Pearson BTEC Level 4 Higher National Certificate in Applied Chemistry

Pearson BTEC Level 5 Higher National Diploma in Applied Chemistry

Specification

Issue 6

Edexcel, BTEC and LCCI qualifications

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This specification is Issue 6. Due to the replacement of the Qualifications and Credit Framework (QCF) by the Regulated Qualifications Framework (RQF), references to the QCF and to its predecessor, the National Qualifications Framework (NQF) have been removed from this specification. In addition, Pearson has assigned Total Qualification Time (TQT) in hours to this qualification; this is covered in the section entitled '*Programme design and delivery'* of this specification.

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Pearson BTEC Level 4 HNC Diploma in Applied Chemistry

Pearson BTEC Level 5 HND Diploma in Applied Chemistry

The BTEC HNCs (Higher National Certificates) are at level 4 and are a minimum of 120 credits in size. They have been nested within the structures of the BTEC HNDs (Higher National Diplomas).

BTEC HNDs are level 5 qualifications. They are a minimum of 240 credits in size.

The qualifications are Intermediate level qualifications on the Framework for Higher Education Qualifications (FHEQ). Progression to BTEC Higher Nationals continues to be from level 3 qualifications. Progression from BTEC Higher Nationals will normally be to qualifications at level 6. Learners' progression routes do not necessarily involve qualifications at every level.

As a nested qualification the HNC is an embedded component of the HND. However, it can be taken as a stand-alone qualification.

If a learner enrols for an HNC they would be eligible to gain a grade for the HNC. If they then move onto an HND, the learner is graded on their HND performance. The grade for the HND will include units from the previously achieved HNC.

If a learner opts to take an HND from the start, then on successful completion of the HND they will receive one grade for the HND achievement only.

If a learner opts to take an HND from the start but later chooses to revert to an HNC programme, then on successful completion of the HNC they will receive a grade for the HNC achievement only.

BTEC Higher Nationals within the RQF and FHEQ

RQF/FHEQ level	Progression opportunities and examples of qualifications within each level
8	PhD/DPhil Professional doctorates (credit based), e.g. EdD
7	Master's degrees Postgraduate diplomas Postgraduate Certificate in Education (PGCE)
6	Bachelor's degrees, e.g. BA, BSc Professional Graduate Certificate in Education Graduate certificates and diplomas
5	**BTEC HNDs** (Higher National Diplomas) Foundation Degrees, e.g. FdA, FdSc Diplomas of Higher Education (Dip HE)
4	**BTEC HNCs** (Higher National Certificates) Certificates of Higher Education (Cert HE) Level 4 National Vocational Qualifications (NVQs)
3	BTEC Level 3 Extended Diplomas BTEC Level 3 Diplomas BTEC Level 3 Subsidiary Diplomas BTEC Level 3 Certificates GCE Advanced Level Level 3 NVQs Advanced Diplomas

Contents

Qualification titles covered by this specification

Pearson BTEC Level 4 HNC Diploma in Applied Chemistry

Pearson BTEC Level 5 HND Diploma in Applied Chemistry

The Qualification Numbers (QNs) for these qualifications are listed below.

These qualification titles are as they will appear on learners' certificates. Learners need to be made aware of this when they are recruited by the centre and registered with Pearson. Providing this happens, centres are able to describe the programme of study leading to the award of the qualification in different ways to suit the medium and the target audience.

The Quality Assurance Agency for Higher Education (QAA) has produced guidelines for centres in preparing programme specifications (reference *Guidelines for preparing programme specifications*: UK Quality Code for Higher Education, Part A Chapter A3.)

Qualification Numbers

The qualification and unit codes will appear on learners' final certification documentation.

The QNs for the qualifications in this publication are:

500/8244/9	Pearson BTEC Level 4 HNC Diploma in Applied Chemistry
500/8247/4	Pearson BTEC Level 5 HND Diploma in Applied Chemistry.

Introduction

This specification contains the units and associated guidance for the Pearson BTEC Level 4 HNC in Applied Chemistry and the Pearson BTEC Level 5 HND in Applied Chemistry.

Each unit sets out the required learning outcomes, assessment criteria and content and may also include advice regarding essential delivery and assessment strategies.

This document also contains details of the teaching, learning, assessment and quality assurance of these qualifications. It includes advice about our policies regarding access to our qualifications, the design of programmes of study and delivery modes.

Structure of the qualification

BTEC Level 4 HNC Diploma

The Pearson BTEC Level 4 HNC Diploma in Applied Chemistry is a qualification with a minimum of 120 credits of which 75 credits are mandatory core.

The BTEC Level 4 HNC programme must contain a minimum of 65 credits at level 4.

BTEC Level 5 HND Diploma

The Pearson BTEC Level 5 HND Diploma in Applied Chemistry is a qualification with a minimum of 240 credits of which 95 credits are mandatory core.

The BTEC Level 5 HND programme must contain a minimum of 125 credits at level 5 or above.

Rules of combination for BTEC Levels 4 and 5 Higher National qualifications

The rules of combination specify the:

- total credit value of the qualification
- minimum credit to be achieved at the level of the qualification
- mandatory core unit credit
- specialist unit credit
- maximum credit that can be centre devised or imported from other BTEC Higher National qualifications accredited from 2010.

When combining units for a BTEC Higher National qualification it is the centre's responsibility to ensure that the following rules of combination are adhered to:

Pearson BTEC Level 4 HNC Diploma in Applied Chemistry

1 Qualification credit value: a minimum of 120 credits. (A maximum of 55 credits may be at level 5.)

2 Minimum credit to be achieved at the level of the qualification (level 4): 65 credits.

3 Mandatory core unit credit: 75 credits

4 Specialist unit credit: 45 credits

5 A maximum of 30 credits can be centre devised or imported from other BTEC Higher National qualifications accredited from 2010 to meet local needs. Level rules and mandatory core units must not be changed.

6 **Total Qualification Time** Higher National Certificate (HNC) = 1,200 hours

7 **Total Guided Learning (GL)** Higher National Certificate (HNC) = 480 hours

Pearson BTEC Level 5 HND Diploma in Applied Chemistry

1 Qualification credit value: a minimum of 245 credits. (A maximum of 30 credits may be at level 6.)

2 Minimum credit to be achieved at the level of the qualification (level 5) or above: 125 credits.

3 Mandatory core unit credit: 95 credits

4 Specialist unit credit: 150 credits

5 The requirements of the HNC have to be met.

6 A maximum of 60 credits can be centre devised or imported from other BTEC Higher National qualifications accredited from 2010 to meet local needs. Level rules and mandatory core units must not be changed.

7 **Total Qualification Time** Higher National Diploma (HND) = 2,450 hours

8 **Total Guided Learning (GL)** Higher National Diploma (HND) = 980 hours

Structure of the Pearson BTEC Level 4 HNC Diploma in Applied Chemistry

Unit number	Mandatory core units – all five units must be taken	Unit level	Unit credit
1	Inorganic Chemistry	4	15
2	Organic Chemistry	4	15
3	Physical Chemistry	4	15
4	Chemical Laboratory Techniques	4	15
6	Analysis of Scientific Data and Information	4	15
	Specialist units – choose units with a total credit value of 45 credits		
7	Laboratory Management	4	15
8	Work-based Investigation	4	15
9	Inorganic Chemistry of Crystal Structures and Transition Metal Complexes	5	15
10	Organic Chemistry of Aromatic and Carbonyl Compounds	5	15
11	Physical Chemistry of Spectroscopy, Surfaces and Chemical and Phase Equilibria	5	15
12	Analytical Chemistry	5	15
13	Environmental Chemical Analysis	5	15
14	Industrial Chemistry	4	15
15	Biochemistry of Macromolecules and Metabolic Pathways	5	15
16	Polymer Chemistry	5	15
17	Medicinal Chemistry	5	15
18	Atomic and Nuclear Physics for Spectroscopic Applications	4	15
19	Environmental Monitoring and Analysis	5	15
20	Environmental Management and Conservation	5	15
21	Quality Assurance and Quality Control	4	15
22	Management of Projects	4	15
23	Managing the Work of Individuals and Teams	5	15
24	Nuclear Chemistry	5	15
25	Nanotechnology	4	15
26	Materials Science and Technology	4	15

Unit number	Specialist units – choose units with a total credit value of 45 credits *(continued)*	Unit level	Unit credit
27	Statistics for Experimental Design	5	15
28	Work-based Experience	5	15
29	Personal and Professional Development	5	15
30	Employability Skills	5	15

The BTEC Level 4 HNC programme must contain a minimum of 65 credits at level 4.

Structure of the Pearson BTEC Level 5 HND Diploma in Applied Chemistry

Unit number	Mandatory core units — all six units must be taken	Unit level	Unit credit
1	Inorganic Chemistry	4	15
2	Organic Chemistry	4	15
3	Physical Chemistry	4	15
4	Chemical Laboratory Techniques	4	15
5	Project for Applied Science	5	20
6	Analysis of Scientific Data and Information	4	15
	Specialist units — choose units with a total credit value of 150 credits		
7	Laboratory Management	4	15
8	Work-based Investigation	4	15
9	Inorganic Chemistry of Crystal Structures and Transition Metal Complexes	5	15
10	Organic Chemistry of Aromatic and Carbonyl Compounds	5	15
11	Physical Chemistry of Spectroscopy, Surfaces and Chemical and Phase Equilibria	5	15
12	Analytical Chemistry	5	15
13	Environmental Chemical Analysis	5	15
14	Industrial Chemistry	4	15
15	Biochemistry of Macromolecules and Metabolic Pathways	5	15
16	Polymer Chemistry	5	15
17	Medicinal Chemistry	5	15
18	Atomic and Nuclear Physics for Spectroscopic Applications	4	15
19	Environmental Monitoring and Analysis	5	15
20	Environmental Management and Conservation	5	15
21	Quality Assurance and Quality Control	4	15
22	Management of Projects	4	15
23	Managing the Work of Individuals and Teams	5	15
24	Nuclear Chemistry	5	15
25	Nanotechnology	4	15

Unit number	Specialist units — choose units with a total credit value of 150 credits *(continued)*	Unit level	Unit credit
26	Materials Science and Technology	4	15
27	Statistics for Experimental Design	5	15
28	Work-based Experience	5	15
29	Personal and Professional Development	5	15
30	Employability Skills	5	15

The BTEC Level 5 HND programme must contain a minimum of 125 credits at level 5.

Key features

BTEC Higher Nationals are designed to provide a specialist vocational programme, linked to professional body requirements and National Occupational Standards where appropriate.

They offer a strong, sector-related emphasis on practical skills development alongside the development of requisite knowledge and understanding.

The qualifications provide a thorough grounding in the key concepts and practical skills required in their sector and their national recognition by employers allows direct progression to employment.

A key progression path for BTEC HNC and HND learners is to the second or third year of a degree or honours degree programme, depending on the match of the BTEC Higher National units to the degree programme in question.

The Pearson BTEC Higher Nationals in Applied Chemistry provide a progression route to the professional qualifications offered by the Royal Society of chemistry.

Pearson BTEC Higher Nationals in Applied Chemistry have been developed to focus on:

- giving individuals the knowledge, understanding and skills needed to succeed in employment in the chemical and related industries
- enabling progression to an undergraduate degree in applied chemistry or a related area
- providing flexibility, knowledge, skills and motivation as a basis for future studies and career development and an educational foundation for a range of careers in chemical sciences and their related industries
- providing opportunities for learners to focus on the development of the higher-level skills in a scientific and technological context
- providing opportunities for learners to develop a range of skills, techniques and attributes essential for successful performance in working life.

BTEC Higher Nationals in Applied Chemistry offer:

- the education and training of applied chemistry technologists who are employed in a variety of types of technical work, such as: quality control, organic preparations, laboratory analysis, materials testing and research and education
- a standard national, vocationally specific qualification providing links to the National Occupational Standards
- a nationally recognised qualification that will give employers confidence when recruiting holders of the qualification who possess the requisite knowledge, understanding and skills
- a programme of learning that ensures full understanding of the role of the applied chemistry technologist. This includes an understanding of the role at departmental/section level as well as an appreciation of how the role and that of the department/section fits within the overall structure of their organisation and within the scientific and local community.

Progression from the BTEC Level 4 HNC Diploma

The Pearson BTEC Level 4 HNC in Applied Chemistry provides a specialist work-related programme of study that covers the key knowledge, understanding and practical skills required in the Applied Chemistry sector and also offers particular specialist emphasis through the choice of specialist units.

BTEC Level 4 HNCs provide a nationally recognised qualification offering career progression and professional development for those already in employment and opportunities to progress into higher education. The qualifications are primarily undertaken by part-time learners studying over two years. In some sectors there are opportunities for those wishing to complete an intensive programme of study in a shorter period of time.

This specification gives centres a framework to develop engaging programmes for higher education learners who are clear about the area of employment that they wish to enter.

The Pearson BTEC Level 4 HNC in Applied Chemistry offers a progression route for learners who are employed in the applied chemistry and related manufacturing and service science industries.

A key progression path from the BTEC Level 4 HNC is to the second or third year of a degree or honours degree programme, depending on the match of the BTEC Higher National units to the degree programme in question.

The BTEC Level 4 HNC in Applied Chemistry offers a progression route to the professional qualifications offered by the Royal Society of Chemistry.

Progression from the BTEC Level 5 HND Diploma

The BTEC Level 5 HND provides greater breadth and specialisation than the BTEC Level 4 HNC. BTEC HNDs are followed predominately by full-time learners. They allow progression into or within employment in the Applied Chemistry sector, either directly on achievement of the award or following further study to degree level.

The Pearson BTEC Level 5 HND in Applied Chemistry provides opportunities for learners to apply their knowledge and practical skills in the workplace. Full-time learners have the opportunity to do this through formal work placements or part-time employment experience.

The qualification prepares learners for employment in the Applied Chemistry sector and will be suitable for learners who have already decided that they wish to enter this area of work. Some adult learners may wish to make the commitment required by this qualification in order to enter a specialist area of employment in Applied Chemistry or progress into higher education. Other learners may want to extend the specialism that they followed on the BTEC Level 4 HNC programme.

Progression from this qualification may well be into or within employment in the Applied Chemistry sector where learners may work towards membership of the Royal Society of Chemistry.

A key progression path from the BTEC Level 5 HND is to the second or third year of a degree or honours degree programme, depending on the match of the BTEC Higher National units to the degree programme in question.

The BTEC Level 5 HND in Applied Chemistry offers a progression route to the professional qualifications offered by the Royal Society of Chemistry.

Professional body recognition

The Pearson BTEC Higher Nationals in Applied Chemistry have been developed with career progression and professional body recognition in mind. It is essential that learners gain the maximum benefit from their programme of study.

Consequently, we have added value to the qualifications by securing recognition from the Royal Society of Chemistry. Learners studying the BTEC Higher Nationals in Applied Chemistry will be able to apply for Affiliate Membership of the Royal Society of Chemistry and a progression route to NVQ L5 in Analytical Chemistry. Learners possessing a BTEC Higher National in Applied Chemistry and a number of years of post–HNC/D experience in the chemical industry are able to apply for Associate Membership of the Royal Society of Chemistry. Learners seeking membership should contact the Royal Society of Chemistry (email: membership@rsc.org).

National Occupational Standards

BTEC Higher Nationals do not purport to deliver occupational competence in the sector, which should be demonstrated in a work context. There are currently no National Occupational Standards for applied chemistry. However, some units in the Higher Nationals in Applied Chemistry relate to Laboratory and Associated Technical Activities NVQ Level 4 units.

Links to Laboratory and Associated Technical Activities (LATA) NVQ units are indicated in each unit. The qualifications provide underpinning knowledge for the National Occupational Standards, as well as developing practical skills in preparation for work and possible achievement of NVQs in due course. *Annexe B* contains mapping of the Higher National units in this specification against the Laboratory and Associated Technical Activities (LATA) Level 4 NVQs where appropriate.

Qualification Frameworks for Higher National Diplomas

In England, Wales and Northern Ireland, BTEC HNC and HND Diplomas may either be awarded by degree-awarding bodies under a licence from Pearson (which allows them to devise, deliver and award Higher National qualifications themselves), or they may be awarded directly by Pearson, as an awarding body regulated by Ofqual. The majority of BTEC HNC and HND Diplomas are awarded by Pearson. Only those HNC and HND Diplomas that are awarded by degree-awarding bodies are included on the Framework for Higher Education Qualifications (FHEQ) (because this framework comprises qualifications awarded by degree-awarding bodies.) BTEC HNC and HND Diplomas awarded directly by Pearson are qualifications at Level 4 and Level 5 on the Regulated Qualifications Framework and are subject to the academic standards and regulations of Pearson.

Level descriptors have been used to describe the relative intellectual demand, complexity, depth of learning and learner autonomy associated with the level 4 or 5 level of learning and achievement.

QAA subject and qualification benchmark statements have also been used to provide points of reference for each level.

Employers and higher education providers can expect that typical learners studying for the Pearson BTEC Higher Nationals in Applied Chemistry should have developed certain higher level skills and abilities and studied a mandatory curriculum and selected optional specialist units. This detail is contained in the 'Qualification Requirements' in *Annexe A* of this specification.

Teaching, learning and assessment

Learners must achieve a minimum of 120 credits (of which at least 65 must be at level 4) on their programme of learning to be awarded a BTEC Level 4 HNC and a minimum of 240 credits (of which at least 125 must be at level 5 or above) to be awarded a BTEC Level 5 HND.

The assessment of BTEC Higher National qualifications is criterion-referenced and centres are required to assess learners' evidence against published learning outcomes and assessment criteria.

All units will be individually graded as 'pass', 'merit' or 'distinction'. To achieve a pass grade for the unit learners must meet the assessment criteria set out in the specifications. This gives transparency to the assessment process and provides for the establishment of national standards for each qualification.

The units in BTEC Higher National qualifications all have a standard format which is designed to provide guidance on the requirements of the qualification for learners, assessors and those responsible for monitoring national standards.

Unit format

Each unit is set out in the following way.

Unit title, unit code and credit value.

Each unit is assigned a level, indicating the relative intellectual demand, complexity and depth of study, and learner autonomy. All units and qualifications within the RQF have a level assigned to them, which represents the level of achievement. There are nine levels of achievement, from Entry level to level 8. The level of the unit has been informed by the level descriptors and, where appropriate, the National Occupational Standards (NOS) and/or other sector/professional benchmarks.

Each unit in BTEC Higher National qualifications has a credit value which specifies the number of credits that will be awarded to a learner who has achieved all the learning outcomes of the unit. Learners will be awarded credits for the successful completion of whole units.

Aim

The aim provides a clear summary of the purpose of the unit and is a succinct statement that summarises the learning outcomes of the unit.

Unit abstract

The unit abstract gives the reader an appreciation of the unit in the vocational setting of the qualification, as well as highlighting the focus of the unit. It gives the reader a snapshot of the unit and the key knowledge, skills and understanding gained while studying the unit. The unit abstract also highlights any links to the appropriate vocational sector by describing how the unit relates to that sector.

Learning outcomes

The learning outcomes identify what each learner must do in order to pass the unit. Learning outcomes state exactly what a learner should 'know, understand or be able to do' as a result of completing the unit. Learners must achieve all the learning outcomes in order to pass the unit.

Unit content

The unit content identifies the breadth of knowledge, skills and understanding needed to design and deliver a programme of learning to achieve each of the learning outcomes. This is informed by the underpinning knowledge and understanding requirements of relevant National Occupational Standards (NOS) where appropriate.

Each learning outcome is stated in full and then the key phrases or concepts related to that learning outcome are listed in italics followed by the subsequent range of related topics.

The information below shows how unit content is structured and gives the terminology used to explain the different components within the content.

- Learning outcome: this is given in bold at the beginning of each section of content.
- Italicised sub-heading: it contains a key phrase or concept. This is content which must be covered in the delivery of the unit. Colons mark the end of an italicised sub-heading.
- Elements of content: the elements are in roman text and amplify the sub-heading. The elements must also be covered in the delivery of the unit. Semi-colons mark the end of an element.
- Brackets contain amplification of elements of content which must be covered in the delivery of the unit.
- 'e.g.' is a list of examples used for indicative amplification of an element (that is, the content specified in this amplification that could be covered or that could be replaced by other, similar material).

It is not a requirement of the unit specification that all of the content is assessed.

Learning outcomes and assessment criteria

Each unit contains statements of the evidence that each learner should produce in order to receive a pass.

Guidance

This section provides additional guidance and amplification related to the unit to support tutors/deliverers and assessors. Its subsections are given below.

- *Links* – sets out possible links between units within the specification. Provides opportunities for the integration of learning, delivery and assessment. Links to relevant National Occupational Standards and Professional Bodies Standards will be highlighted here.
- *Essential requirements* – essential, unique physical and/or staffing resources or delivery/assessment requirements needed for the delivery of this unit are specified here.
- *Employer engagement and vocational contexts* – this is an optional section. Where relevant it offers suggestions for employer contact to enhance the delivery of the unit.

These subsections should be read in conjunction with the learning outcomes, unit content, assessment criteria and the generic grade descriptors.

The centre will be asked to ensure that essential resources are in place when it seeks approval from Pearson to offer the qualification.

Learning and assessment

The purpose of assessment is to ensure that effective learning has taken place of the content of each unit. Evidence of this learning, or the application of the learning, is required for each unit. The assessment of the evidence relates directly to the assessment criteria for each unit, supported by the generic grade descriptors.

The process of assessment can aid effective learning by seeking and interpreting evidence to decide the stage that learners have reached in their learning, what further learning needs to take place and how best to do this. Therefore, the process of assessment should be part of the effective planning of teaching and learning by providing opportunities for both the learner and assessor to obtain information about progress towards learning goals.

The assessor and learner must be actively engaged in promoting a common understanding of the assessment criteria and the grade descriptors (what it is they are trying to achieve and how well they achieve it) for further learning to take place. Therefore, learners need constructive feedback and guidance about how they may improve by capitalising on their strengths and clear and constructive comments about their weaknesses and how these might be addressed.

Assessment instruments are constructed within centres. They should collectively ensure coverage of all assessment criteria within each unit and should provide opportunities for the evidencing of all the grade descriptors.

It is advised that assessment criteria and contextualised grade descriptors are clearly indicated on each assessment instrument to provide a focus for learners (for transparency and to ensure that feedback is specific to the criteria) and to assist with internal standardisation processes. Tasks/activities should enable learners to produce evidence that relates directly to the assessment criteria and grade descriptors.

When centres are designing assessment instruments, they need to ensure that the instruments are valid, reliable and fit for purpose, building on the application of the assessment criteria. Centres are encouraged to place emphasis on practical application of the assessment criteria, providing a realistic scenario for learners to adopt, making maximum use of work-related practical experience and reflecting typical practice in the sector concerned. **The creation of assessment instruments that are fit for purpose is vital to achievement.**

Grading Higher National units

The grading of BTEC Higher National qualifications is at the unit and the qualification level.

Each successfully completed unit will be graded as a pass, merit or distinction.

A pass is awarded for the achievement of all outcomes against the specified assessment criteria.

Merit and distinction grades are awarded for higher-level achievement. The generic merit and distinction grade descriptors listed in *Annexe C* are for grading the total evidence produced for each unit and describe the learner's performance over and above that for a pass grade.

Each of the generic merit and distinction grade descriptors should be amplified by use of **indicative characteristics** which exemplify the merit and distinction grade descriptors. These give a guide to the expected learner performance, and support the generic grade descriptors. The indicative characteristics should reflect the nature of a unit and the context of the sector programme.

The indicative characteristics shown in the table for each of the generic grade descriptors in *Annexe C* **are not exhaustive**. Consequently, centres should select appropriate characteristics from the list **or construct others** that are appropriate for their sector programme and level.

It is important to note that each assessment activity does not need to incorporate all the merit and/or distinction grade descriptors.

Contextualising the generic grade descriptors

The generic merit and distinction grade descriptors need to be viewed as a qualitative extension of the assessment criteria for pass within each individual unit. The relevant generic grade descriptors must be identified and specified within an assignment and the relevant indicative characteristics should be used to place the required evidence in context.

Additional guidance on contextualisation of grade descriptors can be found in HN Delivery Guides on the website.

Summary of grades

In order to achieve a **pass** in a unit	• all learning outcomes and associated assessment criteria have been met
In order to achieve a **merit** in a unit	• pass requirements achieved • all merit grade descriptors achieved and all prescribed indicative characteristics.
In order to achieve a **distinction** in a unit	• pass and merit requirements achieved • all distinction grade descriptors achieved and all prescribed indicative characteristics.

Calculation of the qualification grade

Pass qualification grade

Learners who achieve the minimum eligible credit value specified by the rule of combination will achieve the qualification at a pass grade (see section *Rules of combination for the BTEC Level 4 and 5 Higher National qualifications*). The Rules of combination have been summarised below:

BTEC HNC Diplomas

To achieve the qualification a learner must:

- achieve at least 120 credits at or above the level of the qualification (a maximum of 55 credits may be at Level 5)
- achieve a minimum of 65 credits at Level 4
- complete a valid combination of units.

BTEC HND Diplomas

To achieve the qualification a learner must:

- achieve at least 240 credits at or above the level of the qualification
- achieve a minimum of 125 credits at Level 5 or above.

The best valid combination of units is used to calculate the overall grade, e.g. if a learner has completed more than the minimum number of optional units at the appropriate level the best performance from these will be used.

All learners will receive a Notification of Performance showing all unit grades whether or not they were included in the calculation for the overall grade.

Qualification grades above pass grade

BTEC HNC Diplomas

Calculation of the BTEC HNC qualification grade is based on the learner's best performance in units at or above the level of the qualification to the value of 75 credits:

- The best 75 credits must come from a maximum of 120 credits as a valid rule of combination
- The units from which the best 75 credits are selected come from the whole qualification including the mandatory core credit.

This means that credit from some mandatory core units is likely to form part of the best 75 credits in most programmes (the mandatory core credit units will automatically be included in the calculation once the maximum amount of credit for optional specialist units for the rule of combination is used up.)

It is the responsibility of a centre to ensure that a correct unit combination is adhered to.

Qualification grades

Learners will be awarded a pass, merit or distinction qualification grade using the points gained through the 75 best credits based on unit achievement.

Unit credit points available for specified unit grades, for either Level 4 or Level 5 units

Unit points per credit		
Pass	**Merit**	**Distinction**
0	1	2
Example for level 4 or level 5 unit of 15 credits		
Pass	**Merit**	**Distinction**
0	15	30

BTEC Level 4 HNC overall qualification grades

Points range	Grade	
0–74	Pass	P
75–149	Merit	M
150	Distinction	D

BTEC HND Diplomas

The grade achieved in units from an appropriate HNC may contribute to an HND grade.

If a learner moves from HNC to HND, credits at Level 5 or above from both the HNC and HND can contribute to the best 75 credits of the overall HND grade. Note that for HND learners, level 4 units do not count towards the qualification grade.

Calculation of the BTEC HND qualification grade is based on the learner's best performance in units at or above the level of the qualification – i.e. **only units at level 5** can be counted towards the value of 75 credits:

- The best 75 credits must come from a maximum of 240 credits as a valid rule of combination
- The units from which the 75 best credits are selected come from the whole qualification including the mandatory core credit, but must be level 5 units or above.

This means that credit from some mandatory core units is likely to form part of the best 75 credits in most programmes (the mandatory core credit units will automatically be included in the calculation once the maximum amount of credit for optional specialist units for the rule of combination is used up.)

It is the responsibility of a centre to ensure that a correct unit combination is adhered to.

Qualification grades

Learners will be awarded a pass, merit or distinction qualification grade using the points gained through the 75 best credits based on unit achievement.

Unit credit points for specified unit grades at Level 5 only

Unit points per credit		
Pass	**Merit**	**Distinction**
0	1	2

BTEC Level 5 HND overall qualification grades

Points range	**Grade**	
0–74	Pass	P
75–149	Merit	M
150	Distinction	D

Annexe E gives examples of how qualification grades are calculated.

Recognition of Prior Learning

Recognition of Prior Learning (RPL) is a method of assessment (leading to the award of credit) that considers whether a learner can demonstrate that they can meet the assessment requirements for a unit through knowledge, understanding or skills they already possess and so do not need to develop through a course of learning.

Pearson encourages centres to recognise learners' previous achievements and experiences whether at work, home and at leisure, as well as in the classroom. RPL provides a route for the recognition of the achievements resulting from continuous learning.

RPL enables recognition of achievement from a range of activities using any valid assessment methodology. Provided that the assessment requirements of a given unit or qualification have been met, the use of RPL is acceptable for accrediting a unit, units or a whole qualification. Evidence of learning must be valid and reliable.

For full guidance about Pearson's policy on RPL, please see our *Recognition of Prior Learning Policy and Process* on our website.

Quality assurance of BTEC Higher Nationals

Pearson's quality assurance system for all BTEC higher-level programmes at Levels 4–7 will ensure that centres have effective quality assurance processes to review programme delivery. It will also ensure that the outcomes of assessment are to national standards.

The quality assurance process for centres offering BTEC higher-level programmes at Levels 4–7 comprises three key components.

1) Approval process

Centres new to the delivery of this programme will be required to seek approval through the existing qualification and centre approval process. Prior to approval being given, centres will be required to submit evidence to demonstrate that they:

- have the human and physical resources required for effective delivery and assessment
- understand the implications for independent assessment and agree to abide by these
- have a robust internal assessment system supported by 'fit for purpose' assessment documentation
- have a system to internally verify assessment decisions, to ensure standardised assessment decisions are made across all assessors and sites.

Such applications have to be supported by the head of the centre (principal, chief executive etc) and include a declaration that the centre will operate the programmes strictly as approved and in line with Pearson requirements.

2) Monitoring of internal centre systems

Centres will be required to demonstrate ongoing fulfilment of the centre approval criteria over time and across all programmes. The process that assures this is external examination, which is undertaken by External Examiners. Centres will be given the opportunity to present evidence of the ongoing suitability and deployment of their systems to carry out the required functions. This includes the consistent application of policies affecting learner registrations, appeals, effective internal examination and standardisation processes. Where appropriate, centres may present evidence of their operation within a recognised code of practice, such as that of the Quality Assurance Agency for Higher Education. Pearson reserves the right to confirm independently that these arrangements are operating to Pearson's satisfaction.

Pearson will affirm, or not, the ongoing effectiveness of such systems. Where system failures are identified, sanctions (appropriate to the nature of the problem) will be applied in order to assist the centre in correcting the problem.

3) Independent assessment review

The internal assessment outcomes reached for all BTEC higher-level programmes at Levels 4-7 are subject to an independent assessment review by a Pearson-appointed External Examiner.

The outcomes of this process will be to:

- confirm that internal assessment is to national standards and allow certification

or

- make recommendations to improve the quality of assessment outcomes before certification is released

or

- make recommendations about the centre's ability to continue to be approved for the qualifications in question.

Additional arrangement for ALL centres

Regardless of the type of centre, Pearson reserves the right to withdraw either qualification or centre approval when it deems there is an irreversible breakdown in the centre's ability either to quality assure its programme delivery or its assessment standards.

Programme design and delivery

The BTEC Higher National Certificate (HNC) is a Level 4 qualification made up of 120 credits. It is usually studied full-time over one year, or part-time over two years.

The BTEC Higher National Diploma (HND) is a Level 4 and Level 5 qualification made up of 240 credits. It is usually studied full-time over two years, or part-time over four years.

Pearson would expect that an HND student would have achieved at least 90 credits at Level 4 before progressing to Level 5 units. This allows for the students to submit the remaining 30 credits at Level 4 while undertaking their Level 5 study.

Students undertaking an HND who fail to successfully complete the full qualification may be awarded an HNC, if their credit achievement permits.

BTEC Higher Nationals consist of mandatory core units and specialist units. The specialist units are designed to provide a specific focus to the qualification. Required combinations of specialist units are clearly set out in relation each qualification in the defined structures provided in this document.

All units are usually 15 credits in value, or a multiple thereof. These units have been designed from a learning time perspective, and are expressed in terms of **Total Qualification Time (TQT)**. TQT is an estimate of the total amount of time that could reasonably be expected to be required for a student to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification. TQT includes undertaking each of the activities of Guided Learning, Directed Learning and Invigilated Assessment. Each 15-credit unit approximates to a TQT of 150 hours and 60 hours of Guided Learning. This value has been allocated according to input from curriculum writers.

Total Qualification Time Higher National Certificate (HNC) = 1,200 hours

Total Qualification Time Higher National Diploma (HND) = 2,450 hours

Examples of activities which can contribute to Total Qualification Time include:

- Guided Learning
- Independent and unsupervised research/learning
- Unsupervised compilation of a portfolio of work experience
- Unsupervised e-learning
- Unsupervised e-assessment
- Unsupervised coursework
- Watching a pre-recorded podcast or webinar
- Unsupervised work-based learning.

Guided Learning Hours (GLH) are defined as the time when a tutor is present to give specific guidance towards the learning aim being studied on a programme. This definition includes lectures, tutorials and supervised study in, for example, open learning centres and learning workshops. Guided Learning includes any supervised assessment activity; this includes invigilated examination and observed assessment and observed work-based practice.

Total Guided Learning (GL) Higher National Certificate (HNC) = 480 hours

Total Guided Learning (GL) Higher National Diploma (HND) = 980 hours

Some examples of activities which can contribute to Guided Learning include:

- Classroom-based learning supervised by a tutor
- Work-based learning supervised by a tutor
- Live webinar or telephone tutorial with a tutor in real time
- E-learning supervised by a tutor in real time
- All forms of assessment which take place under the immediate guidance or supervision of a tutor or other appropriate provider of education or training, including where the assessment is competence-based and may be turned into a learning opportunity.

Centres are advised to consider these definitions when planning the programme of study associated with this specification.

Annexe D provides information for centres and learners who wish to compare, for teaching and learning purposes, the units of the Pearson Level 5 BTEC Higher Nationals in Applied Chemistry (2003) with the units in this specification.

Mode of delivery

Pearson does not define the mode of study for the BTEC Higher National qualifications. Centres are free to offer the qualification(s) using any mode of delivery that meets the needs of their learners. This may be through traditional classroom teaching, open learning, distance learning or a combination of these. Whatever mode of delivery is used, centres must ensure that learners have appropriate access to the resources identified in the specification and to the subject specialists delivering the units. This is particularly important for learners studying for the qualification through open or distance learning.

Our 'Distance Learning' and 'Distance Assessment' policies are given on our website.

Learners studying for the qualification on a part-time basis bring with them a wealth of experience that should be utilised to maximum effect by tutors and assessors. Assessment instruments based on learners' work environments should be encouraged. Those planning the programme should aim to enhance the vocational nature of the BTEC Higher National qualification by:

- liaising with employers to ensure that the course is relevant to learners' specific needs
- accessing and using non-confidential data and documents from learners' workplaces
- including sponsoring employers in the delivery of the programme and, where appropriate, in the assessment
- linking with company-based/workplace training programmes
- making full use of the variety of experiences of work and life that learners bring to the programme.

Resources

BTEC Higher National qualifications are designed to prepare learners for employment in specific industry sectors.

Physical resources need to support the delivery of the programme and the proper assessment of the outcomes and, therefore, should normally be of industry standard.

Staff delivering programmes and conducting the assessments should be familiar with current practice, legislation and standards used in the sector concerned.

Centres will need to meet any specialist resource requirements when they seek approval from Pearson.

Please refer to the *Essential requirements* section in individual units for specialist resource requirements.

Delivery approach

It is important that centres develop an approach to teaching and learning that supports the specialist vocational nature of the BTEC Higher National qualification. Specifications contain a balance of practical skill development and knowledge requirements, some of which can be theoretical in nature. Tutors and assessors need to ensure that appropriate links are made between theory and practice and that the knowledge base is applied to the sector. This will require the development of relevant and up-to-date teaching materials that allow learners to apply their learning to actual events and activities within the sector. Maximum use should be made of the learner's experience.

Meeting local needs

Centres should note that the qualifications set out in these specifications have been developed in consultation with centres, employers and relevant professional organisations.

The units are designed to meet the skill needs of the sector and the specialist units allow coverage of the full range of employment within the sector. Centres should make maximum use of the choice available to them within the specialist units to meet the needs of their learners, as well as the local skills and training needs.

Where centres identify a specific need that cannot be addressed using the units in this specification, centres can seek approval from Pearson to use units from other BTEC Higher National qualifications accredited in 2010. Centres will need to justify the need for importing units from other specifications and Pearson will ensure that the vocational focus of the qualification remains the same.

Applications must be made **in advance** of delivery by 31 January in the year of registration (see the website for details).

The flexibility to import standard units from other BTEC Higher National specifications accredited in 2010 is **limited to a maximum of 30 credits in a BTEC HNC qualification and a maximum of 60 credits only in any BTEC HND qualification**. This is an overall maximum and centres should check the 'Rules of Combination' information for the specific qualification to confirm the actual requirements. These units cannot be used at the expense of the mandatory core units in any qualification nor can the qualification rules of combination level rules be compromised. The centre must ensure that approved units are used only in eligible combinations.

Access and recruitment

Pearson's policy regarding access to our qualifications is that:

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

Centres are required to recruit learners to BTEC Higher National qualifications with integrity. This will include ensuring that applicants have appropriate information and advice about the qualifications and that the qualification will meet their needs. Centres should take appropriate steps to assess each applicant's potential and make a professional judgement about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the learner within the centre during their programme of study and any specific support that might be necessary to allow the learner to access the assessment for the qualification.

Centres will need to review the profile of qualifications and/or experience held by applicants, considering whether this profile shows an ability to progress to level 4 or level 5 qualifications. For learners who have recently been in education, the entry profile is likely to include one of the following:

- a BTEC Level 3 Diploma or Extended Diploma in Applied Science or similar discipline
- a GCE level profile that demonstrates strong performance in a relevant subject or an adequate performance in more than one GCE subject. This profile is likely to be supported by GCSE grades at A* to C
- other related level 3 qualifications
- an Access to Higher Education Certificate received from an approved further education institution
- related work experience.

Mature learners may present a more varied profile of achievement that is likely to include extensive work experience (paid and/or unpaid) and/or achievement of a range of professional qualifications in their work sector.

Restrictions on learner entry

BTEC Higher National qualifications are accredited on the RQF for learners in the following age groups:

- 16–18 years old
- 18 years and older.

Equality Act 2010 and Pearson equality policy

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

We are committed to making sure that:

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

You can find details on how to make adjustments for learners with protected characteristics in the policy document *Access Arrangements, Reasonable Adjustments and Special Considerations*, available on our website.

An adjustment may not be considered reasonable if it involves unreasonable costs and/or timeframes or affects the security or integrity of the assessment.

There is no duty on awarding organisations to make any adjustment to the Assessment Objectives being tested in an assessment.

English language expectations

Centres delivering BTEC level 4 to 7 programmes are expected to ensure that all learners who are non-native English speakers or who have not studied the final two years of school in English, can demonstrate capability in English at a standard commensurate with:

- IELTS 5.5, with a minimum of 5.0 being awarded on individual sections for a level 4 or 5 qualification
- IELTS 6.5 for a level 6 or 7 qualification

Pearson's Standard Verifiers (EE) will expect centres to demonstrate that their learners meet these expectations.

Professional body contact details

Royal Society of Chemistry, London
Burlington House
Piccadilly
London W1J 0BA

Telephone: +44 (0) 20 7437 8656
Website: www.rsc.org

How to obtain National Occupational Standards

The National Occupational Standards for the NVQ Level 4 in Laboratory and Associated Technical Activities can be obtained from:

SEMTA Head Office
Unit 2
The Orient Centre
Greycaine Road
Watford
WD24 7GP

Telephone: +44 (0) 845 643 9001
Email: customerservices@semta.org.uk
Website: www.semta.org.uk

Professional development and training

Pearson supports UK and international customers with training related to BTEC qualifications. This support is available through a choice of training options offered on our website at: qualifications.pearson.com/en/support/training-from-pearson-uk

The support we offer focuses on a range of issues, such as:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing learner-centred learning and teaching approaches
- building in effective and efficient quality assurance systems.

The national programme of training we offer is on our website. You can request centre-based training through the website or you can contact one of our advisers in the Training from Pearson UK team via Customer Services to discuss your training needs.

BTEC training and support for the lifetime of the qualifications

Training and networks: our training programme ranges from free introductory events through sector-specific opportunities to detailed training on all aspects of delivery, assignments and assessment. We also host some regional network events to allow you to share your experiences, ideas and best practice with other BTEC colleagues in your region.

Regional support: our team of Curriculum Development Managers and Curriculum Support Consultants, based around the country, are responsible for providing advice and support in centres. They can help you with planning and curriculum developments.

To get in touch with our dedicated support teams please visit our website qualifications.pearson.com/en/support/contact-us

Annexe A

Qualification Requirements

Rationale

The Pearson BTEC Higher Nationals in Applied Chemistry provide:

- the education and training of applied chemistry technologists who are employed in a variety of types of technical work, such as in: quality control, organic preparations, laboratory analysis, materials testing, pilot scale, research and development, education, etc
- a standard national, vocationally specific qualification at Level 4/5, which provides links to the National Occupational Standards and the professional body
- a nationally recognised, vocationally specific qualification that will provide confidence to employers recruiting applied chemistry technologists that holders of the qualification possess the requisite knowledge, understanding and skills
- a qualification that will be assessed to national transparent standards and thus provide confidence to those recruiting to more advanced higher education vocational qualifications such as a full-time degree in applied chemistry or a related area
- a programme of learning that ensures full understanding of the role of the applied chemistry technologist. This includes an understanding of the role at departmental/section level as well as an appreciation of how the role and that of the department/section fits within the overall structure of their organisation and within the scientific and local community.

Aims of the qualification

Qualifications should meet the needs of the above rationale by:

- equipping individuals with knowledge, understanding and skills for success in employment in the applied chemically-based industry
- enabling progression to an undergraduate degree or further professional qualification in applied chemistry or related area
- providing specialist studies relevant to individual vocations and professions in which learners are working or intend to seek employment in the chemical sciences and their related industries
- developing the learners' ability in the chemical sciences environment through effective use and combination of the knowledge and skills gained in different parts of the programme
- developing a range of skills and techniques, personal qualities and attributes essential for successful performance in working life and thereby enabling learners to make an immediate contribution to employment
- providing flexibility, knowledge, skills and motivation as a basis for future studies and career development – an educational foundation for a range of careers in chemical sciences and their related industries

- providing opportunities for learners to focus on the development of the higher level skills in a science and technological context
- providing opportunities for learners to develop a range of skills and techniques and attributes essential for successful performance in working life.

Mandatory curriculum

Unit 1: Inorganic Chemistry

This unit covers the foundations of inorganic chemistry relating to structure and bonding, together with the chemistry of important elements and compounds and a review of some major industrial applications.

Unit 2: Organic Chemistry

This unit develops the principles and practical techniques of organic chemistry. Rationalisation of structure and bonding is used to aid understanding of reaction mechanisms and functional group conversions.

Unit 3: Physical Chemistry

This unit gives learners an understanding of concepts and practical techniques in physical chemistry. These include thermodynamics, reaction kinetics, conductivity, electrochemical cells and electrolysis.

Unit 4: Chemical Laboratory Techniques

This unit gives learners the opportunity to practise and become proficient in a range of practical skills and data analysis, commonly used in analytical and preparative chemistry.

Unit 5: Project for Applied Science

This unit enables learners to integrate acquired knowledge, understanding and skills and display a significant degree of autonomy applying them in an individual practically-based study.

Unit 6: Analysis of Scientific Data and Information

This unit develops skills in mathematical and statistical techniques used in the analysis of scientific data, together with an understanding of the limitations in reporting results.

Optional curriculum

Unit 7: Laboratory Management

This unit enables learners to gain an understanding of the organisation of different types of laboratory and compare the processes associated with their management.

Unit 8: Work-based Investigation

This unit enables learners to gain credit for work-based practical investigations either as an individual or as part of a team. Learners will plan, undertake, monitor progress and communicate the outcomes of a work-based topic.

Unit 9: Inorganic Chemistry of Crystal Structures and Transition Metal Complexes

This unit enables learners to gain an understanding of the first row d block elements. The three main areas covered are the solid state, the first row d block metals and their complexes and catalysis.

Unit 10: Organic Chemistry of Aromatic and Carbonyl Compounds

This unit covers understanding of aromaticity and optical activity. The chemistry of aromatic and carbonyl compounds are examined with respect to reaction mechanisms and use in synthesis.

Unit 11: Physical Chemistry of Spectroscopy, Surfaces and Chemical and Phase Equilibria

This unit develops an understanding of physical chemistry topics that have relevance to industrial chemistry through study of phase and chemical equilibria, spectroscopy and surface chemistry.

Unit 12: Analytical Chemistry

The unit enables learners to understand and perform some key processes involved in analytical chemistry and to gain practical skills in undertaking extended practical investigations.

Unit 13: Environmental Chemical Analysis

The unit applies chemical principles to understanding environmental contexts. The complexity of sampling within the environmental matrix and appropriate strategies for accurate analyses are examined.

Unit 14: Industrial Chemistry

The unit enables learners to gain an understanding of the factors affecting the successful operation and sustainability of an industrial process including its location, operation, health and safety and environmental issues.

Unit 15: Biochemistry of Macromolecules and Metabolic Pathways

This unit enables learners to develop practical skills and examine the chemical characteristics of amino acids, monosaccharides, nucleotides and fatty acids. These are used to develop an understanding of the structure and function of related biological macromolecules.

Unit 16: Polymer Chemistry

This unit enables learners to gain an understanding of aspects of the structure, reaction mechanisms and polymer preparations. The properties, performance, behaviour and breakdown of types of polymer under a variety of conditions are also examined.

Unit 17: Medicinal Chemistry

This unit enables learners to gain an understanding of the factors relating to drug structure and design, pharmacokinetics and pharmacodynamics and biochemical responses of drug treatment.

Unit 18: Atomic and Nuclear Physics for Spectroscopic Applications

This unit provides an understanding of the underlying atomic and nuclear physics involved in the processes of spectroscopy and matter analysis.

Unit 19: Environmental Monitoring and Analysis

This unit provides learners with an understanding of natural environmental cycles and the influence of pollutants on ecosystems. The sources and effects of environmental pollutants together with techniques of sampling methods and chemical analysis are examined.

Unit 20: Environmental Management and Conservation

This unit reviews environmental issues such as conservation sites, recycling and land reclamation. Learners gain an understanding of the causes and effects of pollution, global environmental issues, renewable energy, and the work of environmental pressure groups.

Unit 21: Quality Assurance and Quality Control

This unit reviews quality assurance and quality control measures. Learners are provided with an understanding of quality control and assurance procedures, methods of expressing quality and the benefits of accreditation.

Unit 22: Management of Projects

This unit provides an understanding and experience of project management principles, methodologies, tools and techniques that may be used in industry and the public sector.

Unit 23: Managing the Work of Individuals and Teams

This unit develops learners' understanding and skills associated with managing the work of individuals and teams. It enhances the ability to motivate individuals and to maximise the contribution of teams to achieve outcomes.

Unit 24: Nuclear Chemistry

This unit provides learners with an understanding of stability and radioactive decay in isotopes. Application of radioactive isotopes in chemistry and medicine, nuclear power and the impact of radioactivity on society and the environment are also explored.

Unit 25: Nanotechnology

This unit examines the role of nanotechnology at the interface of Chemistry, Biology, Physics and Engineering, especially its use achieving effects not possible in individual atoms or bulk materials.

Unit 26: Materials Science and Technology

This unit examines aspects of materials science. Learners are provided with an understanding of structure-property relationships, analytical testing and evaluation and the selection of a material for a given application.

Unit 27: Statistics for Experimental Design

This unit provides learners with an understanding of the role of statistics in experimental design and hypothesis testing. Learners will be able to use significance testing to make statistical decisions and analyse the relationship between variables.

Unit 28: Work-based Experience

This unit aims to enable learners to experience the scope and depth of learning which may take place in a work-based context by planning, monitoring and evaluating the work experience.

Unit 29: Personal and Professional Development

This unit aims to help learners become effective and confident, self-directed employees. This helps learners become confident in managing their personal and professional skills to achieve personal and career goals.

Unit 30: Employability Skills

This unit provides learners with the opportunity to acquire honed employability skills required for effective employment.

Links to professional body

We have added value to the qualification by securing recognition from the Royal Society of Chemistry. Learners studying the BTEC Higher Nationals in Applied Chemistry will be able to apply for Affiliate Membership of the Royal Society of Chemistry and a progression route to NVQ L5 in Analytical Chemistry. Learners possessing a BTEC Higher National Certificate/Diploma in Applied Chemistry and a number of years of post–HNC/D experience in the chemical industry are able to apply for Associate Membership of the Royal Society of Chemistry. Learners seeking membership should contact the Royal Society of Chemistry email: membership@rsc.org.

Links to National Standards

The BTEC Higher National programmes in Applied Chemistry provide some of the underpinning knowledge, understanding and skills for the Level 4 NVQ in Laboratory and Associated Technical Activities. The mapping sheets (Annexe B) provide a guide.

Higher level skills and abilities

Learners will be expected to develop the following skills during the programme of study:

- the ability to work effectively as an individual and in teams
- the ability to be flexible and respond to the changing climate within the scientific community
- the ability to design, plan, conduct and report on scientific investigations
- the ability to undertake laboratory investigations in a responsible, safe and ethical manner
- recognition of the moral and ethical issues of scientific enquiry and experimentation and appreciation of the need for ethical standards and professional codes of conduct
- an appreciation of the interdisciplinary nature of science, the capacity to give a clear and accurate account of a subject, marshal arguments in a mature way and engage in debate and dialogue both with specialists and non-specialists
- the ability to communicate effectively and appropriately
- the ability to use ICT and management information systems in a chemical environment

- an understanding of supervisory management responsibilities in an appropriate context
- personal qualities and attributes essential for successful performance in working life
- the ability to analyse, synthesise and summarise information critically
- the ability to read and use appropriate scientific literature with a full and critical understanding
- the ability to solve problems, applying subject knowledge and understanding to address familiar and unfamiliar problems
- the ability to think laterally and be innovative and creative in relevant contexts
- the ability to work as an individual and in teams for successful performance in a chemically-based industrial environment
- the ability to think independently, take responsibility for their own learning and recognise their own learning style.

Annexe B

National Occupational Standards (NOS)

Mapping against the Level 4 NVQ in Laboratory and Associated Technical Activities (LATA)

The grid below maps the knowledge covered in the Level 4 NVQ in Laboratory and Associated Technical Activities (LATA) against the underpinning knowledge of the Pearson BTEC Higher Nationals in Applied Chemistry.

Key

✓ indicates significant coverage of the NVQ unit

a blank space indicates no significant coverage of the underpinning knowledge

HNC/D titles / NVQ unit titles	Unit 5: Project for Applied Science	Unit 7: Laboratory Management	Unit 8: Work-Based Investigation	Unit 21: Quality Assurance and Quality Control	Unit 23: Managing the Work of Individuals and Teams	Unit 28: Work-based Experience	Unit 29: Personal and Professional Development	Unit 30: Employability Skills
Unit 4.01 Develop and maintain a healthy and safe work environment								
		✓						
Unit 4.02 Develop productive working relationships								
4.02.1					✓			✓
4.02.2								
4.02.3								
Unit 4.03 Develop and monitor plans and procedures								
4.03.1		✓		✓				
4.03.2		✓		✓				
Unit 4.04 Determine and implement health and safety risk control measures								
4.04.1								
4.04.2								
Unit 4.05 Devise and agree an overall technical plan								
4.05.1						✓		
4.05.2						✓		
4.05.3						✓		

HNC/D titles / NVQ unit titles	Unit 5: Project for Applied Science	Unit 7: Laboratory Management	Unit 8: Work-Based Investigation	Unit 21: Quality Assurance and Quality Control	Unit 23: Managing the Work of Individuals and Teams	Unit 28: Work-based Experience	Unit 29: Personal and Professional Development	Unit 30: Employability Skills
Unit 4.06 Run technical projects								
4.06.1	✓		✓			✓		
4.06.2	✓		✓			✓		
4.06.3	✓		✓			✓		
Unit 4.07 Write technical reports								
4.07.1	✓							
4.07.2	✓							
4.07.3								
Unit 4.08 Manage activities to meet requirements								
4.08.1			✓			✓		
4.08.2		✓						
4.08.3				✓				
Unit 4.09 Manage the use of financial resources								
4.09.1								
4.09.2								
Unit 4.10 Manage information for action								
4.10.1								
4.10.2								
4.10.3								
Unit 4.11 Develop and deliver teaching and learning activities								
4.11.1								
4.11.2								
Unit 3.09 Carry out investigations								
3.09.1	✓		✓			✓		
3.09.2	✓		✓			✓		
3.09.3	✓		✓			✓		

HNC/D titles / NVQ unit titles	Unit 5: Project for Applied Science	Unit 7: Laboratory Management	Unit 8: Work-Based Investigation	Unit 21: Quality Assurance and Quality Control	Unit 23: Managing the Work of Individuals and Teams	Unit 28: Work-based Experience	Unit 29: Personal and Professional Development	Unit 30: Employability Skills
Unit 3.10 Carry out small scale processing								
3.10.1								
3.10.2								
3.10.3								
Unit 3.12 Manage yourself								
3.12.1						✓	✓	✓
3.12.2						✓	✓	✓
Unit 3.20 Developing the research design								
3.20.1	✓		✓					
3.20.2	✓		✓					
3.20.3	✓		✓					

Annexe C

Grade descriptors

Pass grade

A **pass grade** is achieved by meeting all the requirements defined in the assessment criteria for pass for each unit.

Merit grade

Merit grade descriptors	**Exemplar indicative characteristics** **Centres can identify and use other relevant characteristics. This is NOT a tick list.**
In order to achieve a **merit** the learner must:	The learner's evidence shows for example:
• identify and apply strategies to find appropriate solutions	• effective judgements have been made • complex problems with more than one variable have been explored • an effective approach to study and research has been applied
• select/design and apply appropriate methods/techniques	• relevant theories and techniques have been applied • a range of methods and techniques have been applied • a range of sources of information has been used • the selection of methods and techniques/sources has been justified • the design of methods/techniques has been justified • complex information/data has been synthesised and processed • appropriate learning methods/techniques have been applied
• present and communicate appropriate findings	• the appropriate structure and approach has been used • coherent, logical development of principles/concepts for the intended audience • a range of methods of presentation have been used and technical language has been accurately used • communication has taken place in familiar and unfamiliar contexts • the communication is appropriate for familiar and unfamiliar audiences and appropriate media have been used.

Distinction grade

Distinction grade descriptors	Exemplar indicative characteristics **Centres can identify and use other relevant characteristics. This is NOT a tick list.**
In order to achieve a **distinction** the learner must:	The learner's evidence shows for example:
• use critical reflection to evaluate own work and justify valid conclusions	• conclusions have been arrived at through synthesis of ideas and have been justified • the validity of results has been evaluated using defined criteria • self-criticism of approach has taken place • realistic improvements have been proposed against defined characteristics for success
• take responsibility for managing and organising activities	• autonomy/independence has been demonstrated • substantial activities, projects or investigations have been planned, managed and organised • activities have been managed • the unforeseen has been accommodated • the importance of interdependence has been recognised and achieved
• demonstrate convergent/lateral/ creative thinking	• ideas have been generated and decisions taken • self-evaluation has taken place • convergent and lateral thinking have been applied • problems have been solved • innovation and creative thought have been applied • receptiveness to new ideas is evident • effective thinking has taken place in unfamiliar contexts.

Annexe D

Unit mapping overview

The BTEC Higher National units in Applied Chemistry (specification start date 01/09/2010) are mapped against the 2003 BTEC Higher National units in Applied Chemistry (specification end date 31/08/2010), in the following tables:

Unit number	2010 unit title	Maps to 2003 unit number	Level of similarity between units
1	Inorganic Chemistry	1	X
2	Organic Chemistry	2	F
3	Physical Chemistry	3	F
4	Chemical Laboratory Techniques	4	F
5	Project for Applied Science	5	F
6	Analysis of Scientific Data and Information	6	F
7	Laboratory Management	7	X
8	Work-based Investigation	8	F
9	Inorganic Chemistry of Crystal Structures and Transition Metal Complexes	9	F
10	Organic Chemistry of Aromatic and Carbonyl Compounds	10	F
11	Physical Chemistry of Spectroscopy, Surfaces and Chemical and Phase Equilibria	11	X
12	Analytical Chemistry	12	F
13	Environmental Chemical Analysis	13	F
14	Industrial Chemistry	14	F
15	Biochemistry of Macromolecules and Metabolic Pathways	15	F
16	Polymer Chemistry	16	F
17	Medicinal Chemistry	17	X
18	Atomic and Nuclear Physics for Spectroscopic Applications	18	P
19	Environmental Monitoring and Analysis	20	F

Unit number	2010 unit title	Maps to 2003 unit number	Level of similarity between units
20	Environmental Management and Conservation	21	P
21	Quality Assurance and Quality Control	22	P
22	Management of Projects	23	F
23	Managing the Work of Individuals and Teams	24	F
24	Nuclear Chemistry	-	N
25	Nanotechnology	-	N
26	Materials Science and Technology	-	N
27	Statistics for Experimental Design	-	N
28	Work-based Experience	-	N
29	Personal and Professional Development	-	N
30	Employability Skills	-	N

KEY

P – Partial mapping (some topics from the old unit appear in the new unit)

F – Full mapping (topics in old unit match new unit exactly or almost exactly)

X – Full mapping + new (all the topics from the old unit appear in the new unit, but new unit also contains new topic(s))

N – New unit

Unit mapping in depth

The BTEC Higher National units in Applied Chemistry (specification start date 01/09/2010) are mapped against the 2003 BTEC Higher National units in Applied Chemistry (specification end date 31/08/2010).

2010 units		**2003 units**		**Mapping/comments (new topics in italics)**
Number	**Name**	**Number**	**Name**	
1	Inorganic Chemistry	1	Inorganic Chemistry	**X:** all the topics from the old unit appear in the new unit, but new unit also contains new topic(s). *LO1 Understand the structure of atoms.* *New content: Historical development*
2	Organic Chemistry	2	Organic Chemistry	**F:** topics in old unit match new unit exactly or almost exactly
3	Physical Chemistry	3	Physical Chemistry	**F:** topics in old unit match new unit exactly or almost exactly
4	Chemical Laboratory Techniques	4	Chemical Laboratory Techniques	**F:** topics in old unit match new unit exactly or almost exactly
5	Project for Applied Science	5	Project	**F:** topics in old unit match new unit exactly or almost exactly
6	Analysis of Scientific Data and Information	6	Analysis of Scientific Information and Data	**F:** topics in old unit match new unit exactly or almost exactly

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
7	Laboratory Management	7	Laboratory Management	**X:** all the topics from the old unit appear in the new unit, but new unit also contains new topic(s). *LO1 Understand the typical duties of laboratory managers in different types of laboratory. Expansion/clarification of old LO3.* *LO4 Understand features of managing a quality system. Expansion/clarification of old LO4.*
8	Work-based Investigation	8	Work-based Assignment	**F:** topics in old unit match new unit exactly or almost exactly
9	Inorganic Chemistry of Crystal Structures and Transition Metal Complexes	9	Further Inorganic Chemistry	**F:** topics in old unit match new unit exactly or almost exactly
10	Organic Chemistry of Aromatic and Carbonyl Compounds	10	Further Organic Chemistry	**F:** topics in old unit match new unit exactly or almost exactly
11	Physical Chemistry of Spectroscopy, Surfaces and Chemical and Phase Equilibria	11	Further Physical Chemistry	**X:** all the topics from the old unit appear in the new unit, but new unit also contains new topic(s) *LO1 Be able to apply the concept of chemical equilibrium.* *New content: Equilibrium constants, Problems involving chemical equilibrium*
12	Analytical Chemistry	12	Analytical Chemistry	**F:** topics in old unit match new unit exactly or almost exactly
13	Environmental Chemical Analysis	13	Environmental Chemistry	**F:** topics in old unit match new unit exactly or almost exactly

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
14	Industrial Chemistry	14	Industrial Chemistry	**F:** topics in old unit match new unit exactly or almost exactly
15	Biochemistry of Macromolecules and Metabolic Pathways	15	Biochemistry	**F:** topics in old unit match new unit exactly or almost exactly
16	Polymer Chemistry	16	Polymer Chemistry	**F:** topics in old unit match new unit exactly or almost exactly
17	Medicinal Chemistry	17	Medicinal Chemistry	**X:** all the topics from the old unit appear in the new unit, but new unit also contains new topic(s) *LO3 Understand the stages of drug discovery and design.* *New content: Designing a new drug, Combinatorial chemistry*
18	Atomic and Nuclear Physics for Spectroscopic Applications	18	Physics	**P:** Partial mapping — some topics from the old unit appear in the new unit *New content for:* *LO2 Understand spectroscopic methods that use electromagnetic waves.* *LO3 Understand matter analysis methods that use charged particles.* *LO4 Understand spectroscopic methods that use the nucleus of an atom.*
19	Environmental Monitoring and Analysis	20	Environmental Analysis	**F:** topics in old unit match new unit exactly or almost exactly

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
19	Environmental Monitoring and Analysis	20	Environmental Analysis	**F:** topics in old unit match new unit exactly or almost exactly
20	Environmental Management and Conservation	21	Environmental Management and Conservation	**P:** Partial mapping — some topics from the old unit appear in the new unit *LO2 Understand the causes, effects and the control of pollution.* *New content: Current relevant strategies, Control methods* *LO3 Understand global environmental issues.* *New content: Climate change, Carbon trading, Energy security, Global campaigns* *LO4 Understand how environmental legislation may be put into practice.* *New content: Operation of environmental permitting regulations, Waste management, Environmental management systems*

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
21	Quality Assurance and Quality Control	22	Quality Assurance and Quality Control	**P:** Partial mapping — some topics from the old unit appear in the new unit *LO1 Understand how the quality of an analytical result may be expressed.* *New content: Features of quality, Different types of error, Minimising types of error, Distribution of results* *LO2 Understand features of quality control and quality assurance.* *New content: Internal quality control measures, External quality control measures, Features of quality assurance* *LO3 Understand quality management systems.* *New content: Features of a quality management system, Quality management standards, Operation of a quality management system, Differences between quality management systems* *LO4 Understand the accreditation process.* *New content: Benefits of accreditation, Accreditation procedures, Influence of accreditation*
22	Management of Projects	23	Project Management	**F:** topics in old unit match new unit exactly or almost exactly
23	Managing the Work of Individuals and Teams	24	Managing the Work of Individuals and Teams	**F:** topics in old unit match new unit exactly or almost exactly

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
24	Nuclear Chemistry	-	New unit	**N:** New unit. *LO1 Understand the behaviour of the nucleus.* *LO2 Understand the use of isotopes in chemistry and medicine.* *LO3 Understand the chemistry of the nuclear power industry.* *LO4 Be able to report on the impact of radioactivity on society and the environment.*
25	Nanotechnology	-	New unit	**N:** New unit. *LO1 Know how structure controls properties at the nanoscale dimension.* *LO2 Understand key concepts in engineering, physics, chemistry, and biology used to solve nanotechnology problems.* *LO3 Be able to evaluate current nanotechnology fabrication methods.* *LO4 Know current and potential future commercial nanotechnology applications.*

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
26	Materials Science and Technology	-	New unit	**N:** New unit. *LO1 Understand the structure-property relationships for materials.* *LO2 Understand the factors that control the properties of materials.* *LO3 Be able to characterise a material from the outcomes of analytical tests.* *LO4 Understand the selection process for choosing a material in a given application.*
27	Statistics for Experimental Design	-	New unit included in structure (from HN Applied Biology — Statistics unit)	**N:** New unit. *LO1 Understand the role of statistics in experimental design.* *LO2 Understand how statistical decisions are made using hypothesis testing.* *LO3 Be able to make statistical decisions using significance testing.* *LO4 Be able to analyse the relationship between variables.*
28	Work-based Experience	-	New unit	**N:** New unit. *LO1 Be able to negotiate industry experience.* *LO2 Understand the specific requirements of the placement.* *LO3 Be able to undertake work experience as identified.* *LO4 Be able to monitor and evaluate own performance and learning.*

2010 units		2003 units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
29	Personal and Professional Development	-	New unit	**N:** New unit. *LO1 Understand how self-managed learning can enhance lifelong development.* *LO2 Be able to take responsibility for own personal and professional development.* *LO3 Be able to implement and continually review own personal and professional development plan.* *LO4 Be able to demonstrate acquired interpersonal and transferable skills.*
30	Employability Skills	-	New unit	**N:** New unit. *LO1 Be able to determine own responsibilities and performance.* *LO2 Be able to develop interpersonal and transferable skills.* *LO3 Understand the dynamics of working with others.* *LO4 Be able to develop strategies for problem solving.*

Annexe E

Calculation of the qualification grade

Pass qualification grade

Learners who achieve the minimum eligible credit value specified by the rule of combination will achieve the qualification at pass grade (see section *Rules of combination for BTEC Levels 4 and 5 Higher National qualifications*).

Qualification grades above pass grade

Learners will be awarded a merit or distinction qualification grade by the aggregation of points gained through the successful achievement of individual units. **The graded section of both qualifications is based on the learner's best performance in units at the level or above of the qualification to the value of 75 credits.**

The number of points available is dependent on the unit grade achieved and the credit size of the unit (as shown in the table below).

Points available per credit at specified unit grades

Points per credit		
Pass	**Merit**	**Distinction**
0	1	2

So a 15 credit unit awarded a merit grade will gain 15 points.

Qualification grades

BTEC Level 4 HNC

Points range	Grade	
0-74	Pass	P
75-149	Merit	M
150	Distinction	D

BTEC Level 5 HND

Points range	Grade	
0-74	Pass	P
75-149	Merit	M
150	Distinction	D

These are some examples of how the HNC Diploma grades are calculated:

Example 1: Achievement of a BTEC HNC Diploma with Pass grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	0	
Unit 2	Mandatory core unit	4	15	P	0	
Unit 3	Mandatory core unit	4	15	M	1	15
Unit 4	Mandatory core unit	4	15	M	1	15
Unit 15	Specialist unit	5	15	P	0	
Unit 17	Specialist unit	5	15	P	0	
Unit 18	Specialist unit	4	15	M	1	15
Unit 12	Specialist unit	4	15	M	1	15
Unit 14	Specialist unit	4	10	D	2	20
	Qualification total requirement 120		**130**			**60**

Unit 14 is not included as it is an additional unit on top of the 120 credit qualification

The learner can only include the points from the best 75 out of 120 credits in a valid combination.

Example 2: Achievement of a BTEC HNC Diploma with Merit grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	M	1	15
Unit 2	Mandatory core unit	4	15	P	0	
Unit 3	Mandatory core unit	4	15	M	1	15
Unit 4	Mandatory core unit	4	15	P	0	
Unit 15	Specialist unit	5	15	P	0	
Unit 9	Specialist unit	4	15	M	1	15
Unit 18	Specialist unit	4	15	M	1	15
Unit 12	specialist unit	4	15	M	1	15
	Qualification total requirement 120		**120**			**75**

The best 75 credits include both core and optional units.

The learner has sufficient points for a merit.

Example 3: Achievement of an HNC Diploma with Distinction grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	M	1	(15)
Unit 2	Mandatory core unit	4	15	P	0	
Unit 3	Mandatory core unit	4	15	D	2	30
Unit 4	Mandatory core unit	4	15	P	0	
Unit 15	Specialist unit	4	15	D	2	30
Unit 17	Specialist unit	4	15	D	2	30
Unit 9	Specialist unit	4	15	D	2	30
Unit 12	Specialist unit	4	15	D	2	30
	Qualification total requirement- 120		**120**			**150**

The learner has grade points in more than 75 credits. The best performance is used to calculate the grade.

These can be level 4/5 for the HNC

The learner has enough points for a Distinction from 75 credits.

Examples for the HND Diploma:

The tables below give examples of how the overall grade is determined.

Only points from units at or above the level of the qualification can be counted towards the grade.

Examples used are for illustrative purposes only. Other unit combinations are possible.

Example 1: Achievement of an HND Diploma with a pass grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	X	
Unit 2	Mandatory core unit	4	15	M	X	
Unit 3	Mandatory core unit	4	15	M	X	
Unit 4	Mandatory core unit	4	15	M	X	
Unit 5	Mandatory core unit	4	15	M	X	
Unit 6	Mandatory core unit	5	15	P	0	
Unit 7	Mandatory core unit	5	15	M	1	15
Unit 8	Mandatory core unit	5	20	P	0	
Unit 20	Specialist unit	5	15	M	1	15
Unit 21	Specialist unit	5	15	P	0	
Unit 23	Specialist unit	5	15	P	0	
Unit 25	Specialist unit	4	15	P	X	
Unit 26	Specialist unit	5	15	M	1	15
Unit 29	Specialist unit	4	15	M	X	
Unit 33	Specialist unit	4	15	M	X	
Unit 35	Specialist unit	5	15	M	1	15
	Qualification grade totals	**Min 125 at level 5**	**245**			**60**

Count the points from level 5 units for the best 75 credits

X these units are **below** the level of the HND Diploma so not counted for grading

The learner has sufficient points for a pass grade.

Example 2

Achievement of an HND Diploma with a Merit grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	X	
Unit 2	Mandatory core unit	4	15	M	X	
Unit 3	Mandatory core unit	4	15	M	X	
Unit 4	Mandatory core unit	4	15	M	X	
Unit 5	Mandatory core unit	4	15	M	X	
Unit 6	Mandatory core unit	5	15	M	1	15
Unit 7	Mandatory core unit	5	15	D	2	30
Unit 8	Mandatory core unit	5	20	D	2	40
Unit 20	Specialist unit	5	15	M	1	15
Unit 21	Specialist unit	5	15	M	1	(15)
Unit 23	Specialist unit	5	15	P	0	
Unit 25	Specialist unit	4	15	P	X	
Unit 26	Specialist unit	5	15	M	1	(15)
Unit 29	Specialist unit	4	15	M	X	
Unit 33	Specialist unit	4	15	M	X	
Unit 35	Specialist unit	5	15	M	1	(15)
Unit 36	Specialist unit	5	10	D	2	20
	Qualification grade totals	**Min 125 at level 5**	**255**			**120**

The learner can be considered for a merit:

only count the points from **the best 75** credits from a valid combination of 240 credits

X these units are **below** the level of the qualification so **cannot** be counted for grading

The best 75 credits include both mandatory core and optional units

() these units are not counted in the overall score

The learner has sufficient points for a merit grade.

Example 3

Achievement of an HND Diploma with a distinction grade

		Level	Credit	Grade	Grade points	Points per unit (weighting × credit points)
Unit 1	Mandatory core unit	4	15	P	X	
Unit 2	Mandatory core unit	4	15	M	X	
Unit 3	Mandatory core unit	4	15	D	X	
Unit 4	Mandatory core unit	4	15	D	X	
Unit 5	Mandatory core unit	4	15	M	X	
Unit 6	Mandatory core unit	5	15	D	2	30
Unit 7	Mandatory core unit	5	15	D	2	30
Unit 8	Mandatory core unit	5	20	D	2	30
Unit 20	Specialist unit	5	15	D	2	30
Unit 21	Specialist unit	5	15	D	2	30
Unit 23	Specialist unit	5	15	P	0	
Unit 25	Specialist unit	4	15	P	X	
Unit 26	Specialist unit	5	15	M	1	(15)
Unit 29	Specialist unit	4	15	M	X	
Unit 33	Specialist unit	4	15	M	X	
Unit 35	Specialist unit	5	15	M	1	(15)
Unit 36	Specialist unit	4	15	P	X	
	Qualification grade totals	**Min 125 at level 5**	**245**			**150**

The learner can be considered for a distinction:

only count the points from level 5 units for the best 75 credits from a valid combination of **240** credits

() these units are not counted in the overall score

X not counted as **below the** level of the qualification.

The learner has sufficient points for a distinction grade.

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