a condensation reaction, the molecules join together by the reaction of the functional groups to make water. The ester link is formed by the reaction of a hydroxyl group with a carboxyl group. The parent carboxylic acid and the parent alcohol can be obtained by hydrolysis of an ester. The formation and hydrolysis of an ester is a reversible reaction.		Note the smell of common esters. Find out about the uses of esters. Prepare a selection of esters. Carry out/demonstrate the hydrolysis of an ester.
d) Plastics and synthetic fibres **(i) Uses** Synthetic materials are made by the chemical industry. Most plastics and synthetic fibres are made from chemicals derived from oil. Examples of plastics include polythene, polystyrene, perspex, PVC, nylon, bakelite, formica and silicones. Kevlar, which is very strong, and poly(ethenol), which readily dissolves in water, are recently developed plastics. The everyday uses of plastics are related to their properties.	Knowledge of the structures for Kevlar and poly(ethenol) is not required. Candidates would be expected to be aware of a range of uses of plastics and should be able to link the uses of plastics to the examples specified in the content statements.	Find out about the history of the plastics and synthetic fibres industries and the importance of ethane. Use audio-visual material. Examine samples of plastics. Find out about the uses of plastics in and around the modern home and how the uses of plastics are related to their properties. Obtain information from a database (ITO). Investigate the properties of plastics.
Examples of synthetic fibres include polyesters, eg Terylene, and nylon. For some uses, synthetic materials have advantages over natural materials and vice versa.	Candidates should be able to link advantages of synthetic materials over natural materials to their uses and vice versa.	Make a list of natural and synthetic materials used for the same purpose.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Biopol is a recently developed degradable plastic. Most plastics are not biodegradable and their low density and durability can cause environmental problems.	Knowledge of the structure for Biopol is not required.	Observe the litter in the local environment. Find out about the manufacture, uses and degradability of biopol. Find out about the local arrangements for refuse disposal. Find out about recycling initiatives including the use of a coding system. Make a table to show the advantages and disadvantages associated with the different options for disposal.
Some plastics burn or smoulder to give off toxic fumes, including carbon monoxide, hydrogen chloride and hydrogen cyanide. The toxic gases given off during burning or smouldering can be related to the elements present in the plastic.		Refer to newspaper articles.
Plastics can be either thermoplastic or thermosetting. A thermoplastic is one which can be reshaped on heating. A thermosetting plastic cannot be reshaped by heating.		Make a list of uses for thermoplastics and thermosetting plastics. Classify plastics with a variety of uses. Investigate the effect of a hot nail on different plastics. Use a database to obtain information (ITO).
(ii) Addition polymerisation Plastics are made up of long chain molecules called polymers. Polymer molecules are made from many small molecules called monomers. Addition polymers are made from small unsaturated molecules, produced by cracking, by a process called addition polymerisation.		Use models. Demonstrate the polymerisation of poly(phenylethene). Carry out the depolymerisation of polythene

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
The small unsaturated molecules join together by the opening of the carbon to carbon double bond. The name of the addition polymer is related to the name of the monomer. The repeating unit or the structure of an addition polymer can be drawn given the monomer structure and vice versa.		
(iii) Condensation polymerisation Condensation polymers are made from monomers with two functional groups per molecule. The repeating unit or the structure of a condensation polymer can be drawn given the monomer structures and vice versa.		Use models.
Polyesters are examples of condensation polymers.		Find out about the manufacture of Terylene. Find out about textile fibres and resins.
An amine can be identified from the functional group. Polyamides are examples of condensation polymers. The amide link is formed by the reaction of an amine group with a carboxyl group.		Demonstrate the nylon rope-trick.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
e) Natural products		
(i) Carbohydrates Carbohydrates form an important class of food made by plants. Photosynthesis is the process by which plants make carbohydrates from carbon dioxide and water using light energy in the presence of chlorophyll; oxygen is released in the process. Carbohydrates supply the body with energy. Respiration is the process by which the body obtains a supply of energy by breaking down carbohydrates (using oxygen) to give carbon dioxide and water.		Find out about photosynthesis, respiration and the greenhouse effect. Make a list of foods which are high in carbohydrate. Refer to published data to compare energy values of different foods. Investigate the energy released on burning different carbohydrates. Carry out/demonstrate the combustion of a carbohydrate.
Carbohydrates are compounds which contain carbon, hydrogen and oxygen with the hydrogen and oxygen in the ratio of two to one. Carbohydrates can be divided into sugars and starches. Examples of sugars include glucose, fructose, maltose and sucrose (table sugar).	Candidates would be expected to recognise a molecular formula as that for a carbohydrate but knowledge of molecular formulae for particular carbohydrates is not required.	Make a table giving the names of carbohydrates and their formulae. Examine models of carbohydrate molecules. Demonstrate the addition of concentrated sulphuric acid to sucrose.
Most sugars can be detected by the Benedict's test; sucrose is an exception. Starch can be distinguished from other carbohydrates by the iodine test.		Find out, by experiment, the test for most sugars and starch.
Sugars are carbohydrates with small molecules. Starch is a natural condensation polymer made of many glucose molecules linked together. Plants convert the glucose into starch for storing energy.		Use models.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
During digestion starch is hydrolysed to glucose which is carried by the blood stream to body cells. Starch can be hydrolysed by acid and by enzymes.		Use models. *Investigate the effect of amylase and/or acid on the breakdown of starch (ITO).*
Body enzymes function best at body temperature and are destroyed at higher temperatures.	Knowledge of the denaturing process is not required.	Investigate enzyme activity.
(ii) Proteins Proteins form an important class of food made by plants. Proteins are the major structural materials of animal tissue and are involved in the maintenance and regulation of life processes and include enzymes, many hormones, eg insulin and haemoglobin.		Make a list of foods which are high in proteins. Find out about the importance of proteins.
Proteins are condensation polymers made of many amino acid molecules linked together. The structure of a section of protein is based on the constituent amino acids. Condensation of amino acids produces the peptide (amide) link. The peptide link is formed by the reaction of an amine group with a carboxyl group. Proteins specific to the body's needs are built up within the body.		Use models. View a videotape. Make a table to show the names of some amino acids and their structures.
During digestion enzyme hydrolysis of dietary proteins produces amino acids. The structural formulae of amino acids obtained from the hydrolysis of proteins can be identified from the structure of a section of the protein.		Use models. Carry out the hydrolysis of a protein. Separate amino acids using chromatography. View a videotape.

National Course Specification: course details (cont)

Unit 2: Carbon Compounds (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(iii) Fats and oils Natural fats and oils can be classified according to their origin as animal, vegetable or marine.		Make a list of foods which are high in fats and oils. Look at samples of fats and oils with source and formulae shown.
The lower melting points of oils compared to those of fats is related to the higher unsaturation of oil molecules. The conversion of oils into hardened fats involves the partial removal of unsaturation by addition of hydrogen.		View a videotape. Test fats and oils for unsaturation. Demonstrate the hydrogenation of an oil.
Fats and oils in the diet supply the body with energy and are a more concentrated source of energy than carbohydrates.		Refer to medical information leaflets to find out about the importance of fats and oils in a balanced diet and a link between high intake of saturated fat in the diet and heart disease.
Fats and oils are esters.		
The hydrolysis of fats and oils produces fatty acids and glycerol in the ratio of three moles of fatty acid to one mole of glycerol. Fatty acids are saturated or unsaturated straight chain carboxylic acids, usually with long chains of carbon atoms.	Candidates would be expected to know the structure for glycerol.	Find out about the structures of fats and oils. Use models.

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
a) Acids and bases		
(i) The pH scale The pH scale is a continuous range from below 0 to above 14. Acids have a pH of less than 7; alkalis have a pH of more than 7; pure water and neutral solutions have a pH equal to 7.		Test the pH of solutions and classify as acid/neutral/alkali.
Non-metal oxides which dissolve in water produce acid solutions. Metal oxides and hydroxides which dissolve in water produce alkaline solutions. Ammonia dissolves in water to produce an alkali.		Burn carbon and sulphur and test the pH of solutions of the oxides. Demonstrate the sparking of air. Test the pH of solutions of metal oxides and hydroxides. Demonstrate the solubility of ammonia in water.
Acids and alkalis are in common use in both the laboratory and the home.	Candidates would be expected to know that household acids include vinegar, lemonade, soda water and Coke and that household alkalis include baking soda, dishwashing powder and bleach.	Test the pH of solutions of common house-hold substances.
In water and neutral solutions, the concentration of hydrogen ions is equal to the concentration of hydroxide ions. An acidic solution contains more hydrogen ions than hydroxide ions. An alkaline solution contains more hydroxide ions than hydrogen ions.	Knowledge of actual concentrations of hydrogen and hydroxide ions in acids, neutral solutions and alkalis is not required.	Demonstrate the conductivity of water.
The effect of dilution on the pH of an acid or alkali is explained in terms of the decreasing concentration of hydrogen and hydroxide ions.		Investigate the effect of dilution on the acidity or alkalinity of solutions.

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
In water and aqueous solutions there is an equilibrium between hydrogen and hydroxide ions and water molecules. When a reversible reaction is in equilibrium, the concentrations of reactants and products remain constant although not necessarily equal.		Demonstrate a simulation of equilibrium.
(ii) Concentration The concentration of a solution is expressed in mol l^{-1}. The number of moles of solute, volume and concentration of a solution can be calculated from the other two variables.		Prepare a standard solution.
(ii) Strong and weak acids and bases In aqueous solution, strong acids are completely dissociated into ions but weak acids are only partially dissociated. Hydrochloric acid, sulphuric acid and nitric acid are strong acids. Ethanoic acid is a weak acid. Equimolar solutions of strong and weak acids differ in pH, conductivity and rate of reaction.	A volumetric comparison of equimolar solutions of strong and weak acids is not required.	Compare the properties of equimolar solutions of ethanoic acid and hydrochloric acid.
In aqueous solution, strong bases are completely ionised but weak bases are only partially ionised. Solutions of metal hydroxides are strong bases. Ammonia solution is a weak base. Equimolar solutions of strong and weak bases differ in pH, conductivity and rate of reaction.	A volumetric comparison of equimolar solutions of strong and weak bases is not required.	Compare the properties of equimolar solutions of ammonia and sodium hydroxide.

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
b) Salt preparation		
(i) Reaction of acids Neutralisation is the reaction of acids with bases. Metal oxides, metal hydroxides and metal carbonates are examples of bases. Neutralisation moves the pH of an acid up towards 7. Neutralisation moves the pH of an alkali down towards 7. In the reaction of an acid with an alkali the hydrogen ions and hydroxide ions form water. In the reaction of an acid with a metal oxide the hydrogen ions and the oxide ions form water. In the reaction of an acid with a metal carbonate the hydrogen ions and carbonate ions form water and carbon dioxide.		Carry out a selection of neutralisation experiments (ITO).
Bases which dissolve in water form alkalis.		Use the data booklet.
Everyday examples of neutralisation include the treatment of acid indigestion and using lime to reduce acidity in soil and lochs.		Investigate the effect of adding lime to soil and acid rain-water. Investigate the neutralising effect of indigestion tablets. Use audio-visual material to find out about everyday examples of neutralisation.
An acid reacts with some metals to give off hydrogen gas. In the reaction, hydrogen ions form hydrogen molecules. The test for hydrogen is that it burns with a 'pop'.	Candidates would be expected to know that only metals above hydrogen in the electrochemical series react with acids.	Find out, by experiment, the test for hydrogen. Investigate the reaction of metals with acids.
Sulphur dioxide, produced by the burning of fossil fuels, and nitrogen dioxide, produced by the sparking of air in car engines, dissolve in water in the atmosphere to produce acid rain.		Demonstrate the solubility of sulphur dioxide in water. Use audio-visual material to find out about the causes and effects of acid rain and the social and economic implications.

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Acid rain has damaging effects on buildings made from carbonate rock, structures made of iron and steel, soils and plant and animal life.		Investigate the effect of acid on different rocks. Investigate the effect of sulphur dioxide on different materials. Investigate the effect of sulphur dioxide on plant growth.
(ii) Volumetric titrations The concentration of acids/alkalis can be calculated from the results of volumetric titrations.	Candidates would also be expected to calculate the volumes of acids/alkalis required for neutralisation from titration data.	Carry out a volumetric titration (ITO).
(iii) Naming salts A salt is a compound in which the hydrogen ions of an acid have been replaced by metal ions (or ammonium ions). Salts are formed in the reaction of acids with bases or metals. Hydrochloric acid forms chloride salts, sulphuric acid forms sulphate salts and nitric acid forms nitrate salts.		*Prepare salts by different reactions.*
Some nitrogen salts, including ammonium nitrate, ammonium sulphate and potassium nitrate are made by neutralisation reactions for use as fertilisers; these salts are soluble in water.		Find out about fertilisers. Investigate the solubility of ammonium and nitrate salts.
In the preparation of a soluble salt, it is often easier to use an insoluble metal carbonate or metal oxide as the base.		Use the data booklet to identify the most suitable method of preparing a salt.
(iv) Precipitation Precipitation is the reaction of two solutions to form an insoluble product called a precipitate. Insoluble salts can be formed by precipitation.		Prepare salts by precipitation reactions.

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(v) Ionic equations Spectator ions can be identified in neutralisation and precipitation reactions and the equations can be rewritten omitting these ions.		
c) Metals		
(i) The electrochemical series Electricity can be produced by connecting different metals together, with an electrolyte, to form a simple cell.		Find out about the advantages and disadvantages of batteries compared with mains electricity. Examine a wide variety of batteries, including rechargeable batteries. Find out why batteries have to be replaced. Set up and use a lead-acid cell. Make a lemon cell.
The voltage between different pairs of metals varies and this leads to the electrochemical series.		Use a voltmeter to measure the voltage of various metal couples. *Investigate factors which affect the voltage in a simple cell.*
Displacement reactions occur when a metal is added to a solution containing ions of a metal lower in the electrochemical series.		Carry out displacement reactions.
The reaction of metals with acids can establish the position of hydrogen in the electrochemical series.		Investigate the reaction of metals with acid.
Electricity can be produced in a cell by connecting two different metals in solutions of their metal ions.	Candidates would be expected to know that the further apart metals are in the electrochemical series the higher is the voltage produced by a cell.	Set up suitable cells and examine the direction of electron flow.

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
Electricity can be produced in a cell when at least one of the half-cells does not involve metal atoms. Electrons flow in the external circuit from the species higher in the electrochemical series to the one lower in the electrochemical series. The purpose of the 'ion bridge' (salt bridge) is to allow the movement of ions to complete the circuit. **(ii) Redox reactions** Oxidation is a loss of electrons by a reactant in any reaction. A metal element reacting to form a compound is an example of oxidation. Reduction is a gain of electrons by a reactant in any reaction. A compound reacting to form a metal is an example of reduction. In a redox reaction, reduction and oxidation go on together. Ion-electron equations can be written for oxidation and reduction reactions. Ion-electron equations can be combined to produce redox equations. During electrolysis, oxidation occurs at the positive electrode and reduction occurs at the negative electrode.		Carry out a range of test-tube experiments. Use a database to find out about redox reactions (ITO). Electrolyse a solution.

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
(iii) Reactions of metals		
Metals react with oxygen, water and dilute acid.	Candidates would be expected to use the electrochemical series as a guide and to know that metals below copper would not react with oxygen, metals below magnesium would not react with water and metals below hydrogen would not react with dilute acid.	*Investigate the reaction of metals with oxygen, water and dilute acid.*
Differences in the reaction rates give an indication of the reactivity of the metal.		Use the results of experiments to place metals in order of reactivity.
(iv) Metal ores		
Ores are naturally occurring compounds of metals.		Examine samples of ores/minerals and make a table to show the elements in them.
The less reactive metals, including gold, silver and copper, are found uncombined in the Earth's crust and the more reactive metals have to be extracted from their ores.	Candidates would be expected to know that extracting metals from their ores is an example of reduction.	Find out about how the discovery of the elements was related to social and industrial factors.
Some metals can be obtained from metal oxides by heat alone; some metal oxides need to be heated with other substances, eg carbon or carbon monoxide; other metals cannot be obtained by these methods.	Candidates should be able to suggest the method used to extract a metal from its ore by considering the position of the metal in the electrochemical series.	Extract a metal from its ore by heating with carbon.
Iron is produced from iron ore in the Blast Furnace.		Find out about the Blast Furnace.
The production of carbon monoxide and the reduction of iron oxide are key reactions which take place in the Blast Furnace.	Candidates would be expected to know the two reactions involved in the production of carbon monoxide.	Use audio-visual material.
The more reactive metals, including aluminium, are obtained by electrolysis.		Find out about the extraction of aluminium.
(v) Corrosion		
Corrosion is a chemical reaction which involves the surface of a metal changing from an element to a compound.	Candidates would be expected to know that corrosion is an example of oxidation.	Examine different metals/materials left exposed to the atmosphere. Use audio-visual material.
Different metals corrode at different rates.	Candidates would be expected to link the rate of corrosion of a metal to the reactivity of the metal.	Find out about the economic costs of corrosion.
The term rusting is applied to the corrosion of iron.		Carry out test-tube experiments.
Both water and oxygen, from the air, are required for rusting.		

National Course Specification: course details (cont)

Unit 3: Acids, Bases and Metals (Intermediate 2)

CONTENT STATEMENTS	NOTES	SUGGESTED ACTIVITIES
When iron rusts, initially the iron atom loses two electrons to form iron(II) ions which can be oxidised further to give iron(III) ions. Electrons lost by the iron during rusting are accepted by the water and oxygen to form hydroxide ions.		
Ferroxyl indicator can be used to detect the presence of iron(II) ions and hydroxide ions. Ferroxyl indicator turns blue in the presence of iron(II) ions and pink in the presence of hydroxide ions.		Investigate the effect of acid rain, salt and attaching different metals on the rusting process.
Acid rain increases the rate of corrosion. Salt increases the rate of corrosion. When attached to metals higher in the electrochemical series, electrons flow to the iron, and when attached to metals lower down in the series, electrons flow from the iron.	Candidates would be expected to be able to explain why acid rain/salt increases the rate of corrosion.	
Iron does not rust when attached to the negative terminal of a battery. Electrons flowing to the iron prevents rusting. Anti-corrosion methods are used in everyday situations.		
Painting, greasing, electroplating, galvanising, tin-plating and coating with plastic give a surface barrier to air and water which can provide physical protection against corrosion. Galvanising and the use of scrap magnesium result in electrons flowing to the iron giving sacrificial protection. Scratching tinplate increases the rate of rusting of iron.		Find out about corrosion prevention. Carry out test-tube experiments. Electroplate a metal.

National Course Specification: course details (cont)

COURSE Chemistry (Intermediate 2)

ASSESSMENT

To gain the award of the course, the candidate must achieve all the component units of the course as well as the external assessment. The external assessment will provide the basis for grading attainment in the course award.

When units are taken as component parts of a course, candidates will have the opportunity to achieve at levels beyond that required to attain each of the unit outcomes. This attainment may, where appropriate, be recorded and used to contribute towards course estimates, and to provide evidence for appeals. Further information on key principles of assessment are provided in the paper *Assessment* (HSDU, 1996) and in *Managing Assessment* (HSDU, 1998).

DETAILS OF THE INSTRUMENTS FOR EXTERNAL ASSESSMENT

External assessment will be through an examination which will sample across the performance criteria associated with the three outcomes in each of the three units which comprise the course. The detailed knowledge and understanding required for each unit is listed in the course content.

The examination will consist of one paper of 2 hours with a total allocation of 80 marks.

The paper will consist of two sections:

Section A	Fixed-response questions	30 marks
Section B	Extended-answer questions	50 marks.

Section A will be made up of 30 multiple-choice questions.

In Section B approximately 5 marks will be allocated to questions which will draw on the candidates' experience of the prescribed practical activities. Of the 80 marks in the paper between 46 and 50 marks will be allocated to the assessment of knowledge and understanding and between 30 and 34 marks will be allocated to the assessment of problem solving.

Candidates will be expected to answer all questions.

GRADE DESCRIPTIONS

Grade C

Candidates at Grade C will have demonstrated success in achieving the component units of the course. In the course assessment candidates achieving a Grade C will have demonstrated an overall satisfactory level of performance by:

- retaining knowledge and understanding over a longer period of time
- integrating knowledge and understanding across the three component units of the course
- displaying problem solving skills in less familiar contexts.

Grade A

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

- retaining knowledge and understanding over a longer period of time
- showing a deeper level of knowledge and understanding
- integrating knowledge and understanding across the three component units of the course
- displaying problem solving skills in less familiar and more complex contexts.

DETAILS OF THE INSTRUMENTS FOR INTERNAL ASSESSMENT

Outcomes 1 and 2

For each unit, Outcomes 1 and 2 will be assessed by a single holistic closed-book test. The ratio of marks allocated to Outcomes 1 and 2 will be 3:2.

In each test, all of the performance criteria and aspects of evidence requirements for Outcome 1 and all of the specified performance criteria for Outcome 2, will be assessed.

Outcome 3

Candidates are required to produce one report on an experiment covering all of the performance criteria and related to Intermediate 2 Chemistry.

The report must be based on one of the Unit 1 prescribed practical activities listed below:

- The Effect of Concentration Changes on Reaction Rate
- The Effect of Temperature Changes on Reaction Rate
- Electrolysis.

APPROACHES TO LEARNING AND TEACHING

Appropriate selection from a variety of learning and teaching approaches is required to deliver both knowledge-based and skill-based objectives to candidates with different needs and abilities. In doing so, opportunities should be provided for candidates to work independently, sometimes in small groups and on other occasions as a whole class. Exposition, used in conjunction with questioning and discussion, is a very effective way of developing candidates' knowledge and understanding of the more theoretical chemical concepts as well as a good means of introducing new topics and consolidating completed topics. Resource-based learning can help candidates to acquire knowledge and understanding through the practice of the problem solving and practical skills associated with scientific enquiry. Where resource-based approaches are used, careful thought should be given to the selection of resources, including worksheets, and to the provision of opportunities for blending in whole-class presentations. Both teachers/lecturers and candidates should make full use of opportunities to use models to help the understanding of concepts in chemistry and to use information technology to support learning and to process data.

Practical work should include a balance of illustrative teacher/lecturer demonstrated experiments, which can help to make knowledge more memorable and facilitate understanding, and techniques which develop the skills associated with the types of practical activity which have a clear and important place within the normal study of chemistry. Candidates should also have the opportunity to carry out investigations to enable problem solving skills to be developed within a practical context.

The chemistry courses have been designed to give emphasis to applications and issues and should be presented in a manner which allows candidates to recognise the relevance of the theoretical knowledge to their lives and everyday experiences. In addition, the learning and teaching approaches which are employed should provide opportunities for the development of core skills.

Effective learning and teaching in chemistry cannot take place without effective communication, from the candidates as well as the teacher/lecturer, and at all times the safety of the candidates should be a matter of priority.

Use of the additional 40 hours

This time may be used:

- to provide an introduction to the course and assessment methods
- to allow candidates to develop their ability to integrate knowledge, understanding and skills acquired through the study of the different component units
- to allow some more practical work, on an individual basis if appropriate, within the units to enhance skills and understanding
- for consolidation and integration of learning
- for remediation
- for practice in examination techniques and preparation for the external examination
- to complete reports on prescribed practical activities.

SPECIAL NEEDS

This course specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: general information

UNIT Building Blocks (Intermediate 2)

NUMBER D066 11

COURSE Chemistry (Intermediate 2)

SUMMARY

The unit seeks to develop knowledge and understanding, problem solving and practical abilities in the context of substances; reaction rates; the structure of the atom; bonding, structure and properties; chemical symbolism; and the mole.

OUTCOMES

1 Demonstrate knowledge and understanding related to *Building Blocks*.
2 Solve problems related to *Building Blocks*.
3 Collect and analyse information related to *Intermediate 2 Chemistry* obtained by experiment.

Administrative Information

Superclass: RD

Publication date: March 2004

Source: Scottish Qualifications Authority

Version: 05

National Unit Specification: general information (cont)

UNIT Building Blocks (Intermediate 2)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following awards or its equivalent:

- Standard Grade Chemistry at grades 3 and 4
- Standard Grade Biology, Physics or Science at grades 1 to 3
- Intermediate 1 Chemistry or its component units
- Intermediate 2 Biology or Physics

together with

- Standard Grade Mathematics at grades 3 and 4 or Intermediate 1 Mathematics.

The preferred entry from Standard Grade is based on achievement in the Knowledge and Understanding and Problem Solving elements.

CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF points at SCQF level 5*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, publication code BA0906).

National Unit Specification: statement of standards

UNIT Building Blocks (Intermediate 2)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to 'Building Blocks'.

Performance criteria

(a) Knowledge and understanding of substances are clearly shown in appropriate ways.
(b) Knowledge and understanding of reaction rates are clearly shown in appropriate ways.
(c) Knowledge and understanding of the structure of the atom is clearly shown in appropriate ways.
(d) Knowledge and understanding of bonding, structure and properties are clearly shown in appropriate ways.
(e) Knowledge and understanding of chemical symbolism is clearly shown in appropriate ways.
(f) Knowledge and understanding of the mole is clearly shown in appropriate ways.

Evidence requirements

Evidence of an appropriate level of achievement from a closed-book test with items covering all of the following aspects of the above performance criteria.

Knowledge and understanding of substances

(i) Elements
(ii) Compounds and mixtures

Knowledge and understanding of reaction rates

(i) Following the course of a reaction
(ii) Factors affecting rate
(iii) Catalysts

Knowledge and understanding of the structure of the atom

(i) Sub-atomic particles
(ii) Important numbers
(iii) Isotopes

Knowledge and understanding of bonding, structure and properties

(i) Bonding
(ii) Structure
(iii) Properties
(iv) Electrolysis

National Unit Specification: statement of standards (cont)

UNIT Building Blocks (Intermediate 2)

Knowledge and understanding of chemical symbolism

(i) Formulae: two-element compounds and group ions
(ii) Formulae: using Roman numerals and brackets
(iii) Balanced equations

Knowledge and understanding of the mole

(i) Number of moles
(ii) Using balanced equations

OUTCOME 2

Solve problems related to *Building Blocks*.

Performance criteria

(a) Relevant information is selected and presented in an appropriate way.
(b) Information is accurately processed using calculations where appropriate.
(c) Conclusions drawn are valid and explanations given are supported by evidence.
(d) Experimental procedures are planned, designed and evaluated in an appropriate way.
(e) Predictions and generalisations made are based on available evidence.

Evidence requirements

Evidence of an appropriate level of achievement from a closed-book test with items covering all of the above performance criteria.

National Unit Specification: statement of standards (cont)

UNIT Building Blocks (Intermediate 2)

OUTCOME 3

Collect and analyse information related to *Intermediate 2 Chemistry* obtained by experiment.

Performance criteria

(a) The information is collected by active participation in the experiment.
(b) The experimental procedures are described accurately.
(c) Relevant measurements and observations are recorded in an appropriate format.
(d) Conclusions drawn are valid.

Evidence requirements

A report of one experimental activity is required covering the above performance criteria and related to one of the following experiments:

- the effect of concentration changes on reaction rate
- the effect of temperature changes on reaction rate
- electrolysis

The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate planning the experiment; deciding how it is managed; identifying and obtaining the necessary resources, some of which must be unfamiliar; carrying out the experiment. Depending on the activity, the collection of the information may be group work.

Evidence submitted in support of attainment of PC (c) must be in the format of a table or graph(s) as appropriate. Conclusions drawn should be justified by reference to supporting evidence and include an evaluation. The evaluation should cover all stages of the experiment, including the initial analysis of the situation, and planning and organising the experimental procedures.

National Unit Specification: support notes

UNIT Building Blocks (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The recommended content together with suggested activities for this unit are detailed in the course specification. The subheadings in these tables correspond to the aspects mentioned in the evidence requirements for Outcome 1. The prescribed practical activities for the unit are listed in the *Course Contents*.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

General advice is contained in the course specification and more detailed advice will be contained in the Subject Guide for chemistry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcomes 1 and 2

It is recommended that a holistic approach is taken for assessment of these outcomes. Outcomes 1 and 2 can be assessed by an integrated end of unit test with questions covering all the performance criteria. Within one question, assessment of knowledge and understanding and problem solving can occur. Each question can address a number of performance criteria from either Outcome 1 or 2. Appropriate assessment items are available from the National Assessment Bank.

Outcome 3

Opportunities to generate evidence for attainment at Outcome 3 will arise during the practical work related to the prescribed practical activities.

Related to PC (a) the teacher/lecturer checks by observation that the candidate has taken an active part in the collection of information by experiment.

Candidates should provide a structured report with an appropriate title. The report should relate to the performance criteria as follows:

b) As experiments will follow a given procedure or method there is no need for a detailed description. The procedure, or the steps in the procedure, should be described briefly in outline. The impersonal passive voice should be used. The following should be used as appropriate:

- aim of the experiment
- a labelled diagram, description of apparatus, instruments used
- how measurements were taken or observations made
- comments on safety.

c) Readings or observations (raw data) should be recorded using the following as appropriate:

- a table with correct headings and appropriate units
- a table with readings/observations entered correctly
- a statement of results.

d) Conclusions should contain at least one of the following:

- the overall pattern to readings
- the trends in analysed information or results
- the connection between variables
- an analysis of the observations.

Conclusions should also include evaluation of the experimental procedures and could make reference to one of the following:

- effectiveness of procedures
- control of variables
- limitations of equipment
- possible improvements
- possible sources of error.

The bullet points under each performance criterion give an indication of what should be addressed to achieve a pass. The relevance of the bullet points will vary according to the experiment. These bullet points are intended as helpful guidance. The decision of pass or fail is to be made by the professional judgement of the presenting centre (subject to moderation) against the performance criteria.

Redrafting

It is appropriate to support candidates in producing a report to meet the performance criteria. Redrafting of reports after necessary supportive criticism is to be encouraged both as part of the learning and teaching process and to produce evidence for assessment. Redrafting is only required for the specific performance criteria identified in need of further attention, ie the entire report does not require to be rewritten.

Conditions required to complete the report

Candidates may complete their reports outwith class time provided reasonable measures are taken to ensure that the report is the individual work of the candidate.

Teachers and lecturers may wish candidates to write up reports under their direct supervision so that they can provide appropriate advice and support. However, they may feel confident that any redrafting required need not be undertaken under such close supervision as it will be evident in the candidate's response that it is his or her unaided work. Under such circumstances it would be acceptable for such redrafting to take place outwith class time.

Use of IT

Candidates may, if they wish, present their reports in a word-processed format. Candidates may use Excel or any other suitable data analysis software when tackling Outcome 3. However, candidates must not be given a spreadsheet with pre-prepared column headings or formula since they are being assessed on their ability to enter quantities and units into a table and to make decisions about appropriate scales and labels on graph axes.

Transfer of evidence

Candidates may transfer evidence of Outcome 3 from Unit 1 (Energy Matters) of Higher to Unit 1 (Building Blocks) of Intermediate 2 in respect of the prescribed practical activities 'The Effect of Concentration Changes on Reaction Rate' and 'The Effect of Temperature Changes on Reaction Rate'. The prescribed practical activity 'Enthalpy of Combustion' (Higher) cannot be transferred since it is not in the context of any unit of Intermediate 2.

Candidates may transfer evidence of Outcome 3 from Unit 1 (Building Blocks) of Intermediate 2 to Unit 1 (Chemistry in Action) of Intermediate 1 in respect of the prescribed practical activities 'The Effect of Concentration Changes on Reaction Rate' and 'The Effect of Temperature Changes on Reaction Rate'. The prescribed practical activity 'Electrolysis' (Intermediate 2) cannot be transferred to Unit 1 of Intermediate 1.

Candidates, who are repeating a year, may use evidence of an appropriate standard generated in a previous year.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: general information

UNIT Carbon Compounds (Intermediate 2)

NUMBER D067 11

COURSE Chemistry (Intermediate 2)

SUMMARY

The unit seeks to develop knowledge and understanding, problem solving and practical abilities, in the context of fuels; nomenclature, structural formulae and reactions of carbon compounds; plastics and synthetic fibres; and natural products.

OUTCOMES

1 Demonstrate knowledge and understanding related to *Carbon Compounds*.
2 Solve problems related to *Carbon Compounds*.
3 Collect and analyse information related to *Intermediate 2 Chemistry* obtained by experiment.

Administrative Information

Superclass: RD

Publication date: March 2004

Source: Scottish Qualifications Authority

Version: 05

National Unit Specification: general information (cont)

UNIT Carbon Compounds (Intermediate 2)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following awards or its equivalent:

- Standard Grade Chemistry at grades 3 and 4
- Standard Grade Biology, Physics or Science at grades 1 to 3
- Intermediate 1 Chemistry or its component units
- Intermediate 2 Biology or Physics

together with

- Standard Grade Mathematics at grades 3 and 4 or Intermediate 1 Mathematics.

The preferred entry level from Standard Grade is based on achievement in the Knowledge and Understanding and Problem Solving elements.

CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF points at SCQF level 5*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Carbon Compounds (Intermediate 2)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to 'Carbon Compounds'.

Performance criteria

(a) Knowledge and understanding of fuels are clearly shown in appropriate ways.
(b) Knowledge and understanding of nomenclature and structural formulae are clearly shown in appropriate ways.
(c) Knowledge and understanding of reactions of carbon compounds are clearly shown in appropriate ways.
(d) Knowledge and understanding of plastics and synthetic fibres are clearly shown in appropriate ways.
(e) Knowledge and understanding of natural products are clearly shown in appropriate ways.

Evidence requirements

Evidence of appropriate achievement from a closed-book test with items covering all of the following aspects of the above performance criteria.

Knowledge and understanding of fuels

(i) Combustion
(ii) Fractional distillation

Knowledge and understanding of nomenclature and structural formulae

(i) Hydrocarbons
(ii) Isomers
(iii) Alkanols and alkanoic acids
(iv) Esters

Knowledge and understanding of reactions of carbon compounds

(i) Addition reactions
(ii) Cracking
(iii) Ethanol
(iv) Making and breaking esters

National Unit Specification: statement of standards (cont)

UNIT Carbon Compounds (Intermediate 2)

Knowledge and understanding of plastics and synthetic fibres

(i) Uses
(ii) Addition polymerisation
(iii) Condensation polymerisation

Knowledge and understanding of natural products

(i) Carbohydrates
(ii) Proteins
(iii) Fats and oils

OUTCOME 2

Solve problems related to *Carbon Compounds*.

Performance criteria

(a) Relevant information is selected and presented in an appropriate way.
(c) Conclusions drawn are valid and explanations given are supported by evidence.
(e) Predictions and generalisations made are based on available evidence.

Note: the lettering system for PCs is common to all units in the Intermediate 2 Chemistry course. Not all of the PCs feature in all of the units. For example, PCs (b) and (d) do NOT feature in this unit, although they do feature in other units in the course.

Evidence requirements

Evidence of an appropriate level of achievement from a closed-book test with items covering all the above performance criteria.

OUTCOME 3

Collect and analyse information related to *Intermediate 2 Chemistry* obtained by experiment.

Performance criteria

(a) The information is collected by active participation in the experiment.
(b) The experimental procedures are described accurately.
(c) Relevant measurements and observations are recorded in an appropriate format.
(d) Conclusions drawn are valid.

Evidence requirements

A report of one experimental activity is required, covering the above performance criteria and related to the contents and notes specified for Intermediate 2 Chemistry. The report must be the individual work of the candidate and based on an experiment in which the candidate has been involved. Depending on the activity the collection of the information may be group work.

National Unit Specification: support notes

UNIT Carbon Compounds (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The recommended content together with suggested activities for this unit are detailed in the course specification. The subheadings in these tables correspond to the aspects mentioned in the evidence requirements for Outcome 1. The prescribed practical activities for the unit are listed in the *Course Contents*.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

General advice is contained in the course specification and more detailed advice will be contained in the Subject Guide for chemistry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcomes 1 and 2

It is recommended that a holistic approach is taken for assessment of these outcomes. Outcomes 1 and 2 can be assessed by an integrated end of unit test with questions covering all the performance criteria. Within one question, assessment of knowledge and understanding and problem solving can occur. Each question can address a number of performance criteria from either Outcome 1 or 2. Appropriate assessment items are available from the National Assessment Bank.

Outcome 3

Opportunities to generate evidence for attainment at Outcome 3 will arise during the practical work related to the prescribed practical activities.

Related to PC (a) the teacher/lecturer checks by observation that the candidate has taken part in the collection of information by experiment.

National Unit Specification: support notes (cont)

UNIT Carbon Compounds (Intermediate 2)

Candidates should provide a structured report with an appropriate title. The report should relate to the performance criteria as follows:

b) As experiments will follow a given procedure or method there is no need for a detailed description. The procedure, or the steps in the procedure, should be described briefly in outline. The impersonal passive voice should be used. The following should be used as appropriate:

- aim of the experiment
- a labelled diagram, description of apparatus, instruments used
- how measurements were taken or observations made
- comments on safety.

c) Readings or observations (raw data) should be recorded using the following, as appropriate:

- a table with correct headings and appropriate units
- a table with readings/observations entered correctly
- a statement of results.

d) Conclusions should contain as appropriate a statement of:

- the overall pattern to readings
- the trends in analysed information or results
- the connection between variables
- an analysis of the observations.

The bullet points under each performance criterion give an indication of what should be addressed to achieve a pass. The relevance of the bullet points will vary according to the experiment. These bullet points are intended as helpful guidance. The decision of pass or fail is to be made by the professional judgement of the presenting centre (subject to moderation) against the performance criteria.

Redrafting

It is appropriate to support candidates in producing a report to meet the performance criteria. Redrafting of reports after necessary supportive criticism is to be encouraged both as part of the learning and teaching process and to produce evidence for assessment. Redrafting is only required for the specific performance criteria identified in need of further attention, ie the entire report does not require to be rewritten.

National Unit Specification: support notes (cont)

UNIT Carbon Compounds (Intermediate 2)

Conditions required to complete the report

Candidates may complete their reports outwith class time provided reasonable measures are taken to ensure that the report is the individual work of the candidate.

Teachers and lecturers may wish candidates to write up reports under their direct supervision so that they can provide appropriate advice and support. However, they may feel confident that any redrafting required need not be undertaken under such close supervision as it will be evident in the candidate's response that it is his or her unaided work. Under such circumstances it would be acceptable for such redrafting to take place outwith class time.

Use of IT

Candidates may, if they wish, present their reports in a word-processed format. Candidates may use Excel (or any other suitable data analysis software) when tackling Outcome 3. However, candidates must not be given a spreadsheet with pre-prepared column headings or formula since they are being assessed on their ability to enter quantities and units into a table and to make decisions about appropriate scales and labels on graph axes.

Transfer of evidence

If candidates are taking this unit as part of a course and produce only one report for Outcome 3 across the course, then that report must be on a Unit 1 (Building Blocks) prescribed practical activity.

Candidates, who are repeating a year, may use evidence of an appropriate standard generated in a previous year.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, publication code BA0906).

National Unit Specification: general information

UNIT Acids, Bases and Metals (Intermediate 2)

NUMBER D068 11

COURSE Chemistry (Intermediate 2)

SUMMARY

The unit seeks to develop knowledge and understanding, problem solving and practical abilities in the context of acids and bases; salt preparation; and metals.

OUTCOMES

1 Demonstrate knowledge and understanding related to *Acids, Bases and Metals*.
2 Solve problems related to *Acids, Bases and Metals*.
3 Collect and analyse information related to *Intermediate 2 Chemistry* obtained by experiment.

Administrative Information

Superclass: RD

Publication date: March 2004

Source: Scottish Qualifications Authority

Version: 05

National Unit Specification: general information (cont)

UNIT Acids, Bases and Metals (Intermediate 2)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following awards or its equivalent:

- Standard Grade Chemistry at grades 3 and 4
- Standard Grade Biology, Physics or Science at grades 1 to 3
- Intermediate 1 Chemistry or its component units
- Intermediate 2 Biology or Physics

together with

- Standard Grade Mathematics at grades 3 and 4 or Intermediate 1 Mathematics.

The preferred entry level from Standard Grade is based on achievement in the Knowledge and Understanding and Problem Solving elements.

CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF points at SCQF level 5*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, publication code BA0906).

National Unit Specification: statement of standards

UNIT Acids, Bases and Metals (Intermediate 2)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to *Acids, Bases and Metals*.

Performance criteria

(a) Knowledge and understanding of acids and bases are clearly shown in appropriate ways.
(b) Knowledge and understanding of salt preparation is clearly shown in appropriate ways.
(c) Knowledge and understanding of metals are clearly shown in appropriate ways.

Evidence requirements

Evidence of an appropriate achievement from a closed-book test with items covering all of the aspects of the following performance criteria.

Knowledge and understanding of acids and bases

(i) The pH scale
(ii) Concentration
(iii) Strong and weak acids and bases

Knowledge and understanding of salt preparation

(i) Reactions of acids
(ii) Volumetric titrations
(iii) Naming salts
(iv) Precipitation
(v) Ionic equations

Knowledge and understanding of metals

(i) The electrochemical series
(ii) Redox reactions
(iii) Reactions of metals
(iv) Metal ores
(v) Corrosion

National Unit Specification: statement of standards (cont)

UNIT Acids, Bases and Metals (Intermediate 2)

OUTCOME 2

Solve problems related to *Acids, Bases and Metals*.

Performance criteria

(a) Relevant information is selected and presented in an appropriate way.
(b) Information is accurately processed using calculations where appropriate.
(c) Conclusions drawn are valid and explanations given are supported by evidence.
(d) Experimental procedures are planned, designed and evaluated in an appropriate way.

Note: the lettering system for PCs is common to all units in the Intermediate 2 Chemistry course. Not all of the PCs feature in all of the units. For example, PC (e) does NOT feature in this unit, although it features in other units in the course.

Evidence requirements

Evidence of an appropriate level of achievement from a closed-book test with items covering all the above performance criteria.

OUTCOME 3

Collect and analyse information related to *Intermediate 2 Chemistry* obtained by experiment.

Performance criteria

(a) The information is collected by active participation in the experiment.
(b) The experimental procedures are described accurately.
(c) Relevant measurements and observations are recorded in an appropriate format.
(d) Conclusions drawn are valid.

Evidence requirements

A report of one experimental activity is required, covering the above performance criteria and related to the contents and notes specified for Intermediate 2 Chemistry. The report must be the individual work of the candidate and based on an experiment in which the candidate has been involved. Depending on the activity the collection of the information may be group work.

National Unit Specification: support notes

UNIT Acids, Bases and Metals (Intermediate 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The recommended content together with suggested activities for this unit are detailed in the course specification. The subheadings in these tables correspond to the aspects mentioned in the evidence requirements for Outcome 1. The prescribed practical activities for the unit are listed in the *Course Contents*.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

General advice is contained in the course specification and more detailed advice will be contained in the Subject Guide for chemistry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcomes 1 and 2

It is recommended that a holistic approach is taken for assessment of these outcomes. Outcomes 1 and 2 can be assessed by an integrated end of unit test with questions covering all the performance criteria. Within one question, assessment of knowledge and understanding and problem solving can occur. Each question can address a number of performance criteria from either Outcome 1 or 2. Appropriate assessment items are available from the National Assessment Bank.

Outcome 3

Opportunities to generate evidence for attainment at Outcome 3 will arise during the practical work related to the prescribed practical activities.

Related to PC (a) the teacher/lecturer checks by observation that the candidate has taken part in the collection of information by experiment.

Candidates should provide a structured report with an appropriate title. The report should relate to the performance criteria as follows:

b) As experiments will follow a given procedure or method there is no need for a detailed description. The procedure, or the steps in the procedure, should be described briefly in outline. The impersonal passive voice should be used. The following should be used as appropriate:

- aim of the experiment
- a labelled diagram, description of apparatus, instruments used
- how measurements were taken or observations made
- comments on safety.

c) Readings or observation (raw data) should be recorded using the following, as appropriate:

- a table with correct headings and appropriate units
- a table with readings/observations entered correctly
- a statement of results.

d) Conclusions should contain as appropriate a statement of:

- the overall pattern to readings
- the trends in analysed information or results
- the connection between variables
- an analysis of the observations.

The bullet points under each performance criterion give an indication of what should be addressed to achieve a pass. The relevance of the bullet points will vary according to the experiment. These bullet points are intended as helpful guidance. The decision of pass or fail is to be made by the professional judgement of the presenting centre (subject to moderation) against the performance criteria.

Redrafting

It is appropriate to support candidates in producing a report to meet the performance criteria. Redrafting of reports after necessary supportive criticism is to be encouraged both as part of the learning and teaching process and to produce evidence for assessment. Redrafting is only required for the specific performance criteria identified in need of further attention, ie the entire report does not require to be rewritten.

Conditions required to complete the report

Candidates may complete their reports outwith class time provided reasonable measures are taken to ensure that the report is the individual work of the candidate.

Teachers and lecturers may wish candidates to write up reports under their direct supervision so that they can provide appropriate advice and support. However, they may feel confident that any redrafting required need not be undertaken under such close supervision as it will be evident in the candidate's response that it is his or her unaided work. Under such circumstances it would be acceptable for such redrafting to take place outwith class time.

Use of IT

Candidates may, if they wish, present their reports in a word-processed format. Candidates may use Excel or any other suitable data analysis software when tackling Outcome 3. However, candidates must not be given a spreadsheet with pre-prepared column headings or formula since they are being assessed on their ability to enter quantities and units into a table and to make decisions about appropriate scales and labels on graph axes.

Transfer of evidence

If candidates are taking this unit as part of a course and produce only one report across the course, then that report must be on a Unit 1 (Building Blocks) prescribed practical activity.

Candidates, who are repeating a year, may use evidence of an appropriate standard generated in a previous year.

SPECIAL NEEDS

This course specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).