BTEC Higher Nationals

edexcel

APPLIED CHEMISTRY

Specification

LEVEL 4 HNC

LEVEL 5 HND

QCF Accredited

Issue 4
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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 the Edexcel website: www.edexcel.com

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Edexcel BTEC Level 4 HNC Diploma in Applied Chemistry

Edexcel BTEC Level 5 HND Diploma in Applied Chemistry

The Qualifications and Credit Framework (QCF) has been introduced to replace the National Qualifications Framework (NQF). It recognises achievement through the award of credit for units and qualifications, working at all levels between Entry level and level 8.

To accommodate the new framework we have taken the opportunity to revise the academic level and size of the Edexcel BTEC HNCs (Higher National Certificates). These are now at level 4 and are a minimum of 120 credits in size. They have been nested within the structures of the Edexcel BTEC HNDs (Higher National Diplomas).

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

The qualifications remain as Intermediate level qualifications on the Framework for Higher Education Qualifications (FHEQ). Progression to Edexcel BTEC Higher Nationals continues to be from level 3 qualifications and progression from Edexcel 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.

Existing NQF Higher National units achievement can count towards the QCF Edexcel BTEC Higher Nationals.

Edexcel BTEC Higher Nationals within the QCF, NQF and FHEQ

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

UNITS
The units for the Edexcel BTEC Higher Nationals in Applied Chemistry are on the CD ROM that accompanies this specification and on the Edexcel website.

Contents

Qualification titles covered by this specification

Edexcel BTEC Level 4 HNC Diploma in Applied Chemistry (QCF)

Edexcel BTEC Level 5 HND Diploma in Applied Chemistry (QCF)

These qualifications have been accredited to the Qualifications and Credit Framework (QCF). 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 Edexcel. 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.

Centres are reminded that The Report of the National Committee of Inquiry into Higher Education (the Dearing Report) recommended that they *'develop, for each programme they offer, a 'programme specification' which identifies potential stopping-off points and gives the intended outcomes of the programme ...'*

The Quality Assurance Agency for Higher Education (QAA) has produced guidelines for centres in preparing programme specifications (reference *Guidelines for preparing programme specifications*: QAA 115 06/06) which includes related post-Dearing developments. Annexe 2: *Working with programme specifications: a leaflet for further education colleges* of this QAA document contains additional guidance notes to support further education colleges writing programme specifications for Edexcel awards.

Qualification Numbers

The Qualifications and Credit Framework (QCF) code is known as a Qualification Number (QN). Each unit within a qualification will also have a QCF unit code.

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

The QNs for the qualifications in this publication are:

500/8244/9	Edexcel BTEC Level 4 HNC Diploma in Applied Chemistry (QCF)
500/8247/4	Edexcel BTEC Level 5 HND Diploma in Applied Chemistry (QCF).

Introduction

This specification contains the units and associated guidance for the QCF Edexcel BTEC Level 4 HNC in Applied Chemistry and the Edexcel 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 Edexcel's policies regarding access to its qualifications, the design of programmes of study and delivery modes.

Structure of the qualification

Edexcel BTEC Level 4 HNC Diploma

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

Edexcel BTEC Level 5 HND Diploma

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

Rules of combination for Edexcel 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 QCF Edexcel BTEC Higher National qualifications.

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

Edexcel BTEC Level 4 HNC Diploma in Applied Chemistry (QCF)

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 QCF Edexcel BTEC Higher National qualifications to meet local needs. Level rules and mandatory core units must not be changed.

Edexcel BTEC Level 5 HND Diploma in Applied Chemistry (QCF)

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): 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 QCF Edexcel BTEC Higher National qualifications to meet local needs. Level rules and mandatory core units must not be changed.

Structure of the Edexcel BTEC Level 4 HNC Diploma in Applied Chemistry (QCF)

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
27	Statistics for Experimental Design	5	15

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

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

Structure of the Edexcel BTEC Level 5 HND Diploma in Applied Chemistry (QCF)

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
26	Materials Science and Technology	4	15
27	Statistics for Experimental Design	5	15

Unit number	Specialist units — choose units with a total credit value of 150 credits *(continued)*	Unit level	Unit credit
28	Work-based Experience	5	15
29	Personal and Professional Development	5	15
30	Employability Skills	5	15

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

Key features

Edexcel 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 the development of practical skills 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 Edexcel 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 Edexcel BTEC Higher National units to the degree programme in question.

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

Edexcel 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.

Professional body recognition

The Edexcel 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).

Further details of professional body recognition and exemptions for Edexcel BTEC Higher Nationals are given in the *BTEC Higher Nationals – Professional Recognition and Progression Directory 2008* available from our website: www.edexcel.com/quals/hn/Pages/Keydocuments.aspx

National Occupational Standards

Edexcel 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 Requirement

Edexcel has published Qualification Requirements as part of the revision of Edexcel BTEC Higher Nationals. Qualification Requirements set out the aims and rationale of the qualifications and provide the framework of curriculum content. They also identify the higher-level skills associated with the qualifications and any recognition by relevant professional bodies. The Qualification Requirement for the Edexcel BTEC Higher Nationals in Applied Chemistry is given in *Annexe A*.

Edexcel standard specification titles are developed from the Qualification Requirements. Licensed centres comply with Qualification Requirements when developing Higher Nationals under these standard titles.

Qualification Requirements provide consistent standards within the same vocational area and identify the skills and knowledge that can be expected of any holder of an identical Edexcel BTEC Higher National. This will allow higher education institutions, employers and professional bodies to confidently provide progression opportunities to successful learners.

Higher-level skills

Learners studying for Edexcel BTEC Higher Nationals in Applied Chemistry 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 learning and recognise their learning style.

Edexcel BTEC Level 4 HNC Diploma

The Edexcel 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.

Edexcel 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 mode free but they 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 Edexcel 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.

Edexcel BTEC Level 5 HND Diploma

The Edexcel BTEC Level 5 HND provides greater breadth and specialisation than the Edexcel BTEC Level 4 HNC. Edexcel BTEC HNDs are mode free but 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 Edexcel 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 Edexcel 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.

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 an Edexcel BTEC Level 4 HNC and a minimum of 240 credits (of which at least 125 must be at level 5) to be awarded an Edexcel BTEC Level 5 HND.

The assessment of Edexcel 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 Edexcel 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, QCF level and credit value.

The unit title is accredited on the QCF and this form of words will appear on the learner's Notification of Performance.

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 QCF will 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 QCF level descriptors and, where appropriate, the National Occupational Standards (NOS) and/or other sector/professional benchmarks.

Each unit in Edexcel 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.
- 'eg' 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 Edexcel to offer the qualification.

Learning and assessment

The purpose of assessment is to ensure that effective learning of the content of each unit has taken place. 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 and their importance cannot be over-emphasised.

Grading Higher National units

The grading of Edexcel 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. They can be achieved in a flexible way, for example in a sequential or holistic mode, to reflect the nature of the sector concerned.

Each of the generic merit and distinction grade descriptors can be amplified by use of **indicative characteristics**. 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.

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
In order to achieve a **distinction** in a unit	• pass and merit requirements achieved • all distinction grade descriptors achieved

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 the Edexcel 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 the HNC and the HND 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 'Points available per credit at specified unit grades' table below).

Points available per credit at specified unit grades

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

Qualification grades

Edexcel BTEC Level 4 HNC

Points range	Grade	
0-74	Pass	P
75-749	Merit	M
150	Distinction	D

Edexcel BTEC Level 5 HND

Points range	Grade	
0-74	Pass	P
75-749	Merit	M
150	Distinction	D

Annexe E gives examples of how qualification grades are calculated.

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

If a learner moves from HNC to HND then credits from both the HNC and HND can contribute to the best 75 credits of the overall HND grade.

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.

Edexcel 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 Edexcel's policy on RPL please see our *Recognition of Prior Learning Policy* on our website. Please go to http://www.edexcel.com/Policies/Documents/Recognition of Prior Learning.pdf

Quality assurance of Edexcel BTEC Higher Nationals

Edexcel's quality assurance system for all BTEC higher level programmes on the QCF 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 Edexcel BTEC higher level programmes on the QCF at Levels 4–7 comprises three key components.

1) Approval process

Approval to offer Edexcel BTEC Higher National qualifications will vary depending on the status of the centre.

Centres that have a recent history of delivering Edexcel BTEC Higher National qualifications and have an acceptable quality profile in relation to their delivery will be able to gain approval through Edexcel Online.

Centres new to the delivery of Edexcel BTEC Higher National qualifications will be required to seek approval through the existing Edexcel 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 Edexcel 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 Edexcel's 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. Edexcel reserves the right to confirm independently that these arrangements are operating to Edexcel's satisfaction.

Edexcel 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 Edexcel BTEC higher level programmes on the Qualifications and Credit Framework at Levels 4-7 are subject to an independent assessment review by an Edexcel-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, Edexcel 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

Edexcel BTEC Higher National qualifications 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 to each qualification in the defined qualification structures provided in this document.

In Edexcel BTEC Higher National qualifications each unit's credit value usually consists of multiples of 5 credits. Most units are 15 credits in value. These units have been designed from a learning time perspective. **Each 15-credit unit approximates to a learning time of 150 hours**.

These new Edexcel BTEC Level 5 HND qualifications are the same size as the Edexcel Level 5 BTEC Higher National Diplomas which were accredited onto the National Qualifications Framework (NQF). Therefore, it is expected that these Edexcel BTEC Level 5 HNDs, accredited onto the Qualifications and Credit Framework (QCF), will also require approximately 960 guided learning hours (GLH).

Consequently, using the above approach, the new Edexcel BTEC Level 4 HNCs, which are accredited onto the QCF, and are now half the size of the Edexcel BTEC Level 5 Higher National Diplomas, will require approximately 480 GLH.

Within the information relating to these units on the QCF, each 15-credit unit has been allocated a figure of 60 GLH to help guide centres (other units with smaller or larger credit values have figures calculated on a pro rata basis). Centres delivering these qualifications are required to use their professional expertise in the design and delivery of these qualifications within the overall guided learning hours for the qualification.

Guided learning hours are defined as all the time when a tutor, trainer or facilitator 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. It also includes time spent by staff assessing learners' achievements. It does not include time spent by staff in day-to-day marking of assignments where the learner is not present.

Learning time is defined as the time taken by learners at the level of the unit, on average, to complete the learning outcomes of the unit to the standard determined by the assessment criteria. It should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Centres are advised to consider this definition 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 NQF Edexcel Level 5 BTEC Higher Nationals in Applied Chemistry with the new units of the QCF Edexcel BTEC Higher Nationals in Applied Chemistry.

Mode of delivery

Edexcel does not define the mode of study for Edexcel 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.

Full guidance on our policies on 'distance assessment' and 'electronic assessment' 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 Edexcel 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

Edexcel 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 Edexcel.

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 Edexcel 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 the Royal Society of Chemistry, the professional body for the Applied Chemistry sector, together with support from an appropriate Sector Skills Council (SSC), Sector Skills Body (SSB) or National Training Organisation (NTO) for the Applied Chemistry sector.

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 identified by organisations such as Regional Development Agencies and local funding agencies.

Centres may not always be able to meet local needs using the units in this specification. In this situation, centres can seek approval from Edexcel to use units from other Edexcel BTEC Higher National qualifications on the QCF. Centres will need to justify the need for importing units from other specifications and Edexcel will ensure that the vocational focus of the qualification remains the same.

Locally-devised specialist units

There may be exceptional circumstances where even the flexibility of importing units from other specifications does not meet a particular local need. In this case, centres can seek permission from Edexcel to develop a unit(s) with us to meet this need. Permission will be granted only in a limited number of cases.

Edexcel will ensure that the integrity of the qualification is not compromised and that there is a minimum of overlap and duplication of content of existing units. Centres will need strong evidence of the local need and the reasons why the existing standard units are inappropriate. Edexcel will validate these units.

Limitations on variations from standard specifications

The flexibility to import standard units from other QCF Edexcel BTEC Higher National specifications and/or to develop unique locally-devised specialist units is **limited to a maximum of 30 credits in an Edexcel BTEC HNC qualification and a maximum of 60 credits only in any Edexcel BTEC HND qualification**. 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.

Access and recruitment

Edexcel'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 Edexcel 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 should also show regard for Edexcel's policy (see our website) on learners with particular requirements.

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 Advanced level profile which 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 awarded by 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

The Edexcel BTEC Higher National qualifications are accredited on the QCF for learners aged 18 years and over.

Access arrangements and special considerations

Edexcel's policy on access arrangements and special considerations for BTEC and Edexcel NVQ qualifications aims to enhance access to the qualifications for learners with disabilities and other difficulties (as defined by the Disability Discrimination Act 1995 and the amendments to the Act) without compromising the assessment of skills, knowledge, understanding or competence.

Further details are given on our website (www.edexcel.com).

Useful publications

Further copies of this document and related publications can be obtained from:

Edexcel Publications
Adamsway
Mansfield
Nottinghamshire NG18 4FN

Telephone: 01623 467 467
Fax: 01623 450 481
Email: publication.orders@edexcel.com

Related publications include:

- the current Edexcel publications catalogue and update catalogue
- Edexcel publications concerning the quality assurance system and the internal and external verification of vocationally-related programmes may be found on the Edexcel website and in the Edexcel publications catalogue.

NB: Most of our publications are priced. There is also a charge for postage and packing. Please check the cost when you order.

Professional body contact details

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

Telephone: +44 (0) 20 7437 8656
Fax: +44 (0) 20 7437 8883
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
14 Upton Road
Watford
WD18 0JT

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

Professional development and training

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

The support we offer focuses on a range of issues including:

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

The national programme of training we offer can be viewed on our website (www.edexcel.com\training). You can request customised training through the website or by contacting one of our advisers in the Training from Edexcel team via Customer Services to discuss your training needs.

Our customer service numbers are:

BTEC and NVQ	0844 576 0026
GCSE	0844 576 0027
GCE	0844 576 0025
The Diploma	0844 576 0028
DiDA and other qualifications	0844 576 0031

Calls may be recorded for training purposes.

The training we provide:

- is active – ideas are developed and applied
- is designed to be supportive and thought provoking
- builds on best practice.

Our training is underpinned by the former LLUK standards for those preparing to teach and for those seeking evidence for their continuing professional development.

Further information

For further information please call Customer Services on 0844 576 0026 (calls may be recorded for training purposes) or visit our website at www.edexcel.com.

Annexe A

Qualification Requirement

BTEC Higher Nationals in Applied Chemistry

This Qualification Requirement should be read in conjunction with overarching guidance from Edexcel.

Rationale

The 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.

Entry requirements

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 a Level 4/5 qualification. 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 Advanced level profile which 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 awarded by an approved further education institution
- related work experience.

Annexe B

National Occupational Standards

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 QCF Edexcel 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 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 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

New QCF versions of the Edexcel BTEC Higher National units in Applied Chemistry (specification start date 01/09/2010) mapped against the NQF BTEC Higher National units in Applied Chemistry (specification end date 31/08/2010).

Unit number	QCF unit title	Maps to NQF 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

Unit number	QCF unit title	Maps to NQF unit number	Level of similarity between units
19	Environmental Monitoring and Analysis	20	F
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

New QCF versions of the Edexcel BTEC Higher National units in Applied Chemistry (specification start date 01/09/2010) mapped against the NQF BTEC Higher National units in Applied Chemistry (specification end date 31/08/2010).

New QCF units		NQF 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
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.*

New QCF units		NQF units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
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
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*

New QCF units		NQF units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
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
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*

New QCF units		NQF 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

New QCF units		NQF 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.*
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.*

New QCF units		NQF units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
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.*
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.*

New QCF units		NQF units		Mapping/comments (new topics in italics)
Number	**Name**	**Number**	**Name**	
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 the Edexcel 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 'Points available per credit at specified unit grades' table below).

Points available per credit at specified unit grades

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

Qualification grades

Edexcel BTEC Level 4 HNC

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

Edexcel BTEC Level 5 HND

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

Examples of possible learner profiles of the best 75 credits at the level of the qualification or above. These tables fit both HNC and HND qualifications.

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	30	0	0
Merit	30	1	30
Distinction	15	2	30
		Total	**60**
		Qualification grade	**Pass**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	15	0	0
Merit	45	1	45
Distinction	15	2	30
		Total	**75**
		Qualification grade	**Merit**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	30	0	0
Merit	15	1	15
Distinction	30	2	60
		Total	**75**
		Qualification grade	**Merit**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	0	0	0
Merit	15	1	15
Distinction	60	2	120
		Total	**135**
		Qualification grade	**Merit**

Unit grade	Credits achieved at each unit grade	Points per credit	Points scored
Pass	0	0	0
Merit	0	1	0
Distinction	75	2	150
		Total	**150**
		Qualification grade	**Distinction**

APPLIED CHEMISTRY

Specification

LEVEL 4 HNC

LEVEL 5 HND

Our most advanced specification to date

This new BTEC Higher Nationals specification has been completely revised and updated to bring it into line with the requirements of the Qualifications and Credit Framework (QCF), which comes into force from September 2010. All the units and qualifications covered in the specification have been reviewed by industry representatives and approved by the relevant Sector Skills Council. This means they are recognised as fit for purpose as high level vocational and work-related qualifications.

Each unit in the new specification is allocated a level and a credit value. Each unit in the specification has clearly stated learning outcomes and assessment criteria, so it is clear from the outset what learners must be able to do to achieve the unit.

BTEC Qualifications covered by this specification:

- Edexcel BTEC Level 4 HNC Diploma in Applied Chemistry
- Edexcel BTEC Level 5 HND Diploma in Applied Chemistry

A copy of this specification can be found online at:
www.btec.co.uk

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Acknowledgements

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References

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