



City & Guilds Level 2 Technical Award in Land Based Studies (0170-24)

Version 1.3 (April 2024)

Qualification Handbook

Qualification at a glance

Industry area	Environmental and Land Based
City & Guilds qualification number	0170-24
Age group	14 – 16 (Key Stage 4)
Assessment	This qualification will be assessed through, <ul style="list-style-type: none"> • One externally set, externally moderated assignment • One externally set, externally marked exam, sat under examination conditions
Grading	This qualification is graded Pass/Merit/Distinction/Distinction* For more information on grading, please see Section 6: Grading.
Approvals	This qualification requires full centre and qualification approval
Support materials	Sample assessments Guidance for delivery Guidance on use of marking grids
Registration and certification	Registration and certification of this qualification is through the Walled Garden and is subject to end dates.
External quality assurance	This qualification is externally quality assured by City & Guilds. Internally marked assignments are subject to external moderation. There is no direct claim status available for this qualification.

Title and level	Size (GLH)	TQT	City & Guilds qualification number	Ofqual accreditation number
City & Guilds Level 2 Technical Award in Land Based Studies	120	160	0170-24	610/0652/X

Version and date	Change detail	Section
1.0 May 2022	Initial version.	All
1.1 July 2022	Cap on number of resits removed.	Administration
1.2 March 2024	Reference to grade scale for individual assessments changed from X/P/M/D to U/P/M/D	6. Grading
1.3 April 2024	Revision to UMS scores in UMS grade table	6. Grading

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1 Introduction

What is this qualification about?

The following purpose statement relates to the the **City & Guilds Level 2 Technical Award in Land Based Studies**.

Area	Description
OVERVIEW	
Who is this qualification for?	<p>This qualification allows you to investigate how land is utilised in the UK, for example food and energy production, forestry, leisure use, housing and the rural and urban infrastructure.</p> <p>As part of this programme of study you will investigate the changing use of land over time, look at the advancement of technology within the wider land based industries. There is also the opportunity to develop your plant and animal husbandry skills for a potential future career.</p>
What will the student study as part of this qualification?	<p>You will investigate how historical land use and management has changed from a greater emphasis on food production to an emphasis on sustainability, environmental management and public access. You will find out how science plays a major role in the modern land based sector by investigating different parts of the industry, the role of cultivated and wild plants including crops, farmed and wild animal species whilst considering the importance of biodiversity and the biosecurity of the UK.</p> <p>This qualification has three units:</p> <ul style="list-style-type: none">• Exploring the use of land• Application of science in the land based sector• Application of technology in the land based sector.
What knowledge and skills will the student develop as part of this qualification and how might these be of use and value in further studies?	<p>This qualification develops the following knowledge, understanding and skills:</p> <ul style="list-style-type: none">• different uses of land and associated industries• challenges and conflicts that arise when land is used for food production, leisure and conservation• how the structure and function of plants affects successful propagation and yields• requirements of optimum nutrition for plant and animal growth and health• the role technology plays in the land based sector• the range of technology used within the land based sector• how science and innovation has influenced technology developments

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- development of animal and plant husbandry skills.

Your understanding and skills can be developed further through progression to other qualifications, such as A levels or specific to a sector, including:

- City & Guilds Level 2 Technical Certificates in all the Land based sectors
- City & Guilds Level 3 Advanced Technical qualifications in the Land based sectors.

You would also find the understanding and skills useful to progress to an apprenticeship.

Which subjects will complement this course?

GCSEs in Biology, Physics, Chemistry and Geography will complement this qualification.

Qualification structure

For the **City & Guilds Level 2 Technical Award in Land Based Studies** the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
201	Exploring the use of land	30
202	Application of science in the land based sector	60
203	Application of technology in the land based sector	30

Total qualification time (TQT)

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
City & Guilds Level 2 Technical Award in Land Based Studies	120	160

Assessment requirements

To achieve the **City & Guilds Level 2 Technical Award in Land Based Studies** candidates must successfully complete **both** mandatory assessment components.

Component number	Title
005	Level 2 Land Based Studies - Synoptic assignment (1)*
505	Level 2 Land Based Studies - Theory exam (1)*

**Number of mandatory assessments per assessment type*

2 Centre requirements

Approval

New centres will need to gain centre approval. Existing centres who wish to offer this qualification must go through City & Guilds' **full** Qualification Approval Process. There is no fast track approval for this qualification. Please refer to the City & Guilds website for further information on the approval process: www.cityandguilds.com

Resource requirements

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

Centre staffing

Staff delivering this qualification must be able to demonstrate that they meet the following requirements:

- be technically competent in the areas in which they are delivering
- be able to deliver across the breadth and depth of the content of the qualification being taught
- have recent relevant teaching and assessment experience in the specific area they will be teaching, or be working towards this
- demonstrate continuing CPD.

Physical resources

Centres must be able to demonstrate that they have access to the equipment and technical resources required to deliver this qualification and their assessments.

Internal Quality Assurance

Internal quality assurance is key to ensuring accuracy and consistency of assessment being marked by tutors. Internal Quality Assurers (IQAs) monitor the work of all tutors involved with a qualification to ensure they are applying standards consistently throughout assessment activities. IQAs must have, and maintain, an appropriate level of technical competence and be qualified to make both marking and quality assurance decisions through a teaching qualification or recent, relevant experience.

Learner entry requirements

Centres must ensure that all learners have the opportunity to gain the qualification through appropriate study and training, and that any prerequisites stated in the *What is this qualification about?* section are met when registering on this qualification.

Age restrictions

This qualification is approved for learners aged 14 – 16.

3 Delivering technical qualifications

Delivering a Technical Award – Key tips

Our Technical Awards are high-quality qualifications that give learners a broad introduction to their chosen industry sector. The **City & Guilds Level 2 Technical Award in Land Based Studies** provides learners with exciting opportunities to develop both their applied knowledge and theoretical understanding, alongside their development of key practical and technical skills within the land based sector.

Taking a holistic approach to delivery

Tutors are encouraged to take a holistic approach to the delivery of topics and themes from across the units that make up this Technical Award. Linking key related concepts from across different units will help to develop learners' understanding of the connections between the different elements of knowledge and skills, as well as preparing them to complete the synoptic assessment requirements.

Engaging with employers to develop links between theory and practice

The use of employers and valuable work-related learning contexts are beneficial in developing links between theory and practice. Trips and visits to a range of industry sector providers can help bring concepts to life, enabling learners to apply and deepen their understanding of;

- how key terms, processes and models can be applied in different contexts
- the scale and scope of their industry sector
- the local skills gaps and needs that may exist.

Use of learning technologies

The use of learning technologies can be useful in developing learners' independent learning skills. Online learning content, provided through a virtual learning environment or similar platform, can offer valuable opportunities for reinforcing key concepts and extending learning outside the classroom. Learners should be challenged to develop both their industry related technical knowledge and understanding along with skills in digital literacy and applied English and mathematics. For example, the safe and appropriate use of online discussion forums may help learners to develop their critical evaluation skills when sharing key resources or debating a key concept or process. Smart devices, audio-visual tools and social media should be harnessed, to support learners in researching and recording industry related practices.

Development of learning and thinking skills

Learners should be encouraged to develop confidence in their independent research skills, making effective use of both online and offline information sources. Relevant industry magazines and trade journals, along with good quality websites should be signposted as key sources of sector information. Teaching activities should promote the evaluation of different information sources to consider their validity and reliability.

Tutors are encouraged to use creative and collaborative learning activities which inspire and engage learners to confidently apply and evaluate their developing technical knowledge and skills. Learners should be encouraged to take responsibility for their own learning and development; drawing on their own experiences where possible. Meaningful self and peer-assessment activities are encouraged to develop learners' self-awareness and reflective practice as independent, critical thinkers. Inclusive learning activities which challenge stereotypes and develop learners' awareness of diversity in their industry sector are particularly important.

Support materials

The following resources are available for this qualification:

Description	How to access
Sample assessments Guidance for delivery Guidance on use of marking grids	Available on the qualification pages on the City & Guilds Website: www.cityandguilds.com

4 Assessment

Summary of assessment methods and conditions

Component numbers	Assessment method	Description and conditions
005	Externally moderated synoptic assignment	<p>The synoptic assignment is externally set, internally marked and externally moderated. The assignment requires candidates to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the content area. Candidates will be judged against the assessment objectives.</p> <p>Assignments will be released to centres as per dates indicated in the Assessment and Examination timetable published on our website.</p> <p>Centres will be required to maintain the security of all live assessment materials. Assignments will be password protected and released to centres through a secure method.</p> <p>Please note that for externally set assignments City & Guilds provides guidance and support to centres on the marking and moderation process.</p>
505	Externally marked exam	<p>The exam is externally set and externally marked and will be taken as a paper-based test.</p> <p>The exam is designed to assess the candidate's depth and breadth of understanding across content in the qualification at the end of the period of learning, using a range of question types and will be sat under invigilated examination conditions. See JCQ requirements for details: http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations</p> <p>The exam specification shows the coverage of the exam across the qualification content.</p> <p>For exam dates, please refer to the Assessment and Examination timetable.</p>

What is synoptic assessment?

Technical qualifications are based around the development of a toolkit of knowledge, understanding and skills that an individual needs in order to have the capability to work in a particular industry or occupational area. Individuals in all technical areas are expected to be able to apply their knowledge, understanding and skills in decision making to solve problems and achieve given outcomes independently and confidently.

City & Guilds technical qualifications require candidates to draw together their learning from across the qualification to solve problems or achieve specific outcomes by explicitly assessing this through the synoptic assignment component.

In this externally set, internally marked and externally moderated assessment the focus is on bringing together, selecting and applying learning from across the qualification rather than demonstrating achievement against units or subsets of the qualification content. The candidate will be given an appropriately levelled, substantial, occupationally relevant problem to solve or outcome to achieve. For example this might be in the form of a briefing from a client, leaving the candidate with the scope to select and carry out the processes required to achieve the client's wishes, as they would in the workplace.

Candidates will be marked against assessment objectives (AOs) such as their breadth and accuracy of knowledge, understanding of concepts, and the quality of their technical skills as well as their ability to use what they have learned in an integrated way to achieve a considered and high quality outcome.

How the assignment is synoptic for this qualification

The typical assignment brief could be for learners to investigate an area of land. Learners will explore how the land use has changed over time, organisations and allied services that use the land and how technology and innovation could be used.

Learners will make recommendations for how the use of land can be diversified, either for commercial or private purposes. Learners will have opportunities to demonstrate plant and animal husbandry skills to support their recommendations for diversification.

External exam for stretch, challenge and integration

The external assessment will draw from across the full content of the qualification, using a range of shorter questions to confirm breadth of knowledge and understanding. Extended response questions are included, giving candidates the opportunity to demonstrate higher level understanding and integration through discussion, analysis and evaluation, and ensuring the assessment can differentiate between 'just able' and higher achieving candidates.

Terminal assessment

For the KS4 2024 Performance table qualifications, Ofqual introduced the requirement for a 'terminal rule' relating to the examination which specifies:

"An assessment by examination must be taken at the end of a pupil's course of study ("terminal assessment") and this must contribute at least 40% of the total marks available for the qualification. Ofqual's QLCs require that pupils must use towards their final overall grade the result of the assessment by examination sat in the series in which they are completing the course. This should typically lead to candidates sitting the assessment by examination at the end of year 11."

For this qualification, due to its assessment structure, this means that both the examination and synoptic assessment must take place at the end of the programme. Details of

assessment dates are published in the assessment and examination timetable. To allow candidates to certificate within the KS4 year if they fail the examination on their first attempt, we have amended the grading arrangements (see *Grading* section); removing the requirement to pass the assessments for certification.

Assessment objectives

The assessments for this qualification are set against a set of assessment objectives (AOs) which are used across all City & Guilds Technicals to promote consistency among qualifications of a similar purpose. They are designed to allow judgement of the candidate to be made across a number of different categories of performance.

Each assessment for the qualification has been allocated a set number of marks against these AOs based on weightings recommended by stakeholders of the qualification. This mark allocation remains the same for all versions of the assessments, ensuring consistency across assessment versions and over time.

The following table explains all AOs in detail, including weightings for the synoptic assignments. In some cases, due to the nature of a qualification's content, it is not appropriate to award marks for some AOs. Where this is the case these have been marked as N/A. Weightings for exams (AOs 1, 2 and 4 only) can be found with the exam specification.

Assessment objective	City & Guilds Level 2 Technical Award in Land Based Studies Typical expected evidence of knowledge, understanding and skills	Approximate weighting
AO1 Recalls knowledge from across the breadth of the qualification.	Policies and legislation, land-use type, technology types, scientific principles, use of terminology, historical account, organisations	25%
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Links between land use, geography and scientific principles; application of technology and factors that affect their use; application of legislation and policy on land based industries and associated challenges and conflicts.	30%
AO3 Demonstrates technical skills from across the breadth of the qualification.	Caring for animals ie handling, feeding, monitoring and recording health and welfare; soil testing; use of equipment	20%
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying knowledge and understanding across both tasks, justifying recommendations/approaches taken.	20%
AO5 Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Meets requirements of the task, attention to detail when investigating enterprise case study.	5%

Exam specification

AO weightings per exam

AO	Exam weighting (approx. %)
AO1 Recalls knowledge from across the breadth of the qualification.	23
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	57
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20

The way the exam covers the content of the qualification is laid out in the table below:

Assessment type: Examiner marked, written exam delivered on paper

Assessment conditions: Invigilated examination conditions

Grading: U/P/M/D

Exam 505	Duration: 2 hours		
Unit	Outcome	Number of marks	%
201	Exploring the use of Land	14	23
202	Application of Science in the land based sector	24	40
203	Application of technology in the land based sector	10	17
N/A	Integration across the units	12	20
Total		60	100

*These exams are sat under invigilated examination conditions, as defined by the JCQ: <http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>.

Entry for exams can be made through the City & Guilds Walled Garden.

5 Moderation and standardisation of assessment

City & Guilds' externally set assignments for technical qualifications are designed to draw from across the qualifications' content, and to contribute a significant proportion towards the learner's final qualification grade. They are subject to a rigorous external quality assurance process known as external moderation. This process is outlined below. For more detailed information, please refer to 'Marking and moderation - Technicals centre guidance' available to download on the City & Guilds website.

It is vital that centres familiarise themselves with this process, and how it impacts on their delivery plan within the academic year.

Supervision and authentication of internally assessed work

The Head of Centre is responsible for ensuring that internally assessed work is conducted in accordance with City & Guilds' requirements.

City & Guilds requires both tutors and candidates to sign declarations of authenticity. If the tutor is unable to sign the authentication statement for a particular candidate, then the candidate's work cannot be accepted for assessment.

Internal standardisation

For internally marked work¹ the centre is required to conduct internal standardisation to ensure that all work at the centre has been marked to the same standard. It is the Internal Quality Assurer's (IQA's) responsibility to ensure that standardisation has taken place, and that the training includes the use of reference and archive materials such as work from previous years as appropriate.

Provision for reworking evidence after submission for marking by the tutor

It is expected that in many cases a candidate who is struggling with a specific piece of work may themselves choose to restart and rectify the situation during their normal allocated time, and before it gets to the stage of it being handed in for final marking by the tutor.

In exceptional circumstances however, where a candidate has completed the assignment in the required timescales, and has handed it in for marking by the tutor but is judged to have significantly underperformed, may be allowed to rework or supplement their original evidence for remarking prior to submission for moderation. For this to be allowed, the centre must be confident that the candidate will be able to improve their performance without additional feedback from their tutor and within the required timescales ie the candidate has shown they can perform sufficiently better previously in formative assessments.

The reworked and/or supplemented original evidence must be remarked by the tutor in advance of the original moderation deadline and the moderator informed of any candidates who have been allowed to resubmit evidence.

The process must be managed through the IQA. The justification for allowing a resubmission should be recorded and made available on request. The use of this provision will be monitored by City & Guilds.

¹ For any internally assessed optional unit assignments, the same process must be followed where assessors must standardise their interpretation of the assessment and grading criteria.

Internal appeal

Centres must have an internal process in place for candidates to appeal the marking of internally marked components, ie the synoptic assignment and any optional unit assignments. This must take place before the submission of marks for moderation. The internal process must include candidates being informed of the marks (or grades) the centre has given for internally assessed components, as they will need these to make the decision about whether or not to appeal.

Centres cannot appeal the outcome of moderation for individual candidates, only the moderation process itself. A request for a review of the moderation process should be made to **appeals@cityandguilds.com**.

Moderation

Moderation is the process where external markers are standardised to a national standard in order to review centre marking of internally marked assessments. These markers are referred to as 'moderators'. Moderators will mark a representative sample of candidates' work from every centre. Their marks act as a benchmark to inform City & Guilds whether centre marking is in line with City & Guilds' standard.

Where moderation shows that the centre is applying the marking criteria correctly, centre marks for the whole cohort will be accepted.

Where moderation shows that the centre is either consistently too lenient or consistently too harsh in comparison to the national standard, an appropriate adjustment will be made to the marks of the whole cohort, retaining the centre's rank ordering.

Where centre application of the marking criteria is inconsistent, an appropriate adjustment for the whole cohort may not be possible on the basis of the sample of candidate work. In these instances a complete remark of the candidate work may be necessary. This may be carried out by the centre based on feedback provided by the moderator, or carried out by the moderator directly.

Moderation applies to all internally marked assignments. Following standardisation and marking, the centre submits all marks and candidate work to City & Guilds via the moderation platform. The deadline for submission of evidence will be available on Walled Garden. See the *Marking and moderation - Technicals Centre Guidance* document for full details of the requirements and process.

In most cases candidate work will be submitted directly to the moderator for moderation. This includes written work, photographic and pictorial evidence, or video and audio evidence. For some qualifications there will be a requirement for moderators to visit centres to observe practical assessments being undertaken. This will be for qualifications where the assessment of essential learner skills can only be demonstrated through live observation. The purpose of these visits is to ensure that the centre is assessing the practical skills to the required standards, and to provide the moderators with additional evidence to be used during moderation. These visits will be planned in advance with the centre for all relevant qualifications.

Post-moderation procedures

Once the moderation process has been completed, the confirmed marks for the cohort are provided to the centre along with feedback from the moderator on the standard of marking at the centre, highlighting areas of good practice, and potential areas for improvement. This will inform future marking and internal standardisation activities.

City & Guilds will then carry out awarding, the process by which grade boundaries are set with reference to the candidate evidence available on the platform.

Centres retaining evidence

Centres must retain assessment records for each candidate for a minimum of three years. To help prevent plagiarism or unfair advantage in future versions, candidate work may not be returned to candidates. Samples may however be retained by the centre as examples for future standardisation of marking.

6 Grading

Awarding individual assessments

Individual assessments will be graded as pass/merit/distinction where relevant. The grade boundaries for pass and distinction for each assessment will be set through a process of professional judgement by technical experts. Merit will usually be set at the midpoint between pass and distinction. The grade descriptors for pass and distinction, and other relevant information (eg archived samples of candidate work and statistical evidence) will be used to determine the mark at which candidate performance in the assessment best aligns with the grade descriptor in the context of the qualification's purpose. Boundaries will be set for each version of each assessment to take into account relative difficulty.

Please note that as the Merit grade will usually be set at the arithmetical midpoint between pass and distinction, there are no descriptors for the Merit grade for the qualification overall.

Grade descriptors

To achieve a pass, a candidate will be able to

- Demonstrate the knowledge and understanding required to work in the occupational area, its principles, practices and legislation.
- Describe some of the main factors impacting on the occupation to show good understanding of how work tasks are shaped by the broader social, environmental and business environment it operates within.
- Use the technical industry specific terminology used in the industry accurately.
- Demonstrate the application of relevant theory and understanding to solve non-routine problems.
- Interpret a brief for complex work related tasks, identifying the key aspects, and showing a secure understanding of the application of concepts to specific work related tasks.
- Carry out planning which shows an ability to identify and analyse the relevant information in the brief and use knowledge and understanding from across the qualification (including complex technical information) to interpret what a fit for purpose outcome would be and develop a plausible plan to achieve it.
- Achieve an outcome which successfully meets the key requirements of the brief.
- Identify and reflect on the most obvious measures of success for the task and evaluate how successful they have been in meeting the intentions of the plan.
- Work safely throughout, independently carrying out tasks and procedures, and having some confidence in attempting the more complex tasks.

To achieve a distinction, a candidate will be able to

- Demonstrate the excellent knowledge and understanding required to work to a high level in the occupational area, its principles, practices and legislation.
- Analyse the impact of different factors on the occupation to show deep understanding of how work tasks are shaped by the broader social, environmental, and business environment it operates within.
- Demonstrate the application of relevant theory and understanding to provide efficient and effective solutions to complex and non-routine problems.
- Analyse the brief in detail, showing confident understanding of concepts and themes from across the qualification content, bringing these together to develop a clear and stretching plan, that would credibly achieve an outcome that is highly fit for purpose.
- Achieve an outcome which shows an attention to detail in its planning, development and completion, so that it completely meets or exceeds the expectations of the brief to a high standard.

- Carry out an evaluation in a systematic way, focussing on relevant quality points, identifying areas of development/ improvement as well as assessing the fitness for purpose of the outcome.

Awarding grades and reporting results

The overall qualification grade will be calculated based on aggregation of the candidate's achievement in each of the assessments for the mandatory units, taking into account the assessments' weighting. The **City & Guilds Level 2 Technical Award in Land Based Studies** will be reported on a four grade scale: Pass, Merit, Distinction, Distinction*.

The approximate pass grade boundary for the synoptic assignment in this qualification are:

Synoptic Assignment	Pass Mark (%)
005	40

Please note that each synoptic assignment is subject to an awarding process before final grade boundaries are confirmed.

The contribution of assessments towards the overall qualification grade is as follows:

Assessment method	Grade scale	% contribution	UMS
Synoptic Assignment (005)	U/P/M/D	60%	144
Exam (505)	U/P/M/D	40%	96

Both synoptic assignments and exams are awarded in every series (see 'Awarding individual assessments', at the start of Section 6, above) to identify the raw mark representing the boundary pass merit and distinction standards. These raw mark boundaries are used to make the conversion of raw marks onto a uniform mark scale (UMS). Using a UMS approach allows all of the candidate's marks count when taken into the aggregation process, and ensures their uniform mark has the same value in each series, allowing aggregation of assessments from different series where necessary.

After the conversion of the candidate's raw scores into uniform marks for both the examination and the synoptic assignment, they are added together to give the total uniform mark for the candidate.

There is no minimum mark requirement for either the exam or the synoptic assignment as long as both assessments have been attempted.

The candidate's qualification grade is determined by comparing their total UMS mark to the mark ranges given in the table that follows.

Total UMS	Qualification Grade	% of UMS boundary set at
0 - 95	U	n/a
96 - 131	P	40
132 - 167	M	55
168 – 203	D	70
204 - 240	D*	85

7 Administration

Approved centres must have effective quality assurance systems to ensure valid and reliable delivery and assessment of qualifications. Quality assurance includes initial centre registration by City & Guilds and the centre's own internal procedures for monitoring quality assurance procedures.

Consistent quality assurance requires City & Guilds and its associated centres to work together closely; our Quality Assurance Model encompasses both internal quality assurance (activities and processes undertaken within centres) and external quality assurance (activities and processes undertaken by City & Guilds).

For this qualification, standards and rigorous quality assurance are maintained by the use of:

- internal quality assurance
- City & Guilds external moderation.

In order to carry out the quality assurance role, Internal Quality Assurers (IQAs) must have and maintain an appropriate level of technical competence and have recent relevant assessment experience. For more information on the requirements, refer to *Section 2: Centre requirements* in this handbook.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following procedures are followed:

- suitable training of staff involved in the assessment of the qualification to ensure they understand the process of marking and standardisation
- completion by the person responsible for internal standardisation of the Centre Declaration Sheet to confirm that internal standardisation has taken place
- the completion by candidates and supervisors/tutors of the record form for each candidate's work.

External quality assurance

City & Guilds will undertake external moderation activities to ensure that the quality assurance criteria for this qualification are being met. Centres must ensure that they co-operate with City & Guilds staff and representatives when undertaking these activities.

City & Guilds requires the Head of Centre to

- facilitate any inspection of the centre which is undertaken on behalf of City & Guilds
- make arrangements to receive, check and keep assessment material secure at all times,
- maintain the security of City & Guilds confidential material from receipt to the time when it is no longer confidential and
- keep completed assignment work and examination scripts secure from the time they are collected from the candidates to their dispatch to City & Guilds.

Enquiries about results

The services available for enquiries about results include a review of marking for exam results and review of moderation for internally marked assessments.

For further details on enquiries and appeals process and for copies of the application forms, please visit the **appeals page** of the City & Guilds website at **www.cityandguilds.com**.

Re-sits and shelf-life of assessment results

Candidates who have failed an assessment or wish to re-take it in an attempt to improve their grade, can re-sit assessments. For the exam, the most recent result will count towards the final qualification due to the terminal rule. For the synoptic assignment, the best result will count. In a situation where a learner resits the synoptic assignment after certification and in an attempt to improve their grade, then this will require the exam to be resat and the result of this sitting will be used to towards their qualification grade. See guidance on individual assessment types in Section 5.

Factors affecting individual learners

If work is lost, City & Guilds should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form, JCQ/LCW, to inform City & Guilds Customer Services of the circumstances.

Learners who move from one centre to another during the course may require individual attention. Possible courses of action depend on the stage at which the move takes place. Centres should contact City & Guilds at the earliest possible stage for advice about appropriate arrangements in individual cases.

Malpractice

Please refer to the City & Guilds guidance notes *Managing cases of suspected malpractice in examinations and assessments*. This document sets out the procedures to be followed in identifying and reporting malpractice by candidates and/or centre staff and the actions which City & Guilds may subsequently take. The document includes examples of candidate and centre malpractice and explains the responsibilities of centre staff to report actual or suspected malpractice. Centres can access this document on the City & Guilds website.

Examples of candidate malpractice are detailed below (please note that this is not an exhaustive list):

- falsification of assessment evidence or results documentation
- plagiarism of any nature
- collusion with others
- copying from another candidate (including the use of ICT to aid copying), or allowing work to be copied
- deliberate destruction of another's work
- false declaration of authenticity in relation to assessments
- impersonation.

These actions constitute malpractice, for which a penalty (eg disqualification from the assessment) will be applied.

Where suspected malpractice is identified by a centre after the candidate has signed the declaration of authentication, the Head of Centre must submit full details of the case to City & Guilds at the earliest opportunity. Please refer to the form in the document *Managing cases of suspected malpractice in examinations and assessments*.

Access arrangements and special consideration

Access arrangements are adjustments that allow candidates with disabilities, special educational needs and temporary injuries to access the assessment and demonstrate their skills and knowledge without changing the demands of the assessment. These arrangements must be made before assessment takes place.

It is the responsibility of the centre to ensure at the start of a programme of learning that candidates will be able to access the requirements of the qualification.

Please refer to the *JCQ access arrangements and reasonable adjustments* and *Access arrangements - when and how applications need to be made to City & Guilds* for more information. Both are available on the City & Guilds website:

<http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments>

Special consideration

We can give special consideration to candidates who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given after the examination.

Applications for either access arrangements or special consideration should be submitted to City & Guilds by the Examinations Officer at the centre. For more information please consult the current version of the JCQ document, *A guide to the special consideration process*. This document is available on the City & Guilds website:

<http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments>

Unit 201

Exploring the use of land

UAN:	F/507/7034
Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to develop an appreciation and understanding of the land based industry.

The unit will address the factors that affect land management and food production. The unit compares historical land use and management through the times when land managers were actively encouraged to produce food to the present day with a greater emphasis on sustainability, environmental management and public access.

Learners will investigate primary and associated industries in the sector.

Learning outcomes

In this unit, learners will be able to:

1. Understand different uses of land and associated industries
2. Understand how land use has changed

Learning outcome:

1. Understand different uses of land and associated industries

Topics

1.1 Land use and management

1.2 Factors affecting land use and management

1.3 Land based and associated industries

Topic 1.1

Geographical use of land:

- farming
- infrastructure (roads, quarries, water-supply)
- energy production
- forestry production
- leisure, field and adventure sport
- housing and non-land based industry

Individuals, organisations and their responsibilities to support the use and management of land:

- EU and Government organisations
 - Department for Environment Food and Rural Affairs (DEFRA)
 - Natural England
 - Environment agency
 - National parks
- Non-government organisations
 - Royal Society for the Protection of Birds (RSPB)
 - Royal Society for the Prevention of Cruelty to Animals (RSPCA)
 - National Trust
 - Landlords
- Associated industries eg suppliers (feed, materials), vets, consultants

The importance of policies and legislation, relating to the management of land in the UK:

- Common Agricultural Policy (CAP)
- Single Farm Payment
- Environmental Stewardship Scheme
- Sites of Special Scientific Interest (SSSI).

Topic 1.2

Factors that determine success or failure of land production or usage:

Geographical (latitudinal / longitudinal considerations):

- Geography of UK
 - Mountainous regions
 - Hill Land
 - Lowland
- Weather
 - Affects soil preparation, treatments and harvesting of crops
 - Animal management, horse racing, ground-care practices
- Topography
 - restrict access to land areas, livestock, recreation features
 - determines the type of practice occurring
 - influence size and design of equipment used eg compact tractors, ATV equipment, header width on a combine harvester

- Climate
 - Rainfall levels across the country affects production and usage
 - Temperature ranges: Seasonal and latitude variations from South West to North Scotland. Production and leisure pursuits will vary accordingly.

Geology

- Impact of rock and soil type on enterprise
 - agricultural or horticultural crop choice/performance
 - livestock breed/system/product/performance
 - leisure, field and adventure

Socio-economic

- Population and housing
- Leisure, field and adventure sport

Technology

- Energy production

Topic 1.3

Diversity of land use, management and relationship between clusters of industry:

- Land management and production:
 - agriculture
 - horticulture
 - forestry
 - arboriculture
 - floristry
 - fisheries
 - land based engineering
 - leisure
 - field and adventure sport
- Animal health and welfare:
 - animal care
 - equine
 - farrier
 - vet nursing
- Environmental industries:
 - game and wildlife management
 - environmental conservation

Technical skills and knowledge required to work within the industry:

- health and safety
- level of experience
- technology
- nationally recognised qualifications
- personal skills/attributes.

Learning outcome:

2. Understand how land use has changed

Topics

2.1 Chronological review of land-use

2.2 Challenges and conflicts

Topic 2.1

The history of human activity in the UK and how this has shaped the country today:

- 1600 – Enclosure of land creating hedges and boundaries.
- 1850 – Industrial Revolution
- World Wars I and World War II: increase in land usage for food production.
- 1947 Agriculture Act – increased farmed productivity.
- 1949 – Formation of National Parks and protected Designations to preserve the countryside.
- 1973 – UK joins Common Market and Common Agricultural Policy (CAP): increase food stability; improve competitiveness; increase sustainability; increase efficiency
- 2000 – Countryside and Rights of Way Act: allowing increase in public access for recreation and leisure

Topic 2.2

Challenges and conflicts that arise when land is used for

- food production:
 - intensive farming
 - GM
 - economies of scale
 - local and global markets
 - decrease in subsidies
 - use of technology
 - biosecurity
 - eutrophication
 - increase in population
- leisure:
 - erosion
 - noise
 - light pollution
 - impact on local communities
 - biodiversity
 - biosecurity
 - traffic
 - increase in population
- conservation:
 - fracking
 - impact of leisure activities
 - increase in population

Positive and negative influence on land use from

- government organisations
- non-governmental organisations
- associated industries.

Guidance for delivery

This unit can be delivered in a number of ways. The applied content lends itself naturally to learners undertaking supervised practical activities in realistic work-related contexts as they apply their theoretical knowledge and carry out tasks which professionals are performing on a regular basis. Key speakers such as local countryside rangers, farmers, weather forecasters, geologists, environmental scientists, foresters, gamekeepers, soil scientists, greenkeepers, researchers etc may be used to assist in the delivery of this unit.

Learners' practical work can be augmented by discussions, seminars, presentations, field trips, case studies and site visits to habitats and landscapes. There are opportunities to use information technology for mapping (eg handheld global positioning system (GPS) to recognise and identify features within a landscape), and in the recording, collation and presentation of data. Learners could also use annotated digital photography supported by annotated maps or be introduced to computer-based maps or aerial photography.

Impact can be increased when comparisons between sites are made, such as the contrast between the physical and biological content of lowland and upland regions and the differences in the commercial activities taking place within them. The comparisons can be used to explore similarities or differences and support discussion groups on issues such as man's impact or the impact of climate change on these two environments.

Tutors are encouraged to keep up-to-date on modern developments in the land based sector through publications and media.

Suggested learning resources

Books

The Agricultural Notebook
Published by: Wiley-Blackwell; 20th edition, 2003
ISBN-10: 0632058293
ISBN-13: 978-0632058297
Mc Connell, P

Farming in the 1920s and 1930s (Shire Library)
Published by: Shire Publications, 2012
ISBN-10: 074781094X
ISBN-13: 978-0747810940
Brown, J

British Field Crops: A Pocket Guide to the Identification, History and Uses of Arable Crops in Great Britain
Published by: Sally Francis; 2nd Revised edition, 2009
ISBN-10: 0955046629
ISBN-13: 978-0955046629
Francis, S. A

Land Resources – Now and for the Future
Published by: University of East Anglia, 2000
ISBN: 978-0521785594
Young, A

Trees and woodland in the British landscape
Published by: Weidenfeld & Nicolson History, 2001
ISBN: 978-1842124697

Rackham, O

Journals and magazines

Farmers Weekly
Farmer Guardian

Websites

UK Agriculture: **www.ukagriculture.com**

Farming Futures: **www.farmingfutures.org.uk**

Lantra: **www.lantra.co.uk**

Bright Crop: **www.brightcrop.org.uk**

Health and Safety Executive: **www.hse.gov.uk**

European Commission: **ec.europa.eu**

Global Food Security: **www.foodsecurity.ac.uk**

Farming And Countryside Education: **www.face-online.org.uk**

Unit 202

Application of science in the land based sector

UAN:	J/507/7035
Level:	2
GLH:	60

What is this unit about?

The purpose of this unit is for learners to develop an understanding of how science is applied in land based industries. Learners will develop their understanding of animal and plant physiology, nutrition and health.

The unit introduces learners to the role of the sciences in the modern land based sector through investigating different parts of the industry, exploring the roles of plants/crops and animals, whilst highlighting the importance of biosecurity.

Learners will focus on plant and animal physiology and anatomy in more detail, gaining an understanding of biological processes involved in promoting good health. Learners will be working practically to monitor animal and plant health and taking action where problems are encountered. They will be providing suitable nutrition, keeping records and upholding welfare.

Learners can be introduced to this unit by asking themselves questions, such as:

- What conditions are required to grow a successful potato crop?
- Do strawberries contain more fructose if grown with or without pesticides?
- How can I monitor the health and wellbeing of my pet rabbit?

Unit scope

It is expected that learners will be given the opportunity to work with a range of

- common animals eg cats and dogs
- small mammals eg rabbits
- large mammals eg cattle and sheep, goat, pigs, horses or camelids
- common crops and plants eg root crops: potato, carrots, swede; cereals: wheat, barley, oats and maize; brassicas: broccoli, cabbage, cauliflower; legumes: peas, beans

When handling animals, learners should have access to a range of relevant handling equipment.

Learning outcomes

In this unit, learners will be able to:

1. understand the structure and function of plants
2. use scientific principles for successful propagation of plants and crops
3. understand requirements of nutrition and growth in animals
4. use scientific principles to monitor health and wellbeing of animals.

Learning outcome:

1. Understand the structure and function of plants

Topics

1.1 Plant cells and the structure of monocotyledons and dicotyledons

1.2 Process of plant growth to maturity

Topic 1.1

Structure and function of plant cells:

- cell wall
- cell membrane
- cytoplasm
- nucleus
- mitochondria
- vacuole
- chloroplasts.

Structure and function of plants:

- stems and nodes
- roots
- buds
- flowers
- leaves (palisade mesophyll, spongy mesophyll, guard cells, upper and lower epidermis and waxy cuticle)
- seeds (monocotyledons and dicotyledons).

Topic 1.2

Process of plant growth:

- Photosynthesis: autotrophs/primary producers,
 - required factors: chlorophyll, water, light, carbon dioxide
 - adaptations to survive in different environments: succulent plants, leaf shape, root adaptations
- Respiration: process of aerobic respiration
- Translocation and transpiration
 - Process: uptake of water, evaporation, osmosis and diffusion through roots, xylem and phloem
 - Factors affecting: light, temperature, wind and humidity
- Germination:
 - stages of growth, growth of radicle, plumule, roots, root hairs and cotyledons
 - factors affecting: (temperature, moisture, light, soil nutrients and viability of seeds)
- Maturity
 - recognising maturity in preparation for harvest (cereals, apples and potatoes)

Learning outcome:

2. Use scientific principles for successful propagation of plants and crops

Topics

2.1 Nutritional requirements of plants

2.2 Care of plants for optimum growth

2.3 Treatment of pests and diseases in plants

Topic 2.1

Soil components:

- Rock particles
- Water
- Air
- Organic matter

Soil textures and structures:

- Clay
- Sand
- Loam
- Silt
- Peat

Planting mediums:

- Soil
- Compost
- Rockwool
- Vermiculite

Growing conditions:

- Acid
- Alkaline
- Neutral

Influences of major and minor nutrients on plant growth and health:

- Major: nitrogen, potassium and phosphates
- Minor: copper, magnesium, manganese and boron.

Application of nutrients:

- precision (Global Positioning System application and Real Time Kinematic units) and broadcast
- pre and post planting
- timing of application
- use of organic or inorganic fertiliser
- impact of over fertilisation and eutrophication.

Topic 2.2

Care requirements:

- water (irrigation systems and geographical rainfall)
- light
- heat
- additional protection (support, netting)
- additional nutrients
- repotting
- controlling unwanted weeds/plants

- pests and disease prevention.

Consequences of not providing the correct care for plants:

- rate of growth
- disease/poor biosecurity
- damage
- crop yield.

Topic 2.3

Recognise signs of plant damage caused by common pests:

- Invertebrates: aphids, vine weevil, slug, snails, caterpillars
- Mammals: rabbits, deer, badgers
- Birds: pigeons, corvids

Identification of common plant diseases; application of treatment and prevention methods:

- Botrytis
- Mildew
- Rusts
- Potato blight

Learning outcome:

3. Understand requirements of nutrition and growth for animals

Topics

3.1 Structure and function of ruminant and non-ruminant digestive and excretory systems

3.2 Functions and sources of nutrients

3.3 Plan diets for selected animals according to life stage and nutritional needs

In this outcome, learners will be introduced to nutritional requirements for carnivores, omnivores and herbivores as applied within the agricultural and animal management sectors.

Topic 3.1

Structure and function:

- Monogastric digestive systems:
 - mouth, oesophagus, cardiac sphincter, stomach, pyloric sphincter, duodenum, gall bladder, pancreas, small intestine, (caecum in monogastric herbivores), small colon, large colon, rectum, anus)
- Ruminant digestive system:
 - mouth, oesophagus, rumen (rumination), reticulum, omasum, abomasum (true stomach), duodenum, small intestine, large intestine, rectum) digestive systems

The process of digestion in both systems:

- ingestion
- mastication
- digestion
- absorption
- egestion.

Location and process of chemical and mechanical digestion:

- chemical (carbohydrates digested in mouth and small intestine, Protein digested in stomach and small intestine, fats digested in small intestine)
- mechanical digestion (mastication and peristalsis)

Topic 3.2

Requirements for heterotrophic nutrition:

- to grow
- maintain health
- reproduce
- energy to move.

Functions and sources of nutritional components:

- water
- macro-nutrients: carbohydrates, fats, proteins, fibre
- micro-nutrients: minerals (sodium, iron, calcium) and vitamins (A, B-complex, C, D)

Quantities and ratios of major nutrients for optimum growth and health, minimising risk of deficiency diseases:

- scurvy
- rickets
- anaemia,
- milk fever

Impacts of an unbalanced diet on

- dairy cattle
- poultry
- pigs.

Topic 3.3

Differences in dietary need at different life stages:

- young
- adult
- pregnant
- lactating
- geriatric
- convalescing from illness/operation, and
- change in use of animal – working/non-working

Consequences of improper diet:

- malnutrition
- obesity
- stunted growth
- skeletal problems

Process for administering feed types available for a selection of domestic and agricultural animals

- forage: grazed, hay

- silage
- hard feed

Providing food and water to individual and groups of animals, taking into account:

- feeding and watering equipment: buckets, bowls, water bottles, automatic feeders and drinkers
- importance of routine and record keeping
- how to reduce feeding stress
- prevent disease through correct storage of feeds and hygiene relating to feeds, preparation and feeding equipment
- economic importance in providing a correct and balanced diet.

Learning outcome:

4. Use scientific principles to monitor health and wellbeing of animals

Topics

4.1 Safe handling of animals and keep routine records

4.2 Signs of normal and abnormal health in animals

4.3 Common diseases, signs, prevention and treatment

Complete risk assessments for handling animals.

Importance of wearing and using correct PPE (Personal Protective Equipment)

- steel toe capped boots
- gloves
- overalls
- hard hat.

Topic 4.1

Use of handling equipment:

- leads
- collars
- harnesses
- crooks
- crush cages/crates
- pig boards.

Topic 4.2

Use of physical and observation health checking methods for a range of animals to identify signs of good and poor health.

Visual signs:

- Behaviour - Changes from normal behaviour
- Mouth
- Nose
- Eyes
- Ears
- Mucous membranes
- Coat,

- Skin swellings
- Discharges (vaginal, nasal, aural, ocular, oral)
- Food and/or water intake
- Vomiting
- Urine and faeces output and condition
- Weight change
- Posture and movement
- Coughing

Clinical signs:

- Temperature: principles and process of measurement
- Pulse: finding and recording
- Respiration: through observation

When clinical signs are being measured, the health and wellbeing of the animal must always be taken into consideration.

Topic 4.3

Signs, symptoms, prevention and treatment of diseases (pathogenic and non-pathogenic):

- Bacterial (lymes disease, scours)
- Viral (Myxomatosis)
- Fungal (ringworm)
- Metabolic (milk fever)

Relationship between

- good husbandry and good health
- biosecurity
- 5 needs of the Animal Welfare Act 2006.

Importance of preventative care in:

- reducing animal stress and veterinary costs, and
- increasing productivity.

Guidance for delivery

The unit will begin by focusing on industries relating to plant production within the land based sector. Teaching should highlight how the sciences are important within these industries, linking closely with Unit 201.

Learning Outcomes 1 and 2 will need to be taught through a mixture of practical and classroom based delivery. Visits to arable farms and horticultural establishments are encouraged. It is expected that learners should have the opportunity to investigate a range of soil types and identify the main components as well as classify the soils and structures. They should also have the opportunity to prepare growing mediums, sow seeds and propagate plants, providing feed and water. There is an opportunity here for learners to experiment with different care and to observe the results, applying observations to knowledge on pests, diseases and optimum crop yield.

Tutors are encouraged to organise guest speakers and/or visit relevant agricultural and/or horticultural establishments to experience plant science in industry. The focus should be on

plant growth and care, pest and disease monitoring, treatment and prevention through biosecurity measures.

Learners will work practically to sow, propagate and maintain plants as well as visit farms, nurseries and reserves. To enrich their understanding learners could prepare planting mediums, sow and propagate plants, provide nutrients, water and monitor growth. This will create the potential for learners to experiment with different factors affecting plant growth (light, heat, moisture, nutrients) They will also be able to recognise common plant pests and diseases and take appropriate action.

Learning outcomes 3 and 4 will also need to be taught through a mixture of practical and classroom based delivery, focussing on animals in the land based sector. Tutors are encouraged to organise guest speakers and/or visit relevant animal based industries, focussing on how they provide food and water and how good and poor health are monitored, prevented (to include biosecurity measures), treated and recorded

Learners will have practical opportunities to provide food and water to individual and groups of animals, preparing feeds, presenting feeds to the animal in correct manner, taking into account feeding times, checking animals are eating, cleaning feeding utensils and equipment, storage of feeds and feeding equipment, checking water availability, providing fresh water and cleaning watering equipment. Learners will also have practical knowledge of maintaining feeding records and recognise how good husbandry can prevent poor health.

Tutors will have to ensure that learners are able to recognise signs of normal and abnormal health in a range of animals, through observing animals and practical handling and health checking of animals. In addition, learners should have the opportunity to observe the administration of a range of preventative treatments (eg worming, external parasite treatments, vaccinations, hoof and claw trimming).

Unit 203

Application of technology in the land based sector

UAN:	L/507/7036
Level:	2
GLH:	30

What is this unit about?

The purpose of this unit is for learners to develop an understanding of the way technology is applied within the land based industries. Learners will be given the opportunity to investigate the range, application and innovation involved in the use of the technology whilst studying.

In previous units learners discovered how land based industries are an example of how many small medium enterprise (SME) businesses that operate throughout the UK in an informal structure, utilise living beings, have a close association with our environment and can work together to play a fundamental part in our economy and our culture. An essential part of the success of this vast range of businesses is the continuous improvement of productivity, quality, and value for money.

Technology plays a vital part in that process and it is essential that learners have an opportunity to explore that relationship. The use of technology in pursuit of productivity and quality in this industry can however raise many everyday ethical issues which as adults we face in later life and learners are encouraged to confront some of these issues as they study this unit. Throughout the unit the learner should be encouraged to not just accept what they see and experience but to ask themselves to what extent the technology deployed provides an acceptable solution to the production or access problem it is trying to overcome. At the same time they could consider how science has and could in the future be used to provide a better innovative, sustainable and environmentally friendly solution to the challenges in the industry.

Learners can be introduced to this unit by asking themselves questions, such as:

- What is the impact of drones on crop yields?
- What benefits does technology have on small farming businesses?

Unit scope

It would not be possible for the full range and diversity of technology that exists to be explored; however learners should make use of local business examples to get an understanding of how technology fulfils a role, is applied and designed to meet the needs of local industry.

Learning outcomes

In this unit, learners will be able to:

1. Understand the role technology plays in the management of land based industries
2. Understand the range of technology used within land based industries
3. Understand how science and innovation has influenced technology development

Learning outcome:

1. Understand the role technology plays in the management of land based industries

Topics

1.1 Roles for technology

1.2 Management of technology for the land based industries

Topic 1.1

Role of technology:

- to manage processes
- to provide an acceptable solution to production problems
- to provide access to remote areas within the industry.

Framework for the application of technology:

- Planning:
 - Preparing resources
 - Production methodology
- Implementation:
 - Production
 - Motive power
 - Application
 - Training
 - Materials handling
- Monitoring and control:
 - Business management
 - Environmental protection
 - Efficient production
 - Quality Assurance
- Evaluation:
 - Ethical
 - Profitability

Topic 1.2

Factors that influence the selection, design and operation of technology used across land based industries:

- Cost
 - Value for money
 - Type of business
 - Operating environment
- Design:
 - Climate and weather
 - Geography
 - Topography
 - Geology
 - Operating environment
 - Nature of the business concerned
 - Flexibility of usage
- Operational restrictions:
 - Age, skill level and training required by staff
 - Health and Safety, operator certification
 - Industry/insurance regulation restrictions on activity

Learning outcome:

2. Understand the range of technology used within land based industries

Topics

2.1 Range of technology and design features

Topic 2.1

The following table is not a definitive list but is indicative of the range of technology found across the clusters of industry.

Key considerations:

- varied design of technology
- differentiated within all aspects of the land based industries

Relationships between:

- the sector
- the application
- types of technology
- key design variations.

How key factors affecting the role technology plays within the management of business affects the variation in design of any piece of equipment used

- cost
- design
- operational restrictions

Clusters of industries	Types of technology used
Land management and production	<ul style="list-style-type: none">• Tractors; Materials Handlers; Prime moving, cultivation and application equipment for crops and livestock; bulk product movement; weight sensors• Arable crop harvesting machinery eg Combine harvester, Root crop harvesters• Forage crop harvesters; Biological and Chemical preservation methods
Land management and production	<ul style="list-style-type: none">• Timber harvesting, haulage equipment; Whole tree harvesters; Battery operated chainsaws; Sawmilling; Laser guided equipment; Remote woodland cover sensing; DNA sequencing and chemical tracking.• Soil Testing Technology; Moisture meters; Crop storage• Automated livestock and plant systems includes feeding, recording, communicating, production, regulating and monitoring plant and livestock movement• Bulk Feed handling, mixing and control systems• Electronic animal recognition and Monitoring; Drones; Pregnancy testing• Business and Enterprise Management, Data transfer, IT, hardware and software• Precision farming eg mechatronics; remote sensors; robotic systems; automation; Real Time Kinematics (RTK)• Greenhouse computer controlled environmental systems; Water catchment; Biological controls

	<ul style="list-style-type: none"> • Computer controlled Hydroponics fertigation • Meteorological monitoring equipment • Energy production and storage systems and equipment; Recycling technology • Laser targeting; Incubation; Aquaponics
Animal health and welfare	<ul style="list-style-type: none"> • Building Climate Control • Ultrasound pregnancy testing equipment • Biomechanical measurement equipment; Pressure pads; pedometers • Thermographic imagery • DNA 'fingerprinting' ; Animal cloning; Semen preservation • Hydrotherapy; Exercise equipment; Magnetic therapy; Treadmills; Weighbridge/Scales • Medical and veterinary advances; Heart rate/temperature monitoring equipment • Exotic animal climate control
Environmental industries	<ul style="list-style-type: none"> • GPS Equipment; 4X4 Vehicles; Quad bikes; Access technology • Thermal imaging; Sound sensing equipment; Digital mapping • Remote cameras; Digital camera technology • Tracking and trapping devices eg Humane traps; CCTV, transponders, GPS • Environmental monitoring equipment • Pollution monitoring equipment • Ergonomics of adventure sports equipment: eg Folding Kayaks, Rope technology, disabled access equipment, clothing materials

Learning outcome:

3. Understand how science and innovation has influenced technology development

Topics

3.1 Innovation

3.2 Scientific principles

Topic 3.1

Impact of advances in science on the innovation of new technologies, improving:

- production
- competitiveness
- sustainability
- efficiency.

Topic 3.2

Use of scientific principles to bring about technological advancements:

- scientific cycle: hypotheses, experimentation, observation, development and review
- use of electricity eg electronic, digital, welding, heating equipment
- chemical technology eg batteries, environmentally friendly sprays
- sources of energy eg local harnessing of power from sun and wind etc to power systems
- radio waves eg use of remote sensing and monitoring equipment (cameras; data transfer etc)
- biological understanding eg DNA, inheritance, variation, disease/chemical resistance
- interpreting observations and data eg moisture readings before harvest; pest counts to advise treatments
- identifying patterns and trends eg milk yields; adventure sports performance results

- recording and benchmarking scientific data from practical research eg Botanical research; Agronomists

Guidance for delivery

This unit should be studied in conjunction with the other units from this Technical Award so that the learner does not see the technology in isolation to the other aspects studied. Integrated and applied study will enable a greater understanding of the science principles involved, the application of the technology outlined in this unit and improve learning. Visits and experience of real life examples should be included wherever possible and learners should be encouraged to consider what aspect of their own skills they could bring or would need to develop to join and work within the industry or sector they are experiencing.

Wherever possible the learners should work closely with 'real-life' examples of the technology or visit businesses that work with the equipment listed. The technology itself is very adaptable and can be found in a variety of guises within the land based sector which in turn means that this unit is better if it is delivered holistically with topics grouped delivered through workplace visits, investigations and experiential opportunities. Therefore it is essential that teaching of this unit is carefully planned to relate to other units within this award and real business examples which can be achieved through links with local farms, land based Colleges and land based retail outlets found around the country.

Learning Outcome 1:

Technology works closely with management processes at all levels and stages of production from planning, implementation through to monitoring and evaluation. When exploring technology, learners will appreciate how the range chosen influences real business examples, is utilised at all levels of staffing in the business and features in personal career development

Land based business management is influenced by many external factors which can determine success or failure of that business. Technology and operator skill plays an important part in helping management overcome problems presented by those external factors ensuring safety, timeliness and efficiency of the operation.

Learners will understand that as part of risk management legislation, professional operators of some equipment have to reach prescribed age and or achieve Certificates of Technical Competence before operating equipment. This is linked to both the Health and Safety and business insurance requirements within the industry. Implicit within that is that learners should be aware that managers need a good working knowledge of the industry to be able assess an individual's ability to use the equipment and to make judgement on what part operator skill determines level of pay and progression within the business concerned.

Learning outcome 2:

The examples used to demonstrate the range of technology should reflect current developments in the sector as well as the breadth of enterprises and businesses found within the industry. In particular the tutors should use local resources through visits to ensure that the range of technology is covered. At the same time emphasis should be on how the land based industry differentiates throughout the UK and the designs and types of equipment deployed meets those local needs.

Suggested learning resources

Journals and magazines

Farmers Weekly

Websites

Rothamsted Research	http://www.rothamsted.ac.uk/Content/Resources/HCEFacilities.pdf
Climate Control System Inc	http://climatecontrol.com/index.php/fertigation-manager
Access Irrigation	http://www.access-irrigation.co.uk/design-services/horticultural-irrigation/rainwater-recycling-horticulture
Fagro	http://www.fagro.co.uk/products/biologicalcontrol/default.asp
Ecoscape	http://www.ecoscape.eu/services-view/loose-fill-2/
STIHL	http://www.stihl.co.uk/a-new-generation-of-cordless-power-tools.aspx
IAGrE	http://www.iagre.org
The British Agricultural and Garden Machinery Association	http://www.bagma.com

Appendix 1 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centre Document Library** on **www.cityandguilds.com** or click on the links below:

Quality Assurance Standards: Centre Handbook

This document is for all approved centres and provides guidance to support their delivery of our qualifications. It includes information on

- Centre quality assurance criteria and monitoring activities
- Administration and assessment systems
- Centre-facing support teams at City & Guilds / ILM
- Centre quality assurance roles and responsibilities.

The Centre Handbook should be used to ensure compliance with the terms and conditions of the Centre Contract.

Quality Assurance Standards: Centre Assessment

This document sets out the minimum common quality assurance requirements for our regulated and non-regulated qualifications that feature centre assessed components. Specific guidance will also be included in relevant qualification handbooks and/or assessment documentation.

It incorporates our expectations for centre internal quality assurance and the external quality assurance methods we use to ensure that assessment standards are met and upheld. It also details the range of sanctions that may be put in place when centres do not comply with our requirements, or actions that will be taken to align centre marking/assessment to required standards. Additionally, it provides detailed guidance on the secure and valid administration of centre-assessments.

Access arrangements - When and how applications need to be made to City & Guilds

provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **Centre Document Library** also contains useful information on such things as:

- Conducting examinations
- Registering learners
- Appeals and malpractice

Useful contacts

Please visit the Contact Us section of the City & Guilds website, **Contact us**

About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people, organisations and economies develop their skills for growth. We work with education providers, employers and governments in over 100 countries across the world to help people, businesses and economies grow by shaping skills systems and supporting skills development.

The Group is made up of City & Guilds, ILM, Kineo, The Oxford Group, Gen2, and Intertrain. Together we set the standard for professional and technical education and corporate learning and development around the world.

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