

Pearson BTEC Level 3 National Certificate in Applied Science



Specification

First teaching from September 2016

First certification from 2017

Issue 4

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Edexcel, BTEC and LCCI qualifications

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

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ISBN 978 1 446 95060 9

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Welcome

With a track record built over 30 years of learner success, BTEC Nationals are widely recognised by industry and higher education as the signature vocational qualification at Level 3. They provide progression to the workplace either directly or via study at a higher level. Proof comes from YouGov research, which shows that 62% of large companies have recruited employees with BTEC qualifications. What's more, well over 100,000 BTEC students apply to UK universities every year and their BTEC Nationals are accepted by over 150 UK universities and higher education institutes for relevant degree programmes either on their own or in combination with A Levels.

Why are BTECs so successful?

BTECs embody a fundamentally learner-centred approach to the curriculum, with a flexible, unit-based structure and knowledge applied in project-based assessments. They focus on the holistic development of the practical, interpersonal and thinking skills required to be able to succeed in employment and higher education.

When creating the BTEC Nationals in this suite, we worked with many employers, higher education providers, colleges and schools to ensure that their needs are met. Employers are looking for recruits with a thorough grounding in the latest industry requirements and work-ready skills such as teamwork. Higher education needs students who have experience of research, extended writing and meeting deadlines.

We have addressed these requirements with:

- a range of BTEC sizes, each with a clear purpose, so there is something to suit each learner's choice of study programme and progression plans
- refreshed content that is closely aligned with employers' and higher education needs for a skilled future workforce
- assessments and projects chosen to help learners progress to the next stage. This means some are set by you to meet local needs, while others are set and marked by Pearson so that there is a core of skills and understanding that is common to all learners. For example, a written test can be used to check that learners are confident in using technical knowledge to carry out a certain job.

We are providing a wealth of support, both resources and people, to ensure that learners and their teachers have the best possible experience during their course. See *Section 10* for details of the support we offer.

A word to learners

Today's BTEC Nationals are demanding, as you would expect of the most respected applied learning qualification in the UK. You will have to choose and complete a range of units, be organised, take some assessments that we will set and mark, and keep a portfolio of your assignments. But you can feel proud to achieve a BTEC because, whatever your plans in life – whether you decide to study further, go on to work or an apprenticeship, or set up your own business – your BTEC National will be your passport to success in the next stage of your life.

Good luck, and we hope you enjoy your course.

Collaborative development

Students completing their BTEC Nationals in Applied Science will be aiming to go on to employment, often via the stepping stone of higher education. It was, therefore, essential that we developed these qualifications in close collaboration with experts from professional bodies, businesses and universities, and with the providers who will be delivering the qualifications. To ensure that the content meets providers' needs and provides high-quality preparation for progression, we engaged experts. We are very grateful to all the university and further education lecturers, teachers, employers, professional body representatives and other individuals who have generously shared their time and expertise to help us develop these new qualifications.

In addition, universities, professional bodies and businesses have provided letters of support confirming that these qualifications meet their entry requirements. These letters can be viewed on our website.

Summary of Pearson BTEC Level 3 National Certificate in Applied Science specification Issue 3 and 4 changes

| Summary of changes made between previous issues and this current issue | Page number |
|--|-------------|
| Inclusion of Near Pass grade information for External assessments. Inclusion of text to further clarify Synoptic assessment | Throughout |
| Wording has been added to the Qualification and unit content section to clarify that references in units to regulation, legislation, policies and regulatory/standards organisations can be adapted and updated to reflect changes and variations within the UK. | Page 7 |
| The wording under the synoptic assessment section has been revised to reference synoptic assessment tasks within units. | Page 8 |
| A sentence has been added to the External assessment summary table to clarify the percentage of external assessment within the qualification. | Page 13 |
| External assessment Unit 1: Duration of written examination now 2 hours (was 1.5 hours). | Page 13 |
| Wording has been revised to reference the specific synoptic assessment task/s within units that have been identified for this qualification. | Page 13 |
| Unit 1 Summary of assessment The wording under Summary of assessment has changed to 'the exam will last two hours'. | Page 20 |
| The wording under Unit content – B3 Tissue structure and function has changed to 'interpretation of graphical displays of a nerve impulse and electrocardiogram (ECG) recordings'. | Page 23 |
| Wording has been revised in the Links to other units section in Unit 1. | Page 28 |
| Example tables in Section 9 have been updated to reflect the Near Pass grade. | Section 9 |

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

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Introduction to BTEC National qualifications for the applied science sector

This specification contains the information you need to deliver the Pearson BTEC Level 3 National Certificate in Applied Science. The specification signposts you to additional handbooks and policies. It includes all the units for this qualification.

This qualification is part of the suite of Applied Science qualifications offered by Pearson. In the suite there are qualifications that focus on different progression routes, allowing learners to choose the one best suited to their aspirations.

All qualifications in the suite share some common units and assessments, allowing learners some flexibility in moving between sizes. The qualification titles are given below.

Some BTEC National qualifications provide a broad introduction that gives learners transferable knowledge and skills. These qualifications are for post-16 learners who want to continue their education through applied learning. The qualifications prepare learners for a range of higher education courses and job roles related to a particular sector. They provide progression either by meeting entry requirements in their own right or by being accepted alongside other qualifications at the same level and adding value to them.

In the applied science sector these qualifications are:

Pearson BTEC Level 3 National Certificate in Applied Science (180 GLH) 601/7434/1

Pearson BTEC Level 3 National Extended Certificate in Applied Science (360 GLH) 601/7436/5

Pearson BTEC Level 3 National Foundation Diploma in Applied Science (510 GLH) 601/7438/9

Pearson BTEC Level 3 National Diploma in Applied Science (720 GLH) 601/7435/3

Pearson BTEC Level 3 National Extended Diploma in Applied Science (1080 GLH) 601/7437/7.

This specification signposts all the other essential documents and support that you need as a centre in order to deliver, assess and administer the qualification, including the staff development required. A summary of all essential documents is given in *Section 7*. Information on how we can support you with this qualification is given in *Section 10*.

The information in this specification is correct at the time of publication.

Total Qualification Time

For all regulated qualifications, Pearson specifies a total number of hours that it is estimated learners will require to complete and show achievement for the qualification: this is the Total Qualification Time (TQT). Within TQT, Pearson identifies the number of Guided Learning Hours (GLH) that we estimate a centre delivering the qualification might provide. Guided learning means activities, such as lessons, tutorials, online instruction, supervised study and giving feedback on performance, that directly involve teachers and assessors in teaching, supervising and invigilating learners. Guided learning includes the time required for learners to complete external assessment under examination or supervised conditions.

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

BTEC Nationals have been designed around the number of hours of guided learning expected. Each unit in the qualification has a GLH value of 60, 90 or 120. There is then a total GLH value for the qualification.

Each qualification has a TQT value. This may vary within sectors and across the suite depending on the nature of the units in each qualification and the expected time for other required learning.

The following table shows all the qualifications in this sector and their GLH and TQT values.

Qualifications, sizes and purposes at a glance

| Title | Size and structure | Summary purpose |
|--|--|---|
| Pearson BTEC Level 3 National Certificate in Applied Science | 180 GLH (235 TQT) Equivalent in size to 0.5 of an A Level. 2 units of which both are mandatory and 1 is external. Mandatory content (100%). External assessment (50%). | An introduction to a vocational sector through applied learning. For learners for whom an element of science would be complementary, the qualification supports progression to higher education when taken as part of a programme of study that includes other vocational or general qualifications. |
| Pearson BTEC Level 3 National Extended Certificate in Applied Science | 360 GLH (455 TQT) Equivalent in size to one A Level. 4 units of which 3 are mandatory and 2 are external. Mandatory content (83%). External assessment (58%). | Designed for learners who are interested in learning about the sector alongside other fields of study, with a view to progressing to a wide range of higher education courses, not necessarily in applied science. To be taken as part of a programme of study that includes other appropriate BTEC Nationals or A Levels. |
| Pearson BTEC Level 3 National Foundation Diploma in Applied Science | 510 GLH (640 TQT) Equivalent in size to 1.5 A Levels. 6 units of which 4 are mandatory and 2 are external. Mandatory content (76%). External assessment (41%). | Designed as a one-year, full-time course of study, or as part of a two-year, full-time study programme for learners who wish to study another area alongside it, which may contrast or complement the Applied Science Foundation Diploma. If taken as part of a programme of study that includes other BTEC Nationals or A Levels, it supports progression to higher education. |
| Pearson BTEC Level 3 National Diploma in Applied Science | 720 GLH (890 TQT) Equivalent in size to two A Levels. 8 units of which 6 are mandatory and 3 are external. Mandatory content (83%). External assessment (46%). | Designed to be the substantive part of a 16–19 study programme for learners who want a strong core of sector study. May be complemented with other BTEC Nationals or A Levels to support progression to higher education courses in applied science. The additional qualification(s) studied allow learners either to give breadth to their study by choosing a contrasting subject, or to give their studies more focus by choosing a complementary subject. |

| Title | Size and structure | Summary purpose |
|--|---|--|
| Pearson BTEC Level 3 National Extended Diploma in Applied Science | 1080 GLH (1345 TQT) Equivalent in size to three A Levels. 13 units of which 7 are mandatory and 4 are external. Mandatory content (67%). External assessment (42%). | Designed as a two-year, full-time course that meets entry requirements in its own right for learners who want to progress to higher education courses in the applied science sector before entering employment. Learners can either choose a pathway which focuses on a particular occupational area, such as biomedical science, analytical and forensic science, physical science; or take a general route for further study in the sector. |

Structures of the qualifications at a glance

This table shows all the units and the qualifications to which they contribute. The full structure for this Pearson BTEC Level 3 National in Applied Science is shown in *Section 2*. **You must refer to the full structure to select units and plan your programme.**

Key

| | | | | | |
|--------------------------|--------------------|-----------------|---------------------------------|----------------|------------------|
| Unit assessed externally | M | Mandatory units | O | Optional units | |
| BS | Biomedical Science | AFS | Analytical and Forensic Science | PS | Physical Science |

| Unit (number and title) | Unit size (GLH) | Certificate (180 GLH) | Extended Certificate (360 GLH) | Foundation Diploma (510 GLH) | Diploma (720 GLH) | Extended Diploma (1080 GLH) | Extended Diploma (1080 GLH) | | |
|--|-----------------|-----------------------|--------------------------------|------------------------------|-------------------|-----------------------------|-----------------------------|-----|----|
| | | | | | | | BS | AFS | PS |
| 1 Principles and Applications of Science I | 90 | M | M | M | M | M | M | M | M |
| 2 Practical Scientific Procedures and Techniques | 90 | M | M | M | M | M | M | M | M |
| 3 Science Investigation Skills | 120 | | M | M | M | M | M | M | M |
| 4 Laboratory Techniques and their Application | 90 | | | M | M | M | M | M | M |
| 5 Principles and Applications of Science II | 120 | | | | M | M | M | M | M |
| 6 Investigative Project | 90 | | | | M | M | M | M | M |
| 7 Contemporary Issues in Science | 120 | | | | | M | M | M | M |
| 8 Physiology of Human Body Systems | 60 | | O | O | O | O | O | O | O |
| 9 Human Regulation and Reproduction | 60 | | O | O | O | O | O | O | O |
| 10 Biological Molecules and Metabolic Pathways | 60 | | O | O | O | O | O | O | O |
| 11 Genetics and Genetic Engineering | 60 | | O | O | O | O | O | O | O |
| 12 Diseases and Infections | 60 | | O | O | O | O | O | O | O |
| 13 Applications of Inorganic Chemistry | 60 | | O | O | O | O | O | O | O |
| 14 Applications of Organic Chemistry | 60 | | O | O | O | O | O | O | O |
| 15 Electrical Circuits and their Application | 60 | | O | O | O | O | O | O | O |
| 16 Astronomy and Space Science | 60 | | O | O | O | O | O | O | O |
| 17 Microbiology and Microbiological Techniques | 60 | | | O | O | O | O | O | O |

continued overleaf

| Unit (number and title) | Unit size (GLH) | Certificate (180 GLH) | Extended Certificate (360 GLH) | Foundation Diploma (510 GLH) | Diploma (720 GLH) | Extended Diploma (1080 GLH) | Extended Diploma (1080 GLH) | | |
|---|-----------------|-----------------------|--------------------------------|------------------------------|-------------------|-----------------------------|-----------------------------|-----|----|
| | | | | | | | BS | AFS | PS |
| 18 Industrial Chemical Reactions | 60 | | | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 Practical Chemical Analysis | 60 | | | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 Biomedical Science | 60 | | | | 0 | 0 | 0 | 0 | 0 |
| 21 Medical Physics Applications | 60 | | | | 0 | 0 | 0 | 0 | 0 |
| 22 Materials Science | 60 | | | | 0 | 0 | 0 | 0 | 0 |
| 23 Forensic Evidence, Collection and Analysis | 60 | | | | 0 | 0 | 0 | 0 | 0 |
| 24 Cryogenics and Vacuum Technology | 60 | | | | | 0 | 0 | 0 | 0 |
| 25 Forensic Fire Investigation | 60 | | | | | 0 | 0 | 0 | 0 |
| 26 Forensic Traffic Collision Investigation | 60 | | | | | 0 | 0 | 0 | 0 |

Qualification and unit content

Pearson has developed the content of the new BTEC Nationals in collaboration with employers and representatives from higher education and relevant professional bodies. In this way, we have ensured that content is up to date and that it includes the knowledge, understanding, skills and attributes required in the sector.

Each qualification in the suite has its own purpose. The mandatory and optional content provides a balance of breadth and depth, while retaining a degree of choice for individual learners to study content relevant to their own interests and progression choices. Also, the content may be applied during delivery in a way that is relevant to local employment needs.

The proportion of mandatory content ensures that all learners are following a coherent programme of study and acquiring the knowledge, understanding and skills that will be recognised and valued. Learners are expected to show achievement across mandatory units as detailed in *Section 2*.

BTEC Nationals have always required applied learning that brings together knowledge and understanding (the cognitive domain) with practical and technical skills (the psychomotor domain). This is achieved through learners performing vocational tasks that encourage the development of appropriate vocational behaviours (the affective domain) and transferable skills. Transferable skills are those such as communication, teamwork, research and analysis, which are valued in both higher education and the workplace.

Our approach provides rigour and balance, and promotes the ability to apply learning immediately in new contexts. Further details can be found in *Section 2*.

Centres should ensure that delivery of content is kept up to date. In particular units may include reference to regulation, legislation, policies and regulatory/standards organisations. This is designed to provide guidance on breadth and depth of coverage and may be adjusted to update content and to reflect variations within the UK.

Assessment

Assessment is specifically designed to fit the purpose and objective of the qualification. It includes a range of assessment types and styles suited to vocational qualifications in the sector. There are three main forms of assessment that you need to be aware of: external, internal and synoptic.

Externally-assessed units

Each external assessment for a BTEC National is linked to a specific unit. All of the units developed for external assessment are of 90 or 120 GLH to allow learners to demonstrate breadth and depth of achievement. Each assessment is taken under specified conditions, then marked by Pearson and a grade awarded. Learners are permitted to resit external assessments during their programme. You should refer to our website for current policy information on permitted retakes.

The styles of external assessment used for qualifications in the Applied Science suite are:

- examinations – all learners take the same assessment at the same time, normally with a written outcome
- set tasks – learners take the assessment during a defined window and demonstrate understanding through completion of a vocational task.

Some external assessments include a period of preparation using set information. External assessments are available twice a year. For detailed information on the external assessments please see the table in *Section 2*. For further information on preparing for external assessment see *Section 5*.

Internally-assessed units

Most units in the sector are internally assessed and subject to external standards verification. This means that you set and assess the assignments that provide the final summative assessment of each unit, using the examples and support that Pearson provides. Before you assess you will need to become an approved centre, if you are not one already. You will need to prepare to assess using the guidance in *Section 6*.

In line with the requirements and guidance for internal assessment, you select the most appropriate assessment styles according to the learning set out in the unit. This ensures that learners are assessed using a variety of styles to help them develop a broad range of transferable skills. Learners could be given opportunities to:

- write up the findings of their own research
- use case studies to explore complex or unfamiliar situations
- carry out projects for which they have choice over the direction and outcomes
- demonstrate practical and technical skills using appropriate equipment, procedures and techniques.

You will make grading decisions based on the requirements and supporting guidance given in the units. Learners may not make repeated submissions of assignment evidence. For further information see *Section 6*.

Synoptic assessment

Synoptic assessment requires learners to demonstrate that they can identify and use effectively, in an integrated way, an appropriate selection of skills, techniques, concepts, theories and knowledge from across the whole sector as relevant to a key task. BTEC learning has always encouraged learners to apply their learning in realistic contexts using scenarios and realistic activities that will permit learners to draw on and apply their learning. For these qualifications we have formally identified units which contain a synoptic assessment task. Synoptic assessment must take place after the teaching and learning of other mandatory units in order for learners to be able to draw from the full range of content. The synoptic assessment gives learners an opportunity to independently select and apply learning from across their programmes in the completion of a vocational task. Synoptic tasks may be in internally or externally assessed units. The particular unit that contains the synoptic tasks for this qualification is shown in the structure in *Section 2*.

Language of assessment

Assessment of the internal and external units for these qualifications will be available in English. All learner work must be in English. A learner taking the qualifications may be assessed in British or Irish Sign Language where it is permitted for the purpose of reasonable adjustment. For information on reasonable adjustments see *Section 6*.

Grading for units and qualifications

Achievement in the qualification requires a demonstration of depth of study in each unit, assured acquisition of a range of practical skills required for employment or progression to HE, and successful development of transferable skills. Learners achieving a qualification will have achieved across mandatory units, including external and synoptic assessment.

Units are assessed using a grading scale of Distinction (D), Merit (M), Pass (P), Near Pass (N) and Unclassified (U). The grade of Near Pass is used for externally-assessed units only. All mandatory and optional units contribute proportionately to the overall qualification grade, for example a unit of 120 GLH will contribute double that of a 60 GLH unit.

Qualifications in the suite are graded using a scale of P to D*, **or** PP to D*D*, **or** PPP to D*D*D*. Please see *Section 9* for more details. The relationship between qualification grading scales and unit grades will be subject to regular review as part of Pearson's standards monitoring processes on the basis of learner performance and in consultation with key users of the qualification.

UCAS Tariff points

The BTEC Nationals attract UCAS points. Please go to the UCAS website for full details of the points allocated.

1 Qualification purpose

Pearson BTEC Level 3 National Certificate in Applied Science

In this section you will find information on the purpose of this qualification and how its design meets that purpose through the qualification objective and structure. We publish a full 'Statement of Purpose' for each qualification on our website. These statements are designed to guide you and potential learners to make the most appropriate choice about the size of qualification suitable at recruitment.

Who is this qualification for?

The Pearson BTEC Level 3 National Certificate in Applied Science is intended as an Applied General qualification for post-16 learners who want to continue their education through applied learning and who aim to progress to higher education, and ultimately to employment, possibly in the applied science sector. The qualification is equivalent in size to half an A Level and aims to give a basic introduction to the study of applied science.

Learners who wish to take this qualification will have successfully completed a Level 2 study programme with GCSEs or vocational qualifications. It is normally taken alongside other Level 3 qualifications.

What does this qualification cover?

The content of this qualification has been developed in consultation with academics to ensure that it supports progression to higher education.

Learners will study two mandatory units:

- Unit 1: Principles and Applications of Science I
- Unit 2: Practical Scientific Procedures and Techniques.

What could this qualification lead to?

Learners who have completed this qualification in a year may progress to further learning at Level 3, for example to a BTEC Level 3 National Extended Certificate in a complementary sector, or to a larger size BTEC Level 3 National in Applied Science.

The requirements of the qualification will mean that learners develop the transferable and higher order skills which are valued by higher education providers and employers. For example, when studying *Unit 2: Practical Scientific Procedures and Techniques*, learners will develop laboratory skills, including collaboration and teamwork which support some of the skills learners need to progress to higher education, employment, self-employment or training.

The qualification carries UCAS points and is recognised by higher education providers as contributing to meeting admission requirements for many relevant courses if taken alongside other Level 3 qualifications as part of a programme of learning. Learners will be able to choose a wide range of degree programmes to progress to, depending on the other qualifications they have taken. For example, taken alongside:

- A-Levels in Geography and Economics, and an AS Level in Mathematics to progress to geography courses
- A-Levels in Business, Mathematics and Economics, or Psychology to progress to business or economics courses
- A-Level in Biology and a BTEC Level 3 National Foundation Diploma in Sport and Exercise Science to progress to sport science courses.

Learners should always check the entry requirements for degree programmes with specific higher education providers.

How does the qualification provide employability skills?

In the BTEC National units there are opportunities during the teaching and learning phase to give learners practice in developing employability skills. Where employability skills are referred to in this specification, we are generally referring to skills in the following three main categories:

- **cognitive and problem-solving skills:** use critical thinking, approach non-routine problems applying expert and creative solutions, use systems and technology
- **intrapersonal skills:** communicating, working collaboratively, negotiating and influencing, self-presentation
- **interpersonal skills:** self-management, adaptability and resilience, self-monitoring and development.

There are also specific requirements in some units for assessment of these skills where relevant. For example, where learners are required to undertake real or simulated activities.

How does the qualification provide transferable knowledge and skills for higher education?

All BTEC Nationals provide transferable knowledge and skills that prepare learners for progression to university. The transferable skills that universities value include:

- the ability to learn independently
- the ability to research actively and methodically
- being able to give presentations and being active group members.

BTEC learners can also benefit from opportunities for deep learning where they are able to make connections among units and select areas of interest for detailed study. BTEC Nationals provide a vocational context in which learners can develop the knowledge and skills required for particular degree courses, including:

- reading scientific and technical texts
- effective writing
- analytical skills
- practical skills
- preparation for assessment methods used in degrees.

2 Structure

Qualification structure

Pearson BTEC Level 3 National Certificate in Applied Science

Mandatory units

There are two mandatory units, one internal and one external. Learners must complete and achieve at Near Pass grade or above in the mandatory external unit and achieve a Pass or above in the mandatory internal unit.

| Pearson BTEC Level 3 National Certificate in Applied Science | | | | |
|--|--|-----|------------------------|--------------|
| Unit number | Unit title | GLH | Type | How assessed |
| 1 | Principles and Applications of Science I | 90 | Mandatory and Synoptic | External |
| 2 | Practical Scientific Procedures and Techniques | 90 | Mandatory | Internal |

External assessment

This is a summary of the type and availability of external assessment, which is of units making up 50% of the total qualification GLH. See *Section 5* and the units and sample assessment materials for more information.

| Unit | Type | Availability |
|---|---|---|
| Unit 1: Principles and Applications of Science I | <ul style="list-style-type: none">• Written examination set and marked by Pearson.• 2 hours.• 90 marks. | Jan and May/June First assessment May/June from 2017 |

Synoptic assessment

The mandatory synoptic assessment requires learners to apply learning from across the qualification to the completion of a defined vocational task. Within the assessment for *Unit 1: Principles and Applications of Science I*, learners will make judgements and reach conclusions by evaluating scientific information and making connections between different scientific concepts, procedures and processes. Learners complete the task using knowledge and understanding from their studies of the sector and apply both transferable and specialist knowledge and skills.

In delivering the unit you need to encourage learners to draw on their broader learning so they will be prepared for the assessment.

Employer involvement in assessment and delivery

You are encouraged to give learners opportunities to be involved with employers. See *Section 4* for more information.

3 Units

Understanding your units

The units in this specification set out our expectations of assessment in a way that helps you to prepare your learners for assessment. The units help you to undertake assessment and quality assurance effectively.

Each unit in the specification is set out in a similar way. There are two types of unit format:

- internal units
- external units.

This section explains how the units work. It is important that all teachers, assessors, internal verifiers and other staff responsible for the programme review this section.

Internal units

| Section | Explanation |
|--------------------------|--|
| Unit number | The number is in a sequence in the sector. Numbers may not be sequential for an individual qualification. |
| Unit title | This is the formal title that we always use and it appears on certificates. |
| Level | All units are at Level 3 on the national framework. |
| Unit type | This shows if the unit is internal or external only. See structure information in <i>Section 2</i> for full details. |
| GLH | Units may have a GLH value of 120, 90 or 60 GLH. This indicates the numbers of hours of teaching, directed activity and assessment expected. It also shows the weighting of the unit in the final qualification grade. |
| Unit in brief | A brief formal statement on the content of the unit that is helpful in understanding its role in the qualification. You can use this in summary documents, brochures etc. |
| Unit introduction | This is designed with learners in mind. It indicates why the unit is important, how learning is structured, and how learning might be applied when progressing to employment or higher education. |
| Learning aims | These help to define the scope, style and depth of learning of the unit. You can see where learners should be learning standard requirements ('understand') or where they should be actively researching ('investigate'). You can find out more about the verbs we use in learning aims in <i>Appendix 2</i> . |
| Summary of unit | This new section helps teachers to see at a glance the main content areas against the learning aims and the structure of the assessment. The content areas and structure of assessment are required. The forms of evidence given are suitable to fulfil the requirements. |
| Content | This section sets out the required teaching content of the unit. Content is compulsory except when shown as 'e.g.'. Learners should be asked to complete summative assessment only after the teaching content for the unit or learning aim(s) has been covered. |

| Section | Explanation |
|---|---|
| Assessment criteria | <p>Each learning aim has Pass and Merit criteria. Each assignment has at least one Distinction criterion.</p> <p>A full glossary of terms used is given in <i>Appendix 2</i>. All assessors need to understand our expectations of the terms used.</p> <p>Distinction criteria represent outstanding performance in the unit. Some criteria require learners to draw together learning from across the learning aims.</p> |
| Essential information for assignments | <p>This shows the maximum number of assignments that may be used for the unit to allow for effective summative assessment, and how the assessment criteria should be used to assess performance.</p> |
| Further information for teachers and assessors | <p>The section gives you information to support the implementation of assessment. It is important that this is used carefully alongside the assessment criteria.</p> |
| Resource requirements | <p>Any specific resources that you need to be able to teach and assess are listed in this section. For information on support resources see <i>Section 10</i>.</p> |
| Essential information for assessment decisions | <p>This information gives guidance for each learning aim or assignment of the expectations for Pass, Merit and Distinction standard. This section contains examples and essential clarification.</p> |
| Links to other units | <p>This section shows you the main relationship among units. This section can help you to structure your programme and make best use of materials and resources.</p> |
| Employer involvement | <p>This section gives you information on the units that can be used to give learners involvement with employers. It will help you to identify the kind of involvement that is likely to be successful.</p> |

External units

| Section | Explanation |
|---|--|
| Unit number | The number is in a sequence in the sector. Numbers may not be sequential for an individual qualification. |
| Unit title | This is the formal title that we always use and it appears on certificates. |
| Level | All units are at Level 3 on the national framework. |
| Unit type | This shows if the unit is internal or external only. See structure information in <i>Section 2</i> for full details. |
| GLH | Units may have a GLH value of 120, 90 or 60 GLH. This indicates the numbers of hours of teaching, directed activity and assessment expected. It also shows the weighting of the unit in the final qualification grade. |
| Unit in brief | A brief formal statement on the content of the unit. |
| Unit introduction | This is designed with learners in mind. It indicates why the unit is important, how learning is structured, and how learning might be applied when progressing to employment or higher education. |
| Summary of assessment | This sets out the type of external assessment used and the way in which it is used to assess achievement. |
| Assessment outcomes | These show the hierarchy of knowledge, understanding, skills and behaviours that are assessed. Includes information on how this hierarchy relates to command terms in sample assessment materials (SAMs). |
| Essential content | For external units all the content is obligatory, the depth of content is indicated in the assessment outcomes and sample assessment materials (SAMs). The content will be sampled through the external assessment over time, using the variety of questions or tasks shown. |
| Grade descriptors | We use grading descriptors when making judgements on grade boundaries. You can use them to understand what we expect to see from learners at particular grades. |
| Key terms typically used in assessment | These definitions will help you analyse requirements and prepare learners for assessment. |
| Resources | Any specific resources that you need to be able to teach and assess are listed in this section. For information on support resources see <i>Section 10</i> . |
| Links to other units | This section shows the main relationship among units. This section can help you to structure your programme and make best use of materials and resources. |
| Employer involvement | This section gives you information on the units that can be used to give learners involvement with employers. It will help you to identify the kind of involvement that is likely to be successful. |

Index of units

This section contains all the units developed for this qualification. Please refer to *pages 5–6* to check which units are available in all qualifications in the applied science sector.

| | | |
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| Unit 1: | Principles and Applications of Science I | 19 |
| Unit 2: | Practical Scientific Procedures and Techniques | 29 |

Unit 1: Principles and Applications of Science I

Level: **3**

Unit type: **External**

Guided learning hours: **90**

Unit in brief

This unit covers some of the key science concepts in biology, chemistry and physics. Further key science concepts are considered in *Unit 5: Principles and Applications of Science II*.

Unit introduction

Scientists and technicians working in science and science-related organisations must have a good understanding of core science concepts. A strong grasp of these concepts will enable you to use and apply this knowledge and understanding in vocational contexts when studying other units within this specification.

The topic areas covered in this unit include: animal and plant cells; tissues; atomic structure and bonding; chemical and physical properties of substances related to their uses; waves and their application in communications.

Scientists and technicians working in the chemical industry need to have an understanding of atoms and electronic structure. This allows them to predict how chemical substances will react in the production of a wide range of products – anything from fertilisers in the farming industry to fragrances in the perfume industry. Metals play an important role in the construction industry, in providing the structure to buildings, as well as in electrical wiring and the production of decorative features. So understanding the chemical and physical properties of metals is essential when selecting appropriate building materials.

Medical professionals need to understand the structure and workings of cells. They build on this knowledge to understand how the body stays healthy as well as the symptoms and causes of some diseases. This allows them to diagnose and treat illnesses. The study of bacterial prokaryotic cells gives an understanding of how some other diseases are caused and can be treated.

Scientists and technicians in the food industry also need to understand the structure and function of plant cells to enable them to develop food crops that produce greater yields.

Knowledge of waves is essential in a wide range of industries and organisations. In the communication industry, scientists and technicians apply their knowledge of the electromagnetic spectrum when designing mobile phone and satellite communication, and fibre optics are used to transmit telephone and television signals. Fibre optics are also used in diagnostic tools in medicine.

To complete the assessment task within this unit, you will need to draw on your learning from across your programme. The knowledge and understanding you will learn in this unit will provide a strong basis for you to progress in the science sector and to a variety of science and related programmes such as higher nationals and degrees.

Summary of assessment

This unit will be assessed through a written exam worth 90 marks, which is set and marked by Pearson. The exam will last two hours.

The paper is split into three sections, each worth 30 marks:

- Section A – Biology
- Section B – Chemistry
- Section C – Physics.

The paper will include a range of question types, including multiple choice, calculations, short answer and open response. These question types will assess discrete knowledge and understanding of the content in this unit.

The assessment availability is January and May/June each year. The first assessment availability is May/June 2017.

Sample assessment materials will be available to help centres prepare learners for assessment.

Assessment outcomes

AO1 Demonstrate knowledge of scientific facts, terms, definitions and scientific formulae

Command words: give, label, name, state

Marks: ranges from 12 to 18 marks

AO2 Demonstrate understanding of scientific concepts, procedures, processes and techniques and their application

Command words: calculate, compare, discuss, draw, explain, state, write

Marks: ranges from 39 to 45 marks

AO3 Analyse, interpret and evaluate scientific information to make judgements and reach conclusions

Command words: calculate, comment, compare, complete, describe, discuss, explain, state

Marks: ranges from 18 to 24 marks

AO4 Make connections, use and integrate different scientific concepts, procedures, processes or techniques

Command words: comment, compare, complete, discuss, explain

Marks: ranges from 9 to 12 marks

Essential content

The essential content is set out under content areas. Learners must cover all specified content before the assessment.

A Periodicity and properties of elements

A1 Structure and bonding in applications in science

- Understand the electronic structure of atoms:
 - electronic orbitals
 - Aufbau principle
 - Bohr theory.
- Understand ionic bonding:
 - strong electrostatic attraction between oppositely charged ions
 - effects ionic radius and ionic charge have on the strength of ionic bonding
 - formation of ions in terms of electron loss or gain
 - electronic configuration diagrams of cations and anions.
- Understand covalent bonding:
 - strong electrostatic attraction between two nuclei and the shared pair(s) of electrons between them
 - dot and cross diagrams to show electrons in simple covalent molecules, including those with multiple bonds and dative covalent (coordinate) bonds
 - the relationship between bond lengths and bond strengths in covalent bonds
 - tetrahedral basis of organic chemistry.
- Understand metallic bonding:
 - de-localised electrons
 - positive metal ions
 - regular layer structure.
- Understand the following intermolecular forces:
 - van der Waals
 - dipole-dipole
 - hydrogen bonding.
- Understand the following:
 - balanced equations
 - relative atomic mass
 - atomic number and relative molecular mass
 - moles, molar masses and molarities.
- Understand the quantities used in chemical reactions:
 - mass, volume of solution, concentration
 - reacting quantities
 - percentage yields.

A2 Production and uses of substances in relation to properties

- Understand the periodic table:
 - Periods 1, 2, 3 and 4
 - groups – s block, p block, d block
 - layout of periodic table in relation to s, p, d notation
 - electronic arrangement of elements using s, p, d notation.
- Understand the physical properties of elements:
 - first ionisation energy
 - reasons for trends in ionisation energy across Periods 2–4 and down groups 1, 2 and 7
 - electron affinity
 - atomic radius
 - ionic radius
 - electronegativity
 - type of bonding in the element
 - trends – melting point and boiling point
 - physical properties of metals – electrical conductivity, thermal conductivity, malleability, ductility.
- Understand the chemical properties of elements:
 - products and reactivity of all Period 2 and 3 elements with oxygen
 - products and reactivity of metals with oxygen, water, dilute hydrochloric acid and dilute sulfuric acid
 - position of metals in the reactivity series in relation to position in the periodic table
 - oxidation
 - reduction
 - variable oxidation states of transition metal ions
 - displacement reactions of metals/halogens
 - uses and applications of substances produced within this learning aim.

B Structure and functions of cells and tissues**B1 Cell structure and function**

- Know that cell theory is a unifying concept stating that cells are a fundamental unit of structure, function and organisation in all living organisms.
- Understand the ultrastructure and function of organelles in the following cells:
 - prokaryote cells (bacterial cell) – nucleoid, plasmids, 70S ribosomes, capsule, cell wall
 - eukaryotic cells (plant and animal cells) – plasma membrane, cytoplasm, nucleus, nucleolus, endoplasmic reticulum (smooth and rough), Golgi apparatus, vesicles, lysosomes, 80S ribosomes, mitochondria, centriole
 - eukaryotic cells (plant-cell specific) – cell wall, chloroplasts, vacuole, tonoplast, amyloplasts, plasmodesmata, pits.
- Recognise cell organelles from electron micrographs and the use of light microscopes.
- Understand the similarities and differences between plant and animal cell structure and function.
- Understand how to distinguish between gram-positive and gram-negative bacterial cell walls and why each type reacts differently to some antibiotics.
- Calculate magnification and size of cells and organelles from drawings or images.

B2 Cell specialisation

Understand cell specialisation in terms of structure and function, to include:

- palisade mesophyll cells in a leaf
- sperm and egg cells in reproduction
- root hair cells in plants
- white blood cells
- red blood cells.

B3 Tissue structure and function

- Understand the structure and function of epithelial tissue, to include:
 - squamous as illustrated by the role of alveolar epithelium in gas exchange to include the effect of chronic obstructive pulmonary disease (COPD) in smokers
 - columnar as illustrated by goblet cells and ciliated cells in the lungs to include their role in protecting lungs from pathogens.
- Understand the structure and function of endothelial tissue, as illustrated by blood vessels in the cardiovascular system, including the risk factors that damage endothelial cells and affect the development of atherosclerosis.
- Understand the structure and function of muscular tissue, to include:
 - the microscopic structure of a skeletal muscle fibre
 - structural and physiological differences between fast- and slow-twitch muscle fibres and their relevance in sport.
- Understand the structure and function of nervous tissue, to include:
 - non-myelinated and myelinated neurones
 - the conduction of a nerve impulse (action potential) along an axon, including changes in membrane permeability to sodium and potassium ions and the role of the myelination in saltatory conduction
 - interpretation of graphical displays of a nerve impulse and electrocardiogram (ECG) recordings
 - synaptic structure and the role of neurotransmitters, including acetylcholine
 - how imbalances in certain, naturally occurring brain chemicals can contribute to ill health, including dopamine in Parkinson's disease and serotonin in depression
 - the effects of drugs on synaptic transmission, including the use of L-Dopa in the treatment of Parkinson's disease.

C Waves in communication**C1 Working with waves**

- Understand the features common to all waves and use the following terms as applied to waves:
 - periodic time
 - speed
 - wavelength
 - frequency
 - amplitude
 - oscillation.
- Graphical representation of wave features.
- Understand the difference between the two main types of wave:
 - transverse
 - longitudinal.
- Understand concepts of displacement, coherence, path difference, phase difference, superposition as applied to diffraction gratings.

- Understand the industrial application of diffraction gratings, to include:
 - emission spectra
 - identifying gases.

- Be able to use the wave equation:

$$v = f\lambda$$

- Understand the concept and applications of stationary waves resonance.
- Musical instruments.

- Be able to use the equation:

$$\text{calculation of speed } v = \sqrt{\frac{T}{\mu}}$$

C2 Waves in communication

- Understand the principles of fibre optics:

- refractive index $n = \frac{c}{v} = \frac{\sin i}{\sin r}$

- total internal reflection
- calculation of critical angles at a glass–air interface:

$$\sin c = \frac{1}{n}$$

- Understand the applications of fibre optics in medicine to include endoscopes.
- Understand the applications of fibre optics in communication, to include:
 - analogue and digital signals: analogue-to-digital conversion, broadband.

C3 Use of electromagnetic waves in communication

- Understand that all electromagnetic waves travel with the same speed in a vacuum.
- Be able to use the inverse square law in relation to the intensity of a wave:

$$I = \frac{k}{r^2}$$

- Understand how the regions of the electromagnetic spectrum are grouped according to the frequency.
- Understand how the applications of electromagnetic waves in communications are related to frequency, including:
 - satellite communication
 - mobile phones
 - Bluetooth®
 - infrared
 - Wi-Fi.

Grade descriptors

To achieve a grade learners are expected to demonstrate these attributes across the essential content of the unit. The principle of best fit will apply in awarding grades.

Level 3 Pass

Learners will be able to recall, select and apply scientific knowledge and understanding to vocational and realistic situations. They will be able to use scientific terminology and concepts in given situations, and to use given information and apply appropriate mathematical and technical skills in context. Learners will be able to interpret and analyse information in order to make valid judgements.

Level 3 Distinction

Learners will be able to integrate relevant scientific knowledge and understanding from different areas to demonstrate a deeper understanding of how these apply to vocational and realistic situations. They will be able to use scientific terminology and concepts, communicating consistently and effectively in given situations. They will be able to select relevant information and apply appropriate mathematical and technical skills to justify decisions or solve problems in context. Learners will be able to interpret and analyse information in order to make valid judgements that are supported by evidence, with awareness of limitations.

Key terms typically used in assessment

The following table shows the key terms that will be used consistently by Pearson in our assessments to ensure learners are rewarded for demonstrating the necessary skills.

Please note: the list below will not necessarily be used in every paper/session and is provided for guidance only. Only a single command word will be used per item.

| Command or term | Definition |
|-----------------|---|
| Add/label | Learners label or add to a stimulus material given in the question, for example labelling a diagram or adding units to a table. |
| Assess | Learners give careful consideration to all the factors or events that apply and identify which are the most important or relevant. Make a judgement on the importance of something and come to a conclusion where needed. |
| Calculate | Learners obtain a numerical answer, showing relevant working. If the answer has a unit, this must be included. |
| Comment on | Learners synthesise a number of variables from data/ information to form a judgement. More than two factors need to be synthesised. |
| Compare | Learners look for the similarities and differences of two (or more) things. Should not require the drawing of a conclusion. Answer must relate to both (or all) things mentioned in the question. The answer must include at least one similarity and one difference. |
| Complete | Learners complete a table/diagram. |
| Criticise | Learners inspect a set of data, an experimental plan or a scientific statement and consider the elements. Look at the merits and/or faults of the information presented and back up judgements made. |
| Deduce | Learners draw/reach conclusion(s) from the information provided. |

| Command or term | Definition |
|-------------------|---|
| Derive | Learners combine two or more equations or principles to develop a new equation. |
| Describe | Learners give an account of something. Statements in the response need to be developed as they are often linked but do not need to include a justification or reason. |
| Determine | Learners' answers must have an element that is quantitative from the stimulus provided, or must show how the answer can be reached quantitatively. To gain maximum marks there must be a quantitative element to the answer. |
| Devise | Learners plan or invent a procedure from existing principles/ideas. |
| Discuss | Learners identify the issue/situation/problem/argument that is being assessed in the question. Explore all aspects of an issue/situation/problem/argument. Investigate the issue/situation, etc. by reasoning or argument. |
| Draw | Learners produce a diagram, either using a ruler or using freehand. |
| Evaluate | Learners review information then bring it together to form a conclusion, drawing on evidence, including strengths, weaknesses, alternative actions, relevant data or information. Come to a supported judgement of a subject's qualities and relation to its context. |
| Explain | Learners' explanations require a justification/ exemplification of a point. The answer must contain some element of reasoning/justification – this can include mathematical explanations. |
| Give/state/name | These generally require recall of one or more pieces of information. |
| Give a reason why | When a statement has been made and the requirement is only to give the reasons why. |
| Identify | Usually requires some key information to be selected from a given stimulus/resource. |
| Plot | Learners produce a graph by marking points accurately on a grid from data that is provided and then drawing a line of best fit through these points. A suitable scale and appropriately labelled axes must be included if these are not provided in the question. |
| Predict | Learners give an expected result. |
| Show that | Learners prove that a numerical figure is as stated in the question. The answer must be to at least one more significant figure than the numerical figure in the question. |
| Sketch | Learners produce a freehand drawing. For a graph this would need a line and labelled axes with important features indicated. The axes are not scaled. |

| Command or term | Definition |
|--|---|
| State and justify/identify and justify | When a selection is made and a justification has to be given for the selection. |
| State what is meant by | When the meaning of a term is expected but there are different ways in which this meaning can be described. |
| Write | When the question asks for an equation. |

Links to other units

This assessment for this unit should draw on knowledge, understanding and skills developed from:

- Unit 2 Practical Scientific Procedures and Techniques.

Employer involvement

Centres may involve employers in the delivery of this unit if there are local opportunities. There is no specific guidance related to this unit.

Unit 2: Practical Scientific Procedures and Techniques

Level: **3**

Unit type: **Internal**

Guided learning hours: **90**

Unit in brief

Learners will be introduced to quantitative laboratory techniques, calibration, chromatography, calorimetry and laboratory safety, which are relevant to the chemical and life science industries.

Unit introduction

This unit introduces you to standard laboratory equipment and techniques, including titration, colorimetry, calorimetry, chromatography, calibration procedures and laboratory safety. Through the practical tasks in the unit, you will develop proficiency in the quantitative analytical techniques of titration and colorimetry, including learning to calculate the concentration of solutions. You will use measurement of temperature to study cooling curves and be introduced to paper and thin-layer chromatography (TLC). You will also have the opportunity to calibrate equipment and will be encouraged to be aware of the safety aspects of given laboratory procedures and techniques.

While you develop your practical competence, the discussion and analysis of group results will allow you to understand your progress in relation to that of others and also to gain an understanding of the reliability, repeatability and reproducibility of various procedures and techniques. You will have the opportunity to use problem-solving skills when you undertake calorimetry work. There is scope throughout the unit to reflect on the skills you have gained and how you may develop further. .

The fundamental knowledge, practical skills, transferable skills – for example, organisation, self-assessment and problem-solving, and the ability to interpret data – all developed in this unit will give you confidence when you undertake the more complex practical techniques involved in higher education science courses such as biochemistry, chemistry, forensic science and environmental science.

The experience you gain will be invaluable when you begin your career as a trainee laboratory technician in industries such as contract analysis, oil, biopharmaceuticals, water treatment, and polymers. Employers in these industries will appreciate your ability to follow written scientific procedures and your desire to ensure accuracy by using techniques correctly and by checking that equipment – for example, pipettes, balances, pH meters and thermometers – is calibrated correctly and that appropriate standard calibration documentation has been completed.

Learning aims

In this unit you will:

- A** Undertake titration and colorimetry to determine the concentration of solutions
- B** Undertake calorimetry to study cooling curves
- C** Undertake chromatographic techniques to identify components in mixtures
- D** Review personal development of scientific skills for laboratory work.

Summary of unit

| Learning aim | Key content areas | Recommended assessment approach |
|--|---|---|
| A Undertake titration and colorimetry to determine the concentration of solutions | A1 Laboratory equipment and its calibration A2 Preparation and standardisation of solutions using titration A3 Colorimetry | <p>Pro formas of results for checking the calibration of a pipette and balance(s) and calibration of a pH meter.</p> <p>A report on the use of Na_2CO_3 to standardise HCl, used in turn to standardise NaOH. pH curve from the titration plus a differential plot.</p> <p>Results, calculations and calibration graph for the determination of the concentration of a coloured solution using colorimetry.</p> <p>Explanations of how the accuracy, precision and safety of the quantitative techniques may be optimised.</p> <p>Observation checklist, completed by the teacher, including safety.</p> |
| B Undertake calorimetry to study cooling curves | B1 Thermometers B2 Cooling curves | <p>Results from checking the calibration of at least two types of thermometer.</p> <p>A table of time/temperature data and a graph of temperature against time for a substance cooling.</p> <p>Calculations of the rate of cooling at points on the graph.</p> <p>An analysis of how the rate of cooling is related to intermolecular forces and the state of the substance.</p> <p>A report evaluating the accuracy of the cooling curve experiment.</p> <p>An observation report with a checklist, completed by the teacher, including safety.</p> |
| C Undertake chromatographic techniques to identify components in mixtures | C1 Chromatographic techniques C2 Application of chromatography C3 Interpretation of a chromatogram | <p>Results from the paper chromatography and TLC of extracted plant pigments from paper chromatography of amino acids.</p> <p>An explanation of the principles behind the chromatographic separations.</p> <p>Suggestions for improvements to the chromatographic procedures carried out and full justification of these suggestions.</p> <p>An observation report with a checklist, completed by the teacher, including safety.</p> |
| D Review personal development of scientific skills for laboratory work | D1 Personal responsibility D2 Interpersonal skills D3 Professional practice | <p>A presentation or report that focuses on the evaluation of learners' performance and skill development across all scientific procedures and techniques carried out in learning aims A, B and C.</p> |

Content

Learning aim A: Undertake titration and colorimetry to determine the concentration of solutions

A1 Laboratory equipment and its calibration

Equipment and glassware used in titration and colorimetry and the importance and processes involved in calibration of measuring equipment.

- Use of pH meters and probes:
 - calibration according to the manufacturer's instructions.
- Use of balances and weighing:
 - electronic balances – rough balances (two decimal places), analytical balances (four decimal places)
 - checking calibration with certified weights
 - measurement of mass using increasingly accurate balances
 - suitable containers for weighing liquids and solids
 - density of water at different temperatures.
- Safe use of volumetric glassware:
 - bulb, graduated, automated and teat pipettes
 - burettes
 - glass and plastic filter funnels
 - volumetric flasks
 - accurate dilution
 - use of water as a standard for calibrating volumetric glassware.

A2 Preparation and standardisation of solutions using titration

Processes involved in the preparation and standardisation of solutions using titration.

- Accurate determination of the end-point of titrations from:
 - the colour change of a suitable indicator
 - plots of pH versus volume
 - $\Delta\text{pH}/\Delta\text{volume}$ versus volume.
- Calculation of concentrations:
 - use of molecular mass from periodic table.
- Use of primary and secondary titrimetric standards.

A3 Colorimetry

Understanding and practical application of colorimetry techniques.

- Selection and use of a colorimeter or visible spectrometer – selection of filter (colorimeter) or fixed wavelength (spectrometer).
- Measurement and use of absorbance readings.
- Use of Beer-Lambert law to determine the concentration of a transition metal ion solution.
- Accurate dilution of stock solutions to prepare a range of calibration standards with absorbance in the range 0 to 1.
- Use of blank solutions.
- Calibration plot.
- Determination of unknown solution concentration from reading from graph (graph paper) or from the equation of a linear trend line through the origin (Microsoft Excel).

Learning aim B: Undertake calorimetry to study cooling curves

B1 Thermometers

Types of thermometer, appropriate use and practical application of measurements of heat.

- The relationship between temperature and heat energy.
- Types of thermometer and how they are used to gain accurate readings:
 - electronic thermometers/temperature probes
 - liquid-filled thermometers.
- Checking the calibration of thermometers by using ice and boiling water.
- Accuracy of thermometers and temperature probes at different temperatures.

B2 Cooling curves

Construction and interpretation of cooling curves:

- temperature as a function of time
- rate of cooling from the gradient of the tangent to the cooling curve
- determination of melting point from the shape of a curve for a substance freezing
- super cooling
- shape of the curve and rate of cooling in relation to intermolecular forces and the state (solid or liquid) of the substance.

Learning aim C: Undertake chromatographic techniques to identify components in mixtures

C1 Chromatographic techniques

Theory, equipment and procedures used in chromatography.

- Terminology:
 - mobile and stationary phases
 - adsorption.
- Principles of paper chromatography.
- Principles of thin-layer chromatography (TLC):
 - nature of a TLC plate – glass, metal or plastic sheet with solid adsorbent layer.
- Use of capillary tubes to apply mixtures to paper or TLC plates.
- Choice of developing solvent and vessel.
- Preparative methods for samples:
 - solvent extraction
 - filtration
 - concentration by evaporation.
- The use of locating agents.

C2 Application of chromatography

- Separation of components of a mixture, to include plant pigments extracted from leaves/herbs with propanone (paper chromatography and TLC).
- Identification of unknown mixtures and pure substances using chromatography, to include amino acids (paper chromatography).
- Awareness of other types of chromatography – e.g. gas chromatography, ion-exchange chromatography – and that procedures and chromatogram interpretations are very different.

C3 Interpretation of a chromatogram

- Polarity of molecules/intermolecular forces in relation to solubility in the mobile phase.
- Polarity of molecules/intermolecular forces in relation to retention of molecules in the stationary phase.
- Size of molecules in relation to solubility and mobility.
- Calculation of R_f value.
- Interpretation of chromatograms in terms of the number of substances present and the R_f values of components.
- Awareness of common problems in technique resulting in difficulty interpreting a chromatogram, e.g. overloading samples, disturbing plate/paper during development or contamination of plate/paper.

Learning aim D: Review personal development of scientific skills for laboratory work**D1 Personal responsibility**

Understanding of the personal responsibilities that must be accepted for successful work in science.

- Work to appropriate standards and protocols.
- Application of safe working practices.
- Accept responsibility for the quality of own work.
- Take responsibility for completing tasks and procedures as well as using judgements within defined parameters.

D2 Interpersonal skills

Understanding and development of skills for effective and efficient working with others:

- communication and co-operation in the scientific working environment
- give and receive constructive feedback
- behaviour for safe and efficient working in science.

D3 Professional practice

Understanding and personal development of standard practices applicable to working as a professional scientist:

- recognise problems and apply appropriate scientific methods to identify causes and achieve solutions
- identify, organise and use resources effectively to complete tasks
- maintain and enhance competence.

Assessment criteria

| Pass | Merit | Distinction |
|---|---|--|
| Learning aim A: Undertake titration and colorimetry to determine the concentration of solutions | | A.D1 Evaluate the accuracy of procedures and techniques used in titration and colorimetry in relation to outcomes and suggest improvements. |
| A.P1 Correctly prepare and standardise solutions for titration and colorimetry. A.P2 Investigate the concentration of unknown solutions, using procedures and techniques in titration and colorimetry. | A.M1 Demonstrate skilful application of procedures and techniques in titration and colorimetry to accurately determine the concentration of solutions. | |
| Learning aim B: Undertake calorimetry to study cooling curves | | B.D2 Evaluate the accuracy of practical work in calorimetry in relation to the analysis of the cooling curve. |
| B.P3 Correctly obtain data using different equipment to construct cooling curves. B.P4 Correctly determine the rate of cooling of substances using cooling curves. | B.M2 Analyse the rate of cooling of substances from your data using cooling curves to draw valid conclusions. | |
| Learning aim C: Undertake chromatographic techniques to identify components in mixtures | | C.D3 Evaluate the chromatographic techniques used in relation to outcomes and suggest improvements. |
| C.P5 Correctly use chromatographic techniques to produce chromatograms. C.P6 Explain the use of chromatographic techniques to separate mixtures. | C.M3 Analyse own chromatograms and relate the factors that affect the separation of mixtures to the quality of results obtained. | |
| Learning aim D: Review personal development of scientific skills for laboratory work | | D.D4 Evaluate scientific skills developed in terms of potential for future progression. |
| D.P7 Summarise key personal competencies developed in relation to scientific skills undertaken. | D.M4 Analyse skills developed and suggest improvements to own practice. | |

Essential information for assignments

The recommended structure of assessment is shown in the unit summary along with suitable forms of evidence. *Section 6* gives information on setting assignments and there is further information on our website.

There is a maximum number of four summative assignments for this unit. The relationship of the learning aims and criteria is:

Learning aim: A (A.P1, A.P2, A.M1, A.D1)

Learning aim: B (B.P3, B.P4, B.M2, B.D2)

Learning aim: C (C.P5, C.P6, C.M3, C.D3)

Learning aim: D (D.P7, D.M4, D.D4)

Further information for teachers and assessors

Resource requirements

For this unit, learners must have access to:

- a well-equipped laboratory with a fume cupboard
- accurate balances
- a range of volumetric glassware
- pH meters, thermometers and temperature probes (access to data-logging software is useful but not essential)
- colorimeter or visible spectrometer
- chromatography paper, TLC slides
- a range of suitable chemicals, dependent on specific practical work that centres choose to utilise.

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will interpret outcomes of their quantitative analytical procedures and techniques to make sound judgements on the accuracy of them. They will place the accuracy of their results in the context of those obtained by other learners in a meaningful and quantitative way. Learners will be able to coherently discuss problems/issues with the quantitative procedures and techniques used and develop a strong rationale for suggestions made to improve accuracy and precision in order to obtain reliable and valid outcomes (or for justifying the appropriate steps already taken should no problems be identified).

Learners will provide sound discussion of inherent hazards and risks associated with the analytical techniques and procedures, for example justifying why certain aspects are carried out in a particular way on safety grounds.

For merit standard, learners will undertake quantitative analytical procedures and techniques with minimal supervision, and perform to a high degree of accuracy and precision in order to obtain reliable and valid outcomes, with consideration for health and safety. Learners will demonstrate skill and fluency in a number of areas, such as: calibrating pipettes transferring solids, measuring volumes, mixing solutions, carrying out titrations and making the dilutions for colorimetry standards. They will be fully prepared in terms of equipment, reference material and consumables before attempting each step.

For pass standard, learners will follow instructions to safely undertake titration and colorimetry, although they may need to refer frequently to the instructions. These must be performed correctly to obtain reliable and valid outcomes. Learners will correctly carry out calculations of concentration.

For titration, learners will check the calibration of equipment used to ensure the validity of outcomes obtained (for example the calibration of a pipette, balances and a pH meter using buffer solutions). It is expected that learners will be assessed making a solution by weighing a solid, making the solution to volume and shaking to ensure that it mixes thoroughly. They could use a primary standard acid/base in a titration to standardise sodium hydroxide/hydrochloric acid prepared by the learner. Learners must also safely and correctly calibrate and use a colorimeter or visible spectrometer to determine the concentration of a coloured solution.

Learning aim B

For distinction standard, learners will interpret outcomes of their calorimetry to make sound judgements on accuracy. Learners will be able to use appropriate mathematical terminology (for example rapid increase, decrease, approximately constant, etc.) to describe the patterns and trends in the shapes of cooling curves. They will be able to use the cooling curve of a substance to evaluate how close their values for the melting points are to literature and to class values, explaining where specific errors or problems with the given method or equipment may have led to inaccuracy. Learners could, for example, discuss the way in which the substance was cooled and the resulting changes to the curve. Learners will explain why it may be necessary to make changes to procedures in order to reduce levels of uncertainty.

For merit standard, learners will demonstrate selection of an appropriate amount of solid; selection of a suitable vessel for heating the solid, setting up the equipment to enable heating and cooling of the vessel in an appropriate way and monitoring temperature as a function of time in a safe way.

Learners will demonstrate numerical skills in graph plotting when constructing their cooling curve. These must include selecting the most appropriate scale, using appropriate labels including units, and drawing a smooth, best-fit curve through the points. By drawing tangents at appropriate points and finding their gradients, learners will correctly determine the rate of cooling near the start, end and where the rate appears to have changed dramatically in between. They will draw valid conclusions linking the rate of cooling to what is happening at a molecular level in terms of the positions and velocity of molecules and the forces between them. They will be able to explain which part of the graph corresponds to, for example, the melting point (freezing temperature).

For pass standard, learners will safely check the calibration of a given thermometer, following instructions. This could be done by using ice and boiling water. Learners will also explore the accuracy of the temperature measurements obtained from thermometers and other equipment by comparing their readings in water that is being heated. Learners will use a table of their own design for recording their readings. Learners will demonstrate key practical competencies in calorimetry, including being able to set up a vessel containing a solid, heating it to above its melting point, cooling it and measuring its temperature as a function of time, following a standard procedure.

Learners will plot graphs for a substance undergoing freezing. Learners might not select the most appropriate scale but will label axes correctly and draw a smooth curve through the points. They will accurately determine the rate of cooling near the start, demonstrating the ability to draw a tangent to the curve and find its gradient.

Learning aim C

For distinction standard, learners will articulate strong links between outcomes and techniques used in order to give a rationale for specific improvements that could be made to the chromatographic techniques. They will articulate what would happen if a particular change were to be made. They will demonstrate awareness that some chromatograms may show the spots rising at an angle or have spots that are too big or smeared out rather than being distinct.

For merit standard, learners will demonstrate safe working practices and a high level of proficiency when carrying out paper- and thin-layer chromatography (TLC) with minimal supervision. They will produce chromatograms showing clear separation of spots, repeating the separations if they are not satisfied with the quality of the separation obtained. Learners will also comment on the suitability of the techniques for separation.

Learners will use appropriately calculated R_f values and consider factors that influence separation to justify conclusions drawn about the identification of components in a mixture (for example the polarity of the components of the mixtures and the polarity of the solvents and effect of the size of a molecule on its mobility).

For pass standard, learners will follow instructions, demonstrating safe working practices and a good level of ability when carrying out paper and TLC. Learners will comment on the suitability of the techniques for separation and the chromatogram produced for each technique (TLC and paper chromatography). At this standard, the chromatograms may not produce spots showing an optimum degree of separation (for example the spots may be too large and lacking in distinction). They will determine R_f values using paper chromatograms, using these to correctly identify components in a mixture.

Learning aim D

For distinction standard, learners will draw upon all areas of practical work carried out to critically reflect on strengths and weaknesses of their own performance and skill development drawing on feedback, for example from peers, teachers and industry. Drawing on others' feedback is crucial for developing balanced progression goals.

For merit standard, learners will need to make judgements on their skill development and level in relation to their peer group. They will need to recognise the improvements that need to be made and how they will take steps to achieve them.

For pass standard, learners will identify areas of scientific skills developed in relation to the learning aims. They should draw on scientific skills they have previously acquired and use them to illustrate the transferability and development of skills.

Links to other units

This unit links to:

- Unit 1: Principles and Applications of Science I
- Unit 3: Science Investigation Skills
- Unit 4: Laboratory Techniques and their Application
- Unit 19: Practical Chemical Analysis.

This unit also links to a wide range of optional units available across the qualification.

Employer involvement

Centres may involve employers in the delivery of this unit if there are local opportunities. It would be beneficial for an industry representative to explain the importance of the routine calibration of equipment in ensuring the reliability of results. A visit to a local laboratory would reinforce the importance of calibration of equipment and health and safety. Even if the local organisations that use science only operate on a small scale, their representatives will be able to reinforce the importance of the transferable skills this unit develops.

4 Planning your programme

How do I choose the right BTEC National qualification for my learners?

BTEC Nationals come in a range of sizes, each with a specific purpose. You will need to assess learners very carefully to ensure that they start on the right size of qualification to fit into their 16–19 study programme, and that they take the right pathways or optional units that allow them to progress to the next stage.

Some learners may want to take a number of complementary qualifications or keep their progression options open. These learners may be suited to taking a BTEC National Certificate or Extended Certificate. Learners who then decide to continue with a fuller vocational programme can transfer to a BTEC National Diploma or Extended Diploma, for example for their second year.

Some learners are sure of the sector they want to work in and are aiming for progression into that sector via higher education. These learners should be directed to the two-year BTEC National Extended Diploma as the most suitable qualification.

As a centre, you may want to teach learners who are taking different qualifications together. You may also wish to transfer learners between programmes to meet changes in their progression needs. You should check the qualification structures and unit combinations carefully as there is no exact match among the different sizes. You may find that learners need to complete more than the minimum number of units when transferring.

When learners are recruited, you need to give them accurate information on the title and focus of the qualification for which they are studying.

Is there a learner entry requirement?

As a centre it is your responsibility to ensure that learners who are recruited have a reasonable expectation of success on the programme. There are no formal entry requirements but we expect learners to have qualifications at or equivalent to Level 2.

Learners are most likely to succeed if they have:

- five GCSEs at good grades and/or
- BTEC qualification(s) at Level 2
- achievement in English and mathematics through GCSE or Functional Skills.

Learners may demonstrate ability to succeed in various ways. For example, learners may have relevant work experience or specific aptitude shown through diagnostic tests or non-educational experience.

What is involved in becoming an approved centre?

All centres must be approved before they can offer these qualifications – so that they are ready to assess learners and so that we can provide the support that is needed. Further information is given in *Section 8*.

What level of sector knowledge is needed to teach these qualifications?

We do not set any requirements for teachers but recommend that centres assess the overall skills and knowledge of the teaching team to ensure that they are relevant and up to date. This will give learners a rich programme to prepare them for employment in the sector.

What resources are required to deliver these qualifications?

As part of your centre approval you will need to show that the necessary material resources and work spaces are available to deliver BTEC Nationals. For some units, specific resources are required. This is indicated in the units.

How can myBTEC help with planning for these qualifications?

myBTEC is an online toolkit that supports the delivery, assessment and quality assurance of BTECs in centres. It supports teachers with activities, such as choosing a valid combination of units, creating assignment briefs and creating assessment plans. For further information see *Section 10*.

Which modes of delivery can be used for these qualifications?

You are free to deliver BTEC Nationals using any form of delivery that meets the needs of your learners. We recommend making use of a wide variety of modes, including direct instruction in classrooms or work environments, investigative and practical work, group and peer work, private study and e-learning.

What are the recommendations for employer involvement?

BTEC Nationals are vocational qualifications and, as an approved centre, you are encouraged to work with employers on the design, delivery and assessment of the course to ensure that learners have a programme of study that is engaging and relevant and that equips them for progression. There are suggestions in many of the units about how employers could become involved in delivery and/or assessment but these are not intended to be exhaustive and there will be other possibilities at local level.

What support is available?

We provide a wealth of support materials, including curriculum plans, delivery guides, authorised assignment briefs, additional papers for external assessments and examples of marked learner work.

You will be allocated a Standards Verifier early on in the planning stage to support you with planning your assessments. There will be extensive training programmes as well as support from our Subject Advisor team.

For further details see *Section 10*.

How will my learners become more employable through these qualifications?

All BTEC Nationals are mapped to relevant occupational standards (see *Appendix 1*).

Employability skills, such as team working and entrepreneurialism, and practical hands-on skills have been built into the design of the learning aims and content. This gives you the opportunity to use relevant contexts, scenarios and materials to enable learners to develop a portfolio of evidence that demonstrates the breadth of their skills and knowledge in a way that equips them for employment.

5 Assessment structure and external assessment

Introduction

BTEC Nationals are assessed using a combination of *internal assessments*, which are set and marked by teachers, and *external assessments* which are set and marked by Pearson:

- mandatory units have a combination of internal and external assessments
- all optional units are internally assessed.

We have taken great care to ensure that the assessment method chosen is appropriate to the content of the unit and in line with requirements from employers and higher education.

In developing an overall plan for delivery and assessment for the programme, you will need to consider the order in which you deliver units, whether delivery is over short or long periods and when assessment can take place. Some units are defined as synoptic units (see *Section 2*). Normally, a synoptic assessment is one that a learner would take later in a programme and in which they will be expected to apply learning from a range of units. Synoptic units may be internally or externally assessed. Where a unit is externally assessed you should refer to the sample assessment materials (SAMs) to identify where there is an expectation that learners draw on their wider learning. For internally-assessed units, you must plan the assignments so that learners can demonstrate learning from across their programme. A unit may be synoptic in one qualification and not another because of the relationship it has to the rest of the qualification.

We have addressed the need to ensure that the time allocated to final assessment of internal and external units is reasonable so that there is sufficient time for teaching and learning, formative assessment and development of transferable skills.

In administering internal and external assessment, the centre needs to be aware of the specific procedures and policies that apply, for example to registration, entries and results. An overview with signposting to relevant documents is given in *Section 7*.

Internal assessment

Our approach to internal assessment for these qualifications will be broadly familiar to experienced centres. It offers flexibility in how and when you assess learners, provided that you meet assessment and quality assurance requirements. You will need to take account of the requirements of the unit format, which we explain in *Section 3*, and the requirements for delivering assessment given in *Section 6*.

External assessment

A summary of the external assessment for this qualification is given in *Section 2*. You should check this information carefully, together with the unit specification and the sample assessment materials, so that you can timetable learning and assessment periods appropriately.

Learners must be prepared for external assessment by the time they undertake it. In preparing learners for assessment you will want to take account of required learning time, the relationship with other external assessments and opportunities for retaking. You should ensure that learners are not entered for unreasonable amounts of external assessment in one session. Learners may resit an external assessment to obtain a higher grade of near pass or above. If a learner has more than one attempt, then the best result will be used for qualification grading, up to the permitted maximum. It is unlikely that learners will need to or benefit from taking all assessments twice so you are advised to plan appropriately. Some assessments are synoptic and learners are likely to perform best if these assessments are taken towards the end of the programme.

Key features of external assessment in applied science

In applied science, after consultation with stakeholders, we have developed the following:

- *Unit 1: Principles and Applications of Science I*, an exam-based assessment, in which learners will be asked to respond to a range of different question types, including multiple-choice, calculations, short-answer, and extended open-response questions demonstrating their knowledge and understanding of key areas of science. This assessment covers the core principles across the three science disciplines. Learners will also make judgements and reach conclusions by evaluating scientific information and making connections between different scientific concepts, procedures and processes.

Units

The externally-assessed units have a specific format which we explain in *Section 3*. The content of units will be sampled across external assessments over time through appropriate papers and tasks. The ways in which learners are assessed are shown through the assessment outcomes and grading descriptors. External assessments are marked and awarded using the grade descriptors. The grades available are Distinction (D), Merit (M), Pass (P) and Near Pass (N). The Near Pass (N) grade gives learners credit below a Pass, where they have demonstrated evidence of positive performance which is worth more than an unclassified result but not yet at the Pass standard.

Sample assessment materials

Each externally-assessed unit has a set of sample assessment materials (SAMs) that accompanies this specification. The SAMs are there to give you an example of what the external assessment will look like in terms of the feel and level of demand of the assessment. In the case of units containing synoptic assessment, the SAMs will also show where learners are expected to select and apply from across the programme.

The SAMs show the range of possible question types that may appear in the actual assessments and give you a good indication of how the assessments will be structured. While SAMs can be used for practice with learners, as with any assessment the content covered and specific details of the questions asked will change in each assessment.

A copy of each of these assessments can be downloaded from our website. An additional sample of each of the Pearson-set units will be available before the first sitting of the assessment to allow your learners further opportunities for practice.

6 Internal assessment

This section gives an overview of the key features of internal assessment and how you, as an approved centre, can offer it effectively. The full requirements and operational information are given in the *Pearson Quality Assurance Handbook*. All members of the assessment team need to refer to this document.

For BTEC Nationals it is important that you can meet the expectations of stakeholders and the needs of learners by providing a programme that is practical and applied. Centres can tailor programmes to meet local needs and use links with local employers and the wider vocational sector.

When internal assessment is operated effectively it is challenging, engaging, practical and up to date. It must also be fair to all learners and meet national standards.

Principles of internal assessment

Assessment through assignments

For internally-assessed units, the format of assessment is an assignment taken after the content of the unit, or part of the unit if several assignments are used, has been delivered. An assignment may take a variety of forms, including practical and written types. An assignment is a distinct activity completed independently by learners that is separate from teaching, practice, exploration and other activities that learners complete with direction from, and formative assessment by, teachers.

An assignment is issued to learners as an assignment brief with a defined start date, a completion date and clear requirements for the evidence that they need to provide. There may be specific observed practical components during the assignment period. Assignments can be divided into tasks and may require several forms of evidence. A valid assignment will enable a clear and formal assessment outcome based on the assessment criteria.

Assessment decisions through applying unit-based criteria

Assessment decisions for BTEC Nationals are based on the specific criteria given in each unit and set at each grade level. To ensure that standards are consistent in the qualification and across the suite as a whole, the criteria for each unit have been defined according to a framework. The way in which individual units are written provides a balance of assessment of understanding, practical skills and vocational attributes appropriate to the purpose of qualifications.

The assessment criteria for a unit are hierarchical and holistic. For example, if an M criterion requires the learner to show 'analysis' and the related P criterion requires the learner to 'explain', then to satisfy the M criterion a learner will need to cover both 'explain' and 'analyse'. The unit assessment grid shows the relationships among the criteria so that assessors can apply all the criteria to the learner's evidence at the same time. In *Appendix 2* we have set out a definition of terms that assessors need to understand.

Assessors must show how they have reached their decisions using the criteria in the assessment records. When a learner has completed all the assessment for a unit then the assessment team will give a grade for the unit. This is given simply according to the highest level for which the learner is judged to have met all the criteria. Therefore:

- to achieve a Distinction, a learner must have satisfied all the Distinction criteria (and therefore the Pass and Merit criteria); these define outstanding performance across the unit as a whole
- to achieve a Merit, a learner must have satisfied all the Merit criteria (and therefore the Pass criteria) through high performance in each learning aim
- to achieve a Pass, a learner must have satisfied all the Pass criteria for the learning aims, showing coverage of the unit content and therefore attainment at Level 3 of the national framework.

The award of a Pass is a defined level of performance and cannot be given solely on the basis of a learner completing assignments. Learners who do not satisfy the Pass criteria should be reported as Unclassified.

The assessment team

It is important that there is an effective team for internal assessment. There are three key roles involved in implementing assessment processes in your centre, each with different interrelated responsibilities, the roles are listed below. Full information is given in the *Pearson Quality Assurance Handbook*.

- The Lead Internal Verifier (the Lead IV) has overall responsibility for the programme, its assessment and internal verification to meet our requirements, record keeping and liaison with the Standards Verifier. The Lead IV registers with Pearson annually. The Lead IV acts as an assessor, supports the rest of the assessment team, makes sure that they have the information they need about our assessment requirements and organises training, making use of our guidance and support materials.
- Internal Verifiers (IVs) oversee all assessment activity in consultation with the Lead IV. They check that assignments and assessment decisions are valid and that they meet our requirements. IVs will be standardised by working with the Lead IV. Normally, IVs are also assessors but they do not verify their own assessments.
- Assessors set or use assignments to assess learners to national standards. Before taking any assessment decisions, assessors participate in standardisation activities led by the Lead IV. They work with the Lead IV and IVs to ensure that the assessment is planned and carried out in line with our requirements.

Effective organisation

Internal assessment needs to be well organised so that the progress of learners can be tracked and so that we can monitor that assessment is being carried out in line with national standards. We support you through, for example, providing training materials and sample documentation. Our online myBTEC service can help support you in planning and record keeping. Further information on using myBTEC can be found in *Section 10* and on our website.

It is particularly important that you manage the overall assignment programme and deadlines to make sure that learners are able to complete assignments on time.

Learner preparation

To ensure that you provide effective assessment for your learners, you need to make sure that they understand their responsibilities for assessment and the centre's arrangements.

From induction onwards, you will want to ensure that learners are motivated to work consistently and independently to achieve the requirements of the qualifications. Learners need to understand how assignments are used, the importance of meeting assignment deadlines, and that all the work submitted for assessment must be their own.

You will need to give learners a guide that explains how assignments are used for assessment, how assignments relate to the teaching programme, and how learners should use and reference source materials, including what would constitute plagiarism. The guide should also set out your approach to operating assessment, such as how learners must submit work and request extensions.

Setting effective assignments

Setting the number and structure of assignments

In setting your assignments, you need to work with the structure of assignments shown in the *Essential information for assignments* section of a unit. This shows the structure of the learning aims and criteria that you must follow and the recommended number of assignments that you should use. For some units we provide authorised assignment briefs, for all the units we give you suggestions on how to create suitable assignments. You can find these materials along with this specification on our website. In designing your own assignment briefs you should bear in mind the following points.

- The number of assignments for a unit must not exceed the number shown in *Essential information for assignments*. However, you may choose to combine assignments, for example to create a single assignment for the whole unit.
- You may also choose to combine all or parts of different units into single assignments, provided that all units and all their associated learning aims are fully addressed in the programme overall. If you choose to take this approach, you need to make sure that learners are fully prepared so that they can provide all the required evidence for assessment and that you are able to track achievement in the records.
- A learning aim must always be assessed as a whole and must not be split into two or more tasks.
- The assignment must be targeted to the learning aims but the learning aims and their associated criteria are not tasks in themselves. Criteria are expressed in terms of the outcome shown in the evidence.
- You do not have to follow the order of the learning aims of a unit in setting assignments but later learning aims often require learners to apply the content of earlier learning aims and they may require learners to draw their learning together.
- Assignments must be structured to allow learners to demonstrate the full range of achievement at all grade levels. Learners need to be treated fairly by being given the opportunity to achieve a higher grade if they have the ability.
- As assignments provide a final assessment, they will draw on the specified range of teaching content for the learning aims. The specified content is compulsory. The evidence for assessment need not cover every aspect of the teaching content as learners will normally be given particular examples, case studies or contexts in their assignments. For example, if a learner is carrying out one practical performance, or an investigation of one organisation, then they will address all the relevant range of content that applies in that instance.

Providing an assignment brief

A good assignment brief is one that, through providing challenging and realistic tasks, motivates learners to provide appropriate evidence of what they have learned.

An assignment brief should have:

- a vocational scenario, this could be a simple situation or a full, detailed set of vocational requirements that motivates the learner to apply their learning through the assignment
- clear instructions to the learner about what they are required to do, normally set out through a series of tasks
- an audience or purpose for which the evidence is being provided
- an explanation of how the assignment relates to the unit(s) being assessed.

Forms of evidence

BTEC Nationals have always allowed for a variety of forms of evidence to be used, provided that they are suited to the type of learning aim being assessed. For many units, the practical demonstration of skills is necessary and for others, learners will need to carry out their own research and analysis. The units give you information on what would be suitable forms of evidence to provide learners with the opportunity to apply a range of employability or transferable skills. Centres may choose to use different suitable forms for evidence to those proposed. Overall, learners should be assessed using varied forms of evidence.

Full definitions of types of assessment are given in *Appendix 2*. These are some of the main types of assessment:

- written reports
- projects
- time-constrained practical assessments with observation records and supporting evidence
- recordings of performance
- sketchbooks, working logbooks, reflective journals
- presentations with assessor questioning.

The form(s) of evidence selected must:

- allow the learner to provide all the evidence required for the learning aim(s) and the associated assessment criteria at all grade levels
- allow the learner to produce evidence that is their own independent work
- allow a verifier to independently reassess the learner to check the assessor's decisions.

For example, when you are using performance evidence, you need to think about how supporting evidence can be captured through recordings, photographs or task sheets.

Centres need to take particular care that learners are enabled to produce independent work.

For example, if learners are asked to use real examples, then best practice would be to encourage them to use their own or to give the group a number of examples that can be used in varied combinations.

Making valid assessment decisions

Authenticity of learner work

Once an assessment has begun, learners must not be given feedback on progress towards fulfilling the targeted criteria.

An assessor must assess only learner work that is authentic, i.e. learners' own independent work. Learners must authenticate the evidence that they provide for assessment through signing a declaration stating that it is their own work.

Assessors must ensure that evidence is authentic to a learner through setting valid assignments and supervising them during the assessment period. Assessors must take care not to provide direct input, instructions or specific feedback that may compromise authenticity.

Assessors must complete a declaration that:

- 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.

Centres can use Pearson templates or their own templates to document authentication.

During assessment, an assessor may suspect that some or all of the evidence from a learner is not authentic. The assessor must then take appropriate action using the centre's policies for malpractice. Further information is given in *Section 7*.

Making assessment decisions using criteria

Assessors make judgements using the criteria. The evidence from a learner can be judged using all the relevant criteria at the same time. The assessor needs to make a judgement against each criterion that evidence is present and sufficiently comprehensive. For example, the inclusion of a concluding section may be insufficient to satisfy a criterion requiring 'evaluation'.

Assessors should use the following information and support in reaching assessment decisions:

- the *Essential information for assessment decisions* section in each unit gives examples and definitions related to terms used in the criteria
- the explanation of key terms in *Appendix 2*
- examples of assessed work provided by Pearson
- your Lead IV and assessment team's collective experience, supported by the standardisation materials we provide.

Pass and Merit criteria relate to individual learning aims. The Distinction criteria as a whole relate to outstanding performance across the unit. Therefore, criteria may relate to more than one learning aim (for example A.D1) or to several learning aims (for example DE.D3). Distinction criteria make sure that learners have shown that they can perform consistently at an outstanding level across the unit and/or that they are able to draw learning together across learning aims.

Dealing with late completion of assignments

Learners must have a clear understanding of the centre policy on completing assignments by the deadlines that you give them. Learners may be given authorised extensions for legitimate reasons, such as illness at the time of submission, in line with your centre policies.

For assessment to be fair, it is important that learners are all assessed in the same way and that some learners are not advantaged by having additional time or the opportunity to learn from others. Therefore, learners who do not complete assignments by your planned deadline or the authorised extension deadline may not have the opportunity to subsequently resubmit.

If you accept a late completion by a learner, then the assignment should be assessed normally when it is submitted using the relevant assessment criteria.

Issuing assessment decisions and feedback

Once the assessment team has completed the assessment process for an assignment, the outcome is a formal assessment decision. This is recorded formally and reported to learners.

The information given to the learner:

- must show the formal decision and how it has been reached, indicating how or where criteria have been met
- may show why attainment against criteria has not been demonstrated
- must not provide feedback on how to improve evidence
- must be validated by an IV before it is given to the learner.

Resubmission of improved evidence

An assignment provides the final assessment for the relevant learning aims and is normally a final assessment decision, except where the Lead IV approves one opportunity to resubmit improved evidence based on the completed assignment brief.

The Lead IV has the responsibility to make sure that resubmission is operated fairly. This means:

- checking that a learner can be reasonably expected to perform better through a second submission, for example that the learner has not performed as expected
- making sure that giving a further opportunity can be done in such a way that it does not give an unfair advantage over other learners, for example through the opportunity to take account of feedback given to other learners
- checking that the assessor considers that the learner will be able to provide improved evidence without further guidance and that the original evidence submitted remains valid.

Once an assessment decision has been given to the learner, the resubmission opportunity must have a deadline within 15 working days in the same academic year.

A resubmission opportunity must not be provided where learners:

- have not completed the assignment by the deadline without the centre's agreement
- have submitted work that is not authentic.

Retake of internal assessment

A learner who has not achieved the level of performance required to pass the relevant learning aims after resubmission of an assignment may be offered a single retake opportunity using a new assignment. The retake may only be achieved at a pass.

The Lead Internal Verifier must only authorise a retake of an assignment in exceptional circumstances where they believe it is necessary, appropriate and fair to do so. For further information on offering a retake opportunity, you should refer to the *BTEC Centre Guide to Assessment*. We provide information on writing assignments for retakes on our website (www.btec.co.uk/keydocuments).

Planning and record keeping

For internal processes to be effective, an assessment team needs to be well organised and keep effective records. The centre will also work closely with us so that we can quality assure that national standards are being satisfied. This process gives stakeholders confidence in the assessment approach.

The Lead IV must have an assessment plan, produced as a spreadsheet or using myBTEC. When producing a plan, the assessment team may wish to consider:

- the time required for training and standardisation of the assessment team
- the time available to undertake teaching and carry out assessment, taking account of when learners may complete external assessments and when quality assurance will take place
- the completion dates for different assignments
- who is acting as IV for each assignment and the date by which the assignment needs to be verified
- setting an approach to sampling assessor decisions through internal verification that covers all assignments, assessors and a range of learners
- how to manage the assessment and verification of learners' work so that they can be given formal decisions promptly
- how resubmission opportunities can be scheduled.

The Lead IV will also maintain records of assessment undertaken. The key records are:

- verification of assignment briefs
- learner authentication declarations
- assessor decisions on assignments, with feedback given to learners
- verification of assessment decisions.

Examples of records and further information are given in the *Pearson Quality Assurance Handbook*.

7 Administrative arrangements

Introduction

This section focuses on the administrative requirements for delivering a BTEC qualification. It will be of value to Quality Nominees, Lead IVs, Programme Leaders and Examinations Officers.

Learner registration and entry

Shortly after learners start the programme of learning, you need to make sure that they are registered for the qualification and that appropriate arrangements are made for internal and external assessment. You need to refer to the *Information Manual* for information on making registrations for the qualification and entries for external assessments.

Learners can be formally assessed only for a qualification on which they are registered. If learners' intended qualifications change, for example if a learner decides to choose a different pathway specialism, then the centre must transfer the learner appropriately.

Access to assessment

Both internal and external assessments need to be administered carefully to ensure that all learners are treated fairly, and that results and certification are issued on time to allow learners to progress to chosen progression opportunities.

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 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.

Further information on access arrangements can be found in the Joint Council for Qualifications (JCQ) document *Access Arrangements, Reasonable Adjustments and Special Consideration for General and Vocational Qualifications*.

Administrative arrangements for internal assessment

Records

You are required to retain records of assessment for each learner. Records should include assessments taken, decisions reached and any adjustments or appeals. Further information can be found in the *Information Manual*. We may ask to audit your records so they must be retained as specified.

Reasonable adjustments to assessment

A reasonable adjustment is one that is made before a learner takes an assessment to ensure that they have fair access to demonstrate the requirements of the assessments. You are able to make adjustments to internal assessments to take account of the needs of individual learners. In most cases this can be achieved through a defined time extension or by adjusting the format of evidence. We can advise you if you are uncertain as to whether an adjustment is fair and reasonable. You need to plan for time to make adjustments if necessary.

Further details on how to make adjustments for learners with protected characteristics are given on our website in the document *Supplementary guidance for reasonable adjustment and special consideration in vocational internally-assessed units*.

Special consideration

Special consideration is given after an assessment has taken place for learners who have been affected by adverse circumstances, such as illness. You must operate special consideration in line with our policy (see previous paragraph). You can provide special consideration related to the period of 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.

Appeals against assessment

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 could be a consideration of the evidence by a Lead IV 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. Learners have a final right of appeal to Pearson but only if the procedures that you have put in place have not been followed. Further details are given in the document *Enquiries and appeals about Pearson vocational qualifications and end point assessment policy*.

Administrative arrangements for external assessment

Entries and resits

For information on the timing of assessment and entries, please refer to the annual examinations timetable on our website.

Access arrangements requests

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

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

Access arrangements should always be processed at the time of registration. Learners will then know what type of arrangements are available in place for them.

Granting reasonable adjustments

For external assessment, a reasonable adjustment is one that we agree to make for an individual learner. A reasonable adjustment is defined for the individual learner and informed by the list of available access arrangements.

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

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

Adjustment may be judged unreasonable and not approved if it involves unreasonable costs, timeframes or affects the integrity of the assessment.

Special consideration requests

Special consideration is an adjustment made to a student's mark or grade after an external assessment to reflect temporary injury, illness or other indisposition at the time of the assessment. An adjustment is made only if the impact on the learner is such that it is reasonably likely to have had a material effect on that learner being able to demonstrate attainment in the assessment.

Centres are required to notify us promptly of any learners who they believe have been adversely affected and request that we give special consideration. Further information can be found in the special requirements section on our website.

Conducting external assessments

Centres must make arrangements for the secure delivery of external assessments. External assessments for BTEC qualifications include examinations, set tasks and performance.

Each external assessment has a defined degree of control under which it must take place. Some external assessments may have more than one part and each part may have a different degree of control. We define degrees of control as follows.

High control

This is the completion of assessment in formal invigilated examination conditions.

Medium control

This is completion of assessment, usually over a longer period of time, which may include a period of controlled conditions. The controlled conditions may allow learners to access resources, prepared notes or the internet to help them complete the task.

Low control

These are activities completed without direct supervision. They may include research, preparation of materials and practice. The materials produced by learners under low control will not be directly assessed.

Further information on responsibilities for conducting external assessment is given in the document *Instructions for Conducting External Assessments*, available on our website.

Dealing with malpractice in assessment

Malpractice means acts that undermine the integrity and validity of assessment, the certification of qualifications, and/or that may damage the authority of those responsible for delivering the assessment and certification.

Pearson does not tolerate actions (or attempted actions) of malpractice by learners, centre staff or centres in connection with Pearson qualifications. Pearson may impose penalties and/or sanctions on learners, centre staff or centres where incidents (or attempted incidents) of malpractice have been proven.

Malpractice may arise or be suspected in relation to any unit or type of assessment within the qualification. For further details regarding malpractice and advice on preventing malpractice by learners, please see Pearson's *Centre guidance: Dealing with malpractice and maladministration in vocational qualifications*, available on our website.

The procedures we ask you to adopt vary between units that are internally-assessed and those that are externally assessed.

Internally-assessed units

Centres are required to take steps to prevent malpractice and to investigate instances of suspected malpractice. Learners must be given information that explains what malpractice is for internal assessment and how suspected incidents will be dealt with by the centre. The *Centre Guidance: Dealing with Malpractice* document gives full information on the actions we expect you to take.

Pearson may conduct investigations if we believe that a centre is failing to conduct internal assessment according to our policies. The above document gives further information, examples and details the penalties and sanctions that may be imposed.

In the interests of learners and centre staff, centres need to respond effectively and openly to all requests relating to an investigation into an incident of suspected malpractice.

Externally-assessed units

External assessment means all aspects of units that are designated as external in this specification, including preparation for tasks and performance. For these assessments centres must follow the JCQ procedures set out in the latest version of *JCQ Suspected Malpractice in Examinations and Assessments Policies and Procedures* (www.jcq.org.uk).

In the interests of learners and centre staff, centres need to respond effectively and openly to all requests relating to an investigation into an incident of suspected 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* 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)* 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.

Heads of centres/Principals/Chief Executive Officers or their nominees are required to inform learners and centre staff suspected of malpractice of their responsibilities and rights; see Section 6.15 of the *JCQ Suspected Malpractice in Examinations and Assessments Policies and Procedures* document.

Pearson reserves the right in cases of suspected malpractice to withhold the issuing of results and/or certificates while an investigation is in progress. Depending on the outcome of the investigation results and/or certificates may be released or withheld.

We reserve the right to withhold certification when undertaking investigations, audits and quality assurances processes. You will be notified within a reasonable period of time if this occurs.

Sanctions and appeals

Where malpractice is proven we may impose sanctions or penalties.

Where learner malpractice is evidenced, penalties may be imposed such as:

- mark reduction for external assessments
- disqualification from the qualification
- being barred from registration for Pearson qualifications for a period of time.

If we are concerned about your centre's quality procedures we may impose sanctions such as:

- working with you to create an improvement action plan
- requiring staff members to receive further training
- placing temporary blocks on your certificates
- placing temporary blocks on registration of learners
- debarring staff members or the centre from delivering Pearson qualifications
- suspending or withdrawing centre approval status.

The centre will be notified if any of these apply.

Pearson has established procedures for centres that are considering appeals against penalties and sanctions arising from malpractice. Appeals against a decision made by Pearson will normally be accepted only from Heads of Centres (on behalf of learners and/or members of staff) and from individual members (in respect of a decision taken against them personally). Further information on appeals can be found in our *Enquiries and appeals about Pearson vocational qualifications and end point assessment policy*, which is on our website. In the initial stage of any aspect of malpractice, please notify the Investigations Team by email via pqsmalpractice@pearson.com who will inform you of the next steps.

Certification and results

Once a learner has completed all the required components for a qualification, even if final results for external assessments have not been issued, then the centre can claim certification for the learner, provided that quality assurance has been successfully completed. For the relevant procedures please refer to our *Information Manual*. You can use the information provided on qualification grading to check overall qualification grades.

Results issue

After the external assessment session, learner results will be issued to centres. The result will be in the form of a grade. You should be prepared to discuss performance with learners, making use of the information we provide and post-results services.

Post-assessment services

Once results for external assessments are issued, you may find that the learner has failed to achieve the qualification or to attain an anticipated grade. It is possible to transfer or reopen registration in some circumstances. The *Information Manual* gives further information.

Changes to qualification requests

Where a learner who has taken a qualification wants to resit an externally-assessed unit to improve their qualification grade, you firstly need to decline their overall qualification grade. You may decline the grade before the certificate is issued. For a learner receiving their results in August, you should decline the grade by the end of September if the learner intends to resit an external assessment.

Additional documents to support centre administration

As an approved centre you must ensure that all staff delivering, assessing and administering the qualifications have access to this documentation. These documents are reviewed annually and are reissued if updates are required.

- *Pearson Quality Assurance Handbook*: this sets out how we will carry out quality assurance of standards and how you need to work with us to achieve successful outcomes.
- *Information Manual*: this gives procedures for registering learners for qualifications, transferring registrations, entering for external assessments and claiming certificates.
- *Lead Examiners' Reports*: these are produced after each series for each external assessment and give feedback on the overall performance of learners in response to tasks or questions set.
- *Instructions for Conducting External Assessments (ICEA)*: this explains our requirements for the effective administration of external assessments, such as invigilation and submission of materials.
- *Regulatory policies*: our regulatory policies are integral to our approach and explain how we meet internal and regulatory requirements. We review the regulated policies annually to ensure that they remain fit for purpose. Policies related to this qualification include:
 - adjustments for candidates with disabilities and learning difficulties, access arrangements and reasonable adjustments for general and vocational qualifications
 - age of learners
 - centre guidance for dealing with malpractice
 - recognition of prior learning and process.

This list is not exhaustive and a full list of our regulatory policies can be found on our website.

8 Quality assurance

Centre and qualification approval

As part of the approval process, your centre must make sure that the resource requirements listed 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 in place appropriate health and safety policies relating to the use of equipment by learners.
- Centres must deliver the qualification in accordance with current equality legislation.
- Centres should refer to the teacher guidance section in individual units to check for any specific resources required.

Continuing quality assurance and standards verification

On an annual basis, we produce the *Pearson Quality Assurance Handbook*. It contains detailed guidance on 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 Level 3 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 delivering and quality assuring its BTEC programmes, for example making sure that synoptic units are placed appropriately in the order of delivery of the programme.

Centres that do not fully address and maintain rigorous approaches to delivering, assessing and quality assurance cannot seek certification for individual programmes or for all BTEC Level 3 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 comply with remedial action plans may have their approval to deliver qualifications removed.

9 Understanding the qualification grade

Awarding and reporting for the qualification

This section explains the rules that we apply in awarding a qualification and in providing an overall qualification grade for each learner. It shows how all the qualifications in this sector are graded.

The awarding and certification of these qualifications will comply with regulatory requirements.

Eligibility for an award

In order to be awarded a qualification, a learner must complete all units, achieve a Near Pass (N) or above in all external units and a pass or above in all mandatory units unless otherwise specified. Refer to the structure in *Section 2*.

To achieve any qualification grade, learners must:

- complete and **have an outcome** (D, M, P, N or U) for all units within a valid combination
- achieve the **required units at Pass or above** shown in *Section 2*, and for the Extended Diploma achieve a minimum 900 GLH at Pass or above (or N or above in external units)
- achieve the **minimum number of points** at a grade threshold.

It is the responsibility of a centre to ensure that a correct unit combination is adhered to. Learners who do not achieve the required minimum grade (N or P) in units shown in the structure will not achieve a qualification.

Learners who do not achieve sufficient points for a qualification or who do not achieve all the required units may be eligible to achieve a smaller qualification in the same suite provided they have completed and achieved the correct combination of units and met the appropriate qualification grade points threshold.

Calculation of the qualification grade

The final grade awarded for a qualification represents an aggregation of a learner's performance across the qualification. As the qualification grade is an aggregate of the total performance, there is some element of compensation in that a higher performance in some units may be balanced by a lower outcome in others.

In the event that a learner achieves more than the required number of optional units, the mandatory units along with the optional units with the highest grades will be used to calculate the overall result, subject to the eligibility requirements for that particular qualification title.

BTEC Nationals are Level 3 qualifications and are awarded at the grade ranges shown in the table below.

| Qualification | Available grade range |
|---|-----------------------|
| Certificate, Extended Certificate, Foundation Diploma | P to D* |
| Diploma | PP to D*D* |
| Extended Diploma | PPP to D*D*D* |

The *Calculation of qualification grade* table, shown further on in this section, shows the minimum thresholds for calculating these grades. The table will be kept under review over the lifetime of the qualification. In the event of any change, centres will be informed before the start of teaching for the relevant cohort and an updated table will be issued on our website.

Learners who do not meet the minimum requirements for a qualification grade to be awarded will be recorded as Unclassified (U) and will not be certificated. They may receive a Notification of Performance for individual units. The *Information Manual* gives full information.

Points available for internal units

The table below shows the number of **points** available for internal units. For each internal unit, points are allocated depending on the grade awarded.

| | Unit size | |
|-------------|-----------|--------|
| | 60 GLH | 90 GLH |
| U | 0 | 0 |
| Pass | 6 | 9 |
| Merit | 10 | 15 |
| Distinction | 16 | 24 |

Points available for external units

Raw marks from the external units will be awarded **points** based on performance in the assessment. The table below shows the **minimum number of points** available for each grade in the external units.

| | Unit size | |
|-------------|-----------|---------|
| | 90 GLH | 120 GLH |
| U | 0 | 0 |
| Near Pass | 6 | 8 |
| Pass | 9 | 12 |
| Merit | 15 | 20 |
| Distinction | 24 | 32 |

Pearson will automatically calculate the points for each external unit once the external assessment has been marked and grade boundaries have been set. For more details about how we set grade boundaries in the external assessment please go to our website.

Claiming the qualification grade

Subject to eligibility, Pearson will automatically calculate the qualification grade for your learners when the internal unit grades are submitted and the qualification claim is made. Learners will be awarded qualification grades for achieving the sufficient number of points within the ranges shown in the relevant *Calculation of qualification grade* table for the cohort.

Calculation of qualification grade

Applicable for registration from 1 September 2016.

| Certificate | | Extended Certificate | | Foundation Diploma | | Diploma | | Extended Diploma | |
|--------------|------------------|----------------------|------------------|--------------------|------------------|---------|------------------|------------------|------------------|
| 180 GLH | | 360 GLH | | 510 GLH | | 720 GLH | | 1080 GLH | |
| Grade | Points threshold | Grade | Points threshold | Grade | Points threshold | Grade | Points threshold | Grade | Points threshold |
| U | 0 | U | 0 | U | 0 | U | 0 | U | 0 |
| Pass | 18 | P | 36 | P | 51 | PP | 72 | PPP | 108 |
| | | | | | | MP | 88 | MPP | 124 |
| | | | | | | | | MMP | 140 |
| Merit | 26 | M | 52 | M | 73 | MM | 104 | MMM | 156 |
| | | | | | | DM | 124 | DMM | 176 |
| | | | | | | | | DDM | 196 |
| Distinction | 42 | D | 74 | D | 104 | DD | 144 | DDD | 216 |
| | | | | | | D*D | 162 | D*DD | 234 |
| | | | | | | | | D*D*D | 252 |
| Distinction* | 48 | D* | 90 | D* | 130 | D*D* | 180 | D*D*D* | 270 |

The table is subject to review over the lifetime of the qualification. The most up-to-date version will be issued on our website.

Examples of grade calculations based on table applicable to registrations from September 2016

Example 1: Achievement of a Certificate with a P grade

| | GLH | Type (Int/Ext) | Grade | Unit points |
|---------------|------------|----------------|----------|-------------|
| Unit 1 | 90 | Ext | Pass | 9 |
| Unit 2 | 90 | Int | Merit | 15 |
| Totals | 180 | | P | 24 |

The learner has sufficient points for a P grade

Example 2: Achievement of a Certificate with a M grade

| | GLH | Type (Int/Ext) | Grade | Unit points |
|---------------|------------|----------------|-------------|-------------|
| Unit 1 | 90 | Ext | Near Pass | 6 |
| Unit 2 | 90 | Int | Distinction | 24 |
| Totals | 180 | | M | 30 |

The learner has sufficient points for a M grade

Example 3: An Unclassified result for a Certificate

| | GLH | Type (Int/Ext) | Grade | Unit points |
|---------------|------------|----------------|-------------|-------------|
| Unit 1 | 90 | Ext | U | 0 |
| Unit 2 | 90 | Int | Distinction | 24 |
| Totals | 180 | | U | 24 |

The learner has a U in Unit 1.

The learner has sufficient points for a P grade but has not met the minimum requirement for a Near Pass or above in Unit 1 and a Pass or above in Unit 2.

10 Resources and support

Our aim is to give you a wealth of resources and support to enable you to deliver BTEC National qualifications with confidence. On our website you will find a list of resources to support teaching and learning, and professional development.

Support for setting up your course and preparing to teach

Specification

This **specification** (for teaching from September 2016) includes details on the administration of qualifications and information on all the units for the qualification.

Delivery Guide

This free guide gives you important advice on how to choose the right course for your learners and how to ensure you are fully prepared to deliver the course. It explains the key features of BTEC Nationals (for example employer involvement and employability skills). It also covers guidance on assessment (internal and external) and quality assurance. The guide tells you where you can find further support and gives detailed unit-by-unit delivery guidance. It includes teaching tips and ideas, assessment preparation and suggestions for further resources.

Schemes of work

Free sample schemes of work are provided for each mandatory unit. These are available in Word™ format for ease of customisation.

Curriculum models

These show how the BTECs in the suite fit into a 16–19 study programme, depending on their size and purpose. The models also show where other parts of the programme, such as work experience, maths and English, tutorial time and wider study, fit alongside the programme.

Study skills activities

A range of case studies and activities is provided; they are designed to help learners develop the study skills they need to successfully complete their BTEC course. The case studies and activities are provided in Word™ format for easy customisation.

myBTEC

myBTEC is a free, online toolkit that lets you plan and manage your BTEC provision from one place. It supports the delivery, assessment and quality assurance of BTECs in centres and supports teachers with the following activities:

- checking that a programme is using a valid combination of units
- creating and verifying assignment briefs (including access to a bank of authorised assignment briefs that can be customised)
- creating assessment plans and recording assessment decisions
- tracking the progress of every learner throughout their programme.

To find out more about myBTEC, visit the myBTEC page on the support services section of our website. We will add the new BTEC National specifications to myBTEC as soon possible.

Support for teaching and learning

Pearson Learning Services provides a range of engaging resources to support BTEC Nationals, including:

- textbooks in e-book and print formats
- revision guides and revision workbooks in e-book and print formats
- teaching and assessment packs, including e-learning materials via the Active Learn Digital Service.

Teaching and learning resources are also available from a number of other publishers. Details of Pearson's own resources and of all endorsed resources can be found on our website.

Support for assessment

Sample assessment materials for externally-assessed units

Sample assessments are available for the Pearson-set units. One copy of each of these assessments can be downloaded from the website/available in print. For each suite an additional sample for one of the Pearson-set units is also available, allowing your learners further opportunities for practice.

Further sample assessments will be made available through our website on an ongoing basis.

Sample assessment materials for internally-assessed units

We do not prescribe the assessments for the internally-assessed units. Rather, we allow you to set your own, according to your learners' preferences and to link with your local employment profile.

We do provide a service in the form of Authorised Assignment Briefs, which are approved by Pearson Standards Verifiers. They are available via our website or free on myBTEC.

Sample marked learner work

To support you in understanding the expectation of the standard at each grade, examples of marked learner work at PM/MD grades are linked to the Authorised Assignment Briefs.

Training and support from Pearson

People to talk to

There are many people who are available to support you and provide advice and guidance on delivery of your BTEC Nationals. These include:

- Subject Advisors – available for all sectors. They understand all Pearson qualifications in their sector and so can answer sector-specific queries on planning, teaching, learning and assessment
- Standards Verifiers – they can support you with preparing your assignments, ensuring that your assessment plan is set up correctly, and support you in preparing learner work and providing quality assurance through sampling
- Curriculum Development Managers (CDMs) – they are regionally based and have a full overview of the BTEC qualifications and of the support and resources that Pearson provides. CDMs often run network events
- Customer Services – the ‘Support for You’ section of our website gives the different ways in which you can contact us for general queries. For specific queries, our service operators can direct you to the relevant person or department.

Training and professional development

Pearson provides a range of training and professional development events to support the introduction, delivery, assessment and administration of BTEC National qualifications. These sector-specific events, developed and delivered by specialists, are available both face to face and online.

‘Getting Ready to Teach’

These events are designed to get teachers ready for delivery of the BTEC Nationals. They include an overview of the qualifications’ structures, planning and preparation for internal and external assessment, and quality assurance.

Teaching and learning

Beyond the ‘Getting Ready to Teach’ professional development events, there are opportunities for teachers to attend sector- and role-specific events. These events are designed to connect practice to theory; they provide teacher support and networking opportunities with delivery, learning and assessment methodology.

Details of our training and professional development programme can be found on our website.

Appendix 1 Links to industry standards

BTEC Nationals have been developed in consultation with industry and appropriate sector bodies to ensure that the qualification content and approach to assessment aligns closely to the needs of employers. Where they exist, and are appropriate, National Occupational Standards (NOS) and professional body standards have been used to establish unit content.

In the applied science sector, the following approach has been used:

- Use of Registered Science Technician competencies in the assessment criteria and guidance in units.

Appendix 2 Glossary of terms used for internally-assessed units

This is a summary of the key terms used to define the requirements in the units.

| Term | Definition |
|----------------------------|--|
| Examine | Knowledge with application where learners are expected to select and apply knowledge to less familiar contexts. |
| Explore | Skills and/or knowledge involving practical testing or trialling. |
| Review | Process for learning (knowledge or skills). |
| Undertake | Skills, often referring to given processes or techniques. |
| Understand | For defined knowledge in familiar contexts. |
| Analyse | Learners present the outcome of methodical and detailed examination either: <ul style="list-style-type: none"> • breaking down a theme, topic or situation in order to interpret and study the interrelationships between the parts and/or • of information or data to interpret and study key trends and interrelationships. Analysis can be through performance, practice, written or, less commonly, verbal presentation. |
| Apply | Application of skills, knowledge and understanding to or within context/situation. |
| Assess | Learners present a careful consideration of varied factors or events that apply to a specific situation or, to identify those which are the most important or relevant and arrive at a conclusion. |
| Calculate | Learners manipulate quantitative data to help analyse and compare findings. |
| Compare | Learners identify the main factors relating to two or more items/situations or aspects of a subject that is extended to explain the similarities, differences, advantages and disadvantages. This is used to show depth of knowledge through selection and isolation of characteristics. |
| Conduct/use (of)/carry out | Related to use and demonstration of practical equipment/techniques/procedures. |
| Construct | Used with a standard to demonstrate competence in set up of practical equipment. |

| Term | Definition |
|----------------------------|---|
| Describe | <p>Learners' work gives a clear, objective account in their own words showing recall and, in some cases application, of the relevant features and information about a subject.</p> <p>Use of this verb normally requires breadth of content coverage.</p> <p>Evidence will normally be written but could be through presentation or, less frequently, performance or practice.</p> |
| Determine | <p>Learners use quantitative and/or qualitative information to help analyse and compare findings.</p> |
| Discuss | <p>Learners consider different aspects of:</p> <ul style="list-style-type: none"> • a theme or topic; • how they interrelate; and • the extent to which they are important. <p>A conclusion is not required.</p> |
| Evaluate | <p>Learners' work draws on varied information, themes or concepts to consider aspects such as:</p> <ul style="list-style-type: none"> • strengths or weaknesses • advantages or disadvantages • alternative actions • relevance or significance. <p>Learners' inquiries should lead to a supported judgement showing relationship to its context. This will often be in a conclusion.</p> |
| Explain | <p>Learners' work shows clear details and gives reasons and/or evidence to support an opinion, view or argument. It could show how conclusions are drawn (arrived at). Learners are able to show that they comprehend the origins, functions and objectives of a subject, and its suitability for purpose.</p> |
| Illustrate | <p>Learners include examples, images or diagrams to show what is meant in a specific context.</p> |
| Investigate | <p>Knowledge based on personal research and development.</p> |
| Justify | <p>Learners give reasons or evidence to:</p> <ul style="list-style-type: none"> • support an opinion • prove something right or reasonable. |
| Predict (make predictions) | <p>Learners can synthesise predictions using applications of relevant knowledge and understanding in a given context.</p> |
| Prepare | <p>Used with a standard to demonstrate competence in preparation of testing materials, for example organic and inorganic substances/solutions.</p> |

This is a key summary of the types of evidence used for BTEC Nationals.

| Type of evidence | Definition and purpose |
|---------------------|--|
| Case study | A specific example to which all learners must select and apply knowledge. Used to show application to a realistic context where direct experience cannot be gained. |
| Individual project | A self-directed, large-scale activity requiring planning, research, exploration, outcome and review. Used to show self-management, project management and/or deep learning, including synopticity. |
| Development log | A record kept by learners to show the process of development. Used to show method, self-management and skill development. |
| Report writing | A report, consisting of analysis of findings could be through research or primary investigations conducted. |
| Presentation | A visual or audio presentation of findings that demonstrates knowledge and understanding of a concept. |
| Observations sheets | A witness statement related to the format of the evidence, e.g. practicals. |

Pearson BTEC Level 3 Nationals in Applied Science

Certificate in Applied Science

Extended Certificate in Applied Science

Foundation Diploma in Applied Science

Diploma in Applied Science

Extended Diploma in Applied Science

First teaching from September 2016

First certification from 2017

For more information about Edexcel, BTEC or LCCI qualifications
visit qualifications.pearson.com

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