



Pearson
BTEC

Award

Specification

BTEC FIRST APPLICATION OF SCIENCE

From September 2012

BTEC Level 1/Level 2 First Award in Application of Science

Issue 4

Pearson BTEC Level 1/Level 2 First Award in Application of Science Specification

First teaching September 2012

Issue 4

Pearson Education Limited is one of the UK's largest awarding organisations, offering academic and vocational qualifications and testing to schools, colleges, employers and other places of learning, both in the UK and internationally. Qualifications offered include GCSE, AS and A Level, NVQ and our BTEC suite of vocational qualifications, ranging from Entry Level to BTEC Higher National Diplomas. Pearson Education Limited administers BTEC qualifications.

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This specification is Issue 4. We will inform centres of any changes to this issue. The latest issue can be found on our website.

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Welcome to your BTEC First 2012 specification

For more than 25 years, BTECs have earned their reputation as well-established, enduringly effective qualifications. They have a proven track record in improving motivation and achievement among young learners. Additionally, BTECs provide progression routes to the next stage of education or into employment.

BTECs are evolving

Informed by recent policy developments, including the *Review of Vocational Education – The Wolf Report* (March 2011), we have designed this new suite of BTEC Firsts to:

- ensure high quality and rigorous standards
- conform to quality criteria for non-GCSE qualifications
- be fit for purpose for learners, pre- or post-16, in schools and in colleges.

We conducted in-depth, independent consultations with schools, colleges, higher education, employers, the Association of Colleges and other professional organisations. This new suite builds on the qualities – such as a clear vocational context for learning and teacher-led assessment based on centre-devised assignments – that you told us make BTECs so effective and engaging.

This new suite introduces features to meet the needs of educators, employers and the external environment. They are fully aligned with requirements for progression – to further study at level 3, into an apprenticeship or into the workplace. We believe these features will make BTEC even stronger and more highly valued.

What are the key principles of the new suite of BTEC Firsts?

To support young people to succeed and progress in their education, we have drawn on our consultations with you and embedded some key design principles into the new BTEC Firsts.

1 Standards: a common core and external assessment

Each new Level 2 BTEC First Award has an essential core of knowledge and applied skills. We have introduced external assessment appropriate to the sector. This provides independent evidence of learning and progression alongside the predominantly portfolio-based assessment.

2 Quality: a robust quality-assurance model

Building on strong foundations, we have further developed our quality-assurance model to ensure robust support for learners, centres and assessors.

We will make sure that:

- every BTEC learner's work is independently scrutinised through the external assessment process
- every BTEC assessor will take part in a sampling and quality review during the teaching cycle
- we visit each BTEC centre every year to review and support your quality processes.

We believe this combination of rigour, dialogue and support will underpin the validity of the teacher-led assessment and the learner-centric approach that lie at the heart of BTEC learning.

3 Breadth and progression: a range of options building on the core; contextualised English and mathematics

The **essential core**, developed in consultation with employers and educators, gives learners the opportunity to gain a broad understanding and knowledge of a vocational sector.

Opportunities to develop skills in English and mathematics are indicated in the units where appropriate. These give learners the opportunity to practise these essential skills in naturally occurring and meaningful contexts, where appropriate to the sector. The skills have been mapped against GCSE (including functional elements) English and mathematics subject content areas.

4 Recognising achievement: opportunity to achieve at level 1

The new BTEC Firsts are a level 2 qualification, graded at Pass, Merit, Distinction and Distinction*.

However, we recognise that some learners may fail to achieve a full Pass at Level 2, so we have included the opportunity for learners to gain a level 1 qualification.

Improved specification and support

In our consultation, we also asked about what kind of guidance you, as teachers and tutors, need. As a result, we have streamlined the specification itself to make the units easier to navigate, and provided enhanced support in the accompanying Delivery Guide.

Thank you

Finally, we would like to extend our thanks to everyone who provided support and feedback during the development of the new BTEC Firsts, particularly all of you who gave up many evenings of your own time to share your advice and experiences to shape these new qualifications. We hope you enjoy teaching the course.

Summary of Pearson BTEC Level 1/Level 2 First Award in Applications of Science

Summary of changes made between Issue 2 and Issue 4	Page/section number
The wording in <i>Section 8 Internal assessment</i> subsection <i>Dealing with malpractice</i> has been updated to clarify suspension of certification in certain circumstances.	Page 27
In <i>Section 9</i> , the assessment availability date for the external assessment unit has been changed.	Page 29
The wording under <i>Section 10 Awarding and reporting for the qualifications</i> subsection <i>Calculation of the qualification grade</i> has been updated to clarify current practice in ensuring maintenance and consistency of qualification standards.	Page 32
<p>Unit 5: Applications of Chemical Substances</p> <p><i>Learning aim A: Investigate and understand enthalpy changes associated with chemical reactions</i></p> <p>Topic A.1 Exothermic and endothermic reactions</p> <ul style="list-style-type: none"> • Specific heat capacity units updated to $\text{J}^\circ\text{C}^{-1} \text{g}^{-1}$ and temperature change units updated to $^\circ\text{C}$ 	Page 40
<p>Unit 6: Applications of Physical Science</p> <p><i>Learning aim A: Investigate motion</i></p> <ul style="list-style-type: none"> • Units added to kinetic energy and gravitational potential energy equations. <p>Suggested assignment outlines</p> <p>Scenario</p> <ul style="list-style-type: none"> • 'current flowing through each light' updated to 'current in each light'. 	Page 52, 63
<p>Unit 8: Scientific Skills</p> <ul style="list-style-type: none"> • Reference to 'Key Stage 4 Science Programme of Study' removed from Unit introduction and unit content. 	Pages 73 and 74

Earlier issue(s) show(s) previous changes.

If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com

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Purpose of this specification

This specification sets out:

- the qualification's objective
- any other qualification that a learner must have completed before taking the qualification
- any prior knowledge, skills or understanding that the learner is required to have before taking the qualification
- units that a learner must have completed before the qualification will be awarded, and any optional routes
- any other requirements that a learner must have satisfied before the learner will be assessed, or before the qualification will be awarded
- the knowledge, skills and understanding that will be assessed as part of the qualification (giving a clear indication of their coverage and depth)
- the method of any assessment and any associated requirements relating to it
- the criteria against which learners' level of attainment will be measured (such as assessment criteria)
- any specimen materials (supplied separately)
- any specified levels of attainment.

Source: Ofqual – *General conditions of recognition May 2011*

Qualification title and Qualification Number

Qualification title	Pearson BTEC Level 1/Level 2 First Award in Application of Science
Qualification Number (QN)	600/4796/3

This qualification is on the Regulated Qualifications Framework (RQF). It is eligible for public funding as determined by the Department for Education (DfE) under Section 96 of the Learning and Skills Act 2000.

This qualification title features in the DfE funding lists.

Your centre should use the Qualification Number (QN) when seeking funding for your learners or for league table reporting.

The qualification title, units and QN will appear on each learner's final certificate. You should tell your learners this when your centre recruits them and registers them with us. Further information about certification is in the *Information Manual* on our website, qualifications.pearson.com

1 What are BTEC Firsts?

BTEC First qualifications were originally designed for use in colleges, schools and the workplace as an introductory level 2 course for learners wanting to study in the context of a vocational sector. This is still relevant today. The skills learnt in studying a BTEC First will aid progression to further study and prepare learners to enter the workplace in due course. In Applied Science, typical employment opportunities may be as a laboratory technician or in roles involving sample analysis in environmental protection or healthcare.

These qualifications are intended primarily for learners in the 14–19 age group, but may also be used by other learners who wish to gain an introductory understanding of a vocational area. When taken as part of a balanced curriculum they have a clear progression route to a level 3 course or to an apprenticeship.

BTECs are vocationally related qualifications, where learners develop knowledge and understanding by applying their learning and skills in a work-related context. Additionally, they are popular and effective because they engage learners to take responsibility for their own learning and to develop skills that are essential for the modern-day workplace. These skills include: teamworking; working from a prescribed brief; working to deadlines; presenting information effectively; and accurately completing administrative tasks and processes. BTEC Firsts motivate learners, and open doors to progression into further study and responsibility within the workplace.

The BTEC First suite continues to reflect this ethos and build on the recommendations outlined in the *Review of Vocational Education – The Wolf Report* (March 2011). That report confirmed the importance of a broad and balanced curriculum for all learners.

The BTEC First suite of qualifications

The following qualifications are part of the BTEC First suite for first teaching from September 2012:

- Application of Science
- Art and Design
- Business
- Engineering
- Health and Social Care
- Information and Creative Technology
- Performing Arts
- Principles of Applied Science
- Sport.

Additional qualifications in larger sizes and in different vocational sectors will be available from 2012.

Objectives of the BTEC First suite

The BTEC First suite will:

- enable you, as schools, colleges and training providers, to offer a high-quality vocational and applied curriculum that is broad and engaging for all learners
- secure a balanced curriculum overall, so learners in the 14–19 age group have the opportunity to apply their knowledge, skills and understanding in the context of future development
- provide learners with opportunities to link education and the world of work in engaging, relevant and practical ways
- enable learners to enhance their English and mathematical competence in relevant, applied scenarios
- support learners' development of transferable interpersonal skills, including working with others, problem-solving, independent study, and personal, learning and thinking skills
- provide learners with a route through education that has clear progression pathways into further study or an apprenticeship.

Breadth and progression

This qualification has a core of underpinning knowledge, skills and understanding. This gives learners the opportunity to:

- gain a broad understanding and knowledge of a vocational sector
- investigate areas of specific interest
- develop essential skills and attributes prized by employers, further education colleges and higher education institutions.

This suite of qualifications provides opportunities for learners to progress to either academic or more specialised vocational pathways.

2 Key features of the Pearson BTEC First Award

The Pearson BTEC Level 1/Level 2 First Award:

- is a level 2 qualification; however, it is graded at Level 2 Pass, Level 2 Merit, Level 2 Distinction, Level 2 Distinction*, Level 1 and Unclassified
- is for learners aged 14 years and over
- is a 120 guided-learning-hour qualification (equivalent in teaching time to one GCSE)
- has 25 per cent of the qualification that is externally assessed. Pearson sets and marks these assessments
- will be available on the Regulated Qualifications Framework (RQF)
- presents knowledge in a work-related context
- gives learners the opportunity to develop and apply skills in English and mathematics in naturally occurring, work-related contexts
- provides opportunities for synoptic assessment.

Learners can register on the Pearson BTEC Level 1/Level 2 First Award in Application of Science from April 2012. The first certification opportunity for the Pearson BTEC Level 1/Level 2 First Award in Application of Science will be in 2014.

Types of units within the qualifications

The Pearson BTEC Level 1/Level 2 First Award in Application of Science has mandatory units only. See *Section 4* for more detailed information.

Mandatory units

- This qualification has mandatory units totalling 120 guided learning hours.
- Mandatory units cover the body of content that employers and educators within the sector consider essential for 14–19-year-old learners
- One of the mandatory units is externally assessed.

Total qualification time (TQT)

For all regulated qualifications, Pearson specifies a total number of hours that it is expected learners will be required to undertake in order to complete and show achievement for the qualification: this is the Total Qualification Time (TQT). The TQT value indicates the size of a qualification.

Within this, Pearson will also identify the number of Guided Learning Hours (GLH) that we expect a centre delivering the qualification will need to provide. Guided learning means activities that directly or immediately involve tutors and assessors in teaching, supervising, and invigilating learners, such as lessons, tutorials, online instruction and supervised study.

In addition to guided learning, other required learning directed by tutors or assessors will include private study, preparation for assessment and undertaking assessment when not under supervision, such as preparatory reading, revision and independent research.

Qualifications can also have a credit value, which is equal to one tenth of TQT, rounded to the nearest whole number.

Qualification sizes for BTEC Firsts in the Applied Science sector

This suite of BTEC Firsts for the Applied Science sector is available in the following sizes:

	GLH	TQT
First award	120	160
First extended certificate	360	480
First diploma	480	640

Pearson BTEC Level 1/ Level 2 First Award in Application of Science

3 Pearson BTEC Level 1/Level 2 First Award in Application of Science

Applied Science adopts a different structure from other qualifications in the suite, to reflect the unique nature of science learning. To ensure sufficient breadth and depth, instead of a single Award, Applied Science has two Awards. This specification is for the Pearson BTEC Level 1/Level 2 First Award in Application of Science. There is an additional specification for the Pearson BTEC Level 1/Level 2 First Award in Principles of Applied Science.

The Principles of Applied Science Award delivers the Key Stage 4 Programme of Study for science by covering the key scientific principles vital for both scientists and citizens of the future. It develops and exemplifies these principles in applied and vocational contexts, leading to an understanding of how the principles are applied in practice. As a result, the external assessment is based on key principles of science from the Programme of Study for Science that underpin further learning.

Given the fact that some students are clearly best suited and more interested in vocational learning at the beginning of Key Stage 4, a vocational qualification designed to cover the Programme of Study is appropriate. However, some students need a different learning route at Key Stage 4, either due to constraints on resources in schools or because they themselves are unsure of the learning route they wish to take. For these, learning the programme of study via an academic route, such as GCSE Science, is appropriate. However, having studied in this way, they may then take the decision that a vocational learning route is their best option for further progression or employment. In such circumstances, we have provided an option to follow a vocational learning programme that does not repeat the Programme of Study for Science.

The Application of Science Award is suitable for these learners. It develops the learner's understanding of key applications of science, and builds the skills required both for the scientific workplace and for further study. New knowledge is acquired and applied through the internally assessed units. The final unit is an external assessment of investigative skills to ensure that all learners who have completed two qualifications in Science, using either a fully vocational route or a route beginning with an academic course and being completed with a vocational course, can investigate effectively in a practical context scientific problems that are not familiar, since the ability to do this is vital to progression to vocational qualifications at level 3 or employment in technical roles.

Rationale for the Pearson BTEC Level 1/Level 2 First Award in Application of Science

The Application of Science Award is suitable for learners who have covered the Key Stage 4 Programme of Study from either an applied or academic standpoint. It develops the learner's understanding of key applications of science, and builds the skills required both for the scientific workplace and for further study.

Learners must study the Principles of Applied Science Award (or a GCSE covering the Key Stage 4 Programme for Study) before taking the Application of Science Award, but the latter may be achieved without a requirement for the learner to have achieved the former. The Application of Science Award is composed of four mandatory units which give an introductory grounding in scientific skills and applications. The mandatory unit Scientific Skills, which outlines good practical laboratory and investigatory skills, is externally tested; while the Application of Chemical Substances, Application of Physical Science, and Health Applications of Life Science are internally assessed. Together, these four units provide an introduction to the practical ways in which people make practical use of substances and use science to help society to function economically and to deliver health related benefits. Additionally, English and mathematics have been contextualised within the assessment aims. This allows learners to practise these essential skills in naturally occurring and meaningful contexts, where appropriate.

This qualification has been developed to:

- exemplify scientific principles in vocational contexts, leading to an understanding of how those principles are applied in practice, and can facilitate a move either onto further periods of study or into employment
- give learners the opportunity to gain a broad understanding and knowledge of science principles and practice
- give learners the opportunity to develop a range of related skills and techniques that are essential for successful performance in working life
- give opportunities for learners to achieve a nationally recognised level 1 or level 2 science qualification
- support progression into a more specialised level 3 vocational or academic course or into an apprenticeship
- give full-time learners the opportunity to enter potential employment within a wide range of science sectors such as process, industrial, medical, or forensic.

Employers value employees who are able to communicate effectively both verbally and using electronic communication methods. The qualification provides opportunities for learners to develop their communication skills as they progress through the course. This can be achieved through presentations and in discussions where they have the opportunity to express their opinions.

Vocational learning in science is critical to enabling technical roles in the STEM sector to be supported. The qualification is appropriate for learners of all abilities who benefit from a practical and applied approach to learning in a vocational context. From the knowledge and skills developed in this qualification you may expect to seek employment at a junior level working with either biological science technicians and scientists working in biology, health care, and other biology-related industries; or in companies using science based understanding to develop transportation or electrical applications; or working in companies that use composite other materials to make articles like cars, aeroplanes, mobile phones, and building materials.

Locally available vocational examples and the opportunity to localise assignments to fit learner experience allow a more realistic and motivating basis for learning and can start to ensure learning serves the employment needs of local areas.

Learners should be encouraged to take responsibility for their own learning and achievement, taking account of the industry standards for behaviour and performance.

Progression opportunities

This qualification builds on a foundation of the Key Stage 3 science programme of study and from the material in the Pearson BTEC Level 1/Level 2 First Award in Principles of Applied Science.

Learners can progress from this qualification onto the BTEC Level 3 Nationals in Applied Science, including the Forensic Science and Medical Science endorsed pathways. Learners can also progress to a range of BTEC Level 2 National qualifications in related areas such as Beauty Therapy Science, Health and Social Care, Sport and Exercise Science, Engineering, Construction, Land-based, Pharmacy Services or Dental Technology.

Alternatively they can progress to NVQs such as the Laboratory and Associated Technical Activities or Laboratory Science. The underpinning knowledge, practical and vocational scientific skills learnt on the BTEC course will enhance and support the progression to a competency-based course.

For learners who wish to progress to GCEs in science it is recommended that they also take further units from the larger-sized BTEC First qualifications and are provided with support on GCE assessment methods.

Stakeholder support

The Pearson BTEC Level 1/Level 2 First Award in Application of Science reflects the needs of employers, further and higher education representatives and professional organisations. Key stakeholders were consulted during the development of this qualification. Stakeholders included employers and teachers who deliver vocational qualifications at levels 2 and 3.

4 Qualification structure

The Pearson BTEC Level 1/Level 2 First Award in Application of Science is taught over 120 guided learning hours (GLH). It has four mandatory units.

Learners must complete all mandatory units.

This BTEC First Award has units that your centre assesses (internal) and a unit that Pearson sets and marks (external).

It is expected that learners will have learnt the Key Stage 4 Programme of Study for Science before completing the Pearson BTEC Level 1/Level 2 First Award in Application of Science.

Pearson BTEC Level 1/Level 2 First Award in Application of Science			
Unit	Mandatory units	Assessment method	GLH
5	Application of Chemical Substances	Internal	30
6	Application of Physical Science	Internal	30
7	Health Applications of Life Science	Internal	30
8	Scientific Skills	External	30

5 Programme delivery

Pearson does not define the mode of study for BTEC qualifications. Your centre is free to offer the qualification using any mode of delivery (such as full-time, part-time, evening only or distance learning) that meets your learners' needs. As such, those already employed in the applied science sector could study for the BTEC First Award on a part-time basis, using industry knowledge and expertise gained from the workplace to develop evidence towards meeting the unit assessment criteria.

Whichever mode of delivery is used, your centre must ensure that learners have appropriate access to the resources identified in the specification and to the subject specialists who are delivering the units. This is particularly important for learners studying for the qualification through open or distance learning.

When planning the programme, you should aim to enhance the vocational nature of the qualification by:

- using up-to-date and relevant teaching materials that make use of scenarios relevant to the scope and variety of employment opportunities available in the sector – these materials may be drawn from workplace settings where this is feasible, for example, drawing on local industrial processes that can exemplify the way firms draw on scientific principles in manufacturing
- giving learners the opportunity to apply their learning through practical activities to be found in the workplace, for example, how key principles of biology, chemistry and physics and investigative techniques underpin how scientific organisations operate
- including employers in the delivery of the programme and, where appropriate, in the assessment – you may, for example, wish to seek the cooperation of local employers to provide examples of current work procedures and practices
- liaising with employers to make sure a course is relevant to learners' specific needs – you may, for example, wish to seek employer help in stressing the importance of effective teamwork, verbal and written communication, and mathematical skills in ensuring good laboratory practice.

Resources

As part of the approval process, your centre must make sure that the resource requirements below are in place before offering the qualification.

- Centres must have appropriate physical resources (for example, equipment, IT, learning materials, teaching rooms) to support the delivery and assessment of the qualification.
- Staff involved in the assessment process must have relevant expertise and/or occupational experience.
- There must be systems in place to ensure continuing professional development for staff delivering the qualification.
- Centres must have appropriate health-and-safety policies in place relating to the use of equipment by learners.
- Centres must deliver the qualification in accordance with current equality legislation.
- Your centre should refer to the *Teacher guidance* section in individual units to check for any specific resources required.

Delivery approach

Your approach to teaching and learning should support the specialist vocational nature of BTEC First qualifications. These BTEC Firsts give a balance of practical skill development and knowledge requirements, some of which can be theoretical in nature.

Instruction in the classroom is only part of the learning process. You can reinforce the links between the theory and practical application, and make sure that the knowledge base is relevant and up to date, by teaching through practical work, group work and investigations set in local contexts.

One of the important aspects of your approach to delivery should be to instil into learners who have a limited experience of the world of work some insights into the daily operations that are met in the vocational area being studied. It is suggested that the delivery of the BTEC Firsts can be enriched and extended by the use of learning materials, classroom exercises and internal assessments that draw on current practice in, and experience of, the sector being studied. This may draw on the use of:

- vocationally specific workplace case-study materials, e.g. local scientific companies
- visiting speakers, and the assistance of local employers, e.g. NHS Trusts
- visits by learners to local workplaces, e.g. local government departments responsible to monitoring the environment
- inviting relevant parents or contacts to come to speak to the learners about how they use science in their work
- arranging controlled mystery experiments, which the learners have to solve in pair or group work
- asking a local employer to set learners a problem-solving activity to be carried out in groups.

Personal, learning and thinking skills

Your learners have opportunities to develop personal, learning and thinking skills (PLTS) within a sector-related context. See *Annexe A* for detailed information about PLTS, and mapping to the units in this specification.

English and mathematics knowledge and skills

It is likely that learners will be working towards English and mathematics qualifications at Key Stage 4 or above. This BTEC First qualification provides further opportunity to enhance and reinforce skills in English and mathematics in naturally occurring, relevant, work-related contexts.

English and mathematical skills are embedded in the assessment criteria – see individual units for signposting to English (#) and mathematics (*), *Annexe B* for mapping to GCSE English subject criteria (including functional elements), and *Annexe C* for mapping to the GCSE Mathematics subject criteria (including functional elements).

Health and safety

Learners must observe safe practice when they are carrying out practical work. It is the responsibility of centres to carry out risk assessments for all practical work that they undertake with their learners.

During any internal assessment, learners should be responsible for their own practical work, such as planning and collecting data. However, you, as teachers, should always check and supervise this for health and safety reasons.

6 Access and recruitment

Our policy regarding access to our qualifications is that:

- they should be available to everyone who is capable of reaching the required standards
- they should be free from any barriers that restrict access and progression
- there should be equal opportunities for all those wishing to access the qualifications.

This is a qualification aimed at level 2 learners. Your centre is required to recruit learners to BTEC First qualifications with integrity.

You need to make sure that applicants have relevant information and advice about this qualification to make sure it meets their needs.

Your centre should review the applicant's prior qualifications and/or experience to consider whether this profile shows that they have the potential to achieve the qualification.

For learners with disabilities and specific needs, this review will need to take account of the support available to the learner during the teaching and assessment of the qualification.

Prior knowledge, skills and understanding

Learners do not need to achieve any other qualifications before registering for the Pearson BTEC Level 1/Level 2 First Award in Application of Science. However, it is expected that learners will have learnt all of the materials from the Pearson BTEC Level 1/Level 2 First Award in Principles of Applied Science, or a GCSE in Science covering the Key Stage 4 programme of study for science, before completing the Pearson BTEC Level 1/Level 2 First Award in Application of Science.

Access to qualifications for learners with disabilities or specific needs

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

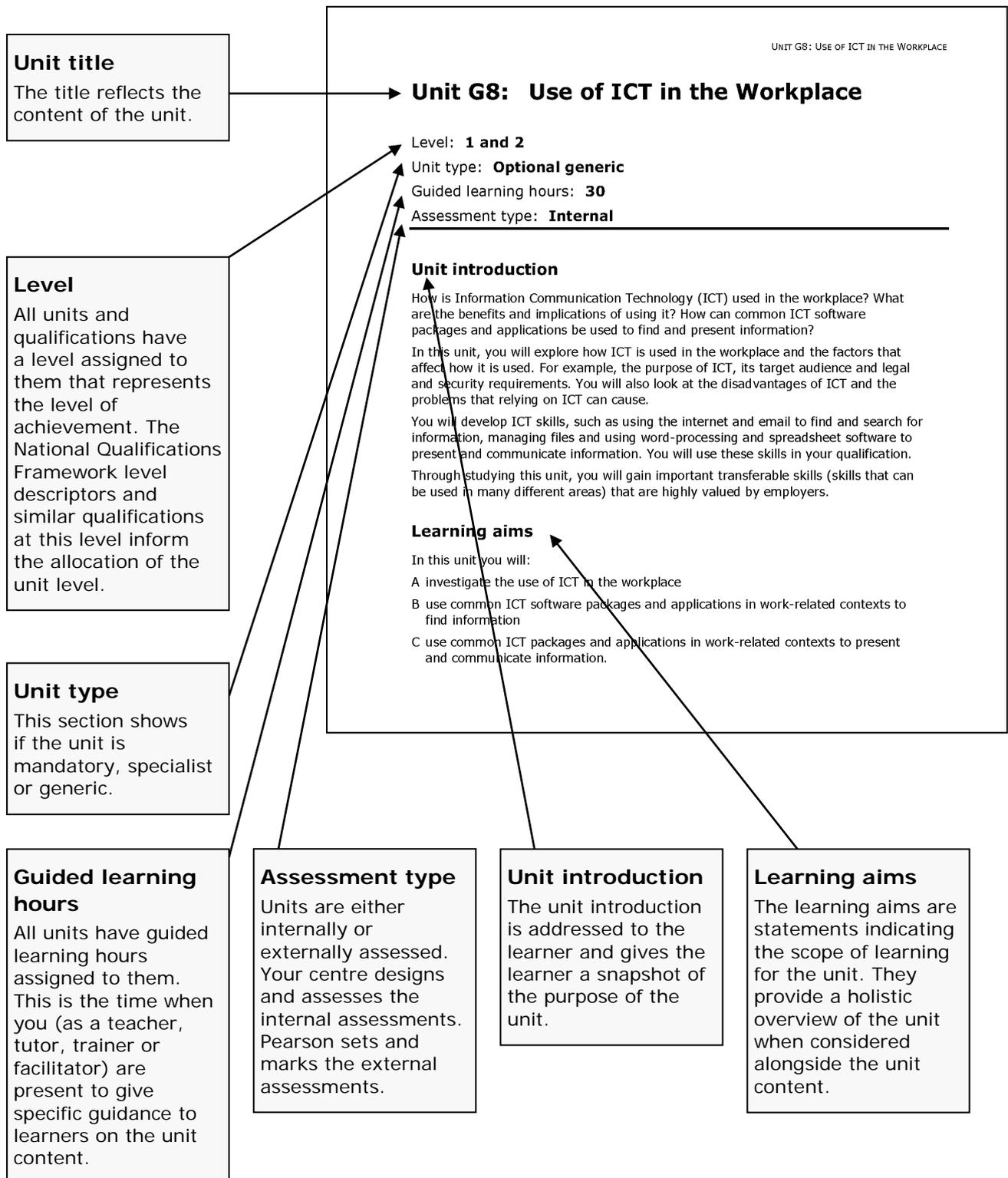
We are committed to making sure that:

- learners with a protected characteristic (as defined by equality legislation) 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.

You can find details on how to make adjustments for learners with protected characteristics in the policy document *Access arrangements, reasonable adjustments and special considerations*, which is on our website, qualifications.pearson.com

7 The layout of units in the specification

Each unit is laid out using the headings given below. The unit shown below is for illustrative purposes only.



UNIT G8: USE OF ICT IN THE WORKPLACE

Learning aims and unit content

What needs to be learnt
<p>Learning aim A: Investigate the use of ICT in the workplace</p> <p>Topic A.1 The various uses of ICT in the workplace, including associated benefits and problems</p> <p>Use of ICT in the workplace:</p> <ul style="list-style-type: none"> • search for, find and interpret information • present and communicate information • record and store information • provide services using technology • specialist services, e.g. payment facilities, CCTV, stock control <p>Benefits of using ICT in the workplace:</p> <ul style="list-style-type: none"> • increases access to services in terms of coverage and speed • fosters communication • increases efficiency in data management • provision of better services <p>Problems with using ICT in the workplace:</p> <ul style="list-style-type: none"> • problems when the server goes down, e.g. loss of information, unable to process information • lack of personal contact, e.g. when using automated systems • not challenging the data produced through ICT, assuming it is correct • additional volume of information caused by increased speed of input/output <p>Topic A.2 Consider the factors that need to be considered when using ICT in the workplace:</p> <ul style="list-style-type: none"> • purpose, e.g. inform, persuade • audience, including internal and external, e.g. colleague, customer, client, public • need to meet legal requirements for the storage and use of data

Learning aims and unit content

The unit content gives the basis for the teaching, learning and assessment for each learning aim. Topic headings are given, where appropriate.

Content covers:

- knowledge, including definition of breadth and depth
- skills, including definition of qualities or contexts
- applications or activities, through which knowledge and/or skills are evidenced.

Content should normally be treated as compulsory for teaching the unit. Definition of content sometimes includes examples prefixed with 'e.g.'. These are provided as examples and centres may use all or some of these, or bring in additional material, as relevant.

UNIT G8: USE OF ICT IN THE WORKPLACE

Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim A: Investigate the use of ICT in the workplace			
1A.1 Outline how ICT is used in the workplace.	2A.P1 Describe how ICT is used in the workplace to benefit organisations and individuals.	2A.M1 Assess the implications of relying on the use of ICT in the workplace.	2A.D1 Evaluate, through relevant examples, the range of benefits and uses of ICT in the workplace to both the organisation and individuals.
1A.2 Identify the factors that need to be considered when using ICT in the workplace.	2A.P2 Describe the factors that need to be considered when using ICT in the workplace.	2A.M2 Assess how current and relevant legislation affects the use of ICT in the workplace.	
Learning aim B: Use common ICT software packages and applications in work-related contexts to find information			
1B.3 Use the internet and email to select information from given sources that is appropriate for a given purpose. #	2B.P3 Use the internet and email to research and select information to meet objectives. #	2B.M3 Use the internet and email to research and select appropriate information from a range of sources to meet objectives. #	2B.D2 Use the internet and email to organise electronic data securely to support a range of sources that meet objectives.
1B.4 Store and save electronic files correctly.	2B.P4 Store and manage electronic files appropriately related to objectives.		

Assessment criteria

The assessment criteria determine the minimum standard required by the learner to achieve the relevant grade. The learner must provide sufficient and valid evidence to achieve the grade.

Teacher guidance

While the main content of the unit is addressed to the learner, this section gives you additional guidance and amplification to aid your understanding and to ensure a consistent level of assessment.

Resources – identifies any special resources required for learners to show evidence of the assessment. Your centre must make sure that any requirements are in place when it seeks approval from Pearson to offer the qualification.

UNIT GB: USE OF ICT IN THE WORKPLACE

Teacher guidance

Resources

The resources required for this unit are:

- a PC
- internet and email access
- word-processing and spreadsheet software (ideally the latest version available, reflecting that commonly used in offices).

It is expected that learners will have basic familiarity with the PC, the operating system and the version of the software that they use.

Assessment guidance

This unit is assessed internally by the centre and externally verified by Edexcel. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Learners should be assessed via centre-devised assignments. Assignments must be set within the vocational context of the qualification that learners are undertaking, and teachers should ensure that assignments involve a variety of assessment methods to engage and motivate learners.

Teachers can either create one holistic assignment to assess all assessment criteria within a level or several smaller assignments.

This unit can be co-assessed with a sector-specific unit. Learners could research, present and communicate information, using ICT to meet the expected outcomes of the sector-specific unit.

At level 2, learners are expected to carry out their own research about suitable websites, for example by using information from textbooks and articles and through search engines. Learners should email others to find information, for example through a questionnaire. Learners should use ICT resources to meet an objective – this could be research carried out for another assignment, or a fact-finding exercise to obtain information about a vocational sector. Level 2 learners will be expected to demonstrate more advanced technical ICT skills, as detailed by the assessment criteria.

When searching for and finding information using the internet and email, level 1 learners should be supported by the teacher. Teachers should give learners a list of suitable websites and suggest suitable terms to use in search engines. Teachers should also give guidance on the people and organisations learners could email for information. Level 1 learners will be expected to demonstrate their technical IT skills within a vocational context.

Practical observations, for example of learners using the internet and email, or managing files, must be evidenced with a signed witness testimony. This can be supplemented with additional evidence, for example screenshots. Learners must include within their evidence a list of website references (supplied by the teacher or learner, depending on the level).

Assessment guidance – gives examples of the quality of work needed to differentiate the standard of work submitted. It also offers suggestions for creative and innovative ways in which learners can produce evidence to meet the criteria. The guidance highlights approaches and strategies for developing appropriate evidence.

Suggested assignment outlines – gives examples of possible assignment ideas. These are not mandatory. Your centre is free to adapt them, or you can design your own assignment tasks.

UNIT GB: USE OF ICT IN THE WORKPLACE

Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1, 1A.2, 2A.P1, 2A.P2, 2A.M1, 2A.M2, 2A.D1	Uses of ICT in the Workplace	You need to investigate the uses of ICT in the business workplace. You can do this by creating an article about the uses and benefits of ICT in two specific workplaces, e.g. your school or college, the business where you have a part-time job or any other local business that you research. You also need to include how ICT benefits these businesses and the individuals working for them. Furthermore, you need to describe factors that need to be considered when using ICT in the workplace, e.g. legal requirements such as those relating to health and safety and security of data and confidentiality.	Written article

8 Internal assessment

Language of assessment

Assessment of the internal and external units for this qualification will be available in English. All learner work must be in English. This qualification can also be made available through the medium of Welsh in which case learners may submit work in Welsh and/or English.

A learner taking the qualification may be assessed in British or Irish Sign Language where it is permitted for the purpose of reasonable adjustment.

Summary of internal assessment

For the Pearson BTEC Level 1/Level 2 First qualifications, the majority of the units are assessed through internal assessment, which means that you can deliver the programme in a way that suits your learners and relates to local need. The way in which you deliver the programme must also ensure that assessment is fair and that standards are nationally consistent over time.

To achieve this, it is important that you:

- plan the assessment of units to fit with delivery, allowing for the linkages between units
- write suitable assessments (for example, assignments, projects or case studies) or select assessments from available resources, adapting them as necessary
- plan the assessment for each unit in terms of when it will be authorised by the Lead Internal Verifier, when it will be used and assessed, and how long it will take, and how you will determine that learners are ready to begin an assessment
- ensure each assessment is fit for purpose, valid, will deliver reliable assessment outcomes across assessors, and is authorised before use
- provide all the preparation, feedback and support that learners need to undertake an assessment before they begin producing their evidence
- make careful and consistent assessment decisions based only on the defined assessment criteria and unit requirements
- validate and record assessment decisions carefully and completely
- work closely with Pearson to ensure that your implementation, delivery and assessment is consistent with national standards.

Assessment and verification roles

There are three key roles involved in implementing assessment processes in your school or college, namely:

- Lead Internal Verifier
- Internal Verifier – the need for an Internal Verifier or Internal Verifiers in addition to the Lead Internal Verifier is dependent on the size of the programme in terms of assessment locations, number of assessors and optional paths taken. Further guidance can be obtained from your Regional Quality Manager or Centre Quality Reviewer if you are unsure about the requirements for your centre
- assessor.

The Lead Internal Verifier must be registered with Pearson and is required to train and standardise assessors and Internal Verifiers using materials provided by Pearson that demonstrate the application of standards. In addition, the Lead Internal Verifier should provide general support. The Lead Internal Verifier:

- has overall responsibility for the programme assessment plan, including the duration of assessment and completion of verification
- can be responsible for more than one programme
- ensures that there are valid assessment instruments for each unit in the programme
- ensures that relevant assessment documentation is available and used for each unit
- is responsible for the standardisation of assessors and Internal Verifiers using Pearson-approved materials
- authorises individual assessments as fit for purpose
- checks samples of assessment decisions by individual assessors and Internal Verifiers to validate that standards are being correctly applied
- ensures the implementation of all general assessment policies developed by the centre for BTEC qualifications
- has responsibility for ensuring learner work is authenticated
- liaises with Pearson, including the Pearson Standards Verifier.

Internal Verifiers must oversee all assessment activity to make sure that individual assessors do not misinterpret the specification or undertake assessment that is not consistent with the national standard in respect of level, content or duration of assessment. The process for ensuring that assessment is being conducted correctly is called internal verification. Normally, a programme team will work together with individuals being both assessors and Internal Verifiers, with the team leader or programme manager often being the registered Lead Internal Verifier.

Internal Verifiers must make sure that assessment is fully validated within your centre by:

- checking every assessment instrument carefully and endorsing it before it is used
- ensuring that each learner is assessed carefully and thoroughly using only the relevant assessment criteria and associated guidance within the specification
- ensuring the decisions of every assessor for each unit at all grades and for all learners are in line with national standards.

Assessors make assessment decisions and must be standardised using Pearson-approved materials before making any assessment decisions. They are usually the teachers within your school or college, but the term 'assessor' refers to the specific responsibility for carrying out assessment and making sure that it is done in a way that is correct and consistent with national standards. Assessors may also draft or adapt internal assessment instruments.

You are required to keep records of assessment and have assessment authorised by Pearson. The main records are:

- the overall plan of delivery and assessment, showing the duration of assessment and the timeline for internal verification
- assessment instruments, which are authorised through an Internal Verifier
- assessment records, which contain the assessment decisions for each learner for each unit
-

an internal verification sampling plan, which shows how assessment decisions are checked, and that must include across the sample all assessors, unit assessment locations and learners

- internal verification records, which show the outcomes of sampling activity as set out in the sampling plan.

Learner preparation

Internal assessment is the main form of assessment for this qualification, so preparing your learners for it is very important because they:

- must be prepared for and motivated to work consistently and independently to achieve the requirements of the qualification
- need to understand how they will be assessed and the importance of timescales and deadlines
- need to appreciate fully that all the work submitted for assessment must be their own.

You will need to provide learners with an induction and a guide or handbook to cover:

- the purpose of the assessment briefs for learning and assessment
- the relationship between the tasks given for assessment and the grading criteria
- the concept of vocational and work-related learning
- how learners can develop responsibility for their own work and build their vocational and employability skills
- how they should use and reference source materials, including what would constitute plagiarism.

Designing assessment instruments

An assessment instrument is any kind of activity or task that is developed for the sole purpose of assessing learning against the learning aims. When you develop assessment instruments you will often be planning them as a way to develop learners' skills and understanding. However, they must be fit for purpose as a tool to measure learning against the defined content and assessment criteria to ensure your final assessment decisions meet the national standard.

You should make sure that assessment tasks and activities enable learners to produce valid, sufficient, authentic and appropriate evidence that relates directly to the specified criteria within the context of the learning aims and unit content. You need to ensure that the generation of evidence is carefully monitored, controlled and produced in an appropriate timescale. This will help you to make sure that learners are achieving to the best of their ability and at the same time that the evidence is genuinely their own.

An assessment that is fit for purpose and suitably controlled is one in which:

- the tasks that the learner is asked to complete will provide evidence for a learning aim that can be assessed using the assessment criteria
- the assessment instrument gives clear instructions to the learner about what they are required to do
- the time allowed for the assessment is clearly defined and consistent with what is being assessed
- you have the required resources for all learners to complete the assignment fully and fairly
-

the evidence the assignment will generate will be authentic and individual to the learner

- the evidence can be documented to show that the assessment and verification has been carried out correctly.

You may develop assessments that cover a whole unit, parts of a unit or several units, provided that all units and their associated learning aims are fully addressed through the programme overall. A learning aim **must** be covered completely in an assessment. Learning aim coverage must not be split between assignments. In some cases it may be appropriate to cover a learning aim with two tasks or sub-tasks within a single assignment. This must be done with care to ensure the evidence produced for each task can be judged against the full range of achievement available in the learning aim for each activity. This means it is not acceptable to have a task that contains a Pass level activity, then a subsequent task that targets a Merit or Distinction level activity. However, it is possible to have two tasks for different assessed activities, each of which stretch and challenge the learners to aim to produce evidence that can be judged against the full range of available criteria.

When you give an assessment to learners, it must include:

- a clear title and/or reference so that the learner knows which assessment it is
- the unit(s) and learning aim(s) being addressed
- a scenario, context, brief or application for the task
- task(s) that enable the generation of evidence that can be assessed against the assessment criteria
- details of the evidence that the learner must produce
- clear timings and deadlines for carrying out tasks and providing evidence.

Your assessment tasks should enable the evidence generated to be judged against the full range of assessment criteria; it is important the learners are given the opportunity for stretch and challenge.

The units include guidance on appropriate approaches to assessment. A central feature of vocational assessment is that it should be:

- current, i.e. it reflects the most recent developments and issues
- local, i.e. it reflects the employment context of your area
- flexible, i.e. it allows you as a centre to deliver the programme, making best use of the vocational resources that you have
- consistent with national standards, with regard to the level of demand.

Your centre should use the assessment guidance within units along with your local resource availability and guidance to develop appropriate assessments. It is acceptable to use and adapt resources to meet learner needs and the local employment context.

You need to make sure that the type of evidence generated fits with the unit requirement, that it is vocational in nature, and that the context in which the assessment is set is in line with unit assessment guidance and content. For many units, this will mean providing for the practical demonstration of skills. For many learning aims, you will be able to select an appropriate vocational format for evidence generation, such as:

- written reports, graphs, posters
- projects, project plans
- time-constrained practical assessments
- audio-visual recordings of portfolio, sketchbook, a working logbook, etc
- presentations.

Authenticity and authentication

You can accept only evidence for assessment that is authentic, i.e. that is the learner's own and that can be judged fully to see whether it meets the assessment criteria.

You should ensure that authenticity is considered when setting assignments. For example, ensuring that each learner has a different focus for research will reduce opportunities for copying or collaboration. On some occasions it will be useful to include supervised production of evidence. Where appropriate, practical activities or performance observed by the assessor should be included.

Learners must authenticate the evidence that they provide for assessment. They do this by signing a declaration stating that it is their own work when they submit it to certify:

- the evidence submitted for this assignment is the learner's own
- the learner has clearly referenced any sources used in the work
- they understand that false declaration is a form of malpractice.

Your assessors should assess only learner evidence that is authentic. If they find through the assessment process that some or all of the evidence is not authentic, they need to take appropriate action, including invoking malpractice policies as required.

It is important that all evidence can be validated through verification. This means that it must be capable of being reassessed in full by another person. When you are using practical and performance evidence, you need to think about how supporting evidence can be captured through using, for example, videos, recordings, photographs, handouts, task sheets, etc. This should be submitted as part of the learner's evidence.

The authentication of learner evidence is the responsibility of your centre. If during external sampling a Pearson Standards Verifier raises concerns about the authenticity of evidence, your centre will be required to investigate further. Depending on the outcomes, penalties may be applied. At the end of this section, you can find an example of a template that can be used to record the declaration of learners in relation to the authenticity of the evidence presented for assessment.

Applying criteria to internal assessments

Each unit and learning aim has specified assessment criteria. Your centre should use these criteria for assessing the quality of the evidence provided. This determines the grade awarded.

Unless specifically indicated by the assessment guidance, assessment criteria are not a set of sequential activities but a way of making a judgement. For example, if a Level 2 Pass specifies a 'description' and a Merit an 'analysis', these do not require two different activities but rather one activity through which some learners will provide only description evidence and others will also provide analysis evidence. The assessment criteria are hierarchical. A learner can achieve a Merit only if they provide sufficient evidence for the Level 2 Pass and Merit criteria. Similarly, a learner can achieve a Distinction only if they give sufficient evidence for the Level 2 Pass, Merit and Distinction criteria.

A final unit grade is awarded after all opportunities for achievement are given.

A learner must achieve all the assessment criteria for that grade. Therefore:

- to achieve a Level 2 Distinction a learner must have satisfied all the Distinction criteria in a way that encompasses all the Level 2 Pass, Merit and Distinction criteria, providing evidence of performance of outstanding depth, quality or application
- to achieve a Level 2 Merit a learner must have satisfied all the Merit criteria in a way that encompasses all the Level 2 Pass and Merit criteria, providing performance of enhanced depth or quality
- to achieve a Level 2 Pass a learner must have satisfied all the Level 2 Pass criteria, showing breadth of coverage of the required unit content and having relevant knowledge, understanding and skills
- a learner can be awarded a Level 1 if the Level 1 criteria are fully met. A Level 1 criterion is not achieved through failure to meet the Level 2 Pass criteria.

A learner who does not achieve all the assessment criteria at Level 1 has not passed the unit and should be given a grade of U (Unclassified).

A learner must achieve all the defined learning aims to pass the internally assessed units. There is no compensation within the unit.

Assessment decisions

Final assessment is the culmination of the learning and assessment process. Learners should be given a full opportunity to show how they have achieved the learning aims covered by a final assessment. This is achieved by ensuring that learners have received all necessary learning, preparation and feedback on their performance and then confirming that they understand the requirements of an assessment, before any assessed activities begin.

There will then be a clear assessment outcome based on the defined assessment criteria. Your assessment plan will set a clear timeline for assessment decisions to be reached. Once an assessment has begun, learners must not be given feedback on progress towards criteria. After the final assignment is submitted, an assessment decision must be given.

An assessment decision:

- must be made with reference to the assessment criteria
- should record how it has been reached, indicating how or where criteria have been achieved
- may indicate why attainment against criteria has not been demonstrated
- must not provide feedback on how to improve evidence to meet higher criteria.

Your Internal Verifiers and assessors must work together to ensure that assessment decisions are reached promptly and validated before they are given to the learner.

Late submission

You should encourage learners to understand the importance of deadlines and of handing work in on time. For assessment purposes it is important that learners are assessed fairly and consistently according to the assessment plan that the Lead Internal Verifier has authorised and that some learners are not advantaged by having additional time to complete assignments. You are not required to accept for assessment work that was not completed by the date in the assessment plan.

Learners may be given authorised extensions for legitimate reasons, such as illness at the time of submission. If you accept a late completion by a learner, the evidence should be assessed normally, unless it is judged to not meet the requirements for authenticity. It is not appropriate, however, to give automatic downgrades on assessment decisions as 'punishment' for late submission.

Resubmission of improved evidence

Once an assessment decision is given to a learner, it is final in all cases except where the Lead Internal Verifier approves **one** opportunity to resubmit improved evidence.

The criteria used to authorise a resubmission opportunity are always:

- initial deadlines or agreed extensions have been met
- the tutor considers that the learner will be able to provide improved evidence without further guidance
- the evidence submitted for assessment has been authenticated by the learner and the assessor
- the original assessment can remain valid
- the original evidence can be extended and re-authenticated.

Your centre will need to provide a specific resubmission opportunity that is authorised by the Lead Internal Verifier. Any resubmission opportunity must have a deadline that is within 10 working days of the assessment decision being given to the learner, and within the same academic year. You should make arrangements for resubmitting the evidence for assessment in such a way that it does not adversely affect other assessments and does not give the learner an unfair advantage over other learners.

You need to consider how the further assessment opportunity ensures that assessment remains fit for purpose and in line with the original requirements; for example, you may opt for learners to improve their evidence under supervised conditions, even if this was not necessary for the original assessment, to ensure that plagiarism cannot take place. How you provide opportunities to improve and resubmit evidence for assessment needs to be fair to all learners. Care must be taken when setting assignments and at the point of final assessment to ensure that the original evidence for assessment can remain valid and can be extended. The learner must not have further guidance and support in producing further evidence. The Standards Verifier will want to include evidence that has been resubmitted as part of the sample they will review.

Appeals

Your centre must have a policy for dealing with appeals from learners. These appeals may relate to assessment decisions being incorrect or assessment not being conducted fairly. The first step in such a policy would be a consideration of the evidence by a Lead Internal Verifier or other member of the programme team. The assessment plan should allow time for potential appeals after assessment decisions have been given to learners.

If there is an appeal by a learner you must document the appeal and its resolution.

Dealing with malpractice

Learner Malpractice

Heads of Centres are required to report incidents of any suspected learner malpractice that occur during Pearson external assessments. We ask that centres do so by completing a JCQ Form M1 (available at www.jcq.org.uk/exams-office/malpractice) and emailing it and any accompanying documents (signed statements from the learner, invigilator, copies of evidence, etc.) to the Investigations Team at pqsmalpractice@pearson.com. The responsibility for determining appropriate sanctions or penalties to be imposed on learners lies with Pearson.

Learners must be informed at the earliest opportunity of the specific allegation and the centre's malpractice policy, including the right of appeal. Learners found guilty of malpractice may be disqualified from the qualification for which they have been entered with Pearson.

Teacher/centre Malpractice

Heads of Centres are required to inform Pearson's Investigations Team of any incident of suspected malpractice by centre staff, before any investigation is undertaken. Heads of Centres are requested to inform the Investigations Team by submitting a JCQ Form M2(a) (available at www.jcq.org.uk/exams-office/malpractice) with supporting documentation to pqsmalpractice@pearson.com. Where Pearson receives allegations of malpractice from other sources (for example Pearson staff or anonymous informants), the Investigations Team will conduct the investigation directly or may ask the head of centre to assist. Incidents of maladministration (accidental errors in the delivery of Pearson qualifications that may affect the assessment of learners) should also be reported to the Investigations Team using the same method.

Reasonable adjustments to assessment

You are able to make adjustments to assessments to take account of the needs of individual learners in line with Pearson's Reasonable Adjustments and Special Considerations policy. In most instances this can be achieved simply by application of the policy, for example to extend time or adjust the format of evidence. We can advise you if you are uncertain as to whether an adjustment is fair and reasonable.

Special consideration

You must operate special consideration in line with Pearson's Reasonable Adjustments and Special Considerations policy. You can provide special consideration only in the time given for evidence to be provided or for the format of the assessment if it is equally valid. You may not substitute alternative forms of evidence to that required in a unit, or omit the application of any assessment criteria to judge attainment. Pearson can consider applications for special consideration in line with the policy.

(Exemplar for centres)

Learner Assessment Submission and Declaration

This sheet must be completed by the learner and provided for work submitted for assessment.

Learner name:		Assessor name:	
Date issued:	Completion date:	Submitted on:	
Qualification:			
Assessment reference and title:			

Please list the evidence submitted for each task. Indicate the page numbers where the evidence can be found or describe the nature of the evidence (e.g. video, illustration).

Task ref.	Evidence submitted	Page numbers or description
Comments for note by the assessor:		

Learner declaration	
I certify that the work submitted for this assignment is my own. I have clearly referenced any sources used in the work. I understand that false declaration is a form of malpractice.	
Learner signature:	Date:

9 External assessment

Externally assessed units have the same grades as internally assessed units:

- Level 2 – Pass, Merit, Distinction
- Level 1
- Unclassified.

The table below shows the type of external assessment and assessment availability for this qualification.

Pearson BTEC Level 1/Level 2 First Award in Application of Science

Unit 8: Scientific Skills	
Type of external assessment	This unit is assessed externally using a paper-based exam marked by Pearson.
Length of assessment	The external assessment will be 1 hour and 15 minutes. The assessment must be taken by the learner under examination conditions.
No. of marks	50
Assessment availability	February and June
First assessment availability	March 2014

Your centre needs to make sure that learners are:

- fully prepared to sit the external assessment
- entered for assessments at appropriate times, with due regard for resit opportunities as necessary.

Sample assessment materials will be available to help centres prepare learners for assessment. Specific arrangements for external assessment are available before the start of each academic year on our website qualifications.pearson.com

Grade descriptors for the internal and external units

Internal units

Each internally assessed unit has specific assessment criteria that your centre must use to judge learner work in order to arrive at a grading decision for the unit as a whole. For internally assessed units, the assessor judges the evidence that the learner has presented to determine whether it meets all the relevant criteria, and then awards a grade at the appropriate level.

The criteria are arrived at with reference to the following grading domains:

- applying knowledge and understanding in vocational and realistic contexts, with reference to relevant concepts and processes, to achieve tasks, produce outcomes and review the success of outcomes
- developing and applying practical and technical skills, acting with increasing independence to select and apply skills through processes and with effective use of resources to achieve, explain and review the success of intended outcomes
- developing generic skills for work through management of self, working in a team and the use of a variety of relevant communication and presentation skills, and the development of critical thinking skills relevant to vocational contexts.

The externally assessed units are assessed using a marks-based scheme. The following criteria are used in the setting and awarding of these units.

External units

The externally assessed units are assessed using a marks-based scheme. For each external assessment, grade boundaries, based on learner performance, will be set by the awarding organisation.

The following criteria are used in the setting and awarding of the external unit.

Level 2 Pass

Learners are able to select appropriate sources of information and data. They will be able to identify and select equipment, methods and technologies for a given task. They will be able to interpret information in order to select and apply knowledge of scientific processes. They will be able to use given information and apply appropriate mathematical and technical skills in context. Learners are able to analyse and interpret given data and information. Learners will be able to identify the limitations of evidence with some supporting explanation. They will be able to draw conclusions consistent with the available evidence

Level 2 Distinction

Learners are able to select appropriate methods and sources of information and data, applying their skills to address scientific questions, solve problems and test hypotheses. They will show depth of knowledge and development of their understanding to make effective judgements based on their scientific knowledge. They will be able to identify and select appropriate equipment, methods and technologies most relevant to the task. They will be able to use and interpret given information and apply appropriate mathematical and technical skills accurately and consistently. They can evaluate information systematically to develop explanations, taking account of the limitations of the available evidence. They make reasoned judgements consistently and draw detailed, evidenced-based conclusions.

10 Awarding and reporting for the qualification

The awarding and certification of this qualification will comply with the requirements of the Office of Qualifications and Examinations Regulation (Ofqual).

Calculation of the qualification grade

This qualification is a level 2 qualification, and the certification may show a grade of Level 2 Pass, Level 2 Merit, Level 2 Distinction or Level 2 Distinction*. If these are not achieved a Level 1 or Unclassified grade may be awarded.

Each individual unit will be awarded a grade of Level 2 Pass, Merit or Distinction, Level 1 or Unclassified. Distinction* is not available at unit level.

Award of Distinction* (D*)

D* is an aggregated grade for the qualification, based on the learner's overall performance. In order to achieve this grade, learners will have to demonstrate a strong performance across the qualification as a whole.

To achieve a level 2 qualification learners must:

- complete and report an outcome for all units (NB Unclassified is a permitted unit outcome)
- achieve the minimum number of points at a grade threshold from the permitted combination. See the *Calculation of qualification grade* table.

Learners who do not achieve a level 2 may be entitled to achieve a level 1 where they:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome)
- achieve the minimum number of points for a level 1. See the *Calculation of qualification grade* table.

Points available for unit size and grades

The table below shows the **number of points scored per 10 guided learning hours** at each grade.

Points per grade per 10 guided learning hours				
Unclassified	Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
0	2	4	6	8

Pearson will automatically calculate the qualification grade for your learners when your learner unit grades are submitted. Learners will be awarded qualification grades for achieving the sufficient number of points within the ranges shown in the *Calculation of qualification grade* table.

Example:

A learner achieves a Level 2 Pass grade for a unit. The unit size is 30 guided learning hours (GLH). Therefore they gain 12 points for that unit i.e. 4 points for each 10 GLH, therefore 12 points for 30 GLH.

Calculation of qualification grade

Award (120 GLH)	
Grade	Minimum points required
U	0
Level 1	24
Level 2 Pass	48
Level 2 Merit	66
Level 2 Distinction	84
Level 2 Distinction*	90

This table shows the minimum thresholds for calculating grades. The table will be kept under review over the lifetime of the qualification. The most up to date table will be issued on our website.

Pearson will monitor the qualification standard and reserves the right to make appropriate adjustments.

Examples used are for illustrative purposes only. Other unit combinations are possible, see *Section 4 Qualification structures*.

Example 1: Achievement of an Award with a Level 2 Merit grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 5	30	3	Level 2 Merit	6	18
Unit 6	30	3	Level 2 Pass	4	12
Unit 7	30	3	Level 2 Merit	6	18
Unit 8	30	3	Level 2 Merit	6	18
Qualification grade totals	120	12	Level 2 Merit		66

The learner has sufficient points for a Level 2 Merit grade.

Example 2: Achievement of an Award with a Level 2 Pass grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 5	30	3	Level 2 Merit	6	18
Unit 6	30	3	Level 1	2	6
Unit 7	30	3	Level 2 Merit	6	18
Unit 8	30	3	Level 1	2	6
Qualification grade totals	120	12	Level 2 Pass		48

The learner has sufficient points for a Level 2 Pass grade.

Example 3: Achievement of an Award with a Level 1 grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 5	30	3	Level 1	2	6
Unit 6	30	3	Level 2 Pass	4	12
Unit 7	30	3	Level 2 Pass	4	12
Unit 8	30	3	Level 1	2	6
Qualification grade totals	120	12	Level 1		36

The learner has sufficient points for a Level 1 grade.

Example 4: Achievement of an Award with an Unclassified grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 5	30	3	Level 1	2	6
Unit 6	30	3	Level 1	2	6
Unit 7	30	3	Level 1	2	6
Unit 8	30	3	Unclassified	0	0
Qualification grade totals	120	12	Unclassified		18

The learner has insufficient points for a Level 1 grade, so achieves an Unclassified grade.

11 Quality assurance of centres

Pearson will produce on an annual basis the *BTEC Quality Assurance Handbook*, which will contain detailed guidance the quality processes required to underpin robust assessment and internal verification.

The key principles of quality assurance are that:

- a centre delivering BTEC programmes must be an approved centre, and must have approval for the programmes or groups of programmes that it is delivering
- the centre agrees, as part of gaining approval, to abide by specific terms and conditions around the effective delivery and quality assurance of assessment; it must abide by these conditions throughout the period of delivery
- Pearson makes available to approved centres a range of materials and opportunities, through online standardisation, intended to exemplify the processes required for effective assessment, and examples of effective standards. Approved centres must use the materials and services to ensure that all staff delivering BTEC qualifications keep up to date with the guidance on assessment
- an approved centre must follow agreed protocols for standardisation of assessors and verifiers, for the planning, monitoring and recording of assessment processes, and for dealing with special circumstances, appeals and malpractice.

The approach of quality-assured assessment is through a partnership between an approved centre and Pearson. We will make sure that each centre follows best practice and employs appropriate technology to support quality-assurance processes, where practicable. We work to support centres and seek to make sure that our quality-assurance processes do not place undue bureaucratic processes on centres.

We monitor and support centres in the effective operation of assessment and quality assurance. The methods we use to do this for BTEC First programmes include:

- making sure that all centres complete appropriate declarations at the time of approval
- undertaking approval visits to centres
- making sure that centres have effective teams of assessors and verifiers who are trained to undertake assessment
- assessment sampling and verification, through requested samples of assessments, completed assessed learner work and associated documentation
- an overarching review and assessment of a centre's strategy for assessing and quality assuring its BTEC programmes.

An approved centre must make certification claims only when authorised by us and strictly in accordance with requirements for reporting.

Centres that do not fully address and maintain rigorous approaches to quality assurance cannot seek certification for individual programmes or for all BTEC First programmes. Centres that do not comply with remedial action plans may have their approval to deliver qualifications removed.

12 Further information and useful publications

For further information about the qualification featured in this specification, or other Pearson qualifications, please call Customer Services on 0844 576 0026 (calls may be monitored for quality and training purposes) or visit our website qualifications.pearson.com.

Related information and publications include:

- *Equality Policy*
- *Information Manual* (updated annually)
- *Access arrangements, reasonable adjustments and special considerations*
- *Quality Assurance Handbook* (updated annually).
 - Publications on the quality assurance of BTEC qualifications are on our website at qualifications.pearson.com

Additional documentation

Additional materials include:

- Sample Assessment Material (for the external unit)
- a guide to *Getting Started with BTEC*
- guides to our support for planning, delivery and assessment (including sample assignment briefs).

Visit www.btec.co.uk/2012 for more information.

Additional resources

If you need to source further learning and teaching material to support planning and delivery for your learners, there is a wide range of BTEC resources available to you.

Any publisher can seek endorsement for their resources, and, if they are successful, we will list their BTEC resources on our website qualifications.pearson.com

13 Professional development and support

Pearson supports UK and international customers with training related to BTEC qualifications. This support is available through a choice of training options offered in our published training directory, or through customised training at your centre.

- The support we offer focuses on a range of issues including:
- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing learner-centred learning and teaching approaches
- building functional skills into your programme
- building in effective and efficient quality-assurance systems.

The national programme of training we offer is on our website at qualifications.pearson.com. You can request customised training through the website, or you can contact one of our advisors in the Training from Pearson team via Customer Services to discuss your training needs.

BTEC training and support for the lifetime of the qualification

Training and networks: our training programme ranges from free introductory events through sector-specific opportunities to detailed training on all aspects of delivery, assignments and assessment. In addition, we have designed our new network events programme to allow you to share your experiences, ideas and best practice with other BTEC colleagues in your region. Sign up to the training you need at: www.btec.co.uk/training

Regional support: our team of Curriculum Development Managers and Curriculum Support Consultants, based around the country, are responsible for providing advice and support in centres. They can help you with planning and curriculum developments. Call **0844 576 0027** to contact the curriculum team for your centre.

Your BTEC Support team

Whether you want to talk to a sector specialist, browse online or submit your query for an individual response, there is someone in our BTEC Support team to help you whenever – and however – you need, with:

- Welcome Packs for new BTEC centres: if you are delivering BTEC for the first time, we will send you a sector-specific Welcome Pack designed to help you get started with the new Pearson BTEC Level 1/Level 2 First Award
- Subject Advisors: find out more about our subject advisor team – immediate, reliable support from a fellow subject expert – at: qualifications.pearson.com/subjectadvisors
- BTEC Hotline: call the BTEC Hotline on 0844 576 0026 with your query
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Units

Unit 5: Applications of Chemical Substances

Level: **1 and 2**

Unit type: **Mandatory**

Guided learning hours: **30**

Assessment type: **Internal**

Unit introduction

It is important for chemists working in the manufacturing industry to be able to measure the amount of energy given out or absorbed during chemical reactions. This will enable them to manufacture products safely and efficiently, and also to find uses for chemical reactions that increase or decrease in temperature, in applications such as heat or cold packs.

For exothermic and endothermic reactions, you will measure the amount of heat that some reactions give out and other reactions take in. You may also be able to relate this to the chemical bonds that are broken and made.

Organic compounds are used extensively in society. Many of these are derived from crude oil. You will look at how crude oil is distilled to produce different fractions. Many of these have uses as fuels. You will study the structure, reactions and uses of some important organic chemicals.

Chemists are constantly finding and developing new types of materials and new ways to use existing materials. More and more composite materials are being used – for example, to make cars, aeroplanes and mobile phones, and in building materials. Some of these composites use waste plastics. Most recently, smart materials (those that change their properties in response to changes in their environment) are finding applications. Polymers with exceptional insulating properties are used in niche applications, such as firefighting.

The aim of this unit is to build on some of the basic fundamental concepts that you have learnt in Units 1 and 2 in relation to bonding and chemical reactions.

Learning aims

In this unit you will:

- A investigate and understand enthalpy changes associated with chemical reactions
- B investigate organic compounds used in society
- C explore the uses of nanochemicals and new materials.

Learning aims and unit content

What needs to be learnt	
Learning aim A: Investigate and understand enthalpy changes associated with chemical reactions	
A.1	<p>Exothermic and endothermic reactions:</p> <ol style="list-style-type: none"> exothermic reactions as reactions that give out heat energy endothermic reactions as reactions that take in heat energy measurement of temperature changes for straightforward exothermic and endothermic reactions classification of temperature changes as positive or negative temperature changes linked to heat energy evolved or absorbed reactions for which enthalpy changes may be measured should include (but are not limited to) dissolution of sodium carbonate and ammonium chloride in water, neutralisation of acids, combustion of alcohols heat/enthalpy change associated with bond-breaking and bond-making overall enthalpy change for a reaction as a combination of bond-breaking and bond-making enthalpy changes use the equation: $q = m C \Delta T$ heat energy absorbed by water (J) = mass of water (g) x specific heat capacity ($J\ ^\circ C^{-1}\ g^{-1}$) x temperature change ($^\circ C$) to determine the amount of heat energy absorbed by water in contact with the reaction simple energy profile diagrams heat packs/cold packs.

What needs to be learnt**Learning aim B: Investigate organic compounds used in society**

- B.1 Fractional distillation of crude oil:
- fractional distillation of crude oil based on boiling ranges of components
 - link between boiling ranges of hydrocarbons and length of hydrocarbon chain
 - uses of fractions based on sizes of molecules – gases, petrol, kerosene, diesel oil, fuel oil, bitumens, waxes
 - uses of alkanes as fuels – natural gas (methane), bottled gas (propane and butane), petrol, diesel, kerosene.
- B.2 Structural and displayed formulae of organic molecules:
- alkanes – methane, ethane, propane, butane
 - alkenes – structure of ethene, propene
 - other organic molecules – poly(ethene), ethanol, ethanoic acid, chloroethene, poly(chloroethene) (PVC), dichloromethane
 - use of a line to denote a single covalent bond/shared pair of electrons and two lines to denote a double bond/two shared pairs of electrons.
- B.3 Test tube reactions to identify classes of organic molecules:
- alkenes decolourise bromine water (addition)
 - carboxylic acids effervesce when sodium carbonate is added (neutralisation)
 - alcohols oxidised by acidified dichromate (VI) solution which changes from orange to green (oxidation).
- B.4 Uses of organic molecules in society:
- ethene in the manufacture of poly(ethene) and ethanol
 - ethanol (made by fermentation/from ethene) in alcoholic drinks, biofuels, solvents, cosmetics
 - ethanoic acid in vinegar and making esters
 - dichloromethane in paint stripper and solvents
 - chloroethene in polymerisation to PVC and uPVC
 - Teflon™ (PTFE) in non-stick coatings and low-friction bearings
 - problems of organic molecules (toxicity of compounds and products formed on combustion, flammability and non-biodegradability).

What needs to be learnt**Learning aim C: Explore the uses of nanochemicals and new materials**

- C.1 Introduction to nanochemistry:
 - a. nanoscale
 - b. carbon nanostructures (fullerenes – buckyballs and nanotubes)
 - c. production of nanotubes.
- C.2 Uses of nanochemistry (sun creams, mascara, textiles, sports equipment, single crystal nanowires for processors, mobile phone batteries).
- C.3 Implications of nanochemistry:
 - a. safety and environmental issues
 - b. ethical issues surrounding the use of nanochemicals whose properties are not fully understood.
- C.4 Smart materials whose properties change in response to an external stimulus.
- C.5 Examples of materials that are highly specialised and their properties, e.g. Kevlar[®], GORE-TEX[®], Thinsulate[®], titanium dioxide.

Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim A: Investigate and understand enthalpy changes associated with chemical reactions			
1A.1 Measure the temperature changes associated with chemical reactions.*	2A.P1 Investigate temperature changes associated with exothermic and endothermic reactions using primary data.*	2A.M1 Explain why an overall reaction is exothermic or endothermic.*	2A.D1 Calculate the energy changes that take place during exothermic and endothermic reactions.*
Learning aim B: Investigate organic compounds used in society			
1B.2 Identify the uses of the main fractions from the distillation of crude oil.	2B.P2 Describe the fractional distillation of crude oil to produce a range of useful products.	2B.M2 Explain how fractional distillation separates compounds due to different boiling ranges.	2B.D2 Analyse the relationship between the boiling range and the length of carbon chain of fractions.*
1B.3 Name alkanes and alkenes from structural and displayed formulae.	2B.P3 Draw accurately the structural and displayed formulae of organic molecules.	2B.M3 Describe the bonding and structure of organic molecules.	2B.D3 Explain the results of experiments to identify organic compounds in terms of their reaction type, structural and displayed formulae, and bonding.
1B.4 Identify an alkene and an alkane using primary observations.	2B.P4 Identify an alkene and a carboxylic acid using primary observations.	2B.M4 Explain how a series of experiments can be used to identify organic compounds based on their solubility and reactions.	
1B.5 Identify uses of ethene, ethanol and ethanoic acid.	2B.P5 Describe the uses of organic compounds in our society.	2B.M5 Explain the problems associated with the use of organic molecules.	2B.D4 Evaluate the benefits and drawbacks of using organic materials.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim C: Explore the uses of nanochemicals and new materials			
1C.6 Define nanochemicals.	2C.P6 Describe a use of nanochemicals, smart and specialised materials.	2C.M6 Explain the benefits of using nanochemicals, smart and specialised materials.	2C.D5 Evaluate the benefits and drawbacks of using nanochemicals, smart and specialised materials.

*Opportunity to assess mathematical skills

#Opportunity to assess English skills

Teacher guidance

Resources

The special resources required for this unit are a laboratory with at least one fume cupboard and samples of specialised materials.

Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

The content of this unit should be approached from a practical point of view as far as possible, e.g. through scientific investigative assignments.

Level 1 exemplifies partial achievement within a level 2 learning aim.

Learning aim A: Investigate and understand enthalpy changes associated with chemical reactions

To achieve 1A.1, learners should carry out at least one exothermic and one endothermic reaction, measure the temperature changes and record these changes. Learners should correctly identify that the temperature increased or decreased but do not need to make the link to the reaction taking in heat or giving out heat. A proforma could be used to allow learners to achieve this criterion. More understanding is required at level 2.

To achieve 2A.P1, learners should carry out two exothermic reactions and one endothermic reaction, and conclude, from the measurements of temperature change, that the reaction was exothermic (gave out heat) or endothermic (took in heat). They must understand the meanings of those terms.

To achieve 2A.M1, learners must be able to explain clearly the link between the sign of the temperature change and the heat absorbed by the water, in contact with the reaction (or increase/decrease in temperature) and whether the reaction gives out heat or takes in heat. The words 'exothermic' and 'endothermic' should be used correctly. The role of the water in absorbing heat or supplying heat must be explained.

To achieve 2A.D1, learners must be able to calculate the heat absorbed by or taken from the water, in contact with the reaction using the equation $m\Delta T$ and relate this to the enthalpy changes for reactions in terms of breaking bonds (which requires heat) and making bonds (which releases heat).

Learning aim B: Investigate organic compounds used in society

To achieve 1B.2, learners should research and identify the uses of crude oil fractions. They must specifically state the uses of the gases: propane and butane. This could be done by the preparation of a poster or by detailed labelling of a fractional distillation diagram.

To achieve 2B.P2, learners must show that they can describe how fractional distillation of crude oil works and be able to identify the uses of a range of the fractions. That could be done by producing an annotated diagram of a fractional distillation column. They must specifically state the uses of propane and butane, petrol, diesel and kerosene.

To achieve 2B.M2, learners need to explain the boiling ranges of the different fractions to show how compounds are separated. This could be achieved by the use of secondary data such as a table or detailed annotation on a fractional distillation column diagram.

To achieve 2B.D2, learners must be able to analyse and explain the link between the boiling point of the fractions and the length of their carbon chains.

To achieve 1B.3, learners must be able to name, from a representation of the structural and displayed formulae, methane, ethane, propane, butane, ethene and propene.

To achieve 2B.P3, learners must be able to accurately draw/provide a representation of straight chain alkanes, with 1–6 carbon atoms, ethene, chloromethanes, chloroethene, poly(ethene), ethanol and ethanoic acid.

To achieve 2B.M3, learners must be able to describe single and double bonding as covalent and explain that the lines in the displayed formulae represent a shared pair of electrons.

To achieve 1B.4, learners should, under supervision, identify an alkane and an alkene from primary observations. The alkane and alkene may be identified on the basis of being insoluble in water. The alkene may be identified by its ability to decolourise bromine water rapidly.

To achieve 2B.P4, learners should follow guidance to identify an alkene and a carboxylic acid (for example, ethanoic acid) from primary observations. Learners will be expected to identify an alkene in the way described in 1B.4. For ethanoic acid this is by its pH and its reaction with sodium carbonate. The guidance given to the learners could be in the form of a flowchart.

To achieve 2B.M4, learners should be able to explain the basis on which the identifications were made for an unknown alkane, alkene and carboxylic acid compound using their practical observations.

To achieve 2B.D3, learners need to use the results of the experiments to identify organic compounds using their reaction type, formulae and bonding in terms of their functional group, such as a double bond in an alkene and carboxylic acid functional group.

To achieve 1B.5, learners should state or provide a very brief description of a use of ethene, a use of ethanol and a use of ethanoic acid.

To achieve 2B.P5, learners should provide a brief account of the use of:

- ethene as a feedstock – including as a raw material for ethanol manufacture
- ethene in polymerisation
- ethanol in alcoholic drinks – as a solvent, as a sterilisation agent, as a feedstock and as a fuel
- poly(ethene)
- poly(vinyl chloride) (PVC) – plasticised and unplasticised
- ethanoic acid in vinegar – as a pickling agent and as a feedstock for making esters.

To achieve 2B.M5, learners should explain the problems of at least two of these uses/applications in detail.

To achieve 2B.D4, learners should be able to contrast the benefits and drawbacks of using two organic materials, for example, PVC. Benefits like cost, stability, versatility and low toxicity could be contrasted with drawbacks like the coupling with endocrine disrupting plasticisers and the production of dioxins when incinerated. They should be able to arrive at a judgement about whether the benefits outweigh the risks.

Learning aim C: Explore the uses of nanochemicals and new materials

It is important for learners to understand that scientific research has always included the discovery of new materials and their applications.

To achieve 1C.6, learners should be able to define the term 'nanochemical'.

To achieve 2C.P6, learners should describe, in detail, the use of at least one smart material, one application involving nanochemicals and one application of another sort of specialised material. Where the materials are used as part of a formulation/in conjunction with other materials, this should be described.

To achieve 2C.M6, learners should be able to explain the benefits of using these nanochemicals, smart and specialised materials.

To achieve 2C.D5, learners should explain the benefits and drawbacks of using nanochemicals, smart and specialised materials, and provide a reasoned judgement about whether the benefits outweigh the risks. Learners should research public concerns about nanochemicals, for example, the possibility of nanochemicals passing through cell walls and causing disruption. They should be able to assess these concerns by providing a brief description and stating the source(s) of their information, and arguing whether the information is likely to be reliable on the basis of its source(s).

Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1, 2A.P1, 2A.M1, 2A.D1	Hot or Cold?	<p>You are a technical science representative for a company that makes heat packs and cold packs to treat minor injuries. You must explain to your customers how the products work.</p> <p>A visiting speaker from industry could be asked to give a talk on exothermic and endothermic reactions.</p>	Experimental reports, including diagrams and graphs.
1B.2, 2B.P2, 2B.M2, 2B.D2 1B.3, 1B.4, 2B.P3, 2B.P4, 2B.M3, 2B.M4, 2B.D3 1B.5, 2B.P5, 2B.M5, 2B.D4	The Importance of the Fractions of Crude Oil	<p>You work as an environmental scientist. You have been asked to research how the crude oil used in Britain is currently refined and used at present.</p> <p>A visiting speaker could be invited in or a visit to a refinery would help put this into context.</p> <p>You have received several drums of organic waste from a company. You need to confirm what is in the drums in order to treat the waste correctly and present your findings to your manager.</p> <p>A visiting analytical chemist or visit to a waste company would help put this into context.</p>	<p>A written report with diagrams.</p> <p>Presentation on the structure, uses and environmental impact of a range of organic chemicals, to include a practical report, models and diagrams.</p> <p>A report showing uses, benefits and drawbacks of a range of organic chemicals.</p>

Criteria covered	Assignment	Scenario	Assessment evidence
		<p>A new organic chemical company produces organic chemicals that are used widely in society. The company is keen to show that these chemicals can be produced from sustainable sources in the future. It is also keen to make the public aware of environmental concerns associated with certain organic compounds, like PVC and they have asked you to help them. As a first step, you need to research a range of organic chemicals and their uses so that you can prepare information to present to the public, on behalf of the company.</p>	
1C.6, 2C.P6, 2C.M6, 2C.D5	New Materials that Change the Way We Live	<p>You work as a materials scientist for a large company that produces a vast range of quality products. To stay ahead of its competitors, the company needs to use the latest technology in its products. You have been asked to provide information about how the company has done this over the years. You are going to research when certain materials were first used. You are going to find out about how innovative materials have been used, why these materials are special and why the public may be worried about products that use nanochemicals.</p> <p>A visit by a materials scientist from a university or research department may help to put this topic into context.</p>	A report showing uses, benefits, safety issues and drawbacks of a range of innovative materials.

Unit 6: Applications of Physical Science

Level: **1 and 2**

Unit type: **Mandatory**

Guided learning hours: **30**

Assessment type: **Internal**

Unit introduction

Scientists have been vital in improving safety in everyday life and in developing many modern technologies by applying their knowledge of forces, waves and electricity. You will develop an understanding of motion and how it relates to road safety. You will also have the opportunity to find out how to represent motion graphically and to carry out investigations, for example, on the way speed cameras operate.

Following on from this, you will develop your understanding of forces and how they are used in applications such as weight measurement or car safety. This theme could be continued through to the investigation of the motion of vehicles.

You will also investigate light and find out, for example, how the reflection of light is used to make our roads safer. You could also explore how the human eye functions and how eye glasses are used to correct defects in vision.

Finally, you will investigate how electricity is used in our world, looking at practical uses of electricity by building circuits.

The aim of this unit is to build on the fundamental concepts you have learnt in Units 1 and 3. In this unit you will apply your knowledge and understanding to explore and investigate a range of applications of physics in the real world.

Learning aims

In this unit you will:

- A investigate motion
- B investigate forces
- C investigate light and sound waves
- D investigate electricity.

Learning aims and unit content

What needs to be learnt	
Learning aim A: Investigate motion	
A.1	Measurement of distance and time in simple investigations.
A.2	Use the equation: distance (m) = speed (m/s) x time (s).
A.3	Use the equation: displacement (m) = velocity (m/s) x time (s).
A.4	Acceleration relates to a change in velocity of an object.
A.5	Use the equation: acceleration (m/s ²) = change in velocity (m/s) / time taken (s).
A.6	Graphical representations of uniform and non-uniform motion (for objects that are stationary, moving at a constant speed, moving with increasing or decreasing speed).
A.7	Conservation of energy in simple experiments, including energy transformation diagrams.
A.8	Calculations of kinetic energy of moving objects in simple situations, using the following equation: $KE = \frac{1}{2} \times \text{mass (kg)} \times (\text{speed (m/s)})^2$.
A.9	Calculate change in gravitational potential energy using the following equation: $GPE = \text{mass (kg)} \times \text{acceleration (m/s}^2\text{) due to gravity} \times \text{change in height (m)}$.
A.10	Energy changes affecting transportation and stopping distance.
Learning aim B: Investigate forces	
B.1	Forces arise from an interaction between two objects.
B.2	The effect of balanced and unbalanced forces on objects.
B.3	Work is done when a force moves through a distance.
B.4	Use the equation: work done (J) = force (N) x distance (m).
B.5	Use the equation: force (N) = mass (kg) x acceleration (m/s ²).
B.6	Identify 'pairs' of forces that act on different objects and understand that these forces are equal in size and opposite in direction.
B.7	Applications of compressive and tensile forces.
B.8	Friction and the normal reaction force arise in response to an applied force. The size of the frictional force matches the applied force up to a specific limit.
B.9	Forces on a: <ul style="list-style-type: none"> a. rocket during various stages of flight b. parachutist c. car during braking and acceleration.

What needs to be learnt**Learning aim C: Investigate light and sound waves**

- C.1 Light rays to represent light moving in straight lines.
- C.2 Laws of reflection, applied to plane mirrors.
- C.3 Reflection of sound (echoes).
- C.4 Ray diagrams showing refraction of light in prisms and lenses:
 - a. convex
 - b. concave.
- C.5 Total internal reflection in prisms and optic fibres.
- C.6 A lens or mirror with a highly curved surface is more powerful than one with a less curved surface.
- C.7 The eye lens focuses light onto the retina and the use of optical lenses to correct simple eye problems.
- C.8 The need for a medium for the transmission of sound waves.
- C.9 The propagation of sound waves and the subsequent air pressure changes:
 - a. compression
 - b. rarefaction.
- C.10 Applications of light:
 - a. clear sightlines at road junctions
 - b. plane and convex mirrors as a rear-view mirror
 - c. using lenses and mirrors in telescopes
 - d. how a simple periscope functions.
- C.11 Applications of total internal reflection:
 - a. fibre optic cables used to provide a light source for keyhole surgery
 - b. reflectors for road safety.
- C.12 Applications of sound waves:
 - a. voice recognition
 - b. ultrasound
 - c. sonar
 - d. breaking down kidney stones using ultrasound.

What needs to be learnt**Learning aim D: Investigate electricity**

- D.1 Electricity:
- a. series circuits
 - b. parallel circuits.
- D.2 Connect meters in circuits to measure voltages and currents.
- D.3 Use the equation:
resistance (Ω) = voltage (V) / current (A).
- D.4 Ohm's law (voltage, current and resistance relationships at a constant temperature).
- D.5 Measure currents and voltages, and perform calculations to find resistance.
- D.6 The rules governing voltage and current when components are connected to a battery in series.
- D.7 The rules governing voltage and current when components are connected to a battery in parallel.
- D.8 Voltage-current characteristics of a negative temperature coefficient (NTC) thermistor or a light-dependent resistor.
- D.9 Applications: thermistors (NTC) as a means of sensing temperature, or light-dependent resistors as a means of sensing the brightness of light.

Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim A: Investigate motion			
1A.1 Produce accurate graphs to represent uniform motion using primary data.*	2A.P1 Produce accurate graphs to represent uniform and non-uniform motion using primary data.*	2A.M1 Interpret graphs to identify objects that are stationary, moving at a constant speed and moving with increasing or decreasing speed.*	2A.D1 Calculate the gradient for distance–time graphs and the gradient and area of speed–time graphs.*
1A.2 Measure distance for simple experiments.*	2A.P2 Calculate speed and velocity for simple experiments.*		
1A.3 Draw energy transformation diagrams for simple experiments.*	2A.P3 Describe the conservation of energy for simple experiments, including energy transformation diagrams.*	2A.M2 Calculate kinetic energy and changes in gravitational potential energy.*	2A.D2 Explain how changes in energy will affect transportation and stopping distances.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim B: Investigate forces			
1B.4 Identify the forces on objects.	2B.P4 Describe the effects of balanced and unbalanced forces on objects.*	2B.M3 Calculate the force on objects, in relation to their mass and acceleration for an application.*	2B.D3 Explain the various forces involved, and their approximate sizes, in a variety of applications.
1B.5 Describe work done in terms of forces moving through a distance.	2B.P5 Calculate the work done by forces acting on objects for simple experiments.*		
1B.6 Identify friction forces and situations where they occur.	2B.P6 Describe how friction and normal reaction forces are produced in response to an applied force.	2B.M4 Explain how friction and normal reaction forces are produced in response to an applied force.	
Learning aim C: Investigate light and sound waves			
1C.7 Describe, using diagrams, reflection of light in plane mirrors for simple applications.	2C.P7 Describe, using diagrams, reflection and refraction of light for simple applications.	2C.M5 Describe how lenses and mirrors can affect rays of light.	2C.D4 Explain how reflection and refraction of light can be used in applications.
1C.8 Describe how sound is reflected for simple applications.	2C.P8 Describe the importance of a medium for the transmission of sound waves through a variety of substances for simple applications.	2C.M6 Describe the propagation of sound waves, including compression and rarefaction.	2C.D5 Explain how sound waves can be applied in everyday uses.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim D: Investigate electricity			
1D.9 Describe, using diagrams, how to build series and parallel circuits.	2D.P9 Measure currents and voltages in series and parallel electric circuits.	2D.M7 Calculate resistances from measured currents and voltages.*	2D.D6 Analyse an everyday life situation in which the resistance of a conducting wire is not constant.
1D.10 Describe the use of a thermistor or LDR for an application.	2D.P10 Investigate an application of thermistors or LDRs using primary data.	2D.M8 Mathematically or graphically process the results of the investigation into thermistors or LDRs to draw conclusions.*	2D.D7 Evaluate the investigation into thermistors or LDRs, suggesting improvements to a real-life application.

*Opportunity to assess mathematical skills

#Opportunity to assess English skills

Teacher guidance

Resources

There are no special resources needed for this unit.

Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

The content of this unit should be approached from a practical point of view as far as possible, e.g. through scientific investigative assignments.

Level 1 exemplifies partial achievement within a level 2 learning aim.

Learning aim A: Investigate motion

The following investigations are examples that could be carried out to enable learners to gain evidence to achieve the appropriate assessment criteria:

- investigate vehicle motion
- investigate thrill-seeking experiences, e.g. rollercoaster rides
- investigate objects moving through different liquids or gases
- investigate energy changes affecting transportation and stopping distance.

At level 1, learners are expected to carry out simple investigations, the conclusions of which should be clear from direct observations with no processing of data.

At level 2, learners are expected to design and carry out more complex investigations that require processing of data before a conclusion can be made.

To achieve 1A.1, learners are expected to produce graphs using primary data from simple uniform motion experiments as shown in the content A.6 for uniform motion.

To achieve 2A.P1, learners are expected to extend the investigation they carried out in 1A.1 and include graphs for non-linear/non-uniform motion.

For 1A.2, learners must measure distance for simple experiments, along with their units that will be recorded during the investigation.

For 2A.P2, learners must use measurements from experiments and use the correct formulae and units to calculate speed and velocity.

For 2A.M1, learners need to be able to interpret graphs to enable them to label/identify which objects are stationary, moving at constant speed and moving at an increasing or decreasing speed.

For 2A.D1, learners need to use their distance–time and speed–time graphs in order to work out the gradient of any slopes. Additionally speed–time graphs should be used to work out the area under the graph.

For 1A.3, learners need to be able to carry out simple energy conservation experiments and draw energy transformation diagrams.

For 2A.P3, this needs to be extended to describing the conservation of energy and applying this to energy transformation diagrams.

For 2A.M2, learners need to calculate kinetic energy and changes in gravitational potential energy in simple situations using appropriate formulae and units.

For 2A.D2, learners must explain how changes in energy will affect transportation and stopping distances.

Learning aim B: Investigate forces

The following investigations are examples that could be carried out to enable learners to gain evidence to achieve the appropriate assessment criteria:

- investigate the use of frictional forces for different road conditions
- investigate the safety features of modern cars that involve forces
- investigate the effect of unbalanced forces on an accelerating mass.

To achieve 1B.4, learners must provide evidence to identify at least two examples of balanced and two examples of unbalanced forces on objects.

For 2B.P4, learners need to extend what they have done in 1B.4 by describing the effect on objects of balanced and unbalanced forces.

For 1B.5, learners need to describe the work done by forces acting on objects for at least three different forces through different distances.

For 2B.P5, learners need to calculate the work done by objects for at least three simple experiments, using the appropriate formulae and units.

To achieve 2B.M3, learners need to use the equation in B.5 of the content to calculate the force on objects, in relation to their mass and acceleration for a real-life application.

For 1B.6, learners need to identify friction forces and situations where they occur. This could be written in the form of a table.

For 2B.P6, learners can further develop 1B.6 and carry out a friction experiment to demonstrate friction and normal reaction forces in response to an applied force, and then write a description.

To achieve 2B.M4, learners would then need to apply what they have learnt to explain how friction and normal reaction forces are produced in response to an applied force.

For 2B.D3, learners need to apply their understanding of forces to a variety of applications by explaining the various forces involved, and their approximate sizes as shown, for example, in content B.8 and B.9.

Learning aim C: Investigate light and sound waves

The following investigations are examples that could be carried out to enable learners to gain evidence to achieve the appropriate assessment criteria:

- investigate the use of light waves with regard to mirrors, lenses and prisms
- investigate the use of sound waves with regard to reflection and transmission.

To achieve 1C.7, learners need to draw diagrams to show the reflection of light in plane mirrors and demonstrate an understanding of how plane mirrors are used for simple applications.

For 2C.P7, learners need to extend 1C.7 by using plane mirrors and glass blocks/prisms to show reflection and refraction by drawing ray diagrams and understanding their use for simple applications.

For 2C.M5, learners need to describe how lenses and mirrors, which are concave and convex, can affect rays of light.

For 2C.D4, learners need to apply their knowledge from 2C.M5 to explain how reflection and refraction of light can be used as in content C.10 and C.11.

To achieve 1C.8, learners need to describe how sound is reflected, and how it is used by bats and in simple applications such as echo sounding and on submarines.

For 2C.P8, learners need to describe the transmission of sound waves through a variety of mediums such as air, water and wall partitions, and why the medium is important in simple applications.

For 2C.M6, learners need to describe the propagation of sound waves, including compression and rarefaction.

For 2C.D5, learners need to apply their knowledge to explain how sound waves can be applied in everyday uses, as shown in content C.12.

Learning aim D: Investigate electricity

The following investigations are examples that could be carried out to enable learners to gain evidence to achieve the appropriate assessment criteria:

- investigate thermistors
- investigate light-dependent resistors (LDRs)
- investigate parallel and series circuits.

To achieve 1D.9, learners could carry out some simple experiments and draw circuit diagrams to describe how to connect electrical series and parallel circuits.

For 2D.P9, learners need to connect meters to measure current and voltage of their series and parallel circuits.

For 2D.M7, learners could use their results from 2D.P1 to calculate resistance from measured current and voltage from the series and parallel circuits, using $\text{resistance} = \text{voltage} / \text{current}$.

For 2D.D6, learners could carry out an experiment to explain the limits of Ohm's law, and analyse a graph of their results in relation to temperature in an everyday situation (as in a filament bulb).

To achieve 1D.10, learners need to describe the role of a thermistor or LDR for an application.

For 2D.P10, learners need to investigate practically an application of thermistors or LDRs to generate data on their effectiveness in a range of conditions.

For 2D.M8, learners need to process the results of their investigation into thermistors or LDRs to draw conclusions mathematically or graphically, for example to conclude which of a set of LDRs is most appropriate.

For 2D.D7, learners need to evaluate their results from the investigation into thermistors or LDRs and suggest improvements that could be used in a real-life application.

Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1, 1A.2, 2A.P1, 2A.P2, 2A.M1, 2A.D1 1A.3, 2A.P3, 2A.M2, 2A.D2	How Speed Cameras Can Be Used to Improve Road Safety	<p>You are working as a road safety scientist for the local council. You have been asked to:</p> <ul style="list-style-type: none"> demonstrate experiments that show how speed can be measured on local roads improve the speed cameras so that they can detect if drivers are slowing down before speed cameras and speeding up after them. This behaviour is dangerous driving and the council would like to reduce it. report on the conservation of energy when applied to transportation. <p>A visit by a road safety scientist/officer would help put this topic into context.</p>	<p>An article or report for a local journal, including a description of the speed measurement investigation, predictions, graphs, calculations, results, conclusion and improvements to the speed cameras to calculate acceleration.</p> <p>An article or report detailing relevant information with regard to energy conservation.</p>
1B.4, 1B.5, 1B.6, 2B.P4, 2B.P5, 2B.P6, 2B.M3, 2B.M6, 2B.D4	Investigating Forces	<p>Working as a physicist for a civil engineering company, you have been asked to investigate a number of different forces with regard to road transportation, frictional forces, stopping times and car accidents.</p>	<p>An article or report detailing your findings and results from experiments.</p>

Criteria covered	Assignment	Scenario	Assessment evidence
<p>1C.7, 2C.P7, 2C.M7, 2C.D6</p> <p>1C.8, 2C.P8, 2C.M6, 2C.D7</p>	<p>Applications of sound and light</p>	<p>As an optical physicist working in quality control, you are testing a batch of optical components including mirrors, prisms and lenses for accuracy. You must make and compare measurements of the incident and reflected/refracted angles.</p> <p>You are a research sound physicist and you have been asked to prepare a report about the insulation properties of materials and their capability of reflecting and transmitting sound from a source that produces a fixed frequency.</p> <p>A visit from a university research physicist or a materials scientist would help put this topic into context.</p>	<p>A report showing the results of experiments.</p> <p>A report outlining the physics involved in the reflection and transmission of sound, and the uses of the new materials in terms of reflecting sound and transmission of sound.</p>

Unit 7: Health Applications of Life Science

Level: **1 and 2**

Unit type: **Mandatory**

Guided learning hours: **30**

Assessment type: **Internal**

Unit introduction

The knowledge and skills developed in this unit are essential for biological science technicians and scientists working in biology, health care, laboratory services and other biology-related industries.

You will consider both the positive and negative aspects of diet and exercise, and the learning programme should encourage you to develop a balanced view of issues such as obesity and eating disorders. There will also be an opportunity to study the human immune system and how vaccinations can be used to boost the natural system. Consideration of the public's response to issues surrounding the use of vaccinations could also be included. There is also a good opportunity for you to investigate some of the screening programmes that are used to help early identification of conditions or early diagnosis of disease. A fascinating study can be made of how scientific research has improved in recent years. Other interesting medical applications, such as blood transfusions and stem cell research, are covered in this unit.

By the end of this unit you will have gained knowledge of medical advances and research that use biological processes in the prevention and treatment of certain conditions and diseases.

In this unit you will be able to build on your understanding of the fundamental concepts of biology that you have learnt in previous biology units. This unit enables you to develop and use your knowledge to investigate health-related factors in more detail.

Learning aims

In this unit you will:

- A investigate factors that contribute to healthy living
- B know how preventative measures can be used to support healthy living
- C investigate how some treatments are used when illness occurs.

Learning aims and unit content

What needs to be learnt	
Learning aim A: Investigate factors that contribute to healthy living	
A.1	Principles, characteristics and the concept of a healthy balanced diet including recommended daily intake of all food groups, and how dietary imbalance may lead to disorder in the human body, to include: <ol style="list-style-type: none"> a. under-eating and over-eating b. age and level of activity.
A.2	The impact of exercise on the health of the human body, to include: <ol style="list-style-type: none"> a. physical effects of exercise (stress, cardiovascular health) b. weight-related issues c. physical mobility issues.
A.3	Measures taken to improve the health of the population, in relation to unhealthy eating, smoking and alcohol intake.
Learning aim B: Know how preventative measures can be used to support healthy living	
B.1	Principles of the immune system and immune response as the human body's first line of defence, to include: <ol style="list-style-type: none"> a. physical barriers b. chemical defences c. non-specific responses (inflammation, phagocytosis) d. specific responses (antibodies) e. potential advantages and disadvantages of vaccination.
B.2	Screening programmes on the human body and their advantages and disadvantages, to include: <ol style="list-style-type: none"> a. screening programmes to detect cancer (breast and prostate) b. screening programmes for antenatal (Down's syndrome) c. screening programmes for the newborn (phenylketonuria (PKU)) d. vascular screening programmes (atherosclerosis).

What needs to be learnt**Learning aim C: Investigate how some treatments are used when illness occurs**

- C.1 Principles, advantages/disadvantages and the use/misuse of simple treatments of disorders, to include:
- a. antibiotics
 - b. anti-fungal treatments
 - c. antiviral treatments
 - d. analgesics.
- C.2 Principles and the uses of:
- a. blood grouping and blood transfusion
 - b. organ donation
 - c. stem cell therapy.

Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim A: Investigate factors that contribute to healthy living			
1A.1 Explain the importance of a balanced diet and exercise.	2A.P1 Describe the possible effects of diet and exercise on the functioning of the human body.	2A.M1 Explain how the diet and exercise plan will affect the functioning of the human body.*	2A.D1 Evaluate the diet and exercise plan, and justify the menus and activities chosen.*
1A.2 Identify a balanced diet for teenagers.*	2A.P2 Develop a diet and exercise plan based on level and type of exercise and appropriate nutritional balance, to promote healthy living for an individual.*		
1A.3 Identify measures taken to improve the health of the population.	2A.P3 Describe the ways in which health improvement measures are intended to improve the health of the population.	2A.M2 Analyse rates of disease in the population in relation to lifestyle choices.	2A.D2 Evaluate measures taken to improve the health of the population.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim B: Know how preventative measures can be used to support healthy living			
1B.4 Identify the role of the immune system in defending the body.	2B.P4 Describe how the immune system defends the body in relation to specific and non-specific immune responses.	2B.M3 Compare the different defence mechanisms the immune system uses to protect the human body.	2B.D3 Evaluate the effectiveness of human vaccination and screening programmes.
1B.5 Identify how a vaccine aids in defending the body.	2B.P5 Describe the changes in the human body following vaccination.		
1B.6 Identify screening programmes.	2B.P6 Describe the role of specific health screening programmes.	2B.M4 Discuss the advantages and disadvantages of a specific health screening programme.	
Learning aim C: Investigate how some treatments are used when illness occurs			
1C.7 Describe how antibiotics are prescribed for use.	2C.P7 Investigate the use and misuse of antibiotics using secondary data.	2C.M5 Analyse the effectiveness of different kinds of medical treatment in health care using secondary data.	2C.D4 Evaluate the use of different kinds of medical treatments, justifying your opinions.
1C.8 Identify pathogens that cannot be treated by antibiotics.	2C.P8 Describe the use of anti-fungal, antiviral and analgesic treatments.		
1C.9 Identify the different blood groups.	2C.P9 Explain the importance of blood group matching in blood transfusions.	2C.M6 Describe organ donation and approaches used to reduce rejection.	2C.D5 Evaluate the potential benefits of stem cell therapy.

*Opportunity to assess mathematical skills

#Opportunity to assess English skills

Teacher guidance

Resources

There are no special resources needed for this unit.

Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

The contents of this unit should be approached from a practical point of view as far as possible, e.g. through scientific investigative assignments.

Level 1 exemplifies partial achievement within a level 2 learning aim.

Learning aim A: Investigate factors that contribute to healthy living

Learning aim A of this unit requires the learner to investigate a range of factors that can contribute to healthy living. Learners should be able to identify the main food groups (proteins, carbohydrates, fats, vitamins and minerals) and the functions of each group. Consideration should be given to the effects of over- and under-eating and there is a clear opportunity for learners to enter into discussions of eating disorders. The positive and potential negative effects of exercise should also be covered and learners should be encouraged to take part in practical work where possible. Learners may carry out investigations into the effects of exercise on the circulatory and respiratory systems. Learners will also need to consider lifestyle and the health of the population.

For 1A.1 and 1A.2, learners should be able to explain the importance of a healthy balanced diet and exercise to enable them to identify the ingredients of a balanced diet and exercise plan for teenagers. This could be done in the form of a table.

For 2A.P1 and 2A.P2, learners need to provide evidence of a basic knowledge of the possible effects of diet and exercise on the functioning of the human body, to enable them to develop a diet and exercise plan for an individual, which covers the following: balanced food groups (fats, carbohydrates, protein, vitamins and minerals); recommended daily intake; exercise (frequency, type and appropriate level to life stage).

For 2A.M1, learners need to develop their understanding of diet and health to explain how the diet and exercise plan will affect the functioning of the body.

This will be followed, for 2A.D1, by the learner justifying the food choices for the diet plan and justifying the activities chosen for the exercise plan. This will allow learners to link age and lifestyle to the choices given.

For 1A.3, learners need to identify measures taken by relevant bodies to educate in order to improve the health of the population.

For 2A.P3, learners need to describe and link specific health improvement measures to how they may reduce the rates of non-infectious disease.

For 2A.M2, learners could investigate and analyse the rates of disease in the population in relation to lifestyle choices; this could be done from a case study or information given to learners by the teacher.

For 2A.D2, learners need to evaluate measures taken to improve the health of the population by looking at different lifestyle choices, including alcohol intake, smoking and unhealthy eating and the measures taken to counteract (or cut out) these choices, for example, eating freshly prepared foods rather than consuming convenient fast foods.

Learning aim B: Know how preventative measures can be used to support healthy living

Learning aim B requires learners to further their study of the immune system. This should lead on to consideration of immunisation programmes. The controversy over the MMR vaccine provides a good discussion point for learners to apply scientific principles, while taking into account public perceptions. Learners should research a selection of health screening programmes. It is expected that learners should then clearly identify the role that these programmes have in maintaining health.

For 1B.4, 1B.5 and 1B.6, learners need to investigate and identify the role of the immune system, vaccinations and screening programmes in relation to the content sections B.1 and B.2.

For 2B.4, 2B.P5 and 2B.P6, this needs to be extended to descriptions of the role of screening, the immune system and how it defends the body, and the effects of vaccinations on the human body.

For 2B.M3 and 2B.M4, learners need to develop their understanding further by comparing specific and non-specific immune responses, physical barriers and chemical defences. Vaccines should be explained in order to identify the changes that result in the body following vaccination. Learners need to discuss health screening programmes as in content B.2, in the context of their advantages and disadvantages. This could be done in the form of a report or table.

2B.D4 should allow learners to evaluate the effectiveness of vaccination and screening programmes. Learners should evaluate at least three of the screening programmes identified in the learning aim.

Learning aim C: Investigate how some treatments are used when illness occurs

For 1.C7, 1C.8, 1C.9 and 2C.P7, 2C.P8 and 2C.P9, learners should consider some treatments that are available when the body ceases to be healthy. Learners should understand standard guidelines on treatment regimes and guidance to complete the course of antibiotics. When practical work is undertaken, health and safety issues relating to laboratory work in the centre or workplace must be emphasised. Risk assessments, the use of COSHH and other regulations in place in laboratories must be followed, and all practical work must be supervised by a teacher or a lab technician. Witness statements/observation records must be completed as evidence that practical work has been carried out safely and appropriately.

For 2C.M5, learners could carry out a further investigation using the internet or other resources. Learners should appreciate that one factor influencing the increase in hospital-acquired infections is the overuse of antibiotics. The effectiveness of the treatments covered in the unit content can then be considered.

For 2C.M6, learners need to give a description of the principles and uses of organ donation and the methods used to reduce organ rejection.

For 2C.D4, learners should evaluate different types of medical treatment investigated and justify the choice of treatment for different disorders.

For 2C.D5, learners need to investigate stem cell therapy and evaluate the possible benefits, including current benefits and future potential benefits.

Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1, 1A.2, 1A.3, 2A.P1, 2A.P2, 2A.P3, 2A.M1, 2A.M2, 2A.D1, 2A.D2	A Healthy Lifestyle	You are a dietician working for the NHS and have been asked to write a report about the effects of lifestyle choices, diet and exercise for your hospital trust. A visit by an NHS dietician or a visit to a hospital trust would help to put this topic into context.	A report with appropriate diagrams, tables and graphs.
1B.4, 1B.5, 1B.6, 2B.P4, 2B.P5, 2B.P6, 2B.M3, 2B.M4, 2B.D4	Preventative Measures	You are a medical health science practitioner at a health centre who has been asked to prepare a presentation on measures that can be taken to help maintain health. A visit by a medical scientist from a university or a visit to a medical health centre would help to put this topic into context.	Written presentation or audio/visual presentation, with appropriate data analysis.
1C.7, 1C.8, 1C.9, 2C.P7, 2C.P8, 2C.P9, 2C.M5, 2C.M6, 2C.D4, 2C.D5	Medical Treatments	You are working as a medical scientist and are asked to prepare a portfolio of information that can be used to demonstrate balanced views of various medical treatments, including stem cell therapy. A visit by a medical scientist from a university or a visit to a medical health centre would help to put this topic into context.	Portfolio of information containing secondary data.

Unit 8: Scientific Skills

Level: **1 and 2**

Unit type: **Mandatory**

Guided learning hours: **30**

Assessment type: **External**

Unit introduction

The aim of this unit is to further develop your knowledge and understanding of the scientific process and build on the scientific investigation skills you have developed in other units.

It is essential that scientists have good investigatory skills, for example:

- carrying out theoretical and practical research
- working in a pilot scale department
- carrying out quality control tests on chemical, biological or physical samples during the stages of the manufacture of products
- calibrating audiological, optical or medical equipment to ensure accuracy of readings when testing hearing
- growing cultures in a laboratory
- testing waste products
- ensuring food products are not harmful
- ensuring water is safe to drink
- testing and drawing conclusions from forensic science evidence.

The examination will contain questions on planning, processing, presenting and analysing data, drawing conclusions and evaluating methodology and conclusions.

You will need to demonstrate the application of the skills learnt in this unit, based on familiar and unfamiliar contexts given in an examination paper.

This unit can draw on your knowledge and understanding from Units 5, 6 and 7 of this qualification.

When developing investigative skills learners can work together, however during the examination the learners will work independently under examination conditions.

Learning aims

In this unit you will:

- A understand how to produce a good plan for an investigation
- B process, present and analyse data, and draw evidence-based conclusions
- C evaluate evidence and investigative methods.

Learning aims and unit content

This unit can draw on your knowledge and understanding from Units 5, 6 and 7 of this qualification.

What needs to be learnt	
Learning aim A: Understand how to produce a good plan for an investigation	
A.1	Produce a good plan: <ul style="list-style-type: none">a. identify relevant equipment and give reasons for these choicesb. identify risks that are relevant to the method and describe how they will be managed (risk assessment)c. identify appropriate variables (dependent and independent) and describe how they will be controlledd. give a suitable range and number of measurements and explain why these were chosene. outline a logically ordered method appropriate to a given hypothesis.
A.2	Provide a hypothesis based on relevant scientific ideas, which is quantitative or qualitative where appropriate.

What needs to be learnt**Learning aim B: Process, present and analyse data, and draw evidence-based conclusions**

- B.1 Tabulate data in a clear, logical way:
 - a. with appropriately headed columns
 - b. with units
 - c. in ascending order of independent variables.
- B.2 Identify anomalous results in tabulated data.
- B.3 Identify approaches to deal with anomalous results in tabulated data.
- B.4 Calculations from tabulated data:
 - a. excluding anomalous results where appropriate
 - b. calculating averages
 - c. calculations using given equations
 - d. calculations from Units 5, 6 and 7.
- B.5 Demonstrate appropriate use of significant figures and application of the correct level of accuracy to which a result can be used.
- B.6 Draw graphs:
 - a. bar charts
 - b. line graphs
 - c. pie charts.
- B.7 Identify anomalous results on graphs.
- B.8 Draw lines of best fit on graphs:
 - a. appropriate to the data, excluding any anomalies where appropriate
 - b. straight line of best fit
 - c. curve of best fit.
- B.9 Obtain data from a given graph to find a specific value.
- B.10 Obtain data from a given graph to carry out calculations.
- B.11 Explain why anomalous results occur:
 - a. do not fit the pattern of results
 - b. errors in the experimental process.
- B.12 Describe the trends and patterns identified in tabulated data and graphs:
 - a. directly and indirectly proportional
 - b. positive and negative correlation
 - c. quantitative relationships.
- B.13 Analyse evidence to draw a conclusion.

What needs to be learnt

Learning aim C: Evaluate evidence and investigative methods

- C.1 Draw inferences from a conclusion.
- C.2 Comment on the extent to which the evidence supports the conclusion.
- C.3 Comment on the extent to which the hypothesis is supported by evidence.
- C.4 Evaluate the method, suggesting improvements or ways of extending the investigation to support the hypothesis further.

Teacher guidance

Resources

There are no special resources needed for this unit.

Assessment guidance

This unit is assessed externally using a paper-based exam marked by Pearson.

Examination format

The learner will complete a 1 hour and 15 minute examination worth 50 marks. The examination will contain questions on planning, processing, presenting and analysing data, drawing conclusions and evaluating methodology and conclusions.

The learner will need to demonstrate the application of the skills learnt in this unit, based on the contexts given in the examination paper.

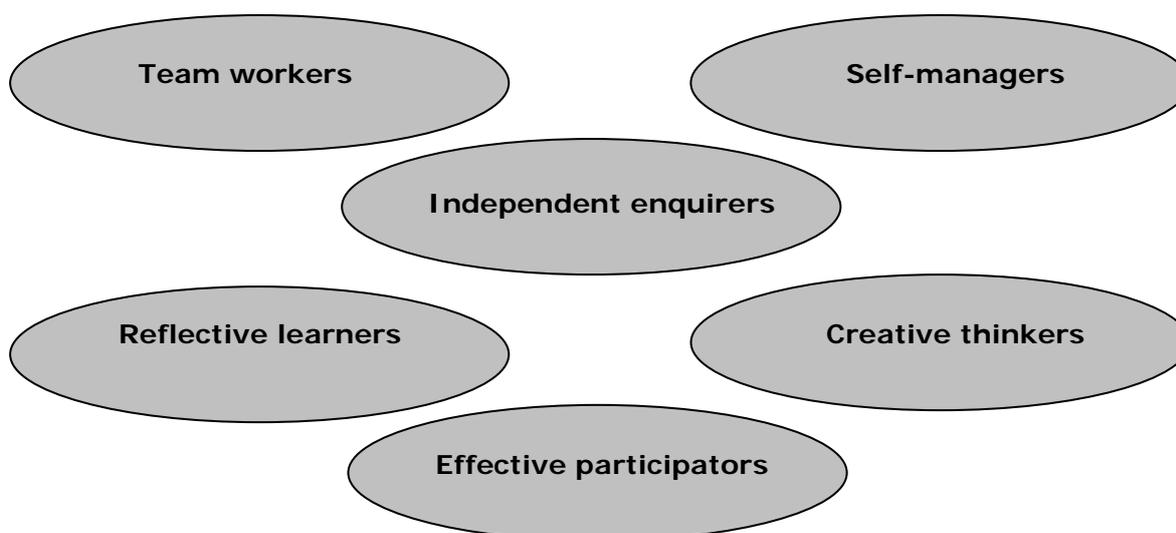
Annexe A

Personal, learning and thinking skills

A FRAMEWORK OF PERSONAL, LEARNING AND THINKING SKILLS 11–19 IN ENGLAND

The framework comprises six groups of skills that are essential to success in learning, life and work. In essence, the framework captures the essential skills of: managing self; managing relationships with others; and managing own learning, performance and work. It is these skills that will enable young people to enter work and adult life confident and capable.

The titles of the six groups of skills are set out below.



For each group, there is a focus statement that sums up the range of skills. This is followed by a set of outcome statements that are indicative of the skills, behaviours and personal qualities associated with each group.

Each group is distinctive and coherent. The groups are also interconnected. Young people are likely to encounter skills from several groups in any one learning experience. For example, an independent enquirer would set goals for their research with clear success criteria (reflective learner) and organise and manage their time and resources effectively to achieve these (self-manager). In order to acquire and develop fundamental concepts such as organising oneself, managing change, taking responsibility and perseverance, learners will need to apply skills from all six groups in a wide range of learning contexts.

The skills

Independent enquirers

Focus:

Young people process and evaluate information in their investigations, planning what to do and how to go about it. They take informed and well-reasoned decisions, recognising that others have different beliefs and attitudes.

Young people:

- identify questions to answer and problems to resolve
- plan and carry out research, appreciating the consequences of decisions
- explore issues, events or problems from different perspectives
- analyse and evaluate information, judging its relevance and value
- consider the influence of circumstances, beliefs and feelings on decisions and events
- support conclusions, using reasoned arguments and evidence.

Creative thinkers

Focus:

Young people think creatively by generating and exploring ideas, making original connections. They try different ways to tackle a problem, working with others to find imaginative solutions and outcomes that are of value.

Young people:

- generate ideas and explore possibilities
- ask questions to extend their thinking
- connect their own and others' ideas and experiences in inventive ways
- question their own and others' assumptions
- try out alternatives or new solutions and follow ideas through
- adapt ideas as circumstances change.

Reflective learners

Focus:

Young people evaluate their strengths and limitations, setting themselves realistic goals with criteria for success. They monitor their own performance and progress, inviting feedback from others and making changes to further their learning.

Young people:

- assess themselves and others, identifying opportunities and achievements
- set goals with success criteria for their development and work
- review progress, acting on the outcomes
- invite feedback and deal positively with praise, setbacks and criticism
- evaluate experiences and learning to inform future progress
- communicate their learning in relevant ways for different audiences.

Team workers

Focus:

Young people work confidently with others, adapting to different contexts and taking responsibility for their own part. They listen to and take account of different views. They form collaborative relationships, resolving issues to reach agreed outcomes.

Young people:

- collaborate with others to work towards common goals
- reach agreements, managing discussions to achieve results
- adapt behaviour to suit different roles and situations, including leadership roles
- show fairness and consideration to others
- take responsibility, showing confidence in themselves and their contribution
- provide constructive support and feedback to others.

Self-managers

Focus:

Young people organise themselves, showing personal responsibility, initiative, creativity and enterprise with a commitment to learning and self-improvement. They actively embrace change, responding positively to new priorities, coping with challenges and looking for opportunities.

Young people:

- seek out challenges or new responsibilities and show flexibility when priorities change
- work towards goals, showing initiative, commitment and perseverance
- organise time and resources, prioritising actions
- anticipate, take and manage risks
- deal with competing pressures, including personal and work-related demands
- respond positively to change, seeking advice and support when needed.

Effective participators

Focus:

Young people actively engage with issues that affect them and those around them. They play a full part in the life of their school, college, workplace or wider community by taking responsible action to bring improvements for others as well as themselves.

Young people:

- discuss issues of concern, seeking resolution where needed
- present a persuasive case for action
- propose practical ways forward, breaking these down into manageable steps
- identify improvements that would benefit others as well as themselves
- try to influence others, negotiating and balancing diverse views to reach workable solutions
- act as an advocate for views and beliefs that may differ from their own.

Summary of the PLTS coverage throughout the programme

This table shows where units support the development of personal, learning and thinking skills.

Key:

- ✓ indicates opportunities for development
- a blank space indicates no opportunities for development

Unit	Personal, learning and thinking skills					
	Independent enquirers	Creative thinkers	Reflective learners	Team workers	Self-managers	Effective participators
Pearson BTEC Level 1/Level 2 First Award in Application of Science						
5	✓	✓		✓	✓	✓
6	✓	✓	✓	✓	✓	
7	✓	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓	

Annexe B

English knowledge and skills signposting

This table shows where an assessment criterion in a BTEC First unit can provide an opportunity to practise a subject content area from the GCSE English subject criteria (including functional elements).

Unit no. and title	Learning aim	Assessment criterion reference	Subject content area from the GCSE Subject criteria (details of the content area can be found below)
Pearson BTEC Level 1/Level 2 First Award in Application of Science			
Unit 5: Applications of Chemical Substances	N/A	N/A	N/A
Unit 6: Applications of Physical Science	N/A	N/A	N/A
Unit 7: Health Applications of Life Science	N/A	N/A	N/A
Unit 8: Scientific Skills (External)	C	N/A	2, 5, 15

GCSE English subject content area

The topic areas below are drawn from the GCSE English subject criteria.

Learners should:

- 1 analyse spoken and written language, exploring impact and how it is achieved
- 2 express ideas and information clearly, precisely, accurately and appropriately in spoken and written communication
- 3 form independent views and challenge what is heard or read on the grounds of reason, evidence or argument
- 4 understand and use the conventions of written language, including grammar, spelling and punctuation
- 5 explore questions, solve problems and develop ideas
- 6 engage with and make fresh connections between ideas, texts and words
- 7 experiment with language to create effects to engage the audience
- 8 reflect and comment critically on their own and others' use of language.

In speaking and listening, learners should:

- 9 present and listen to information and ideas
- 10 respond appropriately to the questions and views of others
- 11 participate in a range of real-life contexts in and beyond the classroom, adapting talk to situation and audience and using standard English where appropriate
- 12 select and use a range of techniques and creative approaches to explore ideas, texts and issues in scripted and improvised work.

In reading, learners should:

- 13 understand how meaning is constructed through words, sentences and whole texts, recognising and responding to the effects of language variation
- 14 evaluate the ways in which texts may be interpreted differently according to the perspective of the reader.

In writing, learners should write accurately and fluently:

- 15 choosing content and adapting style and language to a wide range of forms, media, contexts, audiences and purposes
- 16 adapting form to a wide range of styles and genres.

Annexe C

Mathematics knowledge and skills signposting

This table shows where an assessment criterion in a BTEC First unit can provide an opportunity to practise a subject content area from the GCSE Mathematics subject criteria (including functional elements).

Unit no. and title	Learning aim	Assessment criterion reference	Subject content area from the GCSE Subject criteria (details of the content area can be found below)
Pearson BTEC Level 1/Level 2 First Award in Application of Science			
Unit 5: Applications of Chemical Substances	A	1A.1	1, 10, 11
		2A.P1, 2A.M1, 2A.D1	1, 3, 10, 11, 21
	B	2B.D2	1, 14
Unit 6: Applications of Physical Science	A	1A.1, 2A.P1	9–12, 14
		2A.M1, 2A.D1	9–12, 14, 16
		1A.2	9–11
		2A.P2	1–6, 9–11, 13, 21, 24
		1A.3	1–6, 14
		2A.P3	1–6, 13, 14, 21
		2A.M2	1–6, 13, 14, 21, 24
	B	2B.P4	1–6
		2B.M3	1–6, 13, 21, 24
		2B.P5	1–6, 13, 21, 24
	D	2D.M7	1–6, 13, 21, 24
		2D.M8	1–6, 12–14, 16, 21, 24
Unit 7: Health Applications of Life Science	A	1A.2, 2A.P2, 2A.M1, 2A.D1	1–6, 21
Unit 8: Scientific Skills (External)	B	N/A	1–6, 8, 10–15, 21, 25
	C	N/A	14, 16

GCSE Mathematics subject content area

The topic areas below are drawn from the GCSE Mathematics subject criteria.

Learners should be able to:

- 1 understand number size and scale and the quantitative relationship between units
- 2 understand when and how to use estimation
- 3 carry out calculations involving $+$, $-$, \times , \div , either singly or in combination, decimals, fractions, percentages and positive whole number powers
- 4 understand and use number operations and the relationships between them, including inverse operations and the hierarchy of operations
- 5 provide answers to calculations to an appropriate degree of accuracy, including a given power of ten, number of decimal places and significant figures
- 6 understand and use the symbols $=$, $<$, $>$, \sim
- 7 understand and use direct proportion and simple ratios
- 8 calculate arithmetic means
- 9 understand and use common measures and simple compound measures such as speed
- 10 make sensible estimates of a range of measures in everyday settings and choose appropriate units for estimating or carrying out measurement
- 11 interpret scales on a range of measuring instruments, work out time intervals and recognise that measurements given to the nearest whole unit may be inaccurate by up to one half in either direction
- 12 plot and draw graphs (line graphs, bar charts, pie charts, scatter graphs, histograms) selecting appropriate scales for the axes
- 13 substitute numerical values into simple formulae and equations using appropriate units
- 14 translate information between graphical and numerical form
- 15 design and use data-collection sheets, including questionnaires, for grouped, discrete or continuous data, process, represent, interpret and discuss the data
- 16 extract and interpret information from charts, graphs and tables
- 17 understand the idea of probability
- 18 calculate area and perimeters of shapes made from triangles and rectangles
- 19 calculate volumes of right prisms and of shapes made from cubes and cuboids
- 20 use Pythagoras' theorem in 2-D
- 21 use calculators effectively and efficiently.

In addition, level 2 learners should be able to:

- 22 interpret, order and calculate with numbers written in standard form
- 23 carry out calculations involving negative powers (only -1 for rate of change)
- 24 change the subject of an equation
- 25 understand and use inverse proportion
- 26 understand and use percentiles and deciles
- 27 use Pythagoras' theorem in 2-D and 3-D
- 28 use trigonometric ratios to solve 2-D and 3-D problems.

Annexe D

Synoptic assessment

Synoptic assessment in applied science is embedded throughout the assessment criteria across the units of study. The mandatory units provide the essential knowledge, understanding and skills required in applied science. Learners studying the Pearson Level 1/Level 2 BTEC First Award in Application of Science are able to demonstrate a number of synoptic approaches towards meeting the assessment criteria which includes:

- showing links and holistic understanding/approaches to units of study from the specification
- being able to interrelate overarching concepts and issues, bringing together their scientific knowledge
- drawing together and integrating knowledge, understanding and skills across different units, in order to develop an appreciation of how topics relate to one another, how each may contribute to different scientific contexts/situations
- applying scientific knowledge and approaches to particular vocational contexts or situations
- demonstrating their ability to use a range of investigative methods and techniques
- being able to put forward different perspectives and/or explanations to support decisions they have made or evidence presented
- synthesising information gained from studying a number of different vocational contexts
- applying knowledge, understanding and a range of scientific skills from across different units to a particular vocational context
- using specialist terminology where appropriate
- demonstrating use of transferable skills
- evaluating and justifying their decisions, choices and recommendations.

Unit 8: Scientific Skills in particular, gives learners the opportunity to draw together and demonstrate the skills developed across the qualification. For example, learners will have carried out a number of planning, processing, analysing and evaluating activities as part of Units 5, 6 and 7, which will all be brought together for Unit 8. For this reason it is advisable for centres to develop the skills from Unit 8 throughout the programme of study.

Annexe E

The periodic table of the elements

The Periodic Table of the Elements

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

1	H
	Hydrogen 1

relative atomic mass
atomic symbol
name
atomic (proton) number

* 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.

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