International GCSE

Chemistry (9–1) (Modular)

Specification

Pearson Edexcel International GCSE in Chemistry (Modular) (4XCH1)

First teaching September 2024

First examination June 2025

First certification August 2025

Issue 1

About Pearson

We are the world's leading learning company operating in countries all around the world. We provide content, assessment and digital services to learners, educational institutions, employers, governments and other partners globally. We are committed to helping equip learners with the skills they need to enhance their employability prospects and to succeed in the changing world of work. We believe that wherever learning flourishes so do people.

References to third party materials made in this specification are made in good faith. Pearson does not endorse, approve or accept responsibility for the content of materials, which may be subject to change, or any opinions expressed therein. (Materials may include textbooks, journals, magazines and other publications and websites.)

All information in this specification is correct at time of publication.

Publication code: GQ000038

Contents

1 About this specification

Pearson Edexcel International GCSE in Chemistry (Modular) is part of a suite of International GCSE (Modular) qualifications offered by Pearson.

This qualification is not accredited or regulated by any UK regulatory body.

This specification includes the following key features.

Structure:

Pearson Edexcel International GCSE in Chemistry (Modular) is a modular qualification. All units are available in the June and November exam series and can be sat in any order or re-sat. A cash-in code must be used to obtain an overall grade for the qualification.

Content:

The content is relevant, up-to-date, engaging and appropriate for an international audience.

Assessment:

Untiered, written examinations with questions designed to be accessible to learners of all abilities.

Approach:

It builds a foundation for learners wishing to progress to the Pearson Edexcel Advanced Subsidiary and Advanced GCE, International AS and A Level qualifications or equivalent qualifications, focusing on key chemistry theory.

Specification updates

This specification is Issue 1 and is valid for first teaching from September 2024, with first assessment from June 2025 and first certification from August 2025. If there are any significant changes to the specification, Pearson will inform centres in writing. Changes will also be posted on our website.

For more information, please visit qualifications.pearson.com.

Using this specification

This specification gives teachers guidance and encourages effective delivery of the qualification. The following information will help you get the most out of the content and guidance.

Content:

This is arranged as eight topics in *3: Chemistry content*. A summary of sub-topics is included at the start of each topic. As a minimum, all the bullet points in the content must be taught. The word 'including' in the content helps specify the detail of what must be covered.

Examples:

Throughout the content, we have included examples of what could be covered or what might support teaching and learning. It is important to note that examples are for illustrative purposes only and centres can use other examples. We have included examples that are easily understood and recognised by international centres.

Practical investigations:

These are included within *3: Chemistry content* as specification points in italics. Learners will develop knowledge and understanding of experimental skills through the context of the chemistry they are learning. Experimental skills are assessed through written examinations.

Referencing:

Specification statements that are in bold with a 'C' reference relate to content that is only in the International GCSE in Chemistry (Modular) and is not found in the International GCSE in Science (Double Award) (Modular).

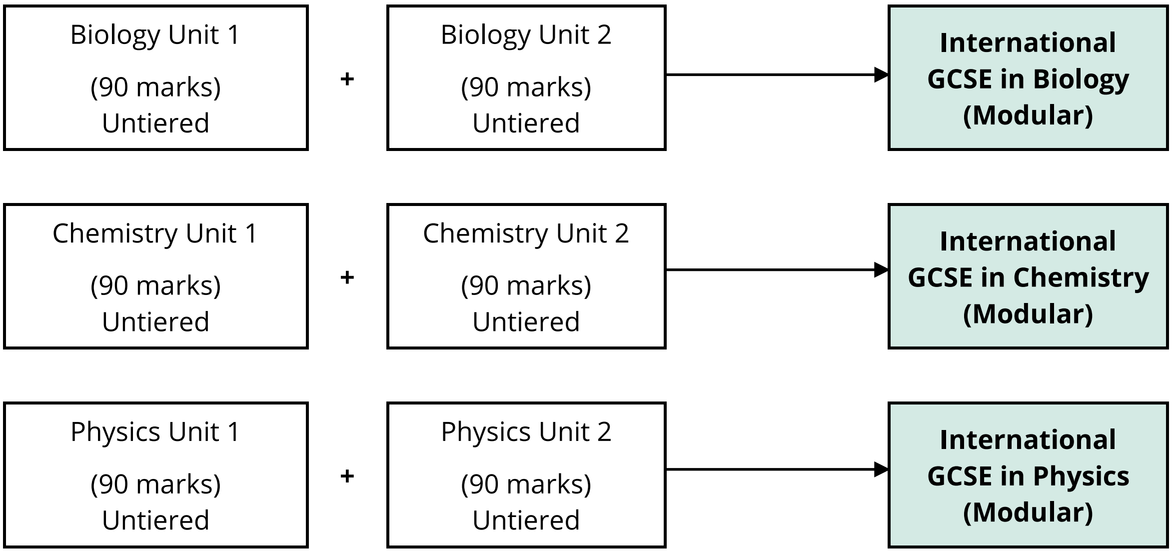
Course introduction

The Pearson Edexcel International GCSE in Chemistry (Modular) is designed for use in schools and colleges. It is part of a suite of International GCSE qualifications offered by Pearson.

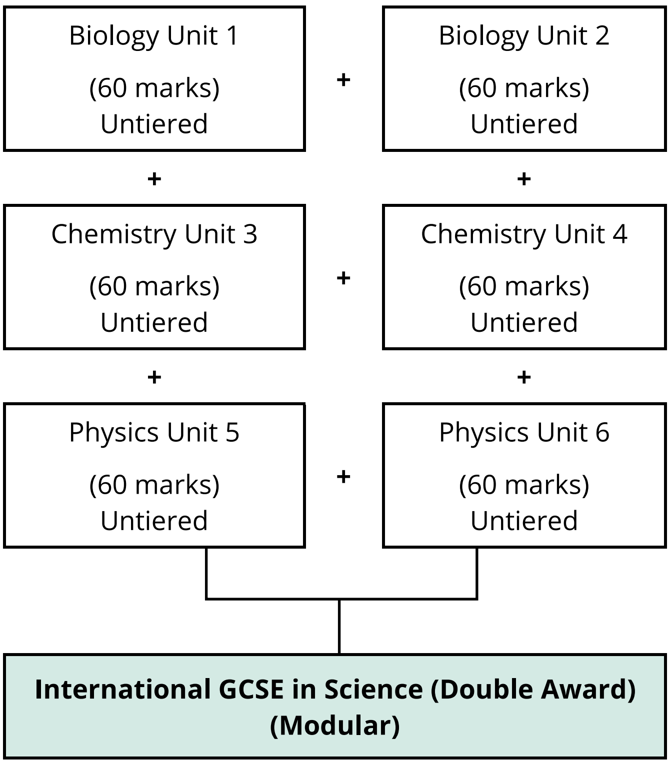
The course gives learners the opportunity to experience chemistry within the context of their general education.

How assessment relates to the qualifications available is shown below.

International GCSE Separate Sciences (Modular)



International GCSE Double Award (Modular)



A Pearson Edexcel International GCSE in Science (Single Award) qualification is available in linear route only.

Qualification aims

The aims and objectives of this qualification are to enable learners to:

- learn about unifying patterns and themes in chemistry and use them in new and changing situations
- acquire knowledge and understanding of chemical facts, terminology, concepts, principles and practical techniques
- apply the principles and concepts of chemistry, including those related to the applications of chemistry, to different contexts
- evaluate chemical information, making judgements on the basis of this information
- appreciate the practical nature of chemistry, developing experimental and investigative skills based on correct and safe laboratory techniques
- analyse, interpret and evaluate data and experimental methods, drawing conclusions that are consistent with evidence from experimental activities and suggesting possible improvements and further investigations
- recognise the importance of accurate experimental work and reporting scientific methods in chemistry
- select, organise and present relevant information clearly and logically using appropriate vocabulary, definitions and conventions
- develop a logical approach to problem solving in a wider context.
- select and apply appropriate areas of mathematics relevant to chemistry as set out under each topic
- prepare for more advanced courses in chemistry and for other courses that require knowledge of chemistry.

Why choose Edexcel qualifications?

Pearson – the world's largest education company

Edexcel academic qualifications are from Pearson, the UK's largest awarding organisation. With over 3.4 million learners studying our academic and vocational qualifications worldwide, we offer internationally recognised qualifications to schools, colleges and employers globally.

Pearson is recognised as the world's largest education company, allowing us to drive innovation and provide comprehensive support for Edexcel learners to acquire the knowledge and skills they need for progression in study, work and life.

A heritage you can trust

The background to Pearson becoming the UK's largest awarding organisation began in 1836, when a royal charter gave the University of London its first powers to conduct exams and confer degrees on its learners. With over 150 years of international education experience, Edexcel qualifications have firm academic foundations, built on the traditions and rigour associated with Britain's education system.

Results you can trust

Pearson's leading online marking technology has been shown to produce exceptionally reliable results, demonstrating that, at every stage, Edexcel qualifications maintain the highest standards.

Why choose Pearson Edexcel International GCSE in Chemistry (Modular)?

We have listened to feedback from all parts of the international school and language teaching community including a large number of teachers. We have made changes that will engage students and give them skills that will support progression to further study in chemistry and other related subjects. Our content and assessment approach has been designed to meet students' needs and be consistent with our approach across the sciences.

Key qualification features

At Pearson we offer separate science modular qualifications in Biology, Chemistry and Physics, as well as Double Award Science modular qualifications – these have been designed to meet different learners' needs. The content and assessment approach in all our science qualifications has been designed to meet learners' needs in the following ways.

- Content that is interesting and engaging for learners but is also designed to ensure good preparation, both for those continuing to further study and for those wishing to work in a chemistry-related field.
- There are opportunities to 'localise' the content to make it more relevant for learners in their own country.

Modular structure

The modular assessment structure offers learners the flexibility to sit examinations when they are ready and provides opportunities to resit individual unit assessments before receiving an overall qualification grade.

Clear and straightforward question papers

- Our question papers are clear and accessible for all learners of all ability ranges and learning styles. Our mark schemes are straightforward, so that the assessment requirements are clear.

Broad and deep development of learners' skills

- The design of the revised international GCSE aims to extend learners' knowledge and understanding by broadening and deepening skills, for example learners develop the ability to:
    - focus on practical skills through a number of practicals listed in the specification content. These can be supplemented with other suggested practicals. The skills developed will be assessed through questions in written examinations.
    - improve learners' analytical and logic skills by applying understanding of scientific concepts and principles to a range of situations. This will include some examination questions that are more problem solving in style
    - address the need for mathematical skills to complement learners' chemistry skills by covering a range of mathematical areas.

Progression

International GCSE (Modular) qualifications enable successful progression to A Level and beyond. Through our development process we have consulted with International Advanced Level and GCE A Level teachers as well as higher education professors to validate the appropriateness of the qualification, including its content, skills development and assessment structure.

Courses to suit your learners' needs and interests

Teachers of chemistry have a choice of International GCSE courses to deliver, each giving different levels of depth to meet learners' needs. As well as the Pearson Edexcel International GCSE in Chemistry (Modular), learners can also be taught our International GCSE in Science (Double Award) (Modular). This course offers a reduced amount of content, but are assessed to the same standard. Progression routes for these courses may vary slightly from those for the Pearson Edexcel International GCSE in Chemistry (Modular).

More information about all our qualifications can be found on our Edexcel International GCSE pages at qualifications.pearson.com.

Supporting you in planning and implementing this qualification

Planning

- Our *Getting Started Guide* gives you an overview of the Pearson Edexcel International GCSE in Chemistry (Modular) to help you understand the changes to content and assessment, and what these changes mean for you and your learners.
- We will provide you with an editable scheme of work.

Teaching and learning

- Print and digital learning and teaching resources promote any time, any place learning to improve learner motivation and encourage new ways of working.

Preparing for exams

We will also give you a range of resources to help you prepare your learners for the assessments, including:

- specimen papers to support formative assessments and mock exams
- examiner commentaries following each examination series.

ResultsPlus

ResultsPlus provides the most detailed analysis available of your learners' exam performance. It can help you to identify the topics and skills where further learning would benefit your learners.

examWizard

This is an included online data bank of past exam questions designed to support learners and teachers with exam preparation and assessment.

Training events

In addition to online training, we host a series of training events for teachers to deepen their understanding of our qualifications.

Get help and support

Our subject advisor service will ensure that you receive help and guidance from us. You can email our subject advisor at: teachingscience@pearson.com. You can also sign up to receive updates to keep up to date with our qualifications and allied support and service news.

2 Qualification at a glance

Qualification overview

The Pearson Edexcel International GCSE in Chemistry comprises two mandatory units:

- Chemistry Unit 1
- Chemistry Unit 2

It is a modular qualification in which unit assessments can be sat and resat in any order. Assessments must be cashed in to obtain a final grade for the qualification.

Content and assessment overview

<table>
<tr><td>Chemistry Unit 1</td><td>*Unit code 4WCH1/1C</td></tr>
<tr><td>Externally assessed
Written examination: 1 hour and 40 minutes
Availability: June and November
90 marks</td><td>50% of the total International GCSE (Modular)</td></tr>
<tr><td colspan="2">Content summary
Assesses content listed below, including content that is in bold and has a ‘C’ reference. Questions may come from any topic area listed below.
Statements in bold cover some sub-topics in greater depth.
1. Principles of chemistry: Part 1
a. states of matter
b. elements, mixtures & compound
c. atomic structure
d. periodic table
e. chemical formulae, equations & calculations
2. Inorganic chemistry: Part 1
a. reactivity series
b. extraction and uses of metals
c. acids, alkalis and titrations
d. acids, bases and salt preparations
3. Physical chemistry: Part 1
a. energetics</td></tr>
</table>

Chemistry Unit 1	*Unit code 4WCH1/1C
4. Organic chemistry: Part 1 a. introduction b. crude oil c. alkanes d. alkenes	
Assessment A combination of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. A calculator may be used in the examinations.	

<table>
<tr><td>Chemistry Unit 2</td><td>*Unit code 4WCH2/1C</td></tr>
<tr><td>Externally assessed
Written examination: 1 hour and 40 minutes
Availability: June and November
90 marks</td><td>50% of the total International GCSE (Modular)</td></tr>
<tr><td colspan="2">Content summary
Assesses content listed below, including content that is in bold and has a ‘C’ reference. Questions may come from any topic area listed below.
Statements in bold cover some sub-topics in greater depth.
5. Principles of chemistry: Part 2
d. periodic table (note that this is the same content from 1. Principles of chemistry: Part 1)
e. chemical formulae, equations & calculations (note that this is the same content from 1. Principles of chemistry: Part 1)
f. ionic bonding
g. covalent bonding
h. metallic bonding
i. electrolysis
6. Inorganic chemistry: Part 2
e. Group 1
f. Group 7
g. gases in the atmosphere
h. chemical tests
7. Physical chemistry: Part 2
b. rates of reaction
c. reversible reactions and equilibrium
8. Organic chemistry: Part 2
e. alcohols
f. carboxylic acids
g. esters
h. synthetic polymers</td></tr>
<tr><td colspan="2">Assessment
A combination of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions.
A calculator may be used in the examinations.</td></tr>
</table>

* See *Appendix 1: Codes* for a description of this code and all the other codes relevant to this qualification.

3 Chemistry content

1 Principles of chemistry: Part 1

The following sub-topics are covered in this section:

(a) States of matter

(b) Elements, compounds and mixtures

(c) Atomic structure

(d) The Periodic Table

(e) Chemical formulae, equations and calculations

(a)	**States of matter**
Learners should:	
1.1	understand the three states of matter in terms of the arrangement, movement and energy of the particles
1.2	understand the interconversions between the three states of matter in terms of: • the names of the interconversions • how they are achieved • the changes in arrangement, movement and energy of the particles.
1.3	understand how the results of experiments involving the dilution of coloured solutions and diffusion of gases can be explained
1.4	know what is meant by the terms: • solvent • solute • solution • saturated solution.
1.5C	**know what is meant by the term solubility in the units g per 100 g of solvent**
1.6C	**understand how to plot and interpret solubility curves**
1.7C	***practical: investigate the solubility of a solid in water at a specific temperature***

(b)	**Elements, compounds and mixtures**
Learners should:	
1.8	understand how to classify a substance as an element, compound or mixture
1.9	understand that a pure substance has a fixed melting and boiling point, but that a mixture may melt or boil over a range of temperatures
1.10	describe these experimental techniques for the separation of mixtures: • simple distillation • fractional distillation • filtration • crystallisation • paper chromatography.
1.11	understand how a chromatogram provides information about the composition of a mixture
1.12	understand how to use the calculation of R_f values to identify the components of a mixture
1.13	*practical: investigate paper chromatography using inks/food colourings*

(c)	**Atomic structure**
Learners should:	
1.14	know what is meant by the terms 'atom' and 'molecule'
1.15	know the structure of an atom in terms of the positions, relative masses and relative charges of sub-atomic particles
1.16	know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (A_r)
1.17	be able to calculate the relative atomic mass of an element (A_r) from isotopic abundances

(d)	**The Periodic Table**
Learners should:	
1.18	understand how elements are arranged in the Periodic Table: • in order of atomic number • in groups and periods.
1.19	understand how to deduce the electronic configurations of the first 20 elements from their positions in the Periodic Table
1.20	understand how to use electrical conductivity and the acid-base character of oxides to classify elements as metals or non-metals
1.21	identify an element as a metal or a non-metal according to its position in the Periodic Table
1.22	understand how the electronic configuration of a main group element is related to its position in the Periodic Table

(d)	The Periodic Table
Learners should:	
1.23	understand why elements in the same group of the Periodic Table have similar chemical properties
1.24	understand why the noble gases (Group 0) do not readily react

(e)	Chemical formulae, equations and calculations
Learners should:	
1.25	write word equations and balanced chemical equations (including state symbols): • for reactions studied in this specification • for unfamiliar reactions where suitable information is provided.
1.26	calculate relative formula masses (including relative molecular masses) (M_r) from relative atomic masses (A_r)
1.27	know that the mole (mol) is the unit for the amount of a substance
1.28	understand how to carry out calculations involving amount of substance, relative atomic mass (A_r) and relative formula mass (M_r)
1.29	calculate reacting masses using experimental data and chemical equations
1.30	calculate percentage yield
1.31	understand how the formulae of simple compounds can be obtained experimentally, including metal oxides, water and salts containing water of crystallisation
1.32	know what is meant by the terms empirical formula and molecular formula
1.33	calculate empirical and molecular formulae from experimental data
1.34C	**understand how to carry out calculations involving amount of substance, volume and concentration (in mol/dm^3) of solution**
1.35C	**understand how to carry out calculations involving gas volumes and the molar volume of a gas (24 dm^3 and 24 000 cm^3 at room temperature and pressure (rtp))**
1.36	*practical: know how to determine the formula of a metal oxide by combustion (e.g. magnesium oxide) or by reduction (e.g. copper(II) oxide)*

Please note: subtopics (d) and (e) will also be assessed in Part 2, as well as Part 1.

2 Inorganic chemistry: Part 1

The following sub-topics are covered in this section:

(a) Reactivity series

(b) Extraction and uses of metals

(c) Acids, alkalis and titrations

(d) Acids, bases and salt preparations

(a)	**Reactivity series**
Learners should:	
2.1	understand how metals can be arranged in a reactivity series based on their reactions with: • water • dilute hydrochloric or sulfuric acid.
2.2	understand how metals can be arranged in a reactivity series based on their displacement reactions between: • metals and metal oxides • metals and aqueous solutions of metal salts.
2.3	know the order of reactivity of these metals: potassium, sodium, lithium, calcium, magnesium, aluminium, zinc, iron, copper, silver, gold
2.4	know the conditions under which iron rusts
2.5	understand how the rusting of iron may be prevented by: • barrier methods • galvanising • sacrificial protection.
2.6	understand the terms: • oxidation • reduction • redox • oxidising agent • reducing agent • in terms of gain or loss of oxygen and loss or gain of electrons.
2.7	*practical: investigate reactions between dilute hydrochloric and sulfuric acids and metals (e.g. magnesium, zinc and iron)*

(b)	Extraction and uses of metals
Learners should:	
2.8C	**know that most metals are extracted from ores found in the Earth's crust and that unreactive metals are often found as the uncombined element**
2.9C	**explain how the method of extraction of a metal is related to its position in the reactivity series, illustrated by carbon extraction for iron and electrolysis for aluminium**
2.10C	**be able to comment on a metal extraction process, given appropriate information** ***detailed knowledge of the processes used in the extraction of a specific metal is not required***
2.11C	**explain the uses of aluminium, copper, iron and steel in terms of their properties** ***the types of steel will be limited to low-carbon (mild), high-carbon and stainless***
2.12C	**know that an alloy is a mixture of a metal and one or more elements, usually other metals or carbon**
2.13C	**explain why alloys are harder than pure metals**

(c)	Acids, alkalis and titrations
Learners should:	
2.14	describe the use of litmus, phenolphthalein and methyl orange to distinguish between acidic and alkaline solutions
2.15	understand how to use the pH scale, from 0–14, can be used to classify solutions as strongly acidic (0–3), weakly acidic (4–6), neutral (7), weakly alkaline (8–10) and strongly alkaline (11–14)
2.16	describe the use of universal indicator to measure the approximate pH value of an aqueous solution
2.17	know that acids in aqueous solution are a source of hydrogen ions and alkalis in a aqueous solution are a source of hydroxide ions
2.18	know that alkalis can neutralise acids
2.19C	**describe how to carry out an acid-alkali titration**

(d)	Acids, bases and salt preparations
Learners should:	
2.20	know the general rules for predicting the solubility of ionic compounds in water: • common sodium, potassium and ammonium compounds are soluble • all nitrates are soluble • common chlorides are soluble, except those of silver and lead(II) • common sulfates are soluble, except for those of barium, calcium and lead(II) • common carbonates are insoluble, except for those of sodium, potassium and ammonium • common hydroxides are insoluble except for those of sodium, potassium and calcium (calcium hydroxide is slightly soluble).
2.21	understand acids and bases in terms of proton transfer
2.22	understand that an acid is a proton donor and a base is a proton acceptor
2.23	describe the reactions of hydrochloric acid, sulfuric acid and nitric acid with metals, bases and metal carbonates (excluding the reactions between nitric acid and metals) to form salts
2.24	know that metal oxides, metal hydroxides and ammonia can act as bases, and that alkalis are bases that are soluble in water
2.25	describe an experiment to prepare a pure, dry sample of a soluble salt, starting from an insoluble reactant
2.26C	**describe an experiment to prepare a pure, dry sample of a soluble salt, starting from an acid and alkali**
2.27C	**describe an experiment to prepare a pure, dry sample of an insoluble salt, starting from two soluble reactants**
2.28	*practical: prepare a sample of pure, dry hydrated copper(II) sulfate crystals starting from copper(II) oxide*
2.29C	***practical: prepare a sample of pure, dry lead(II) sulfate***

3 Physical chemistry: Part 1

The following sub-topics are covered in this section:

(a) Energetics

(a)	Energetics
Learners should:	
3.1	know that chemical reactions in which heat energy is given out are described as exothermic, and those in which heat energy is taken in are described as endothermic
3.2	describe simple calorimetry experiments for reactions such as combustion, displacement, dissolving and neutralisation
3.3	calculate the heat energy change from a measured temperature change using the expression $Q = mc\Delta T$
3.4	calculate the molar enthalpy change (ΔH) from the heat energy change, Q
3.5C	**draw and explain energy level diagrams to represent exothermic and endothermic reactions**
3.6C	**know that bond-breaking is an endothermic process and that bond-making is an exothermic process**
3.7C	**use bond energies to calculate the enthalpy change during a chemical reaction**
3.8	*practical: investigate temperature changes accompanying some of the following types of change:* • *salts dissolving in water* • *neutralisation reactions* • *displacement reactions* • *combustion reactions.*

4 Organic chemistry: Part 1

The following sub-topics are covered in this section:

(a) Introduction

(b) Crude oil

(c) Alkanes

(d) Alkenes

(a)	**Introduction**
Learners should:	
4.1	know that a hydrocarbon is a compound of hydrogen and carbon only
4.2	understand how to represent organic molecules using empirical formulae, molecular formulae, general formulae, structural formulae and displayed formulae
4.3	know what is meant by the terms homologous series, functional group and isomerism
4.4	understand how to name compounds relevant to this specification using the rules of International Union of Pure and Applied Chemistry (IUPAC) nomenclature *learners will be expected to name compounds containing up to six carbon atoms*
4.5	understand how to write the possible structural and displayed formulae of an organic molecule given its molecular formula
4.6	understand how to classify reactions of organic compounds as substitution, addition and combustion *knowledge of reaction mechanisms is not required*

(b)	**Crude oil**
Learners should:	
4.7	know that crude oil is a mixture of hydrocarbons
4.8	describe how the industrial process of fractional distillation separates crude oil into fractions
4.9	know the names and uses of the main fractions obtained from crude oil: refinery gases, gasoline, kerosene, diesel, fuel oil and bitumen
4.10	know the trend in colour, boiling point and viscosity of the main fractions
4.11	know that a fuel is a substance that, when burned, releases heat energy
4.12	know the possible products of complete and incomplete combustion of hydrocarbons with oxygen in the air

(b)	Crude oil
Learners should:	
4.13	understand why carbon monoxide is poisonous, in terms of its effect on the capacity of blood to transport oxygen *references to haemoglobin are not required*
4.14	know that, in car engines, the temperature reached is high enough to allow nitrogen and oxygen from air to react, forming oxides of nitrogen
4.15	explain how the combustion of some impurities in hydrocarbon fuels results in the formation of sulfur dioxide
4.16	understand how sulfur dioxide and oxides of nitrogen contribute to acid rain
4.17	describe how long-chain alkanes are converted to alkenes and shorter-chain alkanes by catalytic cracking (using silica or alumina as the catalyst and a temperature in the range of 600–700 °C)
4.18	explain why cracking is necessary, in terms of the balance between supply and demand for different fractions

(c)	Alkanes
Learners should:	
4.19	know the general formula for alkanes
4.20	explain why alkanes are classified as saturated hydrocarbons
4.21	understand how to draw the structural and displayed formulae for alkanes with up to five carbon atoms in the molecule, and to name the unbranched-chain isomers
4.22	describe the reactions of alkanes with halogens in the presence of ultraviolet radiation, limited to mono-substitution *knowledge of reaction mechanisms is not required*

(d)	Alkenes
Learners should:	
4.23	know that alkenes contain the functional group >C=C<
4.24	know the general formula for alkenes
4.25	explain why alkenes are classified as unsaturated hydrocarbons
4.26	understand how to draw the structural and displayed formulae for alkenes with up to four carbon atoms in the molecule, and name the unbranched-chain isomers *knowledge of cis/trans or E/Z notation is not required*
4.27	describe the reactions of alkenes with bromine to produce dibromoalkanes
4.28	describe how bromine water can be used to distinguish between an alkane and an alkene

5 Principles of chemistry: Part 2

The following sub-topics are covered in this section:

(d) The Periodic Table (refer to *1. Principles of chemistry: Part 1* for more detail)

(e) Chemical formulae, equations and calculations (refer to *1. Principles of chemistry: Part 1* for more detail)

(f) Ionic bonding

(g) Covalent bonding

(h) Metallic bonding

(i) Electrolysis

(f)	**Ionic bonding**
Learners should:	
5.1	understand how ions are formed by electron loss or gain
5.2	know the charges of these ions: • metals in Groups 1, 2 and 3 • non-metals in Groups 5, 6 and 7 • Ag^{+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Pb^{2+}, Zn^{2+} • hydrogen (H^{+}), hydroxide (OH^{-}), ammonium (NH_4^{+}), carbonate (CO_3^{2-}), nitrate (NO_3^{-}), sulfate (SO_4^{2-}).
5.3	write formulae for compounds formed between the ions listed above
5.4	draw dot-and-cross diagrams to show the formation of ionic compounds by electron transfer, limited to combinations of elements from Groups 1, 2, 3 and 5, 6, 7 *only outer electrons need be shown*
5.5	understand ionic bonding in terms of electrostatic attractions
5.6	understand why compounds with giant ionic lattices have high melting and boiling points
5.7	know that ionic compounds do not conduct electricity when solid, but do conduct electricity when molten and in aqueous solution

(g)	**Covalent bonding**
Learners should:	
5.8	know that a covalent bond is formed between atoms by the sharing of a pair of electrons
5.9	understand covalent bonds in terms of electrostatic attractions
5.10	understand how to use dot-and-cross diagrams to represent covalent bonds in: • diatomic molecules, including hydrogen, oxygen, nitrogen, halogens and hydrogen halides • inorganic molecules including water, ammonia and carbon dioxide • organic molecules containing up to two carbon atoms, including methane, ethane, ethene and those containing halogen atoms.

(g)	Covalent bonding
Learners should:	
5.11	explain why substances with a simple molecular structures are gases or liquids, or solids with low melting and boiling points *the term intermolecular forces of attraction can be used to represent all forces between molecules*
5.12	explain why the melting and boiling points of substances with simple molecular structures increase, in general, with increasing relative molecular mass
5.13	explain why substances with giant covalent structures are solids with high melting and boiling points
5.14	explain how the structures of diamond, graphite and C_{60} fullerene influence their physical properties, including electrical conductivity and hardness
5.15	know that covalent compounds do not usually conduct electricity

(h)	Metallic bonding
Learners should:	
5.16C	**know how to represent a metallic lattice by a 2-D diagram**
5.17C	**understand metallic bonding in terms of electrostatic attractions**
5.18C	**explain typical physical properties of metals, including electrical conductivity and malleability**

(i)	Electrolysis
Learners should:	
5.19C	**understand why covalent compounds do not conduct electricity**
5.20C	**understand why ionic compounds conduct electricity only when molten or in aqueous solution**
5.21C	**know that anion and cation are terms used to refer to negative and positive ions respectively**
5.22C	**describe experiments to investigate electrolysis, using inert electrodes, of molten compounds (including lead(II) bromide) and aqueous solutions (including sodium chloride, dilute sulfuric acid and copper(II) sulfate) and to predict the products**
5.23C	**write ionic half-equations representing the reactions at the electrodes during electrolysis and understand why these reactions are classified as oxidation or reduction**
5.24C	***practical: investigate the electrolysis of aqueous solutions***

6 Inorganic chemistry: Part 2

The following sub-topics are covered in this section:

(e) Group 1 (alkali metals) – lithium, sodium and potassium

(f) Group 7 (halogens) – chlorine, bromine and iodine

(g) Gases in the atmosphere

(h) Chemical tests

(e)	**Group 1 (alkali metals) – lithium, sodium and potassium**
Learners should:	
6.1	understand how the similarities in the reactions of these elements with water provide evidence for their recognition as a family of elements
6.2	understand how the differences between the reactions of these elements with air and water provide evidence for the trend in reactivity in Group 1
6.3	use knowledge of trends in Group 1 to predict the properties of other alkali metals
6.4C	**explain the trend in reactivity in Group 1 in terms of electronic configurations**

(f)	**Group 7 (halogens) – chlorine, bromine and iodine**
Learners should:	
6.5	know the colours, physical states (at room temperature) and trends in physical properties of these elements
6.6	use knowledge of trends in Group 7 to predict the properties of other halogens
6.7	understand how displacement reactions involving halogens and halides provide evidence for the trend in reactivity in Group 7
6.8C	**explain the trend in reactivity in Group 7 in terms of electronic configurations**

(g)	**Gases in the atmosphere**
Learners should:	
6.9	know the approximate percentages by volume of the four most abundant gases in dry air
6.10	understand how to determine the percentage by volume of oxygen in air using experiments involving the reactions of metals (e.g. iron) and non-metals (e.g. phosphorus) with air
6.11	describe the combustion of elements in oxygen, including magnesium, hydrogen and sulfur
6.12	describe the formation of carbon dioxide from the thermal decomposition of metal carbonates, including copper(II) carbonate
6.13	know that carbon dioxide is a greenhouse gas and that increasing amounts in the atmosphere may contribute to climate change
6.14	*practical: determine the approximate percentage by volume of oxygen in air using a metal or a non-metal*

(h)	Chemical tests
Learners should:	
6.15	describe tests for these gases: • hydrogen • oxygen • carbon dioxide • ammonia • chlorine.
6.16	describe how to carry out a flame test
6.17	know the colours formed in flame tests for these cations: • Li^+ is red • Na^+ is yellow • K^+ is lilac • Ca^{2+} is orange-red • Cu^{2+} is blue-green.
6.18	describe tests for these cations: • NH_4^+ using sodium hydroxide solution and identifying the gas evolved • Cu^{2+}, Fe^{2+} and Fe^{3+} using sodium hydroxide solution.
6.19	describe tests for these anions: • Cl^-, Br^- and I^- using acidified silver nitrate solution • SO_4^{2-} using acidified barium chloride solution • CO_3^{2-} using hydrochloric acid and identifying the gas evolved.
6.20	describe a test for the presence of water using anhydrous copper(II) sulfate
6.21	describe a physical test to show whether a sample of water is pure

7 Physical chemistry: Part 2

The following sub-topics are covered in this section:

(b) Rates of reaction

(c) Reversible reactions and equilibria

(b)	**Rates of reaction**
Learners should:	
7.1	describe experiments to investigate the effects of changes in surface area of a solid, concentration of a solution, temperature and the use of a catalyst on the rate of a reaction
7.2	describe the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas, temperature and the use of a catalyst on the rate of a reaction
7.3	explain the effects of changes in surface area of a solid, concentration of a solution, pressure of a gas and temperature on the rate of a reaction in terms of particle collision theory
7.4	know that a catalyst is a substance that increases the rate of a reaction, but is chemically unchanged at the end of the reaction
7.5	know that a catalyst works by providing an alternative pathway with lower activation energy
7.6C	**draw and explain reaction profile diagrams showing ΔH and activation energy**
7.7	*practical: investigate the effect of changing the surface area of marble chips and of changing the concentration of hydrochloric acid on the rate of reaction between marble chips and dilute hydrochloric acid*
7.8	*practical: investigate the effect of different solids on the catalytic decomposition of hydrogen peroxide solution*

(c)	**Reversible reactions and equilibria**
Learners should:	
7.9	know that some reactions are reversible and this is indicated by the symbol $\rightleftharpoons$ in equations
7.10	describe reversible reactions such as the dehydration of hydrated copper(II) sulfate and the effect of heat on ammonium chloride
7.11C	**know that a reversible reaction can reach dynamic equilibrium in a sealed container**
7.12C	**know that the characteristics of a reaction at dynamic equilibrium are:** • **the forward and reverse reactions occur at the same rate** • **the concentrations of reactants and products remain constant.**
7.13C	**understand why a catalyst does not affect the position of equilibrium in a reversible reaction**
7.14C	**know the effect of changing either temperature or pressure on the position of equilibrium in a reversible reaction:** • **an increase (or decrease) in temperature shifts the position of equilibrium in the direction of the endothermic (or exothermic) reaction** • **an increase (or decrease) in pressure shifts the position of equilibrium in the direction that produces fewer (or more) moles of gas** ***References to Le Chatelier's principle are not required***

8 Organic chemistry: Part 2

The following sub-topics are covered in this section:

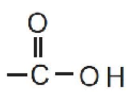
(e) Alcohols

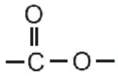
(f) Carboxylic acids

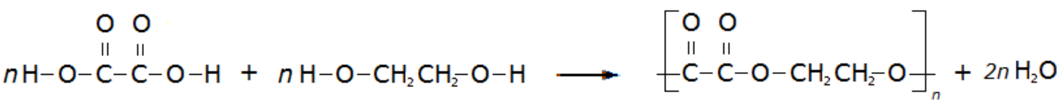
(g) Esters

(h) Synthetic polymers

(e)	**Alcohols**
Learners should:	
8.1C	**know that alcohols contain the functional group −OH**
8.2C	**understand how to draw structural and displayed formulae for methanol, ethanol, propanol (*propan-1-ol only*) and butanol (*butan-1-ol only*), and name each compound** ***the names propanol and butanol are acceptable***
8.3C	**know that ethanol can be oxidised by:** • **burning in air or oxygen (complete combustion)** • **reaction with oxygen in the air to form ethanoic acid (microbial oxidation)** • **heating with potassium dichromate(VI) in dilute sulfuric acid to form ethanoic acid**
8.4C	**know that ethanol can be manufactured by:** • **reacting ethene with steam in the presence of a phosphoric acid catalyst at a temperature of about 300 °C and a pressure of about 60–70 atm** • **the fermentation of glucose, in the absence of air, at an optimum temperature of about 30 °C and using the enzymes in yeast**
8.5C	**understand the reasons for fermentation, in the absence of air, and at an optimum temperature**

(f)	**Carboxylic acids**
Learners should:	
8.6C	**know that carboxylic acids contain the functional group** 
8.7C	**understand how to draw structural and displayed formulae for unbranched-chain carboxylic acids with up to four carbon atoms in the molecule, and name each compound**
8.8C	**describe the reactions of aqueous solutions of carboxylic acids with metals and metal carbonates**
8.9C	**know that vinegar is an aqueous solution containing ethanoic acid**

(g)	Esters
Learners should:	
8.10C	**know that esters contain the functional group** 
8.11C	**know that ethyl ethanoate is the ester produced when ethanol and ethanoic acid react in the presence of an acid catalyst**
8.12C	**understand how to write the structural and displayed formulae of ethyl ethanoate**
8.13C	**understand how to write the structural and displayed formulae of an ester, given the name or formula of the alcohol and carboxylic acid from which it is formed and vice versa**
8.14C	**know that esters are volatile compounds with distinctive smells and are used as food flavourings and in perfumes**
8.15C	***practical: prepare a sample of an ester such as ethyl ethanoate***

(h)	Synthetic polymers
Learners should:	
8.16	know that an addition polymer is formed by joining up many small molecules called monomers
8.17	understand how to draw the repeat unit of an addition polymer, including poly(ethene), poly(propene), poly(chloroethene) and (poly)tetrafluoroethene
8.18	understand how to deduce the structure of a monomer from the repeat unit of an addition polymer and vice versa
8.19	explain problems in the disposal of addition polymers, including: • their inertness and inability to biodegrade • the production of toxic gases when they are burned.
8.20C	**know that condensation polymerisation, in which a dicarboxylic acid reacts with a diol, produces a polyester and water**
8.21C	**understand how to write the structural and displayed formula of a polyester, showing the repeat unit, given the formulae of the monomers from which it is formed including the reaction of ethanedioic acid and ethanediol:** 
8.22C	**know that some polyesters, known as biopolyesters, are biodegradable**

4 Assessment information

Assessment requirements

Unit number	Level	Assessment information	Number of marks allocated in the unit
Unit 1	1/2	Assessed through a 1 hour and 40 minute written examination set and marked by Pearson. The paper is weighted at 50% of the qualification. A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. Assesses all the content prescribed in **Section 2 Qualification at a glance, Content and assessment Unit 1 overview,** including content that is in bold and has a 'C' reference. Questions may come from set topic area across the Unit 1 areas of the specification. Statements in bold cover some sub-topics in greater depth.	90
Unit 2	1/2	Assessed through a 1 hour and 40 minute written examination set and marked by Pearson. The paper is weighted at 50% of the qualification. A mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. Assesses all the content prescribed in **Section 2 Qualification at a glance, Content and assessment Unit 2 overview**, including content that is in bold and has a 'C' reference. Questions may come from set topic area across the Unit 2 areas of the specification. Statements in bold cover some sub-topics in greater depth.	90

Sample assessment materials

Sample unit assessments and mark schemes can be found in the *Pearson Edexcel International GCSE in Chemistry (Modular) Sample Assessment Materials (SAMs)* document.

Experimental skills

The best way to develop experimental skills is to embed practical investigations in teaching or theory. The development of knowledge and experimental skills can then happen together, leading to secure acquisition of both knowledge and skills.

Our practical investigations are embedded within *3: Chemistry content* as specification points in italics. The skills developed through these and other practicals will be assessed through written examinations.

In the assessment of experimental skills, learners may be tested on their ability to:

- solve problems set in a practical context
- apply scientific knowledge and understanding in questions with a practical context
- devise and plan investigations, using scientific knowledge and understanding when selecting appropriate techniques
- demonstrate or describe appropriate experimental and investigative methods, including safe and skilful practical techniques
- make observations and measurements with appropriate precision, record these methodically and present them in appropriate ways
- identify independent, dependent and control variables
- use scientific knowledge and understanding to analyse and interpret data to draw conclusions from experimental activities that are consistent with the evidence
- communicate the findings from experimental activities, using appropriate technical language, relevant calculations and graphs
- assess the reliability of an experimental activity
- evaluate data and methods taking into account factors that affect accuracy and validity.

Calculators

Learners will be expected to have access to a suitable electronic calculator for all unit assessments. Calculators that allow for the retrieval of text or formulae or QWERTY keyboards will not be allowed for use in examinations.

Assessment objectives and weightings

		International GCSE
AO1	Knowledge and understanding of chemistry	38–42%
AO2	Application of knowledge and understanding, analysis and evaluation of chemistry	38-42%
AO3	Experimental skills, analysis and evaluation of data and methods in chemistry	19–21%
		100%

Relationship of assessment objectives to units

Unit number	Assessment objective		
	AO1	AO2	AO3
Chemistry Unit 1	19–21%	19-21%	9.5-10.5%
Chemistry Unit 2	19-21%	19-21%	9.5-10.5%
Total for International GCSE	38–42%	38–42%	19–21%

5 Administration and general information

Entries and forbidden combinations

Details of how to enter learners for the examinations for this qualification can be found in our *International information manual*. A copy is made available to all examinations officers and is also available on our website.

Learners should be advised that if they take two qualifications in the same subject, colleges, universities and employers are very likely to take the view that they have achieved only one of the two GCSEs/International GCSEs. Learners or their advisers, who have any doubts about subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

Forbidden combinations

This qualification may not be taken alongside:

- Pearson Edexcel International GCSE in Science (Double Award) (Linear) (4SD0)
- Pearson Edexcel International GCSE in Chemistry (Linear) (4CH1)
- Pearson Edexcel International GCSE in Science (Double Award) (Modular) (4XSD1)

Access arrangements, reasonable adjustments, special consideration and malpractice

Equality and fairness are central to our work. Our Equality Policy requires all learners to have equal opportunity to access our qualifications and assessments, and our qualifications to be awarded in a way that is fair to every learner.

We are committed to making sure that:

- learners with a protected characteristic (as defined by the UK Equality Act 2010) are not, when they are undertaking one of our qualifications, disadvantaged in comparison to learners who do not share that characteristic
- all learners achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Language of assessment

Assessment of this qualification will only be available in English. All learner work must be in English.

We recommend that learners are able to read and write in English at Level B2 of the Common European Framework of Reference for Languages.

Access arrangements

Access arrangements are agreed before an assessment. They allow learners with special educational needs, disabilities or temporary injuries to:

- access the assessment
- show what they know and can do without changing the demands of the assessment.

The intention behind an access arrangement is to meet the particular needs of an individual learner with a disability without affecting the integrity of the assessment. Access arrangements are the principal way in which awarding bodies comply with the duty under the UK Equality Act 2010 to make ‘reasonable adjustments’.

Access arrangements should always be processed at the start of the course. Learners will then know what is available and have the access arrangement(s) in place for assessment.

Reasonable adjustments

The UK Equality Act 2010 requires an awarding organisation to make reasonable adjustments where a learner with a disability would be at a substantial disadvantage in undertaking an assessment. The awarding organisation is required to take reasonable steps to overcome that disadvantage.

A reasonable adjustment for a particular learner may be unique to that individual and therefore might not be in the list of available access arrangements.

Whether an adjustment will be considered reasonable will depend on a number of factors, including:

- the needs of the learner with the disability
- the effectiveness of the adjustment
- the cost of the adjustment
- the likely impact of the adjustment on the learner with the disability and other learners.

An adjustment will not be approved if it involves unreasonable costs to the awarding organisation or unreasonable timeframes or if it affects the security or integrity of the assessment. This is because the adjustment is not ‘reasonable’.

Special consideration

Special consideration is a post-examination adjustment to a learner's mark or grade to reflect temporary injury, illness or other indisposition at the time of the examination/assessment, which has had, or is reasonably likely to have had, a material effect on a candidate’s ability to take an assessment or demonstrate their level of attainment in an assessment.

Further information

Please see our website for further information about how to apply for access arrangements and special consideration.

For further information about access arrangements, reasonable adjustments and special consideration, please refer to the JCQ website: www.jcq.org.uk.

Candidate malpractice

Candidate malpractice refers to any act by a candidate that compromises or seeks to compromise the process of assessment which undermines the integrity of the qualifications or the validity of results/certificates.

Candidate malpractice in controlled assessments discovered before the candidate has signed the declaration of authentication form does not need to be reported to Pearson.

Candidate malpractice found in controlled assessments after the declaration of authenticity has been signed, and in examinations **must** be reported to Pearson on a *JCQ Form M1* (available at http://www.jcq.org.uk/exams-office/malpractice). The completed form should be emailed to candidatemalpractice@pearson.com. Please provide as much information and supporting documentation as possible. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report candidate malpractice constitutes staff or centre malpractice.

Staff/centre malpractice

Staff and centre malpractice includes both deliberate malpractice and maladministration of our qualifications. As with learner malpractice, staff and centre malpractice is any act that compromises or seeks to compromise the process of assessment, or undermines the integrity of the qualifications or the validity of results/certificates.

All cases of suspected staff malpractice and maladministration **must** be reported immediately, before any investigation is undertaken by the centre, to Pearson on a *JCQ Form M2(a)* (available at www.jcq.org.uk/exams-office/malpractice).

The form, supporting documentation and as much information as possible should be emailed to pqsmalpractice@pearson.com. Note that the final decision regarding appropriate sanctions lies with Pearson.

Failure to report malpractice itself constitutes malpractice.

More-detailed guidance on malpractice can be found in the latest version of the document *JCQ Suspected Malpractice: Policies and Procedures,* available at www.jcq.org.uk/exams-office/malpractice.

Awarding and reporting

The International GCSE qualification (Modular) will be graded and certificated on a nine-grade scale from 9 to 1 using the total UMS where 9 is the highest grade. Individual unit results will be reported. The first certification opportunity for the Pearson Edexcel International GCSE in Chemistry (Modular) will be in August 2025. Learners whose level of achievement is below the minimum judged by Pearson to be of sufficient standard to be recorded on a certificate will receive an unclassified U result.

Unit results

This shows the total UMS for each unit and the associated grade boundaries. Students will receive a uniform mark between 0 and the maximum uniform mark for each unit.

Unit 1 (code: 4WCH1)

Unit Grade	Maximum uniform mark	9	8	7	6	5	4	3	2	1	U
	120	108	96	84	72	60	48	36	24	12	0

Unit 2 (code: 4WCH2)

Unit Grade	Maximum uniform mark	9	8	7	6	5	4	3	2	1	U
	120	108	96	84	72	60	48	36	24	12	0

Qualification results

This shows the total UMS for the qualification as a whole and the associated grade boundaries. The minimum uniform marks required for each grade: International GCSE Chemistry (modular) (cash-in code: 4XCH1)

Qualification Grade	Maximum uniform mark	9	8	7	6	5	4	3	2	1	U
	240	216	192	168	144	120	96	72	48	24	0

Students with a uniform mark range 0-23 will be Unclassified.

Resitting of units

Learners can resit any unit irrespective of whether the qualification is to be cashed in. If a learner resits a unit more than once, only the better of the two most recent attempts of that unit will be available for aggregation to a qualification grade.

Results of units will be held in Pearson's Edexcel's unit bank for as many years as this specification remains available. Once International GCSE in Chemistry (Modular) has been certificated, all unit results are deemed to be used up at that level. These results cannot be used again towards a further award of the same qualification at the same level.

Learner recruitment and progression

Pearson's policy concerning recruitment to our qualifications is that:

- they must be available to anyone who is capable of reaching the required standard
- they must be free from barriers that restrict access and progression
- equal opportunities exist for all learners.

Prior learning and other requirements

The qualification builds on the content, knowledge and skills developed in the Key Stage 3 Programme of Study (ages 11–14) or international equivalences for science.

Progression

Learners can progress from this qualification to:

- International Advanced Subsidiary, for example in Chemistry
- International Advanced Level, for example in Chemistry
- GCE Advanced Subsidiary, for example in Chemistry
- GCE Advanced Level, for example in Chemistry
- Level 3 vocational qualifications in science, for example BTEC Level 3 in Applied Science
- other comparable, Level 3 qualifications, such as the International Baccalaureate
- employment, for example in a science-based industry where an apprenticeship may be available.

Appendices

Appendix 1: Codes

Type of code	Use of code	Code
Cash-in codes	Cash-in codes are used in combination with entry codes to aggregate the learner's unit scores to obtain the overall grade for the qualification.	4XCH1
Entry codes	To enter the learner for their examination, unit codes are used as entry codes. To obtain the overall grade for the qualification, entry codes are used in combination with cash-in codes.	Please refer to the Pearson Edexcel *Information Manual*, available on the Pearson qualifications website.
Unit codes	Each unit is assigned a unit code. This unit code is used as an entry code to indicate that a learner wishes to take the assessment for a particular unit.	Unit 1: 4WCH1/1C Unit 2: 4WCH2/1C

Appendix 2: Transferable skills

The need for transferable skills

In recent years, higher-education institutions and employers have consistently flagged the need for learners to develop a range of transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

The Organisation for Economic Co-operation and Development (OECD) defines skills, or competencies, as 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to successfully and consistently perform an activity or task and can be built upon and extended through learning.'[1]

To support the design of our qualifications, the Pearson Research Team selected and evaluated seven global 21st-century skills frameworks. Following on from this process, we identified the National Research Council's (NRC) framework [2] as the most evidence-based and robust skills framework, and have used this as a basis for our adapted skills framework.

The framework includes cognitive, intrapersonal skills and interpersonal skills.

The skills have been interpreted for this specification to ensure they are appropriate for the subject. All of the skills listed are evident or accessible in the teaching, learning and/or assessment of the qualification. Some skills are directly assessed. Pearson materials will support you in identifying these skills and developing these skills in learners.

The table on the next page sets out the framework and gives an indication of the skills that can be found in chemistry and indicates the interpretation of the skill in this area. A full subject interpretation of each skill, with mapping to show opportunities for learners' development is provided on the subject pages of our website: qualifications.pearson.com

[1] OECD – *Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies* (OECD Publishing, 2012)

[2] Koenig, J. A. (2011) – *Assessing 21st Century Skills: Summary of a Workshop* (National Academies Press, 2011)

Cognitive skills	Cognitive processes and strategies	• Critical thinking • Problem solving • Analysis • Reasoning • Interpretation • Decision making • Adaptive learning • Executive function
	Creativity	• Creativity • Innovation
Intrapersonal skills	Intellectual openness	• Adaptability • Personal and social responsibility • Continuous learning • Intellectual interest and curiosity
	Work ethic/ conscientiousness	• Initiative • Self-direction • Responsibility • Perseverance • Productivity • Self-regulation (metacognition, forethought, reflection) • Ethics • Integrity
	Positive core self-evaluation	• Self-monitoring/self-evaluation/self-reinforcement
Interpersonal skills	Teamwork and collaboration	• Communication • Collaboration • Teamwork • Cooperation • Interpersonal skills
	Leadership	• Leadership • Responsibility • Assertive communication • Self-presentation

Problem solving in the application of unifying patterns and themes in chemistry and using them in new and changing situations.

Initiative when using knowledge of chemistry, independently (without guided learning), to further own understanding.

Communication to convey a science process or technique (verbally or in writing) to peers and teachers and answer questions from others.

Appendix 3: Mathematical skills

The table below identifies the mathematical skills that will be developed and assessed throughout this qualification. These are not explicitly referenced in the content. Details of the mathematical skills in other science subjects are given for reference.

		B	C	P
1	**Arithmetic and numerical computation**			
A	Recognise and use numbers in decimal form	✓	✓	✓
B	Recognise and use numbers in standard form	✓	✓	✓
C	Use ratios, fractions, percentages, powers and roots	✓	✓	✓
D	Make estimates of the results of simple calculations, without using a calculator	✓		✓
E	Use calculators to handle sin x and $\sin^{-1} x$, where x is expressed in degrees			✓
2	**Handling data**			
A	Use an appropriate number of significant figures	✓	✓	✓
B	Understand and find the arithmetic mean (average)	✓	✓	✓
C	Construct and interpret bar charts	✓	✓	✓
D	Construct and interpret frequency tables, diagrams and histograms	✓		✓
E	Understand the principles of sampling as applied to scientific data	✓		
F	Understand simple probability	✓	✓	✓
G	Understand the terms mode and median	✓		
H	Use a scatter diagram to identify a pattern or trend between two variables	✓	✓	✓
I	Make order of magnitude calculations	✓	✓	✓
3	**Algebra**			
A	Understand and use the symbols $<$, $>$, $\propto$, $\sim$		✓	✓
B	Change the subject of an equation	✓	✓	✓
C	Substitute numerical values into algebraic equations using appropriate units for physical quantities	✓	✓	✓
D	Solve simple algebraic equations	✓	✓	✓
4	**Graphs**			
A	Translate information between graphical and numerical form	✓	✓	✓
B	Understand that $y = mx + c$ represents a linear relationship		✓	✓
C	Plot two variables (discrete and continuous) from experimental or other data	✓	✓	✓
D	Determine the slope and intercept of a linear graph	✓	✓	✓
E	Understand, draw and use the slope of a tangent to a curve as a measure of rate of change		✓	✓
F	Understand the physical significance of area between a curve and the x-axis, and measure it by counting squares as appropriate			✓

		B	C	P
5	**Geometry and trigonometry**			
A	Use angular measures in degrees			✓
B	Visualise and represent 2D and 3D objects, including two dimensional representations of 3D objects			✓
C	Calculate areas of triangles and rectangles, surface areas and volumes of cubes	✓		✓

Appendix 4: Command word taxonomy

The following table lists the command words used in the external assessments.

Command word	Definition
Add/Label	Requires the addition or labelling of a stimulus material given in the question, for example labelling a diagram or adding units to a table.
Calculate	Obtain a numerical answer, showing relevant working.
Comment on	Requires the synthesis of a number of variables from data/information to form a judgement.
Compare	Looking for the similarities or differences of two (or more) things. Should not require the drawing of a conclusion. Answer must relate to both (or all) things mentioned in the question.
Complete	Requires the completion of a table/diagram.
Deduce	Draw/reach conclusion(s) from the information provided.
Describe	To give an account of something. Statements in the response need to be developed, as they are often linked but do not need to include a justification or reason.
Determine	The answer must have an element that is quantitative from the stimulus provided, or must show how the answer can be reached quantitatively. To gain maximum marks, there must be a quantitative element to the answer.
Design	Plan or invent a procedure from existing principles/ideas.
Discuss	Identify the issue/situation/problem/argument that is being assessed within the question. Explore all aspects of an issue/situation/problem/argument. Investigate the issue/situation etc. by reasoning or argument.
Draw	Produce a diagram either using a ruler or freehand.
Estimate	Find an approximate value, number or quantity from a diagram/given data or through a calculation.
Evaluate	Review information (e.g. data, methods) then bring it together to form a conclusion, drawing on evidence including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement of a subject’s quality and relate it to its context.
Explain	An explanation requires a justification/exemplification of a point. The answer must contain some element of reasoning/justification – this can include mathematical explanations.
Give/State/Name	All of these command words are really synonyms. They generally all require recall of one or more pieces of information.
Give a reason/reasons	When a statement has been made and the requirement is only to give the reason(s) why.
Identify	Usually requires some key information to be selected from a given stimulus/resource.

Command word	Definition
Justify	Give evidence to support (either the statement given in the question or an earlier answer).
Measure	To determine the dimensions or angle from a diagram using an instrument such as a ruler or protractor.
Plot	Produce a graph by marking points accurately on a grid from data that is provided and then draw a line of best fit through these points. A suitable scale and appropriately labelled axes must be included if these are not provided in the question.
Predict	Give an expected result.
Show that	Verify the statement given in the question.
Sketch	Produce a freehand drawing. For a graph, this would need a line and labelled axes with important features indicated. The axes are not scaled.
State what is meant by	When the meaning of a term is expected but there are different ways for how these can be described.
Suggest	Use your knowledge to propose a solution to a problem in a novel context.
Write	When the question asks for an equation.
Verb proceeding a command word	
Analyse the data/graph to explain	Examine the data/graph in detail to provide an explanation.
Multiple choice questions	
What, Why, Where, Which, How many	Direct command words used for multiple-choice questions.

Appendix 5: Suggested practical investigations

The following suggestions are *additional* practical investigations that exemplify the scientific process. They can be used to supplement learners' understanding of chemistry in addition to the practical investigations found within the main body of the content.

- Investigate the ease of thermal decomposition of carbonates, including calcium carbonate, zinc carbonate and copper carbonate.
- Compare the temperature rise produced when the same volume of water is heated by different fuels.
- Investigate the volume of air used up and products formed when candles are burned.
- Investigate the reactions of calcium compounds: the decomposition of calcium carbonate and the reaction of calcium oxide with water; the reaction of calcium carbonate with acid.
- Carry out simple neutralisation reactions of acids, using metal oxides, hydroxides and/or carbonates.
- Carry out electrolysis of sea water/acidified water.
- Investigate the rusting of iron.
- Investigate simple oxidation and reduction reactions, such as burning elements in oxygen or competition reactions between metals and metal oxides.
- Investigate the fractional distillation of synthetic crude oil and the ease of ignition and viscosity of the fractions.
- Investigate the products produced from the complete combustion of a hydrocarbon.
- Investigate the cracking of paraffin oil.
- Investigate the properties of a group of elements, e.g. Group 2.
- Investigate the properties of typical ionic compounds.
- Test predictions of whether a precipitate forms when soluble salts are mixed.
- Carry out a series of ion tests to identify unknown compounds.
- Build models of simple covalent molecules.
- Investigate the typical properties of simple and giant covalent compounds.
- Investigate the rate of reactions, such as magnesium and hydrochloric acid; or sodium thiosulfate and hydrochloric acid.
- Determine the formula of a hydrated salt such as barium chloride or copper sulfate by heating to drive off water of crystallisation.
- Prepare a substance and calculate the % yield, given the theoretical yield.
- Evaporate a solution to dryness to determine the mass of solute in a given mass of solution.
- Investigate the mass changes at the electrodes during the electrolysis of copper sulfate solution using copper electrodes.
- Investigate the migration of ions in, e.g. potassium manganate (VII) solution.
- Electroplate a metal object.
- Determine the volume of one mole of hydrogen gas by using the reaction of magnesium with hydrochloric acid.

- Determine the molar volume by measuring the volume and mass of a gas (e.g. carbon dioxide).
- Investigate simple reversible reactions, such as the decomposition of ammonium chloride.

Safety is an overriding requirement for all practical work. Centres are responsible for ensuring that whenever their learners complete practical work appropriate safety procedures are followed.

Appendix 6: The Periodic Table

The Periodic Table of the Elements

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

Appendix 7: Glossary

Term	Definition
Assessment objectives	The requirements that learners need to meet to succeed in the qualification. Each assessment objective has a unique focus, which is then targeted in examinations or non-examined assessment (NEA). Assessment objectives may be assessed individually or in combination.
Cash-in codes	Cash-in codes are used in combination with entry codes to aggregate the learner’s unit scores to obtain the overall grade for the qualification.
Entry codes	To enter the learner for their examination, unit codes are used as entry codes. To obtain the overall grade for the qualification, entry codes are used in combination with cash-in codes.
External assessment	Assessment set and marked by an awarding organisation, taken by centres at the same time in the global region.
JCQ	Joint Council for Qualifications. This is a group of UK exam boards which develops policy related to the administration of examinations.
Modular	Modular qualifications contain units of assessment. These units can be taken during the course of study. The final qualification grade is worked out from the combined unit results.
Uniform mark scale (UMS)	A learner’s actual marks (or raw marks) will be converted into a UMS mark so that it is possible to see the proportionate result of a learner. The raw marks for each unit may differ, but the uniform mark will be the same.
Unit	A modular qualification will be divided into a number of units. Each unit will have its own assessment.
Unit codes	Each unit is assigned a unit code. This unit code is used as an entry code to indicate that a learner wishes to take the assessment for a particular unit.

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