Pearson
BTEC Level 2
Technical Diploma in Laboratory Science

Specification

First teaching September 2017
Issue 2
Edexcel, BTEC and LCCI qualifications

Edexcel, BTEC and LCCI qualifications are awarded by Pearson, the UK’s largest awarding body offering academic and vocational qualifications that are globally recognised and benchmarked. For further information, please visit our qualifications website at qualifications.pearson.com. Alternatively, you can get in touch with us using the details on our contact us page at qualifications.pearson.com/contactus

About Pearson

Pearson is the world's leading learning company, with 35,000 employees in more than 70 countries working to help people of all ages to make measurable progress in their lives through learning. We put the learner at the centre of everything we do, because wherever learning flourishes, so do people. Find out more about how we can help you and your learners at qualifications.pearson.com

This specification is Issue 2. Key changes are sidelined. We will inform centres of any changes to this issue. The latest issue can be found on our website.

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

ISBN 978 1 446 95024 1

All the material in this publication is copyright © Pearson Education Limited 2018
Welcome

With a track record built over 30 years of learner success, BTEC qualifications are widely recognised and respected. They provide progression to the workplace, either directly or via study at higher levels. Proof comes from YouGov research, which shows that 62% of large companies have recruited employees with BTEC qualifications.

Why are BTECs so successful?

BTECs embody a fundamentally learner-centred approach to the curriculum, with a flexible, unit-based structure. In these new BTEC Level 2 Technicals, the focus is on the development of technical, practical and transferable work-related skills, and sector-specific knowledge. The development of these skills is key for learners to progress to work or to an Apprenticeship.

When creating the BTEC Level 2 Technicals, we worked with employers to ensure that the qualifications meet their needs. Employers are looking for recruits with the appropriate technical knowledge, and technical and transferable skills essential for employment.

The BTEC Level 2 Technicals meet these requirements through:

- a range of occupationally-related qualifications, each with a clear purpose, so that there is a qualification to suit each learner’s plan for career progression
- up-to-date content that is closely aligned with employers’ needs for a skilled future workforce
- assessments and projects chosen to help learners progress to the next stage. This means that some assessments and projects are set by the centre to meet local needs, while others are set and marked by Pearson. This ensures that there is a core of skills and understanding common to all learners. For example, an externally-set test can be used to check that learners are confident in using technical knowledge to carry out a certain job.

We provide a wealth of support, both resources and people, to ensure that learners and their tutors have the best possible experience during their course. See Section 11 Resources and support for details of the support we offer.

A word to learners...

BTEC Level 2 Technicals will demand a lot of practical work from you. You will need to:

- complete a range of units
- be organised
- take some assessments that Pearson will set and mark
- take other assessments that will demonstrate your technical and practical skills
- keep a portfolio of your assignments.

But you can feel proud to achieve a BTEC because, whatever your plans in life – whether you decide to go on to work or to an Apprenticeship – success in your BTEC Level 2 Technical qualification will help you to progress to the next stage in your life.

Good luck, and we hope you enjoy your course.
Collaborative development

Learners completing their BTEC Level 2 Technicals will be aiming to go on to employment or to an Apprenticeship. It was essential therefore that we developed these qualifications in close collaboration with employers from the healthcare and utilities sectors, and with the providers who will be delivering the qualifications. We are grateful to all the further education lecturers, tutors, employers and other individuals who have generously shared their time and expertise to help us develop these new qualifications.

In addition businesses have provided letters of support confirming that these qualifications meet their recruitment requirements. These letters can be viewed on our website.
# Contents

Pearson BTEC Level 2 Technicals  

1 Pearson BTEC Level 2 Technical Diploma in Laboratory Science  
   - Who is the qualification for?  
   - What does the qualification cover?  
   - What could this qualification lead to?  
   - About the Laboratory Science sector

2 Structure  
   - Total Qualification Time (TQT)  
   - Qualification structure  
   - Qualification and unit content  
   - Assessment  
   - Language of assessment  
   - Grading of the qualification  
   - Employer involvement

3 Units  
   - Understanding your units

4 Planning your programme  
   - Is there a learner entry requirement?  
   - What is involved in becoming an approved centre?  
   - What level of sector knowledge is needed to deliver this qualification?  
   - What resources are required to deliver this qualification?  
   - What makes good vocational teaching?  
   - What are the requirements for meaningful employer involvement?  
   - What support is available for delivery and assessment?  
   - How will my learners become more employable through this qualification?

5 Assessment structure

6 Internal assessment  
   - Principles of internal assessment  
   - Operating internal assessment  
   - Setting assignments  
   - Making valid assessment decisions

7 External assessment  
   - Sample assessment materials  
   - Conducting external assessments
8 Administrative arrangements  
  Introduction  
  Learner registration and entry  
  Access to assessment  
  Administrative arrangements for internal assessment  
  Administrative arrangements for external assessment  
  Dealing with malpractice in assessment  
  Certification and results  
  Additional documents to support centre administration  

9 Quality assurance  
  Centre and qualification approval  
  Continuing quality assurance and standards verification  

10 Understanding the qualification grade  
  Awarding and reporting for the qualification  
  Eligibility for an award  
  Examples of grade calculations based on table applicable to registrations from September 2017  

11 Resources and support  
  Support for setting up your course and preparing to teach  
  Support for teaching and learning  
  Support for assessment  
  Training and support from Pearson
Pearson BTEC Level 2 Technicals

Introduction

BTEC Level 2 Technicals are intermediate qualifications for post-16 learners who want to specialise in a specific occupation, occupational area or technical role. They prepare learners for work or an Apprenticeship by giving them the opportunity to develop sector-specific knowledge, technical and practical skills, and to apply these skills in work-related environments. The qualifications also provide progression to Level 3 Tech Level qualifications.

Developed in close conjunction with leading employers, BTEC Level 2 Technicals also develop transferable workplace skills, such as good communication and the ability to work in a team, which employers have identified as essential for gaining employment in the sector and for progression once the learner is working.

At the core of these qualifications is the concept of preparing young people for the working world. Through practical activities and occupationally-fit-for-purpose assessments, learners will gain the skills and behaviours needed for sustainable employment.

BTEC Level 2 Technicals are designed to be used flexibly, depending on their size and scope:

- as part of a full-time 16–19 study programme, alongside mathematics and English GCSEs and/or Functional Skills, work placement and enrichment activities
- as the technical qualification within an Apprenticeship or off-the-job training for those already in work as a roll-on, roll-off programme for those entering an Apprenticeship or employment.

Pearson has developed the BTEC Level 2 Technicals suite to meet the Department for Education (DfE) requirements for qualifications to be offered as Technical Certificates for 16–19 year olds.

This specification contains the information you need to deliver the Pearson BTEC Level 2 Technical Diploma in Laboratory Science 603/0461/3. The specification signposts you to additional handbooks and policies. It includes all the units for this qualification.
1 Pearson BTEC Level 2 Technical Diploma in Laboratory Science

Purpose

Who is the qualification for?
This qualification is for learners who want to start a career in laboratory science. It is designed for post-16 learners and can be taken as part of a wider study programme. It is an ideal qualification for those intending to progress to employment in a science-related laboratory directly or to a laboratory science apprenticeship.

What does the qualification cover?
The qualification has been developed in consultation with employers in the laboratory science sector, in order to ensure learners develop the skills and behaviours that give them the best opportunity when applying for work within a laboratory.
All the content of the qualification is mandatory and relates directly to the skills, knowledge and behaviours expected by employers in the science laboratory sector. The areas covered include:
- laboratory health and safety
- working in a science laboratory
- assisting the work of a laboratory
- preparing and clearing down a laboratory
- handling scientific data
- planning a scientific investigation
The qualification will also enhance broader skills in literacy and numeracy, which will be invaluable to support progression. In addition, it will also develop transferable technical and practical skills in communication, research and teamwork.

What could this qualification lead to?
Achieving this qualification will give learners an advantage when applying for a job in a laboratory. The types of jobs they will be ready for include:
- health science laboratory assistant
- pharmaceutical laboratory assistant
- food science laboratory assistant
The qualification also gives a sound basis for learners to progress further in the science sector in a wide range of industries, or to an apprenticeship, including dental laboratory assistant, healthcare science assistant or laboratory technician, or a Level 3 qualification.

About the laboratory science sector
The science sector is one of the largest and most diverse sectors in the UK, including, for example, biomedical, pharmaceutical, food, forensic, dental, health, physical and chemical science. There are approximately 5.8 million people employed in science-related occupations in the UK. This equates to approximately 20% of the workforce. Most science organisations depend on the work that takes place in their laboratories, whether that is research and development, or production and manufacture, and the roles of those who work in those laboratories is vital.
2 Structure

Total Qualification Time (TQT)

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

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

The Pearson BTEC Level 2 Technical Diploma in Laboratory Science is a qualification having:
- Total Qualification Time: 455 hours
- Guided Learning: 360 hours.

Centres should take note of these hours in planning their programme but should also use their professional judgement to determine the provision of guided learning and study time across the units.

Qualification structure

Learners are required to complete and achieve all the units included in this qualification.

<table>
<thead>
<tr>
<th>Unit number</th>
<th>Unit title</th>
<th>GLH</th>
<th>Type</th>
<th>How assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Laboratory Health and Safety</td>
<td>60</td>
<td>Mandatory</td>
<td>External</td>
</tr>
<tr>
<td>2</td>
<td>Working in a Science Laboratory</td>
<td>60</td>
<td>Mandatory</td>
<td>External</td>
</tr>
<tr>
<td>3</td>
<td>Assisting in Laboratory Activities</td>
<td>60</td>
<td>Mandatory</td>
<td>Internal</td>
</tr>
<tr>
<td>4</td>
<td>Preparing and Clearing down a Laboratory</td>
<td>60</td>
<td>Mandatory</td>
<td>Internal</td>
</tr>
<tr>
<td>5</td>
<td>Handling Scientific Data</td>
<td>60</td>
<td>Mandatory</td>
<td>Internal</td>
</tr>
<tr>
<td>6</td>
<td>Planning A Scientific Investigation</td>
<td>60</td>
<td>Mandatory</td>
<td>Internal Synoptic</td>
</tr>
</tbody>
</table>

This qualification has 100% mandatory content and 33.3% external assessment.
Qualification and unit content

Pearson has developed the content of this qualification in collaboration with employers and representatives from relevant professional bodies and further education providers. In this way, we have ensured that content is up to date and that it includes the knowledge, technical and practical skills and behaviours required to work in the sector and occupational area.

All units in this qualification are mandatory which provides a balance of breadth and depth, ensuring that all learners develop the technical and practical skills required in the occupational area. Learners are then offered the opportunity to develop a range of transferable skills and attributes expected by employers. It is expected that learners will apply their learning to relevant employment and sector contexts during delivery and that they will have opportunities to engage meaningfully with employers.

BTECs have always required applied learning that brings together knowledge and understanding (the cognitive domain) with practical and technical skills (the psychomotor domain). This is achieved through learners performing practical, work-related tasks that encourage the development of appropriate work-related behaviours (the affective domain) and transferable skills. Transferable skills are those such as communication, teamwork, and planning and completing tasks to high standards, all of which are valued in the workplace.

Our approach provides rigour and balance and promotes the ability to apply learning immediately in new contexts.

Some of the units within the specification may contain references to legislation, policies, regulations and organisations, which may not be applicable in the country you deliver this qualification in (if teaching outside of England), or which may have gone out-of-date during the lifespan of the specification. In these instances, it is possible to substitute such references with ones that are current and applicable in the country you deliver subject to confirmation by your Standards Verifier.

Assessment

Assessment is designed to fit the purpose and objective of the qualification. It includes a range of assessment types and styles suited to skills and occupationally-based qualifications at this level.

External assessment

In this qualification, there are two external assessments, which assess units that contribute to 33.3% of the total qualification GLH. The external assessments for this qualification take the form of onscreen tests that include a variety of question types and allow learners to apply their knowledge to several work-related contexts. Each external assessment is linked to a specific unit as indicated in the qualification structure on the previous page.

Onscreen tests have been chosen to externally assess the identified units because this method is best suited to draw out the evidence required. These units cover the fundamental knowledge required to work in a laboratory, such as laboratory health and safety, and the use and purpose of laboratory equipment and materials.

Each external assessment is taken under specified conditions, then marked by Pearson and a grade awarded. Learners must achieve both external units at Pass grade or above to achieve the qualification. Learners are permitted to resit the external assessments once during their programme by taking a new assessment.

For further information on external assessment see Section 7 External assessment.
Internal assessment

Units 3, 4, 5 and 6 are assessed through internal assessment. Internal assessment allows learners to apply technical knowledge and demonstrate mastery of practical and technical skills through realistic tasks and activities. This style of assessment promotes deep learning through ensuring the connection between knowledge and practice.

Internal assessment is through assignments that are subject to external standards verification. We provide suggestions in each unit for setting assignments. This means that you can adapt materials to your local contexts and assess assignments that provide the valid and rigorous final assessment for each unit.

You will make grading decisions based on the requirements and supporting guidance given in the units. Learners must achieve all the internal units at Pass grade or above to achieve the qualification. For further information on internal assessment, including resubmissions, see Section 6 Internal assessment.

Synoptic internal assessment

There is one internal unit that provides the main synoptic assessment for this qualification. This synoptic assessment is designed to take place towards the end of the programme and draws on the learning throughout the qualification. The design of this assessment ensures that there is sufficient stretch and challenge, enabling the assessment of sector-related knowledge and technical and practical skills at the end of the learning period.

The synoptic assessment for this qualification is in Unit 6 and takes the form of a vocational task, where learners will draw on the knowledge and skills they have developed across the units to put together and present a plan for a scientific investigation in a laboratory science sector of their choice. In delivering the unit, you need to encourage learners to draw on their broader learning so that they are prepared for the assessment.

Language of assessment

Assessment of the internal and external units for this qualification will be available in English. All learner work must be in English. A learner taking the qualifications may be assessed in British sign language where it is permitted for the purpose of reasonable adjustment. For information on reasonable adjustments see Section 8 Administrative arrangements.

Grading of the qualification

Achievement in the qualification requires a demonstration of depth of study in each unit, assured acquisition of the practical skills required for employment in the specific sector and successful development of transferable skills.

Units are assessed using a grading scale of Distinction, Merit, Pass and Unclassified. All units in the qualification contribute proportionately to the overall qualification grade.

The qualification is graded using a scale of PP to DD. Please see Section 10 Understanding the qualification grade for more details.

The relationship between qualification grading scales and unit grades will be subject to regular review as part of Pearson’s standards monitoring processes on the basis of learner performance and in consultation with key users of the qualification.
**Employer involvement**

Employer involvement in the delivery and/or assessment of technical qualifications provides a clear 'line of sight' to work, enriches learning, raises the credibility of the qualification in the eyes of employers, parents and learners, and furthers collaboration between the learning and skills sector and industry.

You need to ensure that all learners have the opportunity to undertake meaningful activity involving employers during their course.

Examples of 'meaningful activity' include:

- Structured work experience or work placements that develop skills and knowledge relevant to the qualification/industry. Note: simulated work environments can’t be used for work experience e.g. college laboratories
- Project(s), exercise(s) and/or assessments/examination(s) set with input from industry practitioner(s)
- Units delivered or co-delivered by an industry practitioner(s); this could take the form of master classes or guest lectures
- Industry practitioners operating as 'expert witnesses' that contribute to the assessment of a learner's work of practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or all assessments for a qualification.

Meaningful employer involvement, as defined above, must be with employers from the laboratory science sector and must contribute significantly to at least one mandatory unit.

We have provided suggestions in some units on how employers could become involved in the delivery and/or assessment of this qualification. These units are listed below:

- Unit 1: Laboratory Health and Safety
- Unit 2: Working in a Science Laboratory
- Unit 4: Preparing and Clearing Down a Laboratory
- Unit 5: Handling Scientific Data
- Unit 6: Planning a Scientific Investigation.

These are suggestions only and there will be other possibilities at local level. Centres may choose to use other approaches but must ensure that these meet the requirement for meaningful employer involvement as defined above. Centres must have an employer involvement plan in place at the start of the programme. It must detail their approach to employer involvement and how it will add value to the delivery and assessment of the qualification.

Each centre’s approach to employer involvement will be monitored in two ways. It will be monitored at centre level as part of the annual quality management review process and captured as part of the standards verification process that addresses centre strategy for delivery, assessment and quality assurance, when we will ask you to show evidence of how employer involvement is provided for all learners. You will need to show evidence in order to gain reporting clearance for certification.

It will also be monitored at programme level as part of the standards verification process to confirm that plans for employer involvement meet the requirements of the specification. These approaches are designed to ensure that additional activities can be scheduled where necessary so that learners are not disadvantaged (see Section 9: Quality assurance).
3 Units

Understanding your units

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

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

- internal units
- external units.

This section explains how the units work. It is important that all tutors, assessors, internal verifiers and other staff responsible for the programme read and are familiar with the information given in this section.

Internal units

<table>
<thead>
<tr>
<th>Section</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit number</td>
<td>The number is in a sequence for the qualification.</td>
</tr>
<tr>
<td>Unit title</td>
<td>This is the formal title of the unit and appears on certificates.</td>
</tr>
<tr>
<td>Level</td>
<td>All units are at Level 2 on the national framework.</td>
</tr>
</tbody>
</table>
| Unit type       | This says if the unit is mandatory or optional for the qualification.  
See Section 2 Qualification structure for details.                                                                                   |
| Assessment type | This says how the unit is assessed – i.e. whether it is external, internal or synaptic internal.  
See Section 2 Qualification structure for details.                                                                                     |
| GLH             | Units have a GLH value of 60 GLH This indicates the numbers of hours of teaching, directed activity and assessment expected. It also shows  
the weighting of the unit in the final qualification grade.                                                                               |
| Unit in brief   | A brief formal statement on the content of the unit that is helpful in understanding its role in the qualification. You can use this in summary  
documents, brochures etc.                                                                                                               |
| Unit introduction | This is designed with learners in mind. It indicates why the unit is important, how learning is structured, and how learning might be  
applied when progressing to employment or higher education.                                                                             |
| Learning aims   | These help to define the scope, style and depth of learning of the unit. You can see where learners should be developing and demonstrating  
their skills or where they should be actively researching or reviewing.                                                                    |
| Unit summary    | This section helps tutors to see at a glance the main content areas against the learning aims and the structure of the assessment. The  
forms of evidence given are suitable to fulfil the requirements.                                                                          |
| Content         | This section sets out the required teaching content of the unit. Content is compulsory except when shown as ‘e.g.’. Learners should be asked  
to complete summative assessment only after the teaching content for the unit or learning aim(s) has been covered. |
<table>
<thead>
<tr>
<th>Section</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment criteria</td>
<td>Each learning aim has assessment criteria to explain the achievement required to obtain Pass, Merit and Distinction grades.</td>
</tr>
<tr>
<td>Essential information for assessment decisions</td>
<td>This information gives guidance for each learning aim or assignment of the expectations for Pass, Merit and Distinction standard. This section contains examples and essential clarification. It is important that this is used carefully alongside the assessment criteria.</td>
</tr>
<tr>
<td>Assessment activity</td>
<td>This section provides information, suggested scenarios and tasks for summative assessment activities.</td>
</tr>
<tr>
<td>Further information for tutors and assessors</td>
<td>The section gives you information to support the delivery and assessment of the unit.</td>
</tr>
<tr>
<td>Delivery guidance</td>
<td>This section offers suggestions of ways of delivering the unit. It offers ideas on practical activities in a sector context that can be used to help develop relevant skills and to encourage progress.</td>
</tr>
<tr>
<td>Essential resources</td>
<td>Any specific resources that you need to be able to teach and assess are listed in this section. For information on support resources see <em>Section 11 Resources and support</em>.</td>
</tr>
<tr>
<td>Links to other units</td>
<td>This section shows you the main relationships of units to other units. This can help you to structure your programme and make the best use of available materials and resources.</td>
</tr>
<tr>
<td>Employer involvement</td>
<td>This section gives you information on the units that can be used to give learners involvement with employers. It will help you to identify the kind of involvement that is likely to be successful.</td>
</tr>
</tbody>
</table>
External units

<table>
<thead>
<tr>
<th>Section</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit number</td>
<td>The number is in a sequence for the qualification.</td>
</tr>
<tr>
<td>Unit title</td>
<td>This is the formal title of the unit and appears on certificates.</td>
</tr>
<tr>
<td>Level</td>
<td>All units are at Level 2 on the national framework.</td>
</tr>
</tbody>
</table>
| Unit type                        | This says if the unit is mandatory or optional for the qualification.  
|                                  | See Section 2 Qualification structure for details.                                                                                                                                                    |
| Assessment type                  | This says how the unit is assessed – i.e. whether it is external, internal or synoptic internal.  
|                                  | See Section 2 Qualification structure for details.                                                                                                                                               |
| GLH                              | Units have a GLH value of 60 GLH. This indicates the numbers of hours of teaching, directed activity and assessment expected. It also shows the weighting of the unit in the final qualification grade. |
| Unit in brief                     | A brief formal statement on the content of the unit.                                                                                                                                              |
| Unit introduction                | This is designed with learners in mind. It indicates why the unit is important, how learning is structured, and how learning might be applied when progressing to employment or higher education.               |
| Summary of assessment            | This sets out the type of external assessment used and the way in which it is used to assess achievement.                                                                                             |
| Assessment outcomes              | These show the hierarchy of knowledge, understanding, skills and behaviours assessed. For tested units, they include information on how this hierarchy relates to command terms in sample assessment materials (SAMs). |
| Essential content                | For external units all the content is obligatory, the depth of content is indicated in the assessment outcomes and sample assessment materials (SAMs). The content will be sampled through the external assessment over time, using the variety of questions or tasks shown. |
| Grade descriptors                | We use grade descriptors when making judgements on grade boundaries. You can use them to understand what we expect to see from learners at particular grades.                                             |
| Key terms typically used in assessment | These definitions will help you to analyse requirements and to prepare learners for assessment.                                                                                                        |
| Links to other units             | This section shows the main relationships of units to other units. This section can help you to structure your programme and make the best use of available materials and resources.                        |
| Employer involvement             | This section gives you information on the units that can be used to give learners involvement with employers. It will help you to identify the kind of involvement that is likely to be successful. |
Units

This section contains all the units developed for this qualification.

Unit 1: Laboratory Health and Safety 13
Unit 2: Working in a Science Laboratory 23
Unit 3: Assisting in Laboratory Activities 33
Unit 4: Preparing and Clearing Down a Laboratory 45
Unit 5: Handling Scientific Data 57
Unit 6: Planning a Scientific Investigation 69
Unit 1: Laboratory Health and Safety

Level: 2
Unit type: Mandatory
Assessment type: External
Guided learning hours: 60

Unit in brief

Learners study the essential health and safety procedures needed to work in a variety of laboratory settings.

Unit introduction

There is a huge range of exciting scientific research going on across the UK, with scientists working in many different types of laboratory. This includes research relating to health, food security, development of medicines, agriculture, construction materials and forensic science, and you could play your part in working at the forefront of scientific progression.

In this unit, you will study the essential health and safety processes, factors and requirements in order to keep yourself and others safe, and to ensure that you are ready to support work in a laboratory environment in an effective way. You will become aware of the different aspects of working in a laboratory, which includes the maintenance of supplies, use of equipment and machinery, disposal of potentially hazardous waste materials, and how to respond if an emergency situation arises.

This unit will give you the essential knowledge and understanding about how to maintain the health and safety of yourself and others, which will support your progression to employment as a junior laboratory assistant in a scientific laboratory, helping to prepare for and support the work of scientists in a laboratory.

Summary of assessment

The unit is assessed using an onscreen test, set and marked by Pearson. The test contains different types of question and is worth 60 marks. The test duration is 75 minutes. The assessment is available on demand. The first assessment is available in January 2018.

Sample assessment materials will be available to help centres prepare learners for assessment.
UNIT 1: LABORATORY HEALTH AND SAFETY

Assessment outcomes

**AO1** Demonstrate knowledge of the signs, symbols and safe working practices related to working safely in a laboratory
Command words: complete, define, give, identify, label, link, match, name, state,
Marks: ranges from 1 to 3 marks

**AO2** Demonstrate understanding of safe working practices in a laboratory, including hazards, risks and control measures
Command words: complete, define, describe, identify, explain, label, link, match
Marks: ranges from 1 to 4 marks

**AO3** Apply knowledge and understanding of safe working practices in a laboratory context
Command words: compare, complete, define, describe, explain, label, link, match
Marks: ranges from 1 to 4 marks

**AO4** Make connections about working safely in different laboratory contexts
Command words: assess, compare, complete, describe, discuss, explain, justify, label, link, match
Marks: ranges from 2 to 6 marks
**Essential content**

The essential content is set out under content areas. Learners must cover all specified content before the assessment. The content must be studied with consideration of the differences in requirements of the following laboratory research areas: environmental, food and agriculture, health and genetics, materials science, construction science, electronics and communication.

**A Rules of the laboratory**

**A1 Professional behaviour in a laboratory**

Learners should understand the purpose of safety rules and safe working practices in laboratories, and the potential risks associated with failing to meet them.

- Requirements or restrictions in certain areas to avoid injury, contamination and infection of fomites (laboratory instruments and clothing):
  - no hand-to-mouth operations
  - using designated areas for consuming food or drink and storing personal possessions
  - using designated areas for performing tasks that present risks to others, to include fume cupboards/hoods
  - requirements for specific safety equipment, qualified personnel and designated places for carrying out different activities
  - wearing appropriate, non-specialist clothing, to include enclosed footwear
  - importance of protecting broken skin
  - maintaining clean and tidy work areas and personal hygiene procedures
  - controlling movement of items into and out of the laboratory
  - removing jewellery.

- Potential routes of exposure to toxicity, to include acute and chronic effects of inhalation, skin contact and ingestion.

**A2 Signs and symbols in the laboratory**

Learners must be able to identify, know the meaning of and understand the appropriate action required in relation to International Organization for Standardization (ISO) signs and symbols found in laboratories, in addition to the hazard pictograms and statements found in the current Classification, Labelling and Packaging of substances and mixtures (CLP) Regulations. These must be linked to their implications for laboratory workers, visitors and emergency services personnel.

- ISO hazard identification labels:
  - biological hazard
  - electrical hazard
  - flammable material hazard
  - general warning
  - glass hazard
  - laser beam hazard
  - radioactive hazard
  - toxic hazard.

- ISO mandatory action labels:
  - ear and eye protection
  - ear protection
  - eye protection
  - face shield
  - foot protection
  - gloves
  - hairnet
UNIT 1: LABORATORY HEALTH AND SAFETY

- hand washing
- hard hat
- head, ear, eye protection
- protective clothing
- read operator’s manual.

- ISO prohibition labels:
  - do not recycle
  - do not operate without guards
  - do not walk or stand here
  - do not wear gloves
  - no flames
  - no heavy load
  - no smoking
  - no thoroughfare.

- CLP hazard pictograms and associated statements for chemicals:
  - acute toxicity
  - corrosive
  - explosive
  - flammable
  - gas under pressure
  - hazardous to the environment
  - health hazard/hazardous to the ozone layer
  - oxidising
  - serious health hazard.

- Use of signs indicating work in progress, to include leaving equipment switched on, reagents and persons responsible if equipment left unattended.

**A3 Safe working practices in the laboratory**

Learners should know and understand the purpose, suitability and requirements for necessary personal protective equipment (PPE) when working with potentially dangerous equipment and materials. They should be able to recognise equipment and materials, relating their properties and features to how they should be safely stored, handled, worked with and in close proximity to, including pre-use safety checks and set-up.

- PPE as appropriate to the task:
  - aprons, to include plastic, rubber and lead-lined
  - ear protection
  - face protection, to include shields, particulate filter masks and respirators
  - gloves, considering levels of protection appropriate to substances being handled and allergies, to include nitrile, latex, knitted and anti-static
  - head protection and hair coverings
  - laboratory coats and overalls, to include both personal and shared
  - safety glasses
  - safety footwear, to include steel toe-caps, insulating boots, shoe coverings.

- Potentially combustible and explosive materials in different phases:
  - separation of combustible and explosive materials from sources of ignition, to include sparks from electrical equipment, static electricity, oxidising chemicals to include potassium nitrate
  - safe storage of gas cylinders
  - in situ preparation of materials, to include Tollens’ reagent and chlorine water
  - group 1 metals
• Sources of heat and open flames:
  o Bunsen burners, hotplates and incubators
  o use of heatproof mats; avoiding sudden temperature changes.
• Cutting equipment, to include knives, scalpels and saws.
• Glassware, to include boiling tubes, distillation equipment, condensers, evaporating dishes, watch glasses, conical flasks:
  o before, during and after use at extremes of temperature and pressure
  o ensuring stability of experimental equipment, to include correct placement and set-up of racks, stands and clamps (ring and test tube)
  o connecting and sealing equipment, to include tubing and joints, rubber/cork bungs, glass stoppers, screw-top lids and dealing with seized joints or stuck stoppers and lids.
• Microbiological equipment and potentially pathogenic organisms, to include:
  o handling and storage techniques to avoid contamination, inhalation of bioaerosols and breakage of equipment and cultures
  o handling and incubating Petri dishes, potentially pathogenic cultures
  o use of spreaders, inoculating loops, light microscopes, slides and cover slips.
• Electrical and electronics equipment:
  o handling and storage techniques for avoiding contamination and breakage of equipment, to include management of static charge and discharge, overload of components, isolation from liquids
  o working with display screen equipment (DSE), to include repetitive strain injury (RSI)
  o high and low alternating current (AC) and direct current (DC) power supplies, to include variable AC power supplies, cells, multiple output supplies, smoothing units and capacitors
  o correct use of equipment associated with electronics, to include diodes, bulbs, heating coils, potentiometers, fixed and variable resistors, soldering irons, wire strippers, ammeters, voltmeters, electrometers, galvanometers, joulemeters, stereomicroscopes
  o low- and high-intensity lasers, to include consideration of reflective surfaces and need for specialist eye protection.
• Hazardous and non-hazardous chemicals and radioactive sources:
  o risks of ionising radiation from sources of alpha, beta and gamma radiation and associated precautions – radioactivity and equivalent radiation doses in becquerels (Bq) and millisieverts (mSv), maximum exposure doses, use of radiation badges and meters
  o equipment and materials to avoid contamination, radiation exposure, equipment breakage, inhalation and chemical spillage, to include storage categories for classes of chemicals and use of mineral absorbents in stores
  o chemicals that may build up pressure in containers, to include fuming nitric acid and concentrated ammonia
  o techniques for safely working to measure volumes, masses and temperatures of liquids and solids, to include burettes, measuring cylinders, graduated pipettes and methods of pipetting, analogue and digital balances, weigh boats, analogue, digital and datalogging meters, to include pH probes, thermometers, timers
  o impact on health and safety requirements for different concentrations and pH of acids and bases, to include hydrochloric acid (HCl) and sodium hydroxide (NaOH)
  o fume-producing chemicals, to include bromine
  o techniques and equipment for safely carrying, dispensing and transferring liquids, use of funnels, beakers, pipettes
UNIT 1: LABORATORY HEALTH AND SAFETY

- techniques and equipment for safely mixing liquids, to include glass rods, magnetic stirrers, centrifuges, vortex mixers, flasks (conical and flat bottomed)
- containment and action of absorbents, to include cat litter, sand and soda lime.

- Manual handling:
  - immediate, short-term and long-term effects of ineffective manual handling techniques, to include accidental injuries, fatigue and back pain
  - team manual handling techniques for long or heavy objects, people or animals, to include coordinated use of commands (lift, walk, stop, down).

- Human and animal subjects:
  - techniques and equipment for avoiding injury caused by or to human or animal test subjects.

B Procedures for working safely in scientific laboratories

B1 Assessing hazards and risks in laboratories

Learners must be aware of the hazards and risks that apply in different laboratory settings, both during normal working procedures and when non-laboratory staff are present.

- Understanding of and compliance with static and dynamic risk assessments, to include:
  - safety data sheets (SDS)
  - meaning and significance of the following terms in risk assessment documents and discussions – hazard, risk, risk control, risk assessment
  - health and safety of laboratory users, casual visitors and learners, ensuring access to suitable PPE, secure storage of hazardous chemicals and preparations, and controlling access.

- Main features of and compliance with health and safety legislation and regulation, to include:
  - Health and Safety at Work etc. Act 1974
  - Control of Substances Hazardous to Health (COSHH) Regulations 2002, to include checking of manufacturing and expiry dates, storage temperatures, appropriate labelling, maintaining security of laboratory materials
  - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995, including roles and responsibilities for reporting and notification procedures.

B2 Decontamination and dealing with laboratory waste

Learners must understand the need for the cleaning and decontamination of work areas and equipment before and after experimental work has been carried out; how to safely dispose of both hazardous and non-hazardous waste; and the potential implications of incorrect laboratory waste disposal.

- Purposes and methods for sterilisation of reusable equipment and instruments such as glassware, to include sterilisation control strips/tubes, autoclaves and pressure cookers, use of indicator tapes to distinguish treated and untreated material.

- Purposes and methods of chemical disinfection following cleaning, as appropriate to intended use of equipment, materials and contamination levels:
  - disposable cloths/paper towels
  - detergents and disinfectants, to include ethanol, chlorine compounds
  - effective dilutions of detergents and disinfectants for effective use.

- Purposes and appropriate use of ventilated and air-filtered work areas, to include fume cupboards/hoods and biosafety cabinets.
• Correct disposal procedures, recognition and segregation of different types of waste within and from the laboratory, including short-term storage ready for disposal:
  o general, uncontaminated waste, to include office waste, glass, chemical bottles, paper, plastic and cardboard
  o biological, clinical and pharmaceutical waste, to include used Petri dishes, pipette tips, medicines, sharps, animal and pathological waste
  o chemical waste, to include surplus chemicals, batteries and oils
  o radioactive, to include radioactive liquids and solids.

• Consequences of incorrect disposal: legal, health and environmental implications as appropriate to chemical, biological and radioactive material.

**B3 Accident, incident and emergency procedures**

Learners must understand the potential causes and implications of accidents, spillages and fires and how to correctly respond to these situations. They should be aware of how different types of fire are classified, the appropriate maintenance, applications and procedures for the use of different types of fire-extinguishing equipment and how to respond in the event of an emergency.

• Procedures for the emergency shut down of gas and electricity supplies.

• First aid:
  o appearance and suitable locations for first-aid kits, eye-wash facilities and laboratory showers
  o contact procedures for nominated first aiders.

• Principles of clearing spillages:
  o suitable locations and use of spillage kits, to include those for oil, general chemical and biological materials.

• Basic methods of fire prevention, to include the need to maintain electrical equipment, keeping fire doors closed and safe methods of storing combustible materials.

• Fires and fire-extinguishing equipment:
  o recognition of burning materials under the British standard fire type classifications A, B, C, D and F
  o fire blankets
  o fire extinguishers as appropriate to different classifications of fire, to include water, carbon dioxide (CO2), foam spray, dry powder, wet chemical and water mist
  o timeframes and methods of checking fire-extinguishing equipment, along with the requirements for basic service, extended service and overhaul of extinguishers.

• Understanding of local evacuation procedures in the event of a fire or incident, to include signage of escape routes and meeting points.
UNIT 1: LABORATORY HEALTH AND SAFETY

**Grade descriptors**

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

**Level 2 Pass**

Learners will demonstrate basic understanding of the signs, symbols, procedures, appropriate behaviours and PPE needed to maintain the health and safety of themselves and others in straightforward laboratory contexts. They will be able to identify hazards and risks that may be encountered in a range of laboratory types, demonstrating a limited application of health and safety procedures applicable to working in straightforward situations.

**Level 2 Distinction**

Learners will demonstrate a thorough understanding of the signs, symbols, procedures, appropriate behaviours and PPE needed to maintain the health and safety of themselves and others in multi-stage processes taking place in different laboratory contexts. They will be able to articulate ways to safely handle laboratory equipment and materials at each stage of use. Learners will be able to analyse and make connections between health and safety procedures in different laboratory settings and in complex situations. They will demonstrate an understanding of the implications of the hazards and risks that may be encountered in different laboratory settings and use them to make recommendations for improving the health and safety of laboratory users.
**Key words typically used in assessment**

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

Please note: the list below will not necessarily be used in every paper/session and is provided for guidance only.

<table>
<thead>
<tr>
<th>Command or term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply</td>
<td>Put knowledge, understanding or skills into action in a particular context.</td>
</tr>
<tr>
<td>Assess</td>
<td>Evaluate or estimate the nature, ability or quality of something.</td>
</tr>
<tr>
<td>Compare</td>
<td>Identify the main factors relating to two or more items, situations or aspects of a subject that is extended to explain the similarities, differences, advantages and disadvantages.</td>
</tr>
<tr>
<td>Complete</td>
<td>Place a word, words or numbers in a sentence, paragraph, table or graph to give the correct answer/sense.</td>
</tr>
<tr>
<td>Define</td>
<td>State or describe the nature, scope or meaning of a subject as objective facts.</td>
</tr>
<tr>
<td>Describe</td>
<td>Give an account in words of (someone or something), including all of the relevant characteristics, qualities or events.</td>
</tr>
<tr>
<td>Discuss</td>
<td>Consider different aspects of a topic, how they interrelate and the extent to which they are important.</td>
</tr>
<tr>
<td>Explain</td>
<td>Understand the origins, functions and objectives of a subject and its suitability for purpose. Give reasons to support an opinion, view or argument, with clear details.</td>
</tr>
<tr>
<td>Give</td>
<td>Provide one or more piece(s) of information.</td>
</tr>
<tr>
<td>Identify</td>
<td>Establish or indicate the origin, nature or definitive character of something.</td>
</tr>
<tr>
<td>Label</td>
<td>Something is named or likened to the correct name.</td>
</tr>
<tr>
<td>Link</td>
<td>Information is matched or a description or explanation is used to give a clearer indication or answer.</td>
</tr>
<tr>
<td>Match</td>
<td>Sets of information, categories or examples are linked together.</td>
</tr>
<tr>
<td>Name</td>
<td>Give the correct term for something.</td>
</tr>
<tr>
<td>State</td>
<td>Name or list something.</td>
</tr>
</tbody>
</table>
Links to other units

This is a mandatory unit and underpins knowledge throughout the qualification

Employer involvement

This unit would benefit from employer involvement in the form of masterclasses in:

- specialist areas of health and safety, e.g. the use of hazardous gases during a laboratory test and the incident and evacuation processes associated with it
- the maintenance of specialist equipment and the checking, fitting and use of specialist PPE
- managing waste in specialist laboratory settings, e.g. radioactive waste, biological and biomedical.
Unit 2: Working in a Science Laboratory

Level: 2
Unit type: Mandatory
Assessment type: External
Guided learning hours: 60

Unit in brief

Learners explore the scope of working in the science industry.

Unit introduction

Have you ever wondered how new materials, technology and advances in healthcare are researched and developed? There is a vast amount of research and development taking place in laboratories across the country and around the world, meaning that there are many varied and exciting possible career pathways.

In this unit, you will gain an understanding of the wider science industry in relation to different types of laboratory, along with how the outcomes of research carried out in laboratories may influence the wider world. You will explore the equipment, features, processes and practices in different types of laboratory and the job roles that are key to making a laboratory run effectively.

This unit will give you the essential knowledge and understanding that will support your progression to employment as an assistant in a science laboratory.

Summary of assessment

The unit is assessed using an onscreen test, set and marked by Pearson. The test contains different types of question and is worth 60 marks. The test duration is 75 minutes. The assessment is available on demand. The first assessment is available in January 2018.

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

**AO1** Demonstrate knowledge of the laboratory features and equipment required to carry out different types of research
Command words: compare, complete, describe, explain, give, identify, label, link, match, name, state
Marks: ranges from 1 to 2 marks

**AO2** Demonstrate understanding of the purpose and impact of different laboratory roles and types of research, including the processes used to carry them out
Command words: analyse, apply, calculate, compare, conclude, describe, discuss, explain, give, justify, label, link, match, name, state
Marks: ranges from 1 to 4 marks

**AO3** Apply understanding of working practices in laboratories
Command words: analyse, apply, calculate, compare, describe, discuss, explain, justify, link, match
Marks: ranges from 1 to 4 marks

**AO4** Analyse laboratory features and processes, making connections to their ethical considerations and impacts of research
Command words: analyse, apply, compare, describe, discuss, justify, link, match
Marks: ranges from 2 to 6 marks
Essential content

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

A The scientific laboratory

Learners should know and understand different areas of research and how the features, environmental controls and equipment facilitate work in different laboratory contexts.

A1 Scientific research and its purpose

Learners must understand the purpose of investigations being carried out in different areas of research in both commercial and academic research institutions. They should understand the positive and negative impacts of carrying out this research.

- Environmental:
  - climate change and weather pattern modelling
  - renewable energy
  - waste and pollution management.

- Food and agriculture:
  - food safety and quality
  - organic farming
  - managing agricultural productivity.

- Health and genetics:
  - causes, diagnosis, management and cures of diseases and disorders
  - DNA analysis and gene therapy
  - psychological and neurological investigation
  - clinical engineering
  - sports, fitness and wellbeing
  - pharmaceuticals.

- Materials science:
  - development of plastics and polymers, smart materials
  - nanotechnology
  - aerospace.

- Construction science:
  - sound and sound proofing
  - vehicles and transport
  - bridges and buildings
  - soil analysis.

- Electronics and communication:
  - radio, microwave and infrared communication
  - robotics
  - computer systems.
A2 Laboratory features, fixtures and fittings

Learners should understand the purpose, requirement and use of laboratory features, fixtures and fittings, including their relevance to wet laboratories (where research activities have a high potential for liquid spills) and dry laboratories:

- environmental controls – temperature, air filtration, dust, humidity, light
- gas supply and taps
- electrical supply and points, to include the ability to vary the power, current and voltage
- water supply and sinks
- emergency shower
- fixed and flexible benching arrangements
- secure storage
- airlock entry
- fume cupboards
- balance space or room for accurate measuring
- dedicated space for analytic machines and computers
- interstitial spaces housing drop-down services.

A3 Use of laboratory equipment

Learners should know laboratory equipment and materials and understand the physical set-up, purpose and processes involved in using them. This should include appropriate situations for the use of equipment, application of given equations and formulae, and relevant standard international (SI) units.

- Recording data, measuring quantities, using vessels and electricity:
  - recording, analysing and storing data: dataloggers and computer software
  - volumetric analysis (titration): burettes, conical flasks, beakers
  - mass: digital and analogue balances, weigh boats
  - length: rulers, metre rules, tape measures
  - pH: pH probes (meters), indicator liquids, indicator papers
  - temperature: alcohol and mercury thermometers, digital thermometers, temperature probes
  - light: light meters, low- and high-intensity lasers
  - time: stopwatches
  - tensile and compressive strength: universal testing machine (UTM)
  - sound: decibel meters
  - volume: beakers, vials, glass flasks, measuring/graduated cylinders, pipettes, graduated pipettes, multichannel pipettes, test tubes, boiling tubes
  - energy: joules, electrical resistance, current, voltage, power, amplitude, frequency
  - power supplies: fixed and variable alternating current (AC) and direct current (DC), cells, multiple output supplies
  - electronics: diodes, bulbs, heating coils, potentiometers, fixed and variable resistors, soldering irons, wire strippers, multimeters, ammeters, voltmeters, electrometers, galvanometers, joulemeters, ohmmeters, oscilloscopes, smoothing units, capacitors.

- Separating and mixing substances in different phases:
  - liquids – laboratory centrifuges, distillation and condensation equipment
  - liquid from solid – filter paper and funnels, Büchner funnels
  - analysis of composition or purity – paper and thin-layer chromatography, gel electrophoresis
  - glass rods, magnetic stirrers, lab blenders, lab shakers, rocking shakers, vortex mixer, concrete and asphalt mixers.
• Connecting, sealing and stabilising:
  o tubing, piping and joints
  o glass stoppers, screw-top lids, solid and bored rubber/cork bungs
  o racks, stands and clamps.
• Microscopy and imaging:
  o compound light and stereo microscopes to include use of lenses, oil immersion, slides and cover slips
  o scanning electron and transmission electron microscopes
  o x-ray fluorescence and x-ray diffraction
  o fluid flow visualisation processes using ink and fog.
• Temperature control:
  o Bunsen burners, hot plates, ovens, incubators, autoclaves, microwaves, refrigerators, freezers, freeze dryers, climatic chambers.
• SI base units and their associated quantities that are dimensionally independent, to include common derivations and calculations (equations and formulae will be provided):
  o metre (m)
  o litre (l)
  o newtons (N)
  o kilogram (kg)
  o seconds (s)
  o ampere (A)
  o volts (V)
  o ohm (Ω)
  o watt (W)
  o kelvin (K) and Celsius (°C)
  o mole (mol)
  o joules (J).
• Effect of gravity on mass: weight and downward acceleration.
• Units of concentration: mol/dm³ (mol/l), parts per million (PPM).

B Roles in a science laboratory
Learners must understand the responsibilities, interactions and hierarchy of the key roles in a working laboratory.

B1 Duties of a laboratory assistant
Learners must understand how to carry out the main responsibilities of a laboratory assistant and the impact of working practices on experimental accuracy, precision, reliability and reproducibility.

• Preparation and maintenance:
  o collecting and preparing equipment and materials
  o preparing samples
  o cleaning, maintaining and storing equipment
  o feeding and caring for laboratory animals.
• Obtaining and recording data:
  o selecting and using equipment
  o measuring accurately and precisely
  o making and recording observations accurately.
• Interpreting data:
  o bar charts and line graphs.
• Administration:
  o checking of invoices, stock arrival and expiry dates, stock levels and storage conditions
  o pricing and ordering equipment and materials.

**B2 Other laboratory personnel**

Know key roles that facilitate work in laboratories and understand how laboratory management may be structured for different research purposes, including line management.

• Research technician:
  o plans, conducts and supports scientific investigations and experiments
  o supervises the work of laboratory assistants and ensures quality control
  o processes samples, measures and observes
  o ensures appropriate treatment of animals and other biological materials
  o examines collected data, drawing conclusions
  o writing reports, reviews and summaries.

• Team leader:
  o supervises research technicians and coordinates their day-to-day work
  o monitors progress of laboratory and research technicians
  o draws conclusions from the data, liaising with the research technicians where repeat tests or other tests are required
  o manages the budget.

• Laboratory manager:
  o controls the budget for all laboratories in the research facility, including major purchases of large equipment
  o meets regularly with laboratory team leaders to discuss the progress of research
  o seeks and applies for funding streams
  o reports on progress to stakeholders.

**C Ethics of scientific research**

Learners should explore how ethical viewpoints are established on both controversial and day-to-day issues and how these are linked to the professional behaviours and requirements of working in a laboratory.

**C1 Ethical study and controversial issues in science**

Learners must be aware of how research impacts on both individuals and society at large. They should be able to come to reasoned conclusions based on the study of scientific research, especially where research is considered to be controversial.

• Establishing ethical viewpoints:
  o what research is being carried out
  o why the research is being carried out
  o how stakeholders, groups, individuals and the public may be affected by the research, the research process and outcomes
  o advances may have positive and negative implications.

• Controversial issues, to include:
  o stem cell research, genetic modification and therapy
  o animal experimentation
  o human participation in clinical trials
  o nanotechnology
  o genetic modification of organisms
- use of human participants in psychology
- environmental research
- climate change
- nuclear power and control of radioactive materials
- availability of medication and vaccines.

**C2 Professional requirements of working in the science industry**

Learners must understand the purposes, processes and impacts of professional requirements when working in different laboratories.

- Checking personal background of staff, to include national databases, Disclosure and Barring Service (DBS) disclosures and security clearances.
- Maintaining appropriate standards of appearance and behaviour.
- Maintaining confidentiality of work in progress, to include complying with company data protection principles.
- Protecting the financial and intellectual interests of the company.
- Commitment to professional development.
- Whistle-blowing.
Grade descriptors

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

Level 2 Pass
Learners will demonstrate knowledge of the general features of laboratories, the purpose of carrying out different types of research and the processes involved in using equipment to collect accurate and reliable data. Learners will understand that working laboratories have management structures and different job roles that allow effective research to be carried out. They will understand the duties of a laboratory assistant and that there are consequences of not following the correct processes. They will demonstrate awareness of ethical and commercial responsibilities associated with working in a laboratory. Learners are able to process and analyse simple data with reference to appropriate SI units.

Level 2 Distinction
Learners will demonstrate a thorough understanding of the different requirements and features of laboratories in different research areas. They will understand the purpose of a range of equipment required to collect, record and analyse data and the processes involved in setting up and operating it in an accurate and reliable manner. They will be able to make connections between the professional behaviours and research activities taking place in a working laboratory. Learners will have a sound grasp of how responsibilities of key roles in a management hierarchy allow the production of high-quality research outcomes. They will be able to make connections between potentially controversial areas of research and how working in these areas has potential implications for stakeholders, individuals and the public. They will demonstrate understanding of the responsibilities of companies and employees with regard to the handling of sensitive information and personal data. Learners will be able to analyse graphical data sets, identifying trends and anomalies and discussing the effect anomalous measurements or recordings may have on the conclusions drawn.
### Key words typically used in assessment

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

Please note: the list below will not necessarily be used in every paper/session and is provided for guidance only.

<table>
<thead>
<tr>
<th>Command or term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply</td>
<td>Put knowledge, understanding or skills into action in a particular context.</td>
</tr>
<tr>
<td>Assess</td>
<td>Evaluate or estimate the nature, ability, or quality of something.</td>
</tr>
<tr>
<td>Calculate</td>
<td>Use mathematical skill to produce a numerical answer.</td>
</tr>
<tr>
<td>Compare</td>
<td>Identify the main factors relating to two or more items, situations or aspects of a subject that is extended to explain the similarities, differences, advantages and disadvantages.</td>
</tr>
<tr>
<td>Complete</td>
<td>Place a word, words or numbers in a sentence, paragraph, table or graph to give the correct answer/sense.</td>
</tr>
<tr>
<td>Define</td>
<td>State or describe the nature, scope or meaning of a subject as objective facts.</td>
</tr>
<tr>
<td>Describe</td>
<td>Give an account in words of (someone or something), including all of the relevant characteristics, qualities or events.</td>
</tr>
<tr>
<td>Discuss</td>
<td>Consider different aspects of a topic, how they interrelate and the extent to which they are important.</td>
</tr>
<tr>
<td>Explain</td>
<td>Understand the origins, functions and objectives of a subject and its suitability for purpose. Give reasons to support an opinion, view or argument, with clear details.</td>
</tr>
<tr>
<td>Give</td>
<td>Provide one or more piece(s) of information.</td>
</tr>
<tr>
<td>Identify</td>
<td>Establish or indicate the origin, nature or definitive character of something.</td>
</tr>
<tr>
<td>Justify</td>
<td>Show or prove to be right or reasonable, usually with reference to evidence.</td>
</tr>
<tr>
<td>Label</td>
<td>Something is named or likened to the correct name.</td>
</tr>
<tr>
<td>Link</td>
<td>Information is matched or a description or explanation is used to give a clearer indication or answer.</td>
</tr>
</tbody>
</table>
**Command or term** | **Definition**  
---|---  
Match | Sets of information, categories or examples are linked together.  
Name | Give the correct term for something.  
State | Name or list something.  

**Links to other units**

This unit assess the underpinning knowledge in:
- Unit 4: Preparing and Clearing Down a Laboratory  
- Unit 5: Handling Scientific Data.

**Employer involvement**

This unit would benefit from employer involvement in the form of masterclasses that can deliver content on:
- specialist areas of laboratory research, e.g. DNA and genetics and nanotechnology  
- how ethical issues impact on the research carried out in specialist laboratories, e.g. animal experimentation, human participation in clinical trials  
- how different laboratories are set up and organised to meet the needs of the research carried out there  
- the importance of laboratory assistants in the work and aims of the organisation, e.g. the importance of accuracy and reliability when collecting and recording data.
Unit 3: Assisting in Laboratory Activities

Level: 2
Unit type: Mandatory
Assessment type: Internal
Guided learning hours: 60

Unit in brief

Learners develop the skills needed to support the work of a laboratory: how to check and order stock, maintain apparatus and equipment, and keep accurate laboratory rotas and schedules.

Unit introduction

A laboratory is often a very busy place. It might be booked for use by individual scientists or researchers, or a variety of groups of people all requiring different equipment, samples and apparatus. It is part of a laboratory assistant’s job to ensure the laboratory runs smoothly for those who want to use it.

In this unit, you will learn how to plan for the use of a laboratory over a period of time. This will include checking and ordering the required stock, as well as learning how to carry out routine maintenance and clean and check laboratory equipment and apparatus. You will learn the appropriate procedures and processes for reporting any equipment faults and keeping accurate records of the maintenance and cleaning activities carried out.

This qualification will help you in gaining employment as a laboratory assistant or junior laboratory technician, and will support you in progressing to other science qualifications.

Learning aims

In this unit you will:

A Schedule the work of laboratory activities over a four-week period
B Carry out stock checks and ordering for laboratory activities
C Carry out and record routine maintenance activities of laboratory equipment.
Unit summary

<table>
<thead>
<tr>
<th>Learning aim</th>
<th>Key teaching areas</th>
<th>Summary of suggested assessment evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Schedule the work of laboratory activities over a four-week period</td>
<td>A1 Scheduling laboratory requests</td>
<td>Four-week plan for the use of the laboratory produced by learners, including the stock and equipment required.</td>
</tr>
<tr>
<td></td>
<td>A2 Organising required equipment and facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A3 Producing a laboratory schedule</td>
<td></td>
</tr>
<tr>
<td>B Carry out stock checks and ordering for laboratory activities</td>
<td>B1 Procedures for carrying out stock checks</td>
<td>Records of stock checks carried out and stock orders recorded using the laboratory procedures.</td>
</tr>
<tr>
<td></td>
<td>B2 Procedures for recording stock required</td>
<td></td>
</tr>
<tr>
<td>C Carry out and record routine maintenance activities of laboratory equipment</td>
<td>C1 Procedures for maintenance of laboratory equipment</td>
<td>Photographs as evidence of the maintenance activities carried out, with supporting notes and supported by observation records.</td>
</tr>
<tr>
<td></td>
<td>C2 Record the routine maintenance of laboratory equipment</td>
<td></td>
</tr>
</tbody>
</table>

Key teaching areas in this unit include:

<table>
<thead>
<tr>
<th>Sector skills</th>
<th>Knowledge</th>
<th>Transferable skills/behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Stock checking and ordering</td>
<td>• The work that is carried out in a laboratory</td>
<td>• Thinking skills/adaptability</td>
</tr>
<tr>
<td>• Maintaining laboratory equipment</td>
<td>• The materials and equipment required for laboratory work</td>
<td>• Problem solving</td>
</tr>
<tr>
<td></td>
<td>• Laboratory processes and procedures</td>
<td>• Managing information</td>
</tr>
</tbody>
</table>
Unit content

Knowledge and sector skills

Learning aim A: Schedule the work of laboratory activities over a four-week period

A1 Scheduling laboratory requests
- Types of laboratory request/uses, such as carrying out research over a day/week, learners’ practical work, visiting scientists/speakers/demonstrators.
- Prioritising and allocating laboratory space, considering number in groups, specific requirements, conferences, demonstrations.
- Special requirements, e.g. accessibility for disabled users, materials for visually- or auditory-impaired users.
- Capacity of laboratory/use of prep room, if appropriate.
- Special facilities required, such as fume cupboards, pressurised cabinets for microbiological work.
- Scheduling for short-/long-term use, e.g. to be used per semester/termly or for one-off sessions/conferences/meetings.

A2 Organising required equipment and facilities
- Materials required for use, e.g. any samples required to be prepared ahead of time.
- Access to ICT/digital/interactive equipment for demonstrations.
- Any required specialist equipment that may need to be ordered in.
- Materials/equipment required for recording results.
- Any required access to facilities, such as electricity, water, gas, blackout, fume cupboards, chemicals.

A3 Producing a laboratory schedule
Consideration of:
- clarity and accuracy of information
- appropriate allocation of timescales for use
- health and safety issues, e.g. requirements for a risk assessment
- formatting and presentation
- usability and accessibility by others.

Learning aim B: Carry out stock checks and ordering for laboratory activities

B1 Procedures for carrying out stock checks
- Carrying out the stock check in accordance with workplace protocols.
- Counting stock and recording that they are within the limits set by the workplace protocols.
- Checking new stock against delivery/purchase orders and storing appropriately.
- Checking the packaging information on stock items to confirm critical details are present, such as expiry dates, hazard labels, safety data.
- Identifying, and recording appropriately, stock that needs replenishing.
Identifying and recording stock that must be disposed of, giving reasons such as out of date, damaged.

Communicating the stock check information to the appropriate people.

**B2 Procedures for recording stock required**

- Consulting with supervisor/manager regarding the stock check and replenishments needed.
- Carrying out and recording replenishment of current stock from goods already held in storage.
- Accessing and updating the information systems used in stock checks and ordering.
- Carrying out the ordering process for replenishing stocks.
- Recording all the activities carried out using the appropriate laboratory protocols.

**Learning aim C: Carry out and record routine maintenance activities of laboratory equipment**

**C1 Procedures for maintenance of laboratory equipment**

- Types of laboratory equipment found in wet and dry laboratories.
- Following manufacturers’ instructions and procedures for routine maintenance of equipment.
- Carrying out auditory and visual checks to confirm equipment is working correctly and ready for use.
- Testing the equipment to confirm it functions correctly.
- Identifying and reporting any equipment faults using the laboratory protocols.
- Following health and safety protocols at all times, including the use of personal protective equipment (PPE), where appropriate, and a risk assessment.

**C2 Record the routine maintenance of laboratory equipment**

To include:

- health and safety protocols and risk assessment prior to routine maintenance
- details of maintenance and operation checks using laboratory protocols
- results of testing the equipment
- faults identified and provision of suggested remedy.

**Transferable skills**

**Thinking skills/adaptability**

- Stock checking and recording, carrying out maintenance on laboratory equipment.

**Problem solving**

- Identifying planning issues when scheduling the work of a laboratory.

**Managing information**

- Organising the information about the work of the laboratory and scheduling it into a workable plan.
### Assessment criteria

<table>
<thead>
<tr>
<th>Pass</th>
<th>Merit</th>
<th>Distinction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning aim A: Schedule the work of laboratory activities over a four-week period</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.P1 Produce a schedule for a laboratory that accurately outlines its activities over a four-week period.</td>
<td>A.M1 Produce a well-presented and accurate schedule for a laboratory over a four-week period, giving detailed information on its activities and the equipment and materials required to meet the laboratory’s needs.</td>
<td>A.D1 Produce a schedule for a laboratory over a four-week period, presenting the information logically and making clear links between the laboratory’s activities and the equipment and materials required, considering contingency.</td>
</tr>
<tr>
<td>A.P2 Outline the materials and equipment required to meet the laboratory’s needs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Learning aim B: Carry out stock checks and ordering for laboratory activities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.P3 Perform basic stock checks, recording the stock levels accurately and following the correct laboratory procedures.</td>
<td>B.M2 Perform stock checks efficiently, following the correct laboratory procedures and producing accurate and well-presented records of stock levels and the required replacement supplies.</td>
<td>B.D2 Perform thorough stock checks, following the correct laboratory procedures and producing detailed and accurate records of stock levels, showing initiative when recording the required replacement supplies.</td>
</tr>
<tr>
<td>B.P4 Identify the required replacement supplies following laboratory procedures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Learning aim C: Carry out and record routine maintenance activities of laboratory equipment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.P5 Perform routine maintenance procedures competently on laboratory equipment, following instructions correctly.</td>
<td>C.M3 Perform routine maintenance procedures competently and efficiently on laboratory equipment, following instructions correctly and producing well-presented records that follow laboratory protocols.</td>
<td>C.D3 Perform routine maintenance procedures confidently on a range of laboratory equipment, producing detailed and accurate records that follow laboratory protocols.</td>
</tr>
<tr>
<td>C.P6 Produce outline records of maintenance procedures carried out that follow laboratory protocols.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Essential information for assessment decisions

Learning aim A
For distinction standard, learners will:
• produce a laboratory schedule that is accurate, detailed and clearly presented so it can be understood and used by others
• show the full range of laboratory activities that are planned over a four-week period
• give details on the number of personnel who will be using the laboratory, the dates and times for which they require lab workspace, and the equipment and materials they will need to carry out their practical work
• show initiative by identifying any possible planning problems and offering solutions
• provide full information on the equipment and materials that will be required for specific lab activities.

For merit standard, learners will:
• produce an accurate and well-formatted schedule
• give correct information on the forthcoming activities that are planned, the number of personnel, the amount of time they require in the lab and identify any possible planning problems
• produce a list of the laboratory activities and the equipment and materials required to meet the needs of the laboratory.

For pass standard, learners will:
• produce a schedule that accurately lists the activities planned but with little consideration of layout or formatting
• give outline details on the number of personnel required and a broad outline of the timeline over the four-week period
• produce some information on the materials and equipment required.

Learning aim B
For distinction standard, learners will:
• carry out comprehensive and accurate stock checks, following the laboratory procedures correctly and referring to the planned activities identified in the schedule
• record the required replacement supplies, using the correct systems, forms and laboratory protocols to identify the orders needed
• show initiative when considering what to order and when planning for contingency.

For merit standard, learners will:
• carry out accurate stock checks and orders using the correct protocols for the laboratory, including using the ordering systems competently. As well as essential replacements, they will cross-reference the stock check with the activities planned for the laboratory.

For pass standard, learners will:
• carry out a stock check and record any essential replacements required using the correct systems.
Learning aim C

For distinction standard, learners will:
- carry out routine maintenance on a full range of laboratory equipment in the time allocated, ensuring the equipment is set up and ready for use when required
- know where to access the required manufacturer’s, or laboratory, instructions and follow them correctly
- use their initiative when faced with a problem, such as a piece of equipment not functioning correctly or not being available. They might do this through finding a replacement piece of equipment, selecting a suitable alternative or checking why something is not functioning. The equipment will be ready for use after the maintenance
- follow the correct health and safety requirements when carrying out maintenance activities
- keep detailed and accurate records of the checks and operations carried out, using the correct procedures for the laboratory.

For merit standard, learners will:
- carry out routine maintenance activities on equipment effectively so it is ready for use when required
- follow manufacturer’s, or laboratory, instructions correctly when performing maintenance procedures
- follow the correct health and safety requirements when carrying out maintenance activities
- make an attempt to solve any problems that arise
- record all the checks and operations carried out, using the correct procedures for the laboratory.

For pass standard, learners will:
- carry out routine maintenance activities on the more basic pieces of laboratory equipment
- refer to manufacturer’s, or laboratory, instructions as a guide but may need to seek further clarification
- follow the correct health and safety requirements when carrying out maintenance activities
- record their checks and operations accurately but without detail.
Assessment activity

The summative assessment activity takes place after learners have completed their formative development. The activity should be practical, be set in a realistic scenario and draw on learning from the unit, including the transferable skills. You will need to give learners a set period of time and number of hours in which to complete the activity. Section 6 gives information on setting assignments and there is further information on our website.

A suggested structure for summative assessment is shown in the Unit summary section, along with suitable forms of evidence. This is for illustrative purposes only and can therefore be adapted to meet local needs or to assess across units where suitable opportunities exist. The information in the Links to other units section will be helpful in identifying opportunities for assessment across units.

The following scenario could be used to produce the required evidence for this unit. Centres are free to use comparable scenarios or other forms of evidence, provided that they meet the assessment requirements of the unit.

Suggested scenario

Over the next four weeks, the laboratory is going to be used by a team of visiting scientists and researchers. Your senior technician has given you details of what the team will be doing and what they will need during their time in the laboratory. You will need to ensure that the required workspace, equipment and materials will be available and ready for them. The laboratory manager has asked you to produce a schedule in advance with information on the following.

- Who is using the laboratory each day and for what purpose.
- The timeline in terms of start, finish and breaks to be taken (giving you a chance to replenish consumables etc.).
- An action list of what needs to be done, and in which order, to ensure that everything is ready.

As part of the preparation for this week of activity you will be required to:

- carry out a stock check of the laboratory and stores to make sure you have all the equipment and materials needed
- record the supplies, as required, using the standard procedures for that laboratory
- carry out routine maintenance of the equipment and supplies required for the week’s work.

If a retake is necessary, an alternative example must be used. The following is an example of a retake assessment activity.

A different scenario could be set up for the use of the laboratory, such as planning for a laboratory practical examination for five students.
Further information for tutors and assessors

Delivery guidance

The following are examples of practical activities and workshops that tutors could use when developing sector and transferable skills in the delivery of this unit. Wherever possible, practical activities should be used to help learners develop both personal and sector skills in preparation for the final assessment. These suggestions are not intended as a definitive guide to cover the full GLH of the unit.

Introduction to unit

Tutors take learners on a guided tour of laboratories, as seen from the laboratory technician’s point of view, including the preparation rooms. During the tour, ask learners to think about/note down certain features, e.g. storage of equipment, chemicals, position of safety equipment, major pieces of equipment, routines for technicians, protocols etc.

In groups, learners share ideas based on a series of questions about the laboratories they have seen, e.g. how is the use of laboratories scheduled and managed, what are the protocols for maintenance of equipment, stock checks, ordering stock, who does these activities? etc.

Tutor-led class discussion to summarise the findings of the groups into some visual representation, e.g. dividing up the routines of the laboratory, how it is used, the technician’s role etc.

Summarise the routine of a laboratory and the role of the technician. Encourage learners to think about their role as a laboratory assistant.

Learners record this entire introduction, e.g. in their laboratory log or notebook, electronically or in hard copy. Encourage the use of flow charts/diagrams etc. rather than lengthy explanations. The emphasis is on an overview: details can be discussed and activities will be carried out in later sessions. Learners should gain a ‘feel’ for the technician’s role. Remind learners that the logbook/notebook must be used to record their activities, including stock maintenance, reordering, reporting faults etc. These activities will be ongoing so the assessor will look at the logbook/notebook for confirmation that these activities have been done.

Suggested time: about 3 hours.

Activity: Laboratory schedules and monitoring

Tutors arrange for class/group time with relevant personnel, e.g. technicians/supervisors who may hold various responsibilities at different levels. Allow work shadowing of a technician to observe/help in planning schedules for the use of laboratories and monitoring the equipment required.

Arrange visits for learners, if possible, to other types of laboratories to observe or take part in the planning processes when scheduling laboratory use and monitoring. Such visits could involve collecting and assembling material, and possibly helping the technician test equipment to make sure everything works. If such visits are not possible, tutors set case studies/scenarios where learners are asked to look at as wide a range of industries as possible, e.g. microbiology, food testing, microelectronics, materials testing laboratories, and how they would schedule and monitor the use of such a laboratory.

Tutors set up scenarios for a particular available laboratory for small groups of learners to work together to schedule its use for a week and detail the requirements of the users. They would need to show they have checked the equipment and materials available and action plan to ensure the booking goes smoothly.

Make sure that learners keep records of their activities.

Suggested time: about 6 hours.
Activity: Stock keeping
In groups, learners take a section of the laboratory to stock check: this could be a bench, a workstation or a set of cupboards – whatever is suitable for the situation. Each group must provide a stocklist for the area given to them. Allow the group to decide how they will record their stocklist.
Class discussion to compare stocklists. Use any visual means to summarise these lists and use them to highlight the need for agreed protocols for recording stock.
Introduce different ways of recording stock, including available computer programs. Involve technicians in this discussion and in the presentation of stock control. If possible, use technicians from other laboratories and industries to explain stock recording to learners.
Investigate the complexities of stock control using laboratories as examples. Give learners guidance on what to look for, e.g. how many of each piece of equipment must be available, how should equipment be stored, specialist stock, such as chemicals or microbes, hazard information, expiry dates, labelling etc.
Tutors arrange a follow-up session, using technician expertise, to summarise which criteria are used in stock checks.
Discuss the different protocols used by laboratories and the reasons for this. Discuss common factors, such as labelling protocols, use of expiry dates, storage protocols.
Tutors set tasks, using case studies if needed, to allow learners to practise stock control using computer packages. It is preferable for this to be a set of practical activities, observed as part of a practice for an assessed observation later on. Learners should be given as much opportunity as possible to practise these skills, ensuring that they record in some way what they are doing.
Allow learners to experience doing stock controls in different types of laboratories, only using case studies if absolutely necessary.
Suggested time: about 10 hours.

Activity: Equipment maintenance
Tutors demonstrate what is meant by equipment maintenance using a range of suitable equipment, emphasising health and safety requirements, the need to follow the manufacturer’s guidelines on maintenance and what can and cannot be attempted. Use technicians, if possible, to demonstrate the equipment maintenance they carry out and how they record what is done.
Tutors set up a number of workstations, each with a piece of equipment for small groups of learners to practise their maintenance skills. Learners rotate to each workstation, identifying what needs doing. At this stage, avoid electrical equipment unless it is something simple such as the replacement of a dead battery in a pH meter. About 4 hours.
Group, and then class, discussion based on learners’ experiences at each workstation, including a comparison of results. Summarise what learners felt needed doing at each workstation and how they recorded their findings. Use this to emphasise the need to be aware of what maintenance can be done and what protocols must be followed, i.e. recording their findings, such as a dead battery, battery replaced with identical one, how many batteries left in stock now etc.
Tutor-led class discussion focusing on how laboratories used for different purposes will have differing maintenance requirements, e.g. ask learners to consider specialist laboratories for handling microbes, testing materials to destruction point, using specialist airflow cabinets, fume cupboards etc. What kinds of maintenance are technicians expected to do in these cases?
Tutors set up some workstations with specific pieces of equipment that need maintenance and ask learners to identify the routine maintenance for them, carry it out and report on what was done. It could be checking the labels on chemical bottles and replacing a damaged label, recording what was done, or it could be reporting the label problem and asking the senior technician what to do, again recording everything for evidence. About 5 hours.
Use discussion to evaluate learners’ experiences and the lessons and skills they have learned. About 2 hours.
Suggested time: about 11 hours.
Essential resources

For this unit, learners will need access to:

- computers
- laboratories staffed with suitably qualified personnel to instruct and supervise.

Links to other units

This unit has strong links to:

- Unit 1: Laboratory Health and Safety
- Unit 2: Working in a Science Laboratory
- Unit 4: Preparing and Clearing Down a Laboratory.

Employer involvement

This unit would benefit from employer involvement in the form of:

- work experience where learners shadow and assist laboratory assistants or technicians in the workplace
- masterclasses held by professional laboratory technicians from commercial laboratories on how the processes and procedures are used for maintaining laboratory equipment
- professional laboratories setting the scenario for the assessment activity by using their work as the focus for the assignment.
Unit 4: Preparing and Clearing Down a Laboratory

Level: 2
Unit type: Mandatory
Assessment type: Internal
Guided learning hours: 60

Unit in brief

Learners develop the skills needed to prepare a laboratory for use, provide assistance during practical work and to clear down afterwards, ensuring health and safety procedures are followed.

Unit introduction

Part of the role of a laboratory assistant or junior technician is to ensure that the laboratory is prepared for use by scientists and researchers to carry out their practical tests and investigations. If a laboratory or workstation is not set up correctly then it could have an impact on the accuracy, reliability and validity of the results. A laboratory assistant will be available to provide support while practical work is taking place. They may provide another pair of hands if the scientist needs it, replace any broken or malfunctioning equipment and keep the laboratory clean and tidy. Once the practical work is finished, the laboratory assistant will ensure it is cleared down and that waste is disposed of correctly, and that the workstation or bench is cleared and cleaned ready for use again.

In this unit, you will develop the skills and practise the procedures to safely prepare and clear down workstations to enable practical investigations to run efficiently and effectively. This could include ensuring equipment such as glassware is clean and available for use, batteries in pH meters are working and that all the electronic components for a circuit-building experiment are available. You will learn how to prepare samples and materials, as required by the scientist, and how to handle apparatus correctly. You will practise the processes and procedures to safely clear down a laboratory after use, ensuring that waste is disposed of in the correct way, and that equipment and samples are labelled accurately and put away in the correct place.

This unit will help you develop the skills needed to work in a science laboratory, as well as enabling you to progress to further science qualifications.

Learning aims

In this unit you will:

A Safely prepare a laboratory for practical work
B Provide assistance during practical work
C Safely clear down a laboratory after use.
## Unit summary

<table>
<thead>
<tr>
<th>Learning aim</th>
<th>Key teaching areas</th>
<th>Summary of suggested assessment evidence</th>
</tr>
</thead>
</table>
| A Safely prepare a laboratory for practical work | **A1** Laboratory processes and procedures to prepare a laboratory for practical work  
**A2** Safe working procedures in preparation for a practical session  
**A3** Keeping records of processes and procedures undertaken | Learners’ laboratory logbooks containing notes and photographic evidence of the preparing, supporting and clearing down processes undertaken, the health and safety checks carried out and the completed laboratory workspace. This will be supported by observation records from the tutor. |
| B Provide assistance during practical work | **B1** Tasks to carry out while assisting practical work  
**B2** Housekeeping duties to perform during practical work |  |
| C Safely clear down a laboratory after use | **C1** Clearing down a laboratory after use  
**C2** Disposal and storage of waste materials  
**C3** Safe working procedures when clearing down a laboratory |  |

### Key teaching areas in this unit include:

<table>
<thead>
<tr>
<th>Sector skills</th>
<th>Knowledge</th>
<th>Transferable skills/behaviours</th>
</tr>
</thead>
</table>
| • Preparing and clearing down procedures for a laboratory  
• Assisting in practical work in a laboratory | • Requirements for wet and dry laboratories  
• Processing samples and materials  
• Health and safety procedures  
• How to keep laboratory records | • Working with others  
• Thinking skills/adaptability  
• Problem solving |
Unit content

Knowledge and sector skills

Learning aim A: Safely prepare a laboratory for practical work

A1 Laboratory processes and procedures to prepare a laboratory for practical work

- Consideration of types of:
  - laboratory, e.g. wet or dry
  - test or investigation, e.g. experiments involving hazardous chemicals, equipment that needs calibration, preparation of samples and materials.

- Procedures to follow, including:
  - checking the list of equipment, materials, samples required by the scientist
  - collecting required resources and equipment for test/experiment
  - handling equipment and materials, following given guidelines
  - preparing the required equipment, materials and resources in accordance with given instructions/workplace procedures
  - checking and testing the required equipment to ensure it works correctly
  - ensuring that equipment instructions are available and displayed, e.g. operation of a centrifuge, operation of a spirometer
  - checking and making known the location of other equipment and consumables that might be required, e.g. chromatography plates, batteries, sharps containers
  - ensuring that enough time is given for the workstation to be set up efficiently and effectively, ready for the scientist.

A2 Safe working procedures in preparation for a practical session

- Carrying out health and safety checks and appropriate procedures to inform risk assessment before laboratory use.
- Ensuring emergency procedures are made clear to those using the laboratory.
- Following Control of Substances Hazardous to Health (COSHH) Regulations 2002 and Hazardous materials and items (HAZMAT) instructions, as appropriate.
- Ensuring guides or Standard Operating Procedures (SOPs) for operating machinery are available for reference.
- Ensuring those working in the laboratory have access to the required health and safety equipment, e.g. personal protective equipment (PPE), correct clothing, accident report forms etc.
- Liaising with the laboratory users during and after the use of the laboratory in order to be aware of any matters that may affect the session, e.g. a spillage, equipment not working correctly.
- Demonstrating correct use of equipment to avoid harm to the user.

A3 Keeping records of processes and procedures undertaken

- Ensuring accurate records are kept of the processes and procedures undertaken, e.g. advise on updating SOPs where necessary.
- Ensuring health and safety records are clear, up to date and accurate.
Learning aim B: Provide assistance during practical work

B1 Tasks to carry out while assisting practical work

- Assisting laboratory users to complete tasks such as:
  - processing samples as required
  - labelling samples/materials
  - checking weight/volume of samples
  - fetching additional equipment and materials if required.

- Supporting the work by:
  - being visible and aware of the work being carried out in the laboratory
  - showing initiative
  - communicating with laboratory users/offering help
  - multitasking.

B2 Housekeeping duties to perform during practical work

- Washing equipment for reuse throughout.
- Ensuring water bottles are topped up for use.
- Supervising the equipment in the laboratory, ensuring that it works.
- Keeping an eye on electrical equipment/boiling samples.
- Inputting data as required.
- Replacing equipment if needed.

Learning aim C: Safely clear down a laboratory after use

C1 Clearing down a laboratory after use

- Ensuring work surfaces are clean, decontaminated and cleared.
- Checking that standard laboratory equipment is ready for future use, e.g. glassware, weighing instruments.
- Checking that stock levels and protective clothing is stored appropriately, e.g. gloves, eye protection.

C2 Disposal and storage of waste materials

- Using appropriate procedure for storage and disposal of a range of laboratory waste, such as general waste, clinical, radioactive, pharmaceutical, confidential paperwork.
- Disposing of equipment and materials such as:
  - sharps
  - liquids
  - materials used in tests
  - PPE, e.g. gloves, gowns, masks.
- Sterilising reusable equipment and instruments.

C3 Safe working procedures when clearing down a laboratory

- Ensuring correct health and safety procedures are followed when dismantling equipment and cleaning before storage.
- Using agreed procedures to clean work surfaces and dispose of waste.
- Ensuring the correct storage and labelling of hazardous materials.
- Demonstrating the transport and disposal of waste materials.
• Demonstrating correct self-protective procedures, e.g. correct coveralls, goggles, gloves, masks, as necessary.
• Demonstrating health and safety SOPs, e.g. removal of spillages, dealing with biological materials.
• Keeping a record of checks made and reporting to the supervisor when required.

Transferable skills

Working with others
• Communicating with the laboratory staff/scientists/researchers.

Thinking skills/adaptability
• When working with scientist/researcher and there is a change in procedure/requirement.

Problem solving
• Showing initiative if equipment/materials don’t work and need replacing.
### Assessment criteria

<table>
<thead>
<tr>
<th>Pass</th>
<th>Merit</th>
<th>Distinction</th>
</tr>
</thead>
</table>

#### Learning aim A: Safely prepare a laboratory for practical work

**A.P1** Prepare and set up a laboratory for practical work, following laboratory procedures and carrying out basic tests on equipment to check it is fit for use.

**A.P2** Follow correct health and safety working procedures when preparing a laboratory for practical work.

**A.M1** Prepare and set up a laboratory for practical work efficiently, following procedures correctly, carrying out tests on equipment to ensure it is fit for use, identifying issues and solving simple problems.

**A.D1** Prepare and set up a laboratory for practical work confidently, demonstrating a consistently professional approach, carrying out thorough testing of equipment ensuring it is fit for use, and showing initiative when confronted with issues.

#### Learning aim B: Provide assistance during practical work

**B.P3** Demonstrate some basic support for laboratory users during practical work, carrying out essential housekeeping duties.

**B.M2** Demonstrate efficient support for laboratory users during practical work, responding to requests and carrying out housekeeping duties as required.

**B.D2** Demonstrate effective support for laboratory users during practical work, showing initiative when responding to requests and carrying out thorough housekeeping duties.

#### Learning aim C: Safely clear down a laboratory after use

**C.P4** Perform basic clearing down procedures safely, checking equipment and storing materials appropriately.

**C.P5** Dispose of waste safely when clearing down a laboratory.

**C.M3** Perform clearing down procedures competently and safely, carrying out checks of equipment, ensuring the area is decontaminated and that waste is disposed of and stored safely.

**C.D3** Consistently perform clearing down procedures correctly, safely and confidently, carrying out thorough checks of equipment, ensuring the area is fully decontaminated and that waste is disposed of and stored correctly.
Essential information for assessment decisions

Learning aim A

For distinction standard, learners will:
- correctly prepare and set up a laboratory space for both simple and complex laboratory tests or investigations, selecting the equipment and materials required, e.g. the appropriate glassware for measuring small samples or the appropriate meters for registering currents. They will check and test all the necessary equipment to ensure it is fit for use and demonstrate that they can lay out and put together the equipment while following the correct health and safety protocols
- demonstrate control over the laboratory procedures, showing initiative if faced with a problem such as a piece of equipment not functioning correctly or not being available. They might do this through finding a replacement piece of equipment, selecting a suitable alternative or checking why something is not functioning
- fully consider and apply the required health and safety procedures for the practicals.

For merit standard, learners will:
- correctly prepare and set up a laboratory space so that it is fit for use for a range of laboratory tests and investigations, selecting for themselves most of the correct equipment and materials, but possibly needing some support. They will carry out tests on the equipment to ensure it is ready for use
- demonstrate a clear understanding of laboratory procedures, applying them correctly while setting up the laboratory space, although they may need some assistance if faced with a problem with equipment or materials
- demonstrate a clear understanding of the health and safety procedures associated with handling the equipment and materials they have selected.

For pass standard, learners will:
- assemble the appropriate equipment and materials required to prepare and set up a laboratory space for tests or investigations, although maybe not making all of the selection by themselves. They will attempt to set up the workspace, although further adjustments may be required to make it fit for use
- follow health and safety procedures when handling or putting together equipment and materials.

Learning aim B

For distinction standard, learners will:
- provide thorough assistance to the laboratory users throughout the practical work, adding value to the practical work that is taking place, being helpful and communicating confidently with the laboratory users
- multitask, responding to different requests as well as showing initiative to carry out tasks they have not been asked to do
- carry out ongoing housekeeping tasks to ensure the laboratory is kept clean and tidy.

For merit standard, learners will:
- respond to requests from laboratory users quickly, providing competent assistance and communicating effectively with them
- show awareness of the work that is being carried out, prioritising any assistance needed and solving some simple problems themselves
- carry out required housekeeping activities as necessary so that areas of the laboratory are kept clean and tidy.
UNIT 4: PREPARING AND CLEARING DOWN A LABORATORY

For pass standard, learners will:
- respond to requests from laboratory users as required, communicating clearly and asking questions to clarify any points
- focus on one request at a time and be reactive rather than proactive
- carry out some of the basic housekeeping activities but will not necessarily have an overview of the laboratory.

Learning aim C

For distinction standard, learners will:
- carry out the clearing down procedures for a laboratory, thoroughly checking that all surfaces and equipment are decontaminated and following the correct safety procedures for cleaning, clearing away and checking equipment and/or machinery
- show initiative and follow protocols if they come across any issues such as spillages or broken machinery, recording health and safety issues
- work within health and safety guidelines at all times, demonstrating an awareness of the protocols for storing and disposing of a range of waste materials. They will handle delicate equipment appropriately.

For merit standard, learners will:
- follow the required clearing and cleaning down procedures, showing attention to detail when checking that all surfaces and equipment are decontaminated and carrying out the required checks of the equipment/or machinery
- follow health and safety procedures, although they may have to refer to guidelines
- handle waste materials and equipment carefully in order to clear and clean the area, disposing of them appropriately. They will demonstrate that they can follow procedures and will report any problems accordingly.

For pass standard, learners will:
- carry out the routine clearing and cleaning down procedures required, often referring to guidelines, and may not demonstrate attention to detail while checking that all surfaces and equipment are decontaminated. They will perform the required checks of the equipment and/or machinery
- follow the required health and safety protocols, often referring to guidelines
- ensure the equipment and materials are removed and stored away ready for reuse, although they may ask for advice if any problems arise.
Assessment activity

The summative assessment activity takes place after learners have completed their formative development. The activity should be practical, be set in a realistic scenario and draw on learning from the unit, including the transferable skills. You will need to give learners a set period of time and number of hours in which to complete the activity. Section 6 gives information on setting assignments and there is further information on our website.

A suggested structure for summative assessment is shown in the Unit summary section, along with suitable forms of evidence. This is for illustrative purposes only and can therefore be adapted to meet local needs or to assess across units where suitable opportunities exist. The information in the Links to other units section will be helpful in identifying opportunities for assessment across units. The following scenario could be used to produce the required evidence for this unit. Centres are free to use comparable scenarios or other forms of evidence, provided that they meet the assessment requirements of the unit.

Suggested scenario

You have been asked to support a scientific investigation that is taking place in the laboratory over three days. The laboratory technician has given you details of the methodology that is going to be used for the investigation and has asked you to carry out the following activities.

• Collect the materials and equipment required by the scientist for the practical sessions.
• Prepare samples/solutions, as appropriate.
• Assemble and test the equipment, ensuring the materials are fit for use and in date.
• Set up the workstation so it is ready for use following laboratory procedures.
• Follow appropriate health and safety procedures at all times.

You will provide support for the laboratory while some of the practical work is taking place. You will respond to any requests from the scientists and carry out general housekeeping duties to ensure the laboratory is functioning effectively and is kept clean and tidy while being used.

When the practical sessions are finished, you will clean down the workstation and ensure that the waste is disposed of in the correct place and that safety procedures are followed at all times.

• You must take responsibility for all the equipment and materials used, disposing of them safely, putting all the equipment away in the correct places and following the correct health and safety procedures when carrying out this work.
• Make sure you check the stock levels of anything that has been used
• Make sure you note down what you do, any problems that arise and how to solve them.

You will keep a record of the processes you have followed throughout, making notes, taking photographic evidence with annotations and identifying any problems and how you solved them.

If a retake is necessary, an alternative example must be used. The following is an example of a retake assessment activity.

A retake would involve preparing, supporting and clearing down a laboratory for an alternative situation such as for a group of visiting students.
Further information for tutors and assessors

Delivery guidance

The following are examples of practical activities and workshops that tutors could use when developing sector and transferable skills in the delivery of this unit. Wherever possible, practical activities should be used to help learners develop both personal and sector skills in preparation for the final assessment. These suggestions are not intended as a definitive guide to cover the full GLH of the unit.

<table>
<thead>
<tr>
<th>Activity: Introduction to unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce learners to the importance of the laboratory’s assistant role in setting up and clearing down a laboratory correctly.</td>
</tr>
<tr>
<td>In pairs, ask learners to come up with implications of carrying out these tasks incorrectly, e.g. impact on the results of the test/experiment, the health and safety implications of disposing of waste incorrectly.</td>
</tr>
<tr>
<td>Each pair feed back to the whole group.</td>
</tr>
<tr>
<td><strong>Suggested time:</strong> about 1 hour.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity: Preparation lists</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the laboratory, give each group a preparation list that a technician has been asked to get ready. Ask the groups to find the items on their list and make them ready for use. Start with a simple set of equipment and materials.</td>
</tr>
<tr>
<td>Discuss with the groups how the activity went, e.g. any difficulties, how they were overcome, what went well etc. Make sure they record this activity in some way. Repeat the activity over a number of sessions, increasing the complexity of the preparation lists.</td>
</tr>
<tr>
<td>In between these laboratory-based activities, demonstrate equipment use and how to follow the instructions so that all the components needed are available, e.g. a centrifuge which uses special test tubes, or meters needing to be checked before use in circuit boards. Allow laboratory time so that learners can, under supervision, practise these skills.</td>
</tr>
<tr>
<td>Scenarios can be set so that individual learners can do them if there is insufficient space for a whole group to be in a laboratory at any one time. For example, a preparation list that says food tests or chromatography or testing circuits and does not give details. Can the learners make up a list of the equipment required?</td>
</tr>
<tr>
<td><strong>Suggested time:</strong> about 5 hours.</td>
</tr>
</tbody>
</table>
### Activity: The role of a laboratory technician

Arrange for class/group time with relevant personnel, e.g. technicians who may hold various responsibilities at different levels, supervisors etc. Learners find out from people in the job exactly what they do and what is required of them.

Arrange class visits, if possible, to other types of laboratories. If this is not possible, use promotional videos for companies that show the roles of technicians.

Set individual projects for learners to research technician roles so they are aware of the wide variety of posts available. Make sure they cover all branches of industry, e.g. building and construction, production of chemicals and biological products, laboratories producing microchips, the brewing industry, microelectronic industry etc.

**Suggested time:** about 6 hours.

### Activity: How to clear down a laboratory

In groups, learners are presented with a photograph (or a video clip on a computer) of a laboratory just after it has been used. Ask each group to list what they think the technician would do in order to clear down the area shown.

Class discussion regarding the list of jobs in the clear down procedure and their order of priority. Make sure safe routines are mentioned. Learners draw up a list of activities to be followed when routinely clearing down a laboratory, including checking stock levels.

Tutors could set up scenarios in a laboratory so that learners can practise clearing up and carrying out routine maintenance safely.

In groups, learners are each given a work station (area of the laboratory) to clear up and maintain, following the list drawn up previously (including the agreed protocols for that laboratory). Supervision will be needed by suitably qualified personnel. Learners record what they have done and then discuss their practical activity with their supervisors, noting good procedures and where they could improve. Encourage them to evaluate and record their performance.

Learners repeatedly practise their skills under supervision whenever possible, making sure they log the activities they are involved in. They work with some apparatus, e.g. centrifuges, pH meters etc. so they are familiar with operating procedures and can ensure the apparatus is working correctly.

Scenarios can be set so learners can do them if there is insufficient space for a whole group to be in a laboratory at any one time. The scenarios could be a series of situations using drawings or photographs that present learners with problems to solve. This will help them to show initiative without any danger to themselves.

**Suggested time:** about 5 hours.
Essential resources

For this unit, learners will need access to laboratories where they can practise the skills required of a laboratory assistant or technician. This includes being able to maintain the laboratory or workstations after use and prepare them for use.

Links to other units

This unit has strong links to:
• Unit 1: Laboratory Health and Safety
• Unit 2: Working in a Science Laboratory.

Employer involvement

This unit would benefit from employer involvement in the form of:
• work experience where learners can support a laboratory technician/laboratory assistant in the preparation and clearing down of the laboratory
• visits from scientists/researchers who can carry out experiments, using learners to prepare their laboratory space and support them during the practical work
• masterclasses with professional lab technicians on the processes and procedures they follow when preparing and clearing down laboratories.
Unit 5: Handling Scientific Data

Level: 2
Unit type: Mandatory
Assessment type: Internal
Guided learning hours: 60

Unit in brief
Learners develop the skills needed to observe, record and present scientific data from practical investigations.

Unit introduction
When scientists carry out practical tests or investigations in a laboratory, they are often supported by a laboratory assistant or junior technician who will observe the practical, take measurements and record results. This support from the laboratory assistant is essential to ensure the reliability and validity of the results and that data is captured accurately.

In this unit, you will develop the skills to observe, take measurements and collect data using the appropriate methods, scientific apparatus and equipment. You will learn how to record the results and present them to the scientist in the required data format, drawing some simple conclusions on the quality of the data.

The skills you develop in this unit will support you in progressing to work as a laboratory assistant or junior laboratory technician, or to further science qualifications.

Learning aims

In this unit you will:
A Carry out observations and take measurements during practical experiments
B Record data from practical experiments
C Present and review data from practical experiments.
### Unit summary

<table>
<thead>
<tr>
<th>Learning aim</th>
<th>Key teaching areas</th>
<th>Summary of suggested assessment evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Carry out observations and take measurement during practical experiments</td>
<td>A1 How to observe and take measurements during practical experiments</td>
<td>Lab book containing learners’ notes of the observations/measurements collected, supported by observation records.</td>
</tr>
<tr>
<td>B Record data from practical experiments</td>
<td>B1 Designing an appropriate recording template</td>
<td></td>
</tr>
<tr>
<td>B2 Recording scientific data from practical experiments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C Present and review data from practical experiments</td>
<td>C1 How to present data from practical experiments</td>
<td>Template designed by learner. Data from practical experiments recorded in template.</td>
</tr>
<tr>
<td>C2 Reviewing the observation, measuring and recording the processes used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Key teaching areas in this unit include:

<table>
<thead>
<tr>
<th>Sector skills</th>
<th>Knowledge</th>
<th>Transferable skills/behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Observing, measuring, collecting, recording and presenting data</td>
<td>• How to organise data into appropriate formats</td>
<td>• Communication</td>
</tr>
<tr>
<td>• Using graphs, tables and bar charts to present data</td>
<td>• How to present information to tutor in the correct format using the appropriate terminology</td>
<td>• Managing information</td>
</tr>
<tr>
<td>• Reflecting on the quality of the data</td>
<td></td>
<td>• Thinking skills</td>
</tr>
</tbody>
</table>
Unit content

Knowledge and sector skills

Learning aim A: Carry out observations and take measurements during practical experiments

Learners should practise these skills and techniques across a number of different practical experiments before the final assessment.

A1 How to observe and take measurements during practical experiments

In a science laboratory, collecting, recording and presenting data is vital to enable trends to be identified and to see patterns between variables. It is difficult for scientists or researchers to analyse data if it is not adequately collected or properly recorded.

- A laboratory assistant may have to:
  - select the appropriate equipment to allow for observation and accurate measurement of results, e.g. consideration of appropriate scale for observation when using microscopes, burettes, meters
  - check the equipment is in good working order
  - make up standard solutions, as required
  - ensure access to appropriate personal protective equipment (PPE) and identify possible hazards before carrying out observations
  - follow instructions to carry out observations/measurements to ensure accuracy and reliability of observations
  - communicate with scientist/researcher, as/if required
  - use appropriate SI units to measure odds for observable events and record the data.

Learning aim B: Record data from practical experiments

B1 Designing an appropriate recording template

Before scientific data is recorded, a suitable template should be designed to ensure that all the relevant data will be recorded accurately.

- A laboratory assistant may have to:
  - design or use an appropriate template to record data, e.g. in logbook, laboratory report, electronic record
  - ensure template includes the correct variables that are being investigated and accommodates recording of repeating measures
  - ensure correct labelling of columns with correct SI units, where relevant, with the scale of measurement recorded
  - ensure samples/products are stored appropriately.

B2 Recording scientific data from practical experiments

A laboratory assistant should ensure that:

- observations/measurements are recorded in an appropriate format
- both qualitative and quantitative observations are made, as appropriate
- data that is collected electronically is effectively stored to enable backup, easy access and security
- simple calculations are carried out, as required
- any adaptations to the procedure or any errors/anomalies in and arising from data should be noted down and communicated to the supervisor.
Learning aim C: Present and review data from practical experiments

Laboratory assistants may often have to present the data from the practical experiments to other staff in the laboratory in the most suitable format to allow for further analysis. They may have to reflect on the processes used, highlighting any issues or comments on the data.

C1 How to present data from practical experiments

• Choosing appropriate method for presenting data.
• Organising data into a suitable format to interpret results, e.g. clearly labelled table, graph, bar chart.

C2 Reviewing the observation, measuring and recording the processes used

A laboratory assistant should reflect on the:

• observation/measuring equipment used
• methodology used
• accuracy of the measurements taken
• reliability of the results taken, e.g. whether they were repeated
• validity of the results taken, e.g. the controls used, whether all variables were constant
• improvements that could have been made to improve the handling of the data.

Transferable skills

Communication

• Working with and communicating with other laboratory staff when supporting their work.

Managing information

• Collecting and recording data, using graphs, tables, bar charts, calculations using results.

Thinking skills

• Reflecting about the quality of the data that has been handled.
### Assessment criteria

<table>
<thead>
<tr>
<th>Pass</th>
<th>Merit</th>
<th>Distinction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning aim A: Carry out observations and take measurements during practical experiments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.P1 Select equipment to take measurements and carry out observations for a range of practical experiments.</td>
<td>A.M1 Select equipment that is appropriate to take measurements and carry out observations efficiently for a range of practical experiments, taking measurements with precision.</td>
<td>A.D1 Select correct equipment to carry out observations and take measurements for a range of practical experiments, showing initiative to ensure measurements are taken with precision and accuracy.</td>
</tr>
<tr>
<td>A.P2 Take observations and measurements during practical experiments.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Learning aim B: Record data from practical experiments** |
| B.P3 Design basic recording templates with appropriate formatting and labelling for practical experiments. | B.M2 Design appropriate recording templates that capture data for a range of practical experiments, recording data accurately and efficiently. | B.D2 Design recording templates that effectively capture data for a range of practical experiments, confidently recording and organising data, and showing initiative throughout. |
| B.P4 Record outline data from practical experiments. |

| **Learning aim C: Present and review the data from practical experiments** |
| C.P5 Present the data from practical experiments in a basic format. | C.M3 Present the data from practical experiments in an appropriate format that clearly shows the results, making relevant comments on its validity and accuracy. | C.D3 Present data from a range of practical experiments in the correct format, drawing conclusions on the validity, accuracy and reliability of the results taken. |
| C.P6 Review the data from practical experiments, making outline comments on its validity and accuracy. |
Essential information for assessment decisions

Learning aims A and B

For distinction standard, learners will:

- select the correct observational/measuring equipment across a range of practical experiments that they are supporting, demonstrating that they can set them up and check them correctly
- produce data recording templates that are the most appropriate for the practical work they are supporting. They will be clearly presented with the correct variables and SI units and will accommodate the need for repeated readings
- record results appropriately using the correct SI units and number of significant figures/decimal places. They will make correct observations and take precise measurements, using their initiative to ensure they obtain valid and reliable results and, where necessary, repeat an activity a number of times to get accurate results, e.g. obtaining three accurate precise readings and calculating the average during an acid-base titration.

For merit standard, learners will:

- select observational/measuring equipment for the practical experiments they are supporting which, although appropriate and fit for purpose, would not always be the most suitable. They will take mostly precise observations or measurements throughout the practical work in a timely and organised manner. They will make some attempt to ensure they obtain valid results through repeating some of the activities
- produce recording templates that are fit for purpose and are formatted and presented clearly to enable accurate capture of data
- record data and observations that are predominately accurate. They will record results appropriately using the correct SI units and the correct number of significant figures/decimal places.

For pass standard, learners will:

- select observational/measuring equipment for practical work that shows some consideration of the scale required, although may not be the most appropriate. They will check and set up the equipment. Their measurements will be broad and not always precise, and their observations simple and undeveloped throughout. They will not necessarily repeat activities or make the appropriate checks
- produce recording templates that capture some outline readings and show some consideration of the practical work they are supporting by labelling the columns and rows appropriately
- record some broad and rough results and make limited observations.

Learning aim C

For distinction standard, learners will:

- organise the data into the most appropriate format for the data capture, such as a clearly labelled table of results/graph/bar chart or pie chart using the correct SI units and terminology
- describe how they could have made improvements to their methodology, making links to the purpose of the experiment
- carry out some basic interpretation of the data, recognising patterns, trends and any irregularities/errors. They will draw some developed conclusions on whether they think the data they have collected is accurate, reliable and valid, referring to specific examples.
For merit standard, learners will:

- present the data in a suitable format with elements clearly labelled so the results can be understood easily
- identify some areas for improvements in the methodology they used and the equipment they selected
- make some relevant comments on whether they think the data they collected is accurate, reliable and valid, using relevant examples and perhaps recognising some patterns or trends in the data.

For pass standard, learners will:

- present the data in a suitable format with elements clearly labelled so the results can be understood easily
- identify some areas for improvements in the methodology they used and the equipment they selected
- make some relevant comments on whether they think the data they collected is accurate, reliable and valid, using relevant examples and perhaps recognising some patterns or trends in the data.
Assessment activity

The summative assessment activity takes place after learners have completed their formative development. The activity should be practical, be set in a realistic scenario and draw on learning from the unit, including the transferable skills. You will need to give learners a set period of time and number of hours in which to complete the activity. Section 6 gives information on setting assignments and there is further information on our website.

A suggested structure for summative assessment is shown in the Unit summary section, along with suitable forms of evidence. This is for illustrative purposes only and can therefore be adapted to meet local needs or to assess across units where suitable opportunities exist. The information in the Links to other units section will be helpful in identifying opportunities for assessment across units.

The following scenario could be used to produce the required evidence for this unit. Centres are free to use comparable scenarios or other forms of evidence, provided that they meet the assessment requirements of the unit.

Suggested scenario

You have been asked, as the senior laboratory assistant in a pharmaceutical organisation, to support a team of visiting research scientists during their practical experiments by making observations, taking measurements and checking the accuracy and reliability of the scientific data produced.

The laboratory technician has given you a list of the practical experiments you will be supporting and has asked you to carry out the following tasks.

- Select the measuring equipment and materials that are most appropriate to carry out observations and measurements for the practical experiments on the list.
- Produce a template to record and organise the data into an appropriate format.
- Take precise and reliable observations and measurements throughout the practical work, taking repeat measurements as required.
- Organise and present the data in the most appropriate format.
- Note down any comments or observations on the reliability, accuracy and validity of the data.

If a retake is necessary, an alternative example must be used. The following is an example of a retake assessment activity.

Learners could support the work of a different group of scientists with a different list of practical experiments.
Further information for tutors and assessors

Delivery guidance

The following are examples of practical activities and workshops that tutors could use when developing sector and transferable skills in the delivery of this unit. Wherever possible, practical activities should be used to help learners develop both personal and sector skills in preparation for the final assessment. These suggestions are not intended as a definitive guide to cover the full GLH of the unit.

### Introduction to unit

Tutors introduce the unit and how it fits in with the other units in the qualification through the use of a flow chart, mind map or other visual representation. They discuss with learners their previous experience of observing, recording, interpreting and presenting results from practical experiments or activities.

**Suggested time:** about 4 hours.

### Activity: Equipment for measuring and recording

In a laboratory, tutors demonstrate some typical equipment, apparatus, instruments and sensors used to make observations and take measurements.

Tutors discuss with learners the appropriate PPE and any risks/hazards in making observations and taking measurements. They discuss with learners the use of appropriate procedures to carry out observations and measurements, and how to ensure their accuracy and reliability using the appropriate units. They also discuss any alterations to the appropriate procedures when making observations/measurements.

**Suggested time:** about 3 hours.

### Activity: Using, measuring and recording equipment

Learners practise taking observations and measurements for a range of different practicals under supervision, with feedback. Tutors discuss with learners the use of their logbooks, practical report books or the electronic recording of observations and measurements, as well as the correct format in which to record the data.

Tutors discuss with learners any alterations to the appropriate procedures when making observations/measurements.

**Suggested time:** about 4 hours.

### Activity: Labelling samples and communicating observations/measurements

Tutors introduce how to communicate observations/measurements to a laboratory supervisor. They introduce learners to recording measurements in a working laboratory and the way in which samples/products need to be labelled for identification purposes, to ensure accuracy.

**Suggested time:** about 2 hours.

### Activity: Taking observations/measurements for different types of practical

Tutors set up scenarios for learners in which they take observations and measurements for a variety of biology, chemistry and physics laboratory experiments/activities/tests, such as melting points of solid barbiturates in a pharmaceutical manufacturing laboratory.

**Suggested time:** about 2 hours.
Activity: Assisting in practicals
Tutors set up practical tests for learners to follow procedures when taking observations and measurements and recording results. This could be followed by a circus of practical experiments/activities, where learners are observed taking observations/measurements and recording results using a variety of instruments/apparatus/equipment as part of an assessment.

Suggested time: about 4 hours.

Activity: Handling electronic data
Using a scenario such as testing laboratory in a manufacturing company, tutors discuss with learners how data can be stored as part of the laboratory management information system. Tutors show some of the data on CD, or online, e.g. Control of Substances Hazardous to Health (COSHH) Regulations 2002, or where to purchase equipment/apparatus. Tutors discuss with learners how data can be easily accessed, backed up and secured.

Suggested time: about 3 hours.

Activity: Methods of presenting data
Tutors discuss with learners how to organise data into a suitable format to enable them to interpret the results. They give learners a number of example sets of data and ask them to organise the data into tables, bar charts and graphs. Tutors introduce learners to methods of communicating results to their supervisor, and the need to sign off any results and conclusions. Tutors set up practical tests for learners to practise following procedures for organising data into a suitable format, interpreting results and drawing conclusions, before presenting them.

Suggested time: about 2 hours.

Activity: Reviewing data
Tutors ask learners to interpret a number of graphs, tables and bar charts etc., such as the relationship between the y- and x-axis of a graph. From what they have seen, learners try to identify potential improvements, e.g. when measuring the melting points of some samples, the laboratory technician may have heated the oil in the melting point instrument too quickly, leading to a wide range of results for a particular melting point. If they had slowed the heating down when they were getting close to the actual melting point of the solids, they would have obtained accurate and sharp melting points. Learners are given a number of sets of data so that they can practise organising and interpreting the results, drawing conclusions and presenting.

Suggested time: about 3 hours.
Essential resources

For this unit, learners will need access to:
- science laboratories
- appropriate equipment and material (for taking measurements).

Links to other units

This unit has strong links to:
- Unit 4: Preparing and Clearing Down a Laboratory
- Unit 6: Planning a Scientific Investigation.

Employer involvement

This unit would benefit from employer involvement in the form of:
- masterclasses with professional laboratory technicians on the processes and procedures used to measure, record and handle scientific data
- work experience in a professional laboratory where learners can assist scientists/researchers in observing, measuring and recording data
- an expert witness where an employer can assist in the assessment of learners carrying out their assessment activity.
Unit 6: Planning a Scientific Investigation

Level: 2
Unit type: Mandatory
Assessment type: Internal Synoptic
Guided learning hours: 60

Unit in brief

Learners develop a scientific question in a vocational area of laboratory science and plan a scientific investigation to address the question.

Unit introduction

Is there an area of laboratory science that you would like to work in? Perhaps environmental or food science interests you? Or maybe the healthcare sector? You will discover that there are job roles in laboratories across a wide range of sectors, from construction to pharmaceuticals.

In this unit, you will draw together the skills and knowledge you have gained from across the units to plan a laboratory investigation in an area of vocational science of your choice. In discussion with your tutor, you will formulate a realistic and measureable scientific question to plan out. You will look into any similar scientific research in that area and consider any variables and preliminary testing that would need to be done before the investigation, giving an indication of the outcomes you would expect. Your plan will include the staff needed in the laboratory, the equipment and materials required to carry out the investigation, plans for how the data will be measured and recorded, and the laboratory processes and procedures that would need to be followed. You will then present your question and plan to an audience, taking questions on it.

This is a synoptic unit that can showcase the skills and knowledge you have developed throughout the course, and may be a useful discussion point during an interview when progressing to employment as a laboratory assistant or apprentice, or to further study.

Learning aims

In this unit you will:

A Develop a scientific question that can be tested in a laboratory
B Plan a laboratory investigation that addresses the scientific question
C Present the plan for the scientific investigation to an audience.
# Unit 6: Planning a Scientific Investigation

## Unit summary

<table>
<thead>
<tr>
<th>Learning aim</th>
<th>Key teaching areas</th>
<th>Summary of suggested assessment evidence</th>
</tr>
</thead>
</table>
| **A** Develop a scientific question that can be tested in a laboratory | **A1** Selecting a scientific question  
**A2** Developing a scientific question | Lab book covering the development of the scientific question, the reasons for choosing it, research into similar work and the expected findings. Plan for a scientific investigation. |
| **B** Plan a laboratory investigation that addresses the scientific question | **B1** Planning a scientific investigation  
**B2** Health and safety considerations | Presentation of scientific question and plan for laboratory investigation. |
| **C** Present the plan for the scientific investigation to an audience | **C1** Putting together information for a presentation  
**C2** Consideration of audience, format and structure | |

### Key teaching areas in this unit include:

<table>
<thead>
<tr>
<th>Sector skills</th>
<th>Knowledge</th>
<th>Transferable skills/behaviours</th>
</tr>
</thead>
</table>
| Developing scientific questions  
Planning a scientific investigation  
Presentation skills | Types of investigations carried out across sectors of laboratory science  
Understanding of independent and dependent variables | Problem solving  
Managing information  
Communication |
Unit content

Knowledge and sector skills

Learning aim A: Develop a scientific question that can be tested in a laboratory

This should be negotiated and agreed with learners to ensure it is focused, manageable and appropriate for Level 2.

A1 Selecting a scientific question

- Selecting an area of laboratory science to investigate further, ensuring it is linked to a particular vocational sector of laboratory science, e.g. food science, environmental science, materials science, electronics and communication.
- Selecting or formulating a scientific question from the chosen vocational area that can be answered in a measurable way through laboratory testing, e.g. food composition, water quality, soil analysis, blood testing, air pollution from car exhausts, testing of electronic components, strength testing of materials.

A2 Developing a scientific question

- Reviewing information that is already in the public domain relating to the scientific question and researching the topic area to gain a greater understanding.
- Carrying out some observations, and preliminary tests, if appropriate.
- Considering which variables are established to test, measure and control, including independent and dependent variables.
- Expectations of the outcomes/results: what will be proved/disproved?

Learning aim B: Plan a laboratory investigation that addresses the scientific question

B1 Planning a scientific investigation

Factors to consider:

- the type of laboratory that will be used, e.g. wet or dry, physics, chemistry, biology
- the resources required, such as equipment, instrumentation, apparatus, sensors and materials
- the techniques/methods for obtaining primary results
- whether samples/materials need to be prepared in advance
- the observations and measurements that need to be taken (quantitative and qualitative)
- how results should be recorded and presented
- roles and responsibilities of laboratory staff during investigation
- identifying constraints, such as resources, stock, time, use of facilities, environmental constraints
- whether there are variables to be controlled – how this will be done and what impact it could have
- whether any trials need to be carried out to establish type of technique or method to be used
- any confidentiality/ethical issues
- consideration of contingency planning.
B2 Health and safety considerations
- Health and safety procedures to be carried out ahead of activity.
- Laboratory procedures for risk assessment.
- Identification of potential hazards and level of risk and procedures to put in place for the prevention of hazards.
- The procedures for the disposal and clearing away of laboratory waste.
- Control of Substances Hazardous to Health (COSHH) Regulations 2002 requirements.
- Requirements for personal protective equipment (PPE).

Learning aim C: Present the plan for the scientific investigation to an audience

C1 Putting together information for a presentation
- Selecting relevant content to present.
- Summarising information.
- Checking coherence and clarity.
- Checking spelling, punctuation and grammar.
- Using accurate scientific terminology when explaining the rationale for the investigation and plan.

C2 Consideration of audience, format and structure
- Consideration of audience, e.g. peers, tutors, laboratory professionals, visiting employers.
- Type of presentation, e.g. report, PowerPoint®, poster.
- Structure of research findings and activity.
- Organisation of findings, e.g. use of headings, sub-headings.
- Clarity of communication, e.g. written, verbal.
- Using communication techniques, e.g. vocal clarity and expression, body language.
- Responding to questions about the investigation, e.g. viva, question and answer session with peers.

Transferable skills

Problem solving
- Designing a plan for a laboratory investigation to answer a scientific question.

Managing information
- Organising the research findings from different sources.

Communication
- Presenting to an audience and answering questions.
## Assessment criteria

<table>
<thead>
<tr>
<th>Pass</th>
<th>Merit</th>
<th>Distinction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning aim A: Develop a scientific question that can be tested in a laboratory</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.P1 Select a simple scientific question that can be tested in a laboratory.</td>
<td>A.M1 Demonstrate the development of a focused scientific question that is vocationally relevant and demonstrates consideration of the factors of testing in a laboratory.</td>
<td>A.D1 Demonstrate the thorough development of a scientific question, justifying its vocational relevance and showing full consideration of the factors involved in testing in a laboratory.</td>
</tr>
<tr>
<td>A.P2 Demonstrate the basic development of a scientific question that shows a consideration of expected outcomes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Learning aim B: Plan a laboratory investigation that addresses the scientific question</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.P3 Produce an outline plan for a scientific investigation that shows limited consideration of the factors involved for laboratory work.</td>
<td>B.M2 Produce a detailed and workable plan for a scientific investigation that addresses the requirements of the question and covers the relevant considerations for laboratory work.</td>
<td>B.D2 Produce a well-structured and detailed plan for a scientific investigation that makes clear links to the requirements of the question and comprehensively covers the considerations for laboratory work.</td>
</tr>
<tr>
<td><strong>Learning aim C: Present the plan for the scientific investigation to an audience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.P4 Give a presentation that outlines the scientific question and investigation plan, showing consideration of structure and formatting and answering basic questions about their work.</td>
<td>C.M3 Give a presentation that clearly and logically describes the scientific question and the planned investigation, showing consideration of the audience and competently answering a range of questions about their work.</td>
<td>C.D3 Give a well-structured and confident presentation that fully explains the investigative question, its development and how the planned investigation would address it, responding to a range of questions with assurance.</td>
</tr>
</tbody>
</table>
Essential information for assessment decisions

Learning aims A and B

For distinction standard, learners will:

- develop a logically structured scientific question that clearly identifies the variables to investigate and measure, showing relevant scientific knowledge and understanding of the topic area chosen
- produce a well-structured plan for a vocationally relevant and realistic laboratory investigation that considers all relevant factors, such as the type of laboratory and workspace, the laboratory staff required, appropriate resources, equipment and materials, and health and safety requirements. They will identify any constraints or possible problems that may occur and suggest possible solutions. They will identify the correct procedures to be followed and the observations/measurements to be taken.

For merit standard, learners will:

- develop a testable scientific question that makes reference to the variables to investigate and measure, showing some relevant scientific knowledge and understanding of the topic area chosen
- produce a detailed plan for a laboratory investigation that shows a broad consideration of the most relevant factors, such as the type of laboratory, the laboratory staff required, appropriate resources, and health and safety requirements. They will identify the correct procedures to be followed and the observations/measurements to be taken.

For pass standard, learners will:

- develop a simple scientific question that shows some consideration of the factors involved and understanding of the topic area chosen
- produce an outline plan for laboratory investigation that shows consideration of some of the factors involved, such as the type of laboratory, the materials and equipment required, and health and safety considerations. They will identify procedures to be followed and observations/measurements that will need to be taken, with some consideration of the results they expect.

Learning aim C

For distinction standard, learners will:

- give a well-structured and confident presentation, communicating clearly their scientific question and making links to how their investigation will answer it. They will show full consideration of the audience they are presenting to and the supporting material will be clearly formatted, with very few grammatical or spelling errors. They will respond to questions confidently, showing they have a clear understanding of what they are communicating.

For merit standard, learners will:

- give a presentation that communicates their scientific question and planned investigation. Their supporting material will be organised and in a concise and understandable format. There may be a few grammatical or spelling errors and they will show a consideration of the audience they are presenting to by using eye contact and speaking directly to them. They will respond to questions well, demonstrating they are knowledgeable about their work.
For pass standard, learners will:

- give a presentation, mostly reading directly from the supporting material, that gives a broad outline of their scientific question and planned investigation. Their presentation will show consideration of layout and format but may have a number of grammatical and spelling errors. They will answer simple questions about their work, mostly repeating what is in the presentation.
Assessment activity

The summative assessment activity takes place after learners have completed their formative development. The activity should be practical, be set in a realistic scenario and draw on learning from the unit, including the transferable skills. You will need to give learners a set period of time and number of hours in which to complete the activity. Section 6 gives information on setting assignments and there is further information on our website.

A suggested structure for summative assessment is shown in the Unit summary section, along with suitable forms of evidence. This is for illustrative purposes only and can therefore be adapted to meet local needs or to assess across units where suitable opportunities exist. The information in the Links to other units section will be helpful in identifying opportunities for assessment across units.

The following scenario could be used to produce the required evidence for this unit. Centres are free to use comparable scenarios or other forms of evidence, provided that they meet the assessment requirements of the unit.

Suggested scenario

You will develop a scientific vocational question for an area of laboratory science that interests you. After discussions with your tutor, and agreeing on the focus of your question, you will put together an investigation plan for tests/experiments that will try to answer your question.

Your plan should include:

- the type of laboratory space/workstation required
- the equipment and materials needed to carry out the activities
- whether there are variables to be controlled – how this will be done and what impact it could have
- whether samples/materials need to be prepared in advance
- the observations and measurements that need to be taken (quantitative and qualitative)
- how results should be recorded and presented
- consideration of the health and safety requirements for the investigation
- considerations of confidentiality/ethical issues.

You will present your work to an audience of local employers who will ask you some questions about your investigation and plan.

If a retake is necessary, an alternative example must be used. The following is an example of a retake assessment activity.

Learners will choose a different scientific question to investigate and put together a plan for tests or experiments to try to answer the question.
Further information for tutors and assessors

Delivery guidance

The following are examples of practical activities and workshops that tutors could use when developing sector and transferable skills in the delivery of this unit. Wherever possible, practical activities should be used to help learners develop both personal and sector skills in preparation for the final assessment. These suggestions are not intended as a definitive guide to cover the full GLH of the unit.

<table>
<thead>
<tr>
<th>Introduction to unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutors could give an overview and introduce the unit as a synoptic unit, explaining how it integrates the knowledge and skills learned in the other units in the qualification with what is learned in this unit. This could be demonstrated through the use of a flow chart, mind map or other visual representation. They could discuss with learners their previous experience of completing any research or science activities in a vocational topic. <strong>Suggested time:</strong> about 5 hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity: Investigating the different vocational sectors of laboratory science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutors could discuss with learners the different vocational areas, the types of laboratories in the sectors and the types of work/functions carried out in the sectors. Learners could research the different job roles and responsibilities of laboratory assistants and junior technicians in different laboratories and vocational areas. A STEM Ambassador could be invited to talk about job roles and the importance of researching and preparing activities to be carried out in the laboratory in different vocational areas. <strong>Suggested time:</strong> about 2 hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity: Researching scientific questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutors could lead a discussion on different types of scientific questions that learners could research and plan for. They could introduce learners to the process of researching scientific investigations in a vocational area and what it includes, e.g. how to search for and use different sources of information. Tutors could discuss sources of information, including websites, speaking to laboratory assistants/technicians/YouTube™ clips, articles and books etc. They could also address how learners should reference the information they collect and record the date and time. Learners could then start to plan for the type of question they would like to research and the sources they would use. <strong>Suggested time:</strong> about 3 hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity: Selecting and developing a scientific question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners discuss the scientific question they would like to plan for with their tutors, gaining permission to proceed. Learners could then focus their research on their question, using sources of information and recording their findings. <strong>Suggested time:</strong> about 2 hours.</td>
</tr>
</tbody>
</table>
Activity: Considerations for laboratory plans
Tutors will share examples of laboratory plans for investigations. They could discuss with learners how to put together a structured and realistic plan for an investigation.
Tutors could discuss with learners the types of considerations when putting a plan together, such as the laboratory bench space layout required, the services and equipment, and the materials and resources needed. Tutors could ask learners about the constraints of the activity and if there are any pre-prepared samples/materials required, such as mixtures of materials or solutions.
Tutors could discuss with learners the importance of following procedures accurately and the role of the laboratory assistant carrying out the activity in making observations and taking measurements, and the need to use a recording medium.
Tutors would need to ask learners about related health and safety issues and risk assessments. Tutors could discuss with learners about any confidentiality or ethical issues which relate to their activity.
Suggested time: about 4 hours.

Activity: Presentation format
Tutors could discuss with learners the different types of presentation they could use to convey their question and plan. Learners decide on the type of presentation they are going to use and produce, and communicate their presentation in a suitable format, using correct terminology, headings and tense.
Learners then work on their presentation.
Suggested time: about 2 hours.
Essential resources

For this unit, learners will need access to:

- a laboratory with various types of equipment, apparatus, recording instruments, sensors, computers and materials
- the internet.

Links to other units

This unit draws on the knowledge and skills taught in:

- Unit 1: Laboratory Health and Safety
- Unit 2: Working in a Science Laboratory
- Unit 3: Assisting in Laboratory Activities
- Unit 4: Preparing and Clearing Down a Laboratory
- Unit 5: Handling Scientific Data.

Employer involvement

This unit would benefit from employer involvement in the form of:

- work experience in laboratories in the sectors learners have chosen as part of their research, where they could interview laboratory technicians or assistants and observe some laboratory activities to help inform their own planning
- industry practitioners operating as expert witnesses where they could sit in on learners’ final presentations, asking questions and providing feedback on the vocational relevance of the content and performance.
4 Planning your programme

Is there a learner entry requirement?

As a centre, it is your responsibility to ensure that recruited learners have a reasonable expectation of success on the programme. There are no formal entry requirements but we expect learners to have qualifications at or equivalent to Level 1.

Learners are most likely to succeed if they have:

- three or four GCSEs at intermediate grades and/or
- BTEC qualification(s) at Level 1 or Level 1/2
- Level 1 equivalent achievement in English and mathematics through GCSE or Functional Skills.

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

What is involved in becoming an approved centre?

All centres must be approved before they can offer this qualification – so that you are ready to assess learners and so that we can provide the support needed. Further information is given in Section 8 Administrative arrangements.

What level of sector knowledge is needed to deliver this qualification?

We do not set any requirements for tutors but expect centres to assess the overall skills and knowledge of the teaching team to ensure that they are relevant and up to date with current industry practice. This will give learners a rich programme to prepare them for progression.

What resources are required to deliver this qualification?

As part of your centre approval, you will need to show that the necessary material resources and workspaces are available to deliver the qualification. For some units, specific resources are required.

What makes good vocational teaching?

The approach to vocational teaching must be led by what is right for the particular sector. Therefore, each unit includes delivery guidance and suggested assessment tasks. Using the delivery guidance and suggested assessment tasks and our additional free delivery guidance and assignment briefs, you can build a course that contextualises learning in real-life and/or employment scenarios. This will naturally draw in the kind of broader attributes valued in the sector, for example organisation in laboratory science, as well as the more general skills needed in work that fit well with project-based learning, for example teamwork, independent learning.
**What are the requirements for meaningful employer involvement?**

This qualification has been designed as a Technical Certificate qualification and as an approved centre you are required to ensure that during their study, every learner has access to meaningful activity involving employers. See *Section 2 Structure* for the requirements for employer involvement.

**Support for employer involvement**

It is important that you give learners opportunities that are of a high quality and which are directly relevant to their study. We will support you in this through guidance materials and by giving you examples of best practice. See *Section 11 Resources and support* for details of the support available, including the Work Experience Toolkit.

**What support is available for delivery and assessment?**

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

To support you with planning your assessments, you will be allocated a Standards Verifier early in the planning stage. There will be extensive training programmes and support from our Subject Advisor team.

For further details see *Section 11 Resources and support*.

**How will my learners become more employable through this qualification?**

Learners will be acquiring the key technical and sector knowledge, and practical and technical skills that employers need. Employability skills, such as teamwork and entrepreneurialism, and completing realistic tasks have also been built into the design of the learning aims and content. This gives tutors the opportunity to use relevant contexts, scenarios and materials to enable learners to develop a portfolio of evidence that demonstrates the breadth of their skills and knowledge in a way that equips them for employment.
5 Assessment structure

The BTEC Level 2 Diploma in Laboratory Science is assessed using a combination of internal assessments, which are set and marked by tutors, and external assessments which are set and marked by Pearson.

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

In developing an overall plan for delivery and assessment for the programme you will need to consider the order in which you deliver units, whether delivery is over short or long periods and when assessment can take place.

One internally-assessed unit in the qualification is defined as synoptic (see Section 2 Structure). A synoptic assessment is one that a learner should take later in a programme and in which they will be expected to apply learning from a range of units. As such, you must plan the assignments that learners can demonstrate learning from across their programme.

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

In administering internal and external assessment, the centre needs to be aware of the specific procedures and policies that apply, for example to registration, entries and results. An overview with signposting to relevant documents is given in Section 8 Administration arrangements.
6 Internal assessment

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

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

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

Principles of internal assessment

Our approach to internal assessment for this qualification offers flexibility in how and when you assess learners, provided that you meet assessment and quality assurance requirements. You will need to take account of the requirements of the unit format, which we explain in Section 3 Units, and the requirements for delivering assessment given in Section 8 Administrative arrangements.

Operating internal assessment

The assessment team

It is important that there is an effective team for internal assessment so that all assessment is planned and verified. For this qualification it is likely that the team will be small but it is still necessary to ensure that the assessment process is followed. Full information is given in the Pearson Guide to Quality Assurance.

The key roles are:

- the Lead Internal Verifier (Lead IV) for the qualification has responsibility for the planning, record keeping and standard setting for the qualification. The Lead IV registers with Pearson annually and organises training using our support materials
- Internal Verifiers (IVs) check that assignments and assessment decisions are valid and that they meet our requirements. In a small team, all people will normally be assessors and IVs. No one can verify their own actions as an assessor.
- assessors set or use assignments to assess learners to national standards.

Planning and record keeping

The Lead IV should make sure that there is a plan for assessment of the internally-assessed units and maintain records of assessment undertaken. The key records are:

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

Examples of records and further information are given in the Pearson Guide to Quality Assurance.
Effective organisation

Internal assessment needs to be well organised so that learners’ progress can be tracked and so that we can monitor that assessment is being carried out in line with national standards. We support you through, for example, providing training materials and sample documentation. Our online myBTEC service can help support you in planning and record keeping. Further information on using myBTEC can be found in Section 11 Resources and support and on our website.

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

Learner preparation

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

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

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

You are encouraged to employ a range of formative assessment approaches before putting learners through to the assignments to formally assess the units. Formative assessment supports teaching and learning, and should be ongoing throughout the learning process. It enables tutors to enhance learning by giving learners constructive feedback so that they can identify their strengths and weaknesses, and to put measures in place to target areas that need work. Formative assessment approaches that incorporate reflective learning and regular skills assessment are important in encouraging self-development and reflective practice, to ensure that learners progress.

Setting assignments

An assignment is issued to learners as an assignment brief with a defined start date, a completion date and clear requirements for the evidence that they need to provide. This assignment will be separate from the practice and exploration activities that have been used during the learning period, and learners must understand that the assignment is being used to judge the learning aims. There may be specific observed practical components during the assignment period. Assignments can be divided into tasks and may require several forms of evidence. A valid assignment will enable a clear and formal assessment outcome, based on the assessment criteria.

When setting your assignments, you need to work with the information given in the Essential information for assessment decisions and the Assessment activity sections of the units. You can choose to use the suggested scenarios or to adapt them to take account of local circumstances, provided that assignments are verified.
In designing your own assignment briefs you should bear in mind the following points.

- A learning aim must always be assessed as a whole and must not be split into two or more tasks.
- Assignments must be structured to allow learners to demonstrate the full range of achievement at all grade levels. Learners need to be treated fairly by being given the opportunity to achieve a higher grade if they have the ability.
- Learners should be given clear tasks, activities and structures for evidence; the criteria should not be given as tasks.
- You must ensure that assignments for synoptic assessment are designed to enable learners to draw on the specific units identified and demonstrate that they can identify and use effectively an appropriate selection of skills, techniques, concepts, theories and knowledge in an integrated way. Assignments for the synoptic unit will be monitored at programme level as part of the standards verification process to ensure that they encourage learners to select and apply their learning from across the qualification in an integrated way.
- Where there is a requirement for assessment to be conducted in the real work environment (mandatory work placement), assignments must be designed to facilitate this. Where there is no mandatory requirement for workplace assessment but learners will be in work placement or work experience settings as a part of the programme, then it would be worthwhile if these assignments were also designed for completion in the real work environment. You must ensure that the work placement or work experience setting gives learners the opportunity to achieve at all grade levels.

As assignments provide a final assessment, they will draw on the specified range of teaching content for the learning objective. The specified teaching content is compulsory. The evidence for assessment need not cover every aspect of the teaching content as learners will normally be given particular examples, case studies or contexts in their assignments. For example, if a learner is carrying out a practical performance, then they must address all the relevant range of content that applies in that instance.

An assignment brief should have:

- a vocational scenario or context that motivates the learner to apply their learning through the assignment
- an audience or purpose for which the evidence is being provided
- clear instructions to the learner about what they are required to do, normally set out through a series of tasks.

**Forms of evidence**

The units allow for a variety of forms of evidence to be used, provided that they are suited to the type of learning aim and the learner being assessed. For most units, the practical demonstration of skills is necessary. The units give you information on suitable forms of evidence that would give learners the opportunity to apply a range of transferable and sector skills. Centres may choose to use different suitable forms for evidence to those proposed. Overall, learners should be assessed using varied forms of evidence.

The main forms of evidence include:

- observation and recordings of practical tasks or performance in the workplace with supporting evidence
- projects
- recordings of role play, interviews and other types of simulated activities
- oral or written presentations with assessor questioning
- work logbooks, reflective journals.
It is important to note that an observation record is a source of evidence and does not confer an assessment decision. It must be sufficiently detailed to enable others to make a judgement about the quality and sufficiency of the performance and must clearly document the rationale for the assessment decision. Observation records should be accompanied by supporting evidence, which may take the form of videos, audio recordings, photographs, preparation notes, learner logs and other similar types of record.

The form(s) of evidence selected must allow:

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

Centres need to take particular care in ensuring that learners produce independent work.

**Making valid assessment decisions**

**Assessment decisions through applying unit-based criteria**

Assessment decisions for this qualification are based on the specific criteria given in each unit and set at each grade level. The way in which individual units are written provides a balance of assessment of sector-specific knowledge, technical and practical skills, and transferable skills appropriate to the purpose of the qualification.

Pass, Merit and Distinction criteria all relate to individual learning aims. The assessment criteria for a unit are hierarchical and holistic where in satisfying the M criteria a learner would also have satisfied the P criteria. The unit assessment grid shows the relationships among the criteria so that assessors can apply all the criteria to the learner’s evidence at the same time.

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

- to achieve a Distinction, a learner must have satisfied all the Distinction criteria (and all the Pass and Merit criteria); these define outstanding performance across the unit as a whole
- to achieve a Merit, a learner must have satisfied all the Merit criteria (and all the Pass criteria) through high performance in each learning aim
- to achieve a Pass, a learner must have satisfied all the Pass criteria for the learning aims, showing coverage of the unit content and therefore attainment at Level 2 of the national framework.

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

As an assessor, you review authenticated learner work and make judgements on standards using the assessment criteria and the supporting information provided in units and training materials. The evidence from a learner can be judged using all the relevant criteria at the same time. The assessor needs to make a judgement against each criterion that evidence is present and sufficiently comprehensive.

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

- the Essential information for assessment decisions section in each unit
- your Lead IV and assessment team’s collective experience, supported by the standardisation materials we provide.

Once the team has agreed the outcome, a formal assessment decision is recorded and reported to learners. The information given:

- must show the formal decision and indicate where criteria have been met
- may show where attainment against criteria has not been demonstrated
- avoid giving direct, specific instructions on how the learner can improve the evidence to achieve a higher grade.

Authenticity of learner work

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

Once an assessment has begun, learners must not be given feedback that relates specifically to their evidence and how it can be improved, learners must work independently.

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

Assessors must complete a declaration that:

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

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

During assessment, an assessor may suspect that some or all of the evidence from a learner is not authentic. The assessor must then take appropriate action using the centre’s policies for malpractice. Further information is given in Section 8 Administrative arrangements.
Resubmission of improved evidence

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

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

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

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

For assessment to be fair, it is important that learners are all assessed in the same way and that some learners are not advantaged by having additional time or the opportunity to learn from others. Therefore, learners who did not complete assignments by your planned deadline or an authorised extension deadline, if one was given for specific circumstances, may not have the opportunity to subsequently resubmit. Similarly, learners who submit work that is not their own should not be given an opportunity to resubmit.

The outcome of any resubmission of the assignment by the learner is then recorded as the final decision.

A learner who has not achieved their expected level of performance in the relevant learning aims after resubmission of an assignment may be offered a single retake opportunity using a new assignment. The highest grade that may be awarded is a Pass.

The Lead IV must authorise a retake with a new assignment only in exceptional circumstances and where it is necessary, appropriate and fair to do so. For further information on offering a retake opportunity you should refer to the BTEC Centre Guide to Assessment available on our website. We provide information on writing assignments for retakes on our website (www.btec.co.uk/keydocuments).
7 External assessment

A summary of the type and availability of external assessment for this qualification is given below. These external assessments assess units that are 33.3% of the total qualification GLH and are weighted to contribute the same proportion of the overall qualification grade. The external assessments for these qualifications are available so that learners may be assessed at any suitable point in their programme.

See the units and sample assessment materials for more information.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Type</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1: Laboratory Health and Safety</td>
<td>• Onscreen test set and marked by Pearson.</td>
<td>On demand</td>
</tr>
<tr>
<td></td>
<td>• 75 minutes.</td>
<td>First assessment January 2018</td>
</tr>
<tr>
<td></td>
<td>• 60 marks.</td>
<td></td>
</tr>
<tr>
<td>Unit 2: Working in a Science Laboratory</td>
<td>• Onscreen test set and marked by Pearson.</td>
<td>On demand</td>
</tr>
<tr>
<td></td>
<td>• 75 minutes.</td>
<td>First assessment January 2018</td>
</tr>
<tr>
<td></td>
<td>• 60 marks.</td>
<td></td>
</tr>
</tbody>
</table>

For Units 1 and 2, onscreen tests are available on demand starting from January 2018. These tests use a range of question types, including examiner-marked. As tests have a full marking process, results for individual learners will be released once the process is complete and the time to issue results will vary.

We will provide a detailed timetable for entries, assessment and results annually in our Information Manual. Resits cannot be scheduled until a learner's result has been issued.

Learners must be prepared for external assessment by the time they undertake it. In preparing learners for assessment, you will want to take account of required learning time, the relationship with any other external assessments and opportunities for resits. Learners who take an external assessment and who do not perform as expected may have one further opportunity using a later external assessment. Learners cannot take a further assessment until they have a result from the first assessment.

Units
The externally-assessed units have a specific format which we explain in Section 3 Units. The content of units will be sampled across external assessments over time through appropriate papers. The ways in which learners are assessed are shown through the assessment outcomes and grading descriptors.
Sample assessment materials

Each externally-assessed unit has a set of sample assessment materials (SAMs) that accompanies this specification. The SAMs are there to give you an example of what the external assessment will look like in terms of the feel and level of demand of the assessment.

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

These sample assessments can be downloaded from our website.

Conducting external assessments

Centres must make arrangements for the secure delivery of external assessments. You need to ensure that learners are aware that they need to work independently and be aware of the requirements for any external assessment.

Each external assessment has a defined degree of control under which it must take place.

High control

This is the completion of assessment in formal invigilated examination conditions. This applies to onscreen tests.

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

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

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

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

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

Our equality policy requires that all learners have equal opportunity to access our qualifications and assessments, and that our qualifications are awarded in a way that is fair to every learner. We are committed to making sure that:

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

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

Records
You are required to retain records of assessment for each learner. Records should include assessments taken, decisions reached and any adjustments or appeals. Further information can be found in our Information Manual. Records must be maintained as specified as we may ask to audit them.

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

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

Special consideration
Special consideration is given after an assessment has taken place for learners who have been affected by adverse circumstances, such as illness. You must operate special consideration in line with our policy (see previous paragraph). You can provide special consideration related to the period of time given for evidence to be provided or for the format of the assessment if it is equally valid. You may not substitute alternative forms of evidence to that required in a unit, or omit the application of any assessment criteria to judge attainment. Pearson can consider applications for special consideration only in line with the policy.

Appeals against assessment
Your centre must have a policy for dealing with appeals from learners. These appeals may relate to assessment decisions being incorrect or assessment being conducted unfairly. The first step in such a policy could be a consideration of the evidence by a Lead IV or other member of the programme team. The assessment plan should allow time for potential appeals after assessment decisions have been given to learners. If there is an appeal by a learner you must document the appeal and its resolution. Learners have a final right of appeal to Pearson but only if the procedures that you have put in place have not been followed. Further details are given in our policy Enquiries and appeals about Pearson Vocational Qualifications.
Administrative arrangements for external assessment

Entries and resits
For information on the timing of assessment and entries, please refer to the annual examinations timetable on our website. Learners are permitted to have one resit of an external assessment.

Access arrangements requests
Access arrangements are agreed with Pearson before an assessment. They allow learners with special educational needs, disabilities or temporary injuries to:
- access the assessment
- show what they know and can do without changing the demands of the assessment.
Access arrangements should always be processed at the time of registration. Learners will then know what type of arrangements are available in place for them.

Granting reasonable adjustments
For external assessment, a reasonable adjustment is one that we agree to make for an individual learner. A reasonable adjustment is defined for the individual learner and informed by the list of available access arrangements.
Whether an adjustment will be considered reasonable will depend on a number of factors to include the:
- needs of the learner with the disability
- effectiveness of the adjustment
- cost of the adjustment; and
- likely impact of the adjustment on the learner with the disability and other learners.
Adjustment may be judged unreasonable and not approved if it involves unreasonable costs, timeframes or affects the integrity of the assessment.

Special consideration requests
Special consideration is an adjustment made to a learner’s mark or grade after an external assessment to reflect temporary injury, illness or other indisposition at the time of the assessment. An adjustment is made only if the impact on the learner is such that it is reasonably likely to have had a material effect on that learner being able to demonstrate attainment in the assessment.
Centres are required to notify us promptly of any learners who they believe have been adversely affected and request that we give special consideration. Further information can be found in the special requirements section on our website.
Dealing with malpractice in assessment

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

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

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

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

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

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

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

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

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

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

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

Heads of Centres are required to inform Pearson’s Investigations Team of any incident of suspected malpractice by centre staff, before any investigation is undertaken. Heads of Centres are requested to inform the Investigations Team by submitting a JCQ Form M2(a) with supporting documentation to pqsmalpractice@pearson.com. Where Pearson receives allegations of malpractice from other sources (for example Pearson staff or anonymous informants), the Investigations Team will conduct the investigation directly or may ask the head of centre to assist.

Incidents of maladministration (accidental errors in the delivery of Pearson qualifications that may affect the assessment of learners) should also be reported to the Investigations Team using the same method.

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

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

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

Sanctions and appeals

Where malpractice is proven we may impose sanctions or penalties.

Where learner malpractice is evidenced, penalties may be imposed such as:
- mark reduction for external assessments
- disqualification from the qualification
- being barred from registration for Pearson qualifications for a period of time.

If we are concerned about your centre’s quality procedures we may impose sanctions such as:
- working with you to create an improvement action plan
- requiring staff members to receive further training
- placing temporary blocks on your certificates
- placing temporary blocks on registration of learners
- debarring staff members or the centre from delivering Pearson qualifications
- suspending or withdrawing centre approval status.

The centre will be notified if any of these apply.

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

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

**Results issue**

Results for external assessment will be issued once marking is complete.

Qualification results will be issued once a learner has completed all components of the qualification and you have claimed certification. The result will be in the form of a grade. You should be prepared to discuss performance with learners, making use of the information we provide and post-results services.

**Post-assessment services**

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

**Changes to qualification requests**

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

**Additional documents to support centre administration**

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

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

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

Centre and qualification approval

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

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

Continuing quality assurance and standards verification

On an annual basis, we produce the Pearson Quality Assurance Handbook. It contains detailed guidance on the quality processes required to underpin robust assessment, internal verification and planning of appropriate employer involvement.

The key principles of quality assurance are that:

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

The approach of quality-assured assessment is through a partnership between an approved centre and Pearson. We will make sure that each centre follows best practice and employs appropriate technology to support quality-assurance processes, where practicable. We work to support centres and seek to make sure that our quality-assurance processes do not place undue bureaucratic processes on centres. We monitor and support centres in the effective operation of assessment and quality assurance.
The methods we use to do this for BTEC Technical Certificate and Diploma qualifications include:

- making sure that all centres complete appropriate declarations at the time of approval
- undertaking approval visits to centres
- making sure that centres have effective teams of assessors and verifiers who are trained to undertake assessment
- undertaking an overarching review and assessment of a centre’s strategy for ensuring sufficient and appropriate engagement with employers at the beginning of delivery of any BTEC programme(s)
- undertaking a review of the employer involvement planned at programme level to ensure its appropriateness at a time when additional activities can be scheduled where necessary
- assessment sampling and verification, through requested samples of assessments, completed assessed learner work and associated documentation
- an overarching review and assessment of a centre’s strategy for delivering and quality assuring its BTEC programmes.

Centres that do not fully address and maintain rigorous approaches to delivering, assessing and quality assurance cannot seek certification for individual programmes or for the BTEC Technical Certificate and Diploma qualifications. An approved centre must make certification claims only when authorised by us and strictly in accordance with requirements for reporting.

Centres that do not comply with remedial action plans may have their approval to deliver qualifications removed.
10 Understanding the qualification grade

Awarding and reporting for the qualification

This section explains the rules that we apply in providing an overall qualification grade for each learner. The final grade awarded for a qualification represents a holistic performance across all of the qualification. As the qualification grade is an aggregate of the total performance, there is some element of compensation in that a higher performance in some units will be balanced by a lower outcome in others.

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

Eligibility for an award

In order to be awarded the qualification, a learner must complete all units and achieve a Pass or above in all units. See the structure in Section 2 Structure for full details.

To achieve the qualification grade, learners must:

- achieve and report a grade (D, M or P) for all units within a valid combination
- achieve the minimum number of points at a grade threshold.

Where there are optional units in a qualification, it is the responsibility of the centre to ensure that a correct unit combination is adhered to. Learners who do not pass all the required units shown in the structure will not achieve the qualification. For example, learners who have not passed the required external units or who have not taken enough units will not achieve that qualification even if they have enough points.

Calculation of the qualification grade

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

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

The qualification is awarded at the grade ranges shown in the table below.

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Available grade range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma</td>
<td>PP to DD</td>
</tr>
</tbody>
</table>
The *calculation of qualification grade* table, which appears later in this section, shows the minimum thresholds for calculating these grades. The table will be kept under review over the lifetime of the qualification. In the event of any change, centres will be informed before the start of teaching for the relevant cohort and an updated table will be issued on our website.

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

**Points available for internal units**

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

<table>
<thead>
<tr>
<th>Unit size</th>
<th>60 GLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>0</td>
</tr>
<tr>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td>Distinction</td>
<td>32</td>
</tr>
</tbody>
</table>

**Points available for the external units**

Raw marks from the external units will be awarded *points* based on performance in the assessment. The points scores available for each external unit at grade boundaries are as follows.

<table>
<thead>
<tr>
<th>Unit size</th>
<th>60 GLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>0</td>
</tr>
<tr>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td>Distinction</td>
<td>32</td>
</tr>
</tbody>
</table>

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

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

Calculation of qualification grade table

<table>
<thead>
<tr>
<th>Grade</th>
<th>Points threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP</td>
<td>96</td>
</tr>
<tr>
<td>MP</td>
<td>112</td>
</tr>
<tr>
<td>MM</td>
<td>128</td>
</tr>
<tr>
<td>DM</td>
<td>152</td>
</tr>
<tr>
<td>DD</td>
<td>176</td>
</tr>
</tbody>
</table>

The table is subject to review over the lifetime of the qualification. The most up-to-date version will be issued on our website.
Examples of grade calculations based on table applicable to registrations from September 2017

**Example 1:** Achievement of Diploma with a PP grade

<table>
<thead>
<tr>
<th>Unit</th>
<th>GLH</th>
<th>Type</th>
<th>Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>External</td>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>External</td>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>Internal</td>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>Internal</td>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>Internal</td>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>Internal</td>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>360</td>
<td></td>
<td>PP</td>
<td>104</td>
</tr>
</tbody>
</table>

The learner has achieved a Pass or above in all units. The learner has sufficient points for a PP grade.

**Example 2:** Achievement of a Diploma with a DD grade

<table>
<thead>
<tr>
<th>Unit</th>
<th>GLH</th>
<th>Type</th>
<th>Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>External</td>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>External</td>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>Internal</td>
<td>Distinction</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>Internal</td>
<td>Distinction</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>Internal</td>
<td>Distinction</td>
<td>32</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>Internal</td>
<td>Distinction</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>360</td>
<td></td>
<td>DD</td>
<td>176</td>
</tr>
</tbody>
</table>

The learner has sufficient points for a DD grade.
Example 3: Achievement of a Diploma with an Unclassified result

<table>
<thead>
<tr>
<th>Unit</th>
<th>GLH</th>
<th>Type</th>
<th>Grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
<td>External</td>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>External</td>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>60</td>
<td>Internal</td>
<td>Unclassified</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
<td>Internal</td>
<td>Pass</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
<td>Internal</td>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td>6</td>
<td>60</td>
<td>Internal</td>
<td>Merit</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>360</td>
<td></td>
<td>U</td>
<td>112</td>
</tr>
</tbody>
</table>

The learner has a U in Unit 3.

The learner has sufficient points for a MP but has not met the requirement for a Pass, or above, in all units.
11 Resources and support

Our aim is to give you support to enable you to deliver Pearson BTEC Level 2 Technicals with confidence. You will find resources to support teaching and learning, assessing, and professional development on our website.

Support for setting up your course and preparing to teach

Schemes of Learning
Our free Schemes of Learning give you suggestions and ideas for how to deliver the units in the qualifications, including opportunities to develop employability skills, tips on embedding mathematics and English, and how to link units through holistic assessments.

Delivery planner
High-level models showing how the course can be delivered over different timescales, for example six months, one year or two years.

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

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

To find out more about myBTEC, visit the myBTEC page on the support services section of our website.

Support for teaching and learning

Work Experience Toolkit
Our free Work Experience Toolkit gives guidance for tutors, assessors, work-based supervisors and learners on how to make the most of work placements and work experience.

Pearson Learning Services provides a range of engaging resources to support BTEC qualifications. Teaching and learning resources may also be available from a number of other publishers. Details of Pearson’s own resources and of all endorsed resources are on our website.

Support for assessment

Sample assessment materials for externally-assessed units
Sample assessment materials (SAMs) are available for externally-assessed units and can be downloaded from the Pearson Qualifications website. An additional set of sample assessment materials for externally-assessed units will also be available, giving your learners further opportunities for practice.

Sample assessment materials for internally-assessed units
We do not prescribe the assessments for the internally-assessed units. Rather, we allow you to set your own, according to your learners’ preferences.

We provide assignment briefs which are approved by Pearson Standards Verifiers.
Sample marked learner work
To support you in understanding the expectation of the standard at each grade, examples of sample marked learner work will be made available on our website.

Training and support from Pearson

People to talk to
There are lots of people who can support you and give you advice and guidance on delivering your Pearson BTEC Level 2 Technicals. They include the following.

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

Training and professional development
We provide a range of training and professional development events to support the introduction, delivery, assessment and administration of the Pearson BTEC Level 2 Technicals.
These sector-specific events, developed and delivered by specialists, are available both face to face and online.
BTEC Level 2 Technical Diploma in
LABORATORY SCIENCE

Like what you see?

• Discover the full range of BTEC Level 2 Technicals available.
• Explore free course materials and training events.
• Get your questions answered by our subject experts.

All this and more at: quals.pearson.com/btecl2techLS

@TeachBTEC @PearsonSciences  TeachingScience@pearson.com