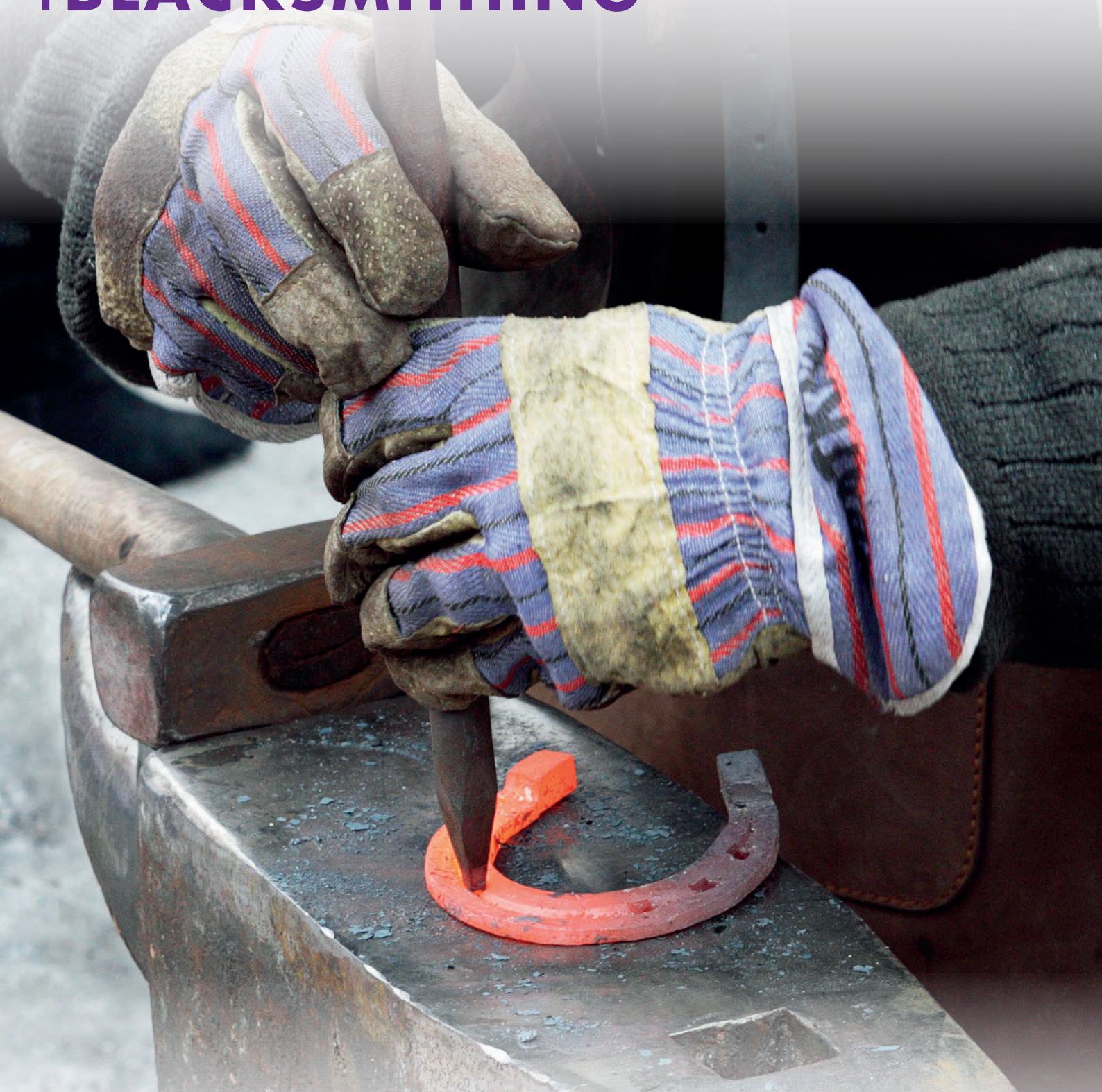


BTEC Level 2 Technical Diploma in
BLACKSMITHING



SPECIFICATION

First teaching: September 2018 | First certification: Summer 2019

ISSUE 3



Pearson BTEC Level 2 Technical Diploma in Blacksmithing

Specification

First teaching September 2018

Issue 3

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 3. Key changes are listed in the summary table on the page after next of the document. We will inform centres of any changes to this issue. The latest issue can be found on the Pearson website: qualifications.pearson.com

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 95050 0

All the material in this publication is copyright
© Pearson Education Limited 2019

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 chosen to help learners progress to the next stage. This means that all assessments are set by the centre to meet local needs. This ensures that there is a core of skills and understanding common to all learners.

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 10 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 experts from businesses 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.

Summary of Pearson BTEC Level 2 Technical Diploma in Blacksmithing specification Issue 3 changes

Summary of changes made between the previous issue and this current issue	Page number
<i>Unit 9: Research, Design and Make Blacksmith Products</i> has been changed from being externally-assessed to being internally-assessed.	Pages 111-123
The wording in <i>Section 7 Teacher/centre malpractice</i> has been updated to clarify suspension of certification in certain circumstances.	Pages 136, 137
The wording under <i>Section 9 Understanding the qualification grade</i> has been updated to clarify current practice in ensuring maintenance and consistency of qualification standards.	Page 141

Contents

Pearson BTEC Level 2 Technicals	1
Introduction	1
1 Pearson BTEC Level 2 Technical Diploma in Blacksmithing	2
Purpose	2
Who is the qualification for?	2
What does the qualification cover?	2
What could this qualification lead to?	2
About the blacksmithing sector	2
2 Structure	3
Total Qualification Time (TQT)	3
Qualification structure	3
Qualification and unit content	4
Assessment	4
Language of assessment	4
Grading of the qualification	5
Employer involvement	5
3 Units	6
Understanding your units	6
4 Planning your programme	111
Is there a learner entry requirement?	125
What is involved in becoming an approved centre?	125
What level of sector knowledge is needed to deliver this qualification?	125
What resources are required to deliver this qualification?	125
What makes good vocational teaching?	125
What are the requirements for meaningful employer involvement?	126
What support is available for delivery and assessment?	126
How will my learners become more employable through this qualification?	126
5 Assessment structure	127
6 Internal assessment	128
Principles of internal assessment	128
Operating internal assessment	128
Setting assignments	129
Making valid assessment decisions	131

7	Administrative arrangements	134
	Introduction	134
	Learner registration and entry	134
	Access to assessment	134
	Administrative arrangements for internal assessment	135
	Dealing with malpractice in assessment	136
	Certification and results	138
	Additional documents to support centre administration	138
8	Quality assurance	139
	Centre and qualification approval	139
	Continuing quality assurance and standards verification	139
9	Understanding the qualification grade	141
	Awarding and reporting for the qualification	141
	Eligibility for an award	141
	Examples of grade calculations based on table applicable to registrations from September 2018	143
10	Resources and support	145
	Support for setting up your course and preparing to teach	145
	Support for teaching and learning	145
	Support for assessment	145
	Training and support from Pearson	146

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 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.

These qualifications are not eligible for performance tables in England.

This specification contains the information you need to deliver the Pearson BTEC Level 2 Technical Diploma in Blacksmithing (QN 603/2657/8). 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 Blacksmithing

Purpose

Who is the qualification for?

This qualification, is for you if you want to start a career in blacksmithing. It is designed for post-16 learners and can be taken as part of a wider study programme. It is an ideal qualification if you are intending to progress directly to employment in blacksmithing.

What does the qualification cover?

This qualification has been developed in consultation with employers in the blacksmithing sector to ensure that you learn the skills and behaviours that will give you the best opportunity to be successful when applying for work.

There are six mandatory units that relate directly to the skills, knowledge and behaviours expected by employers in the blacksmithing sector. The areas you will cover are:

- health and safety in blacksmithing
- metallurgy and heat treatment
- the forging process
- welding and thermal cutting processes
- technical and freehand techniques
- researching, designing and making blacksmith products.

You will be able to add one optional unit to the mandatory content, which cover areas such as:

- fabrication techniques
- forge work and construction techniques
- horse biology and handling.

You will also enhance your broader skills in literacy and numeracy, which will be invaluable in supporting progression in other areas. In addition, you will develop transferable technical and practical skills in communication (working with colleagues, customers and clients), and research and project work, giving you an opportunity to demonstrate your reflective practice by suggesting alternative approaches to a problem.

What could this qualification lead to?

Achieving this qualification will give you an advantage when applying for a job in the blacksmithing sector.

When studied as part of a full study programme, this qualification will give you a sound basis to progress in the blacksmithing sector to a Level 3 qualification, such as the Pearson BTEC Level 3 National Diploma in Blacksmithing and Metalworking.

About the blacksmithing sector

A blacksmith is a metalsmith who creates objects from wrought iron or steel by casting and forging the metal. Blacksmiths practise a highly skilled trade that requires many hours of training in order to understand the properties of metals, to master the tools to hammer, bend and cut, and to develop the skills needed to create objects, including horseshoes. Farriery is the ancient and highly-skilled craft of making and fitting horseshoes. It demands the skills to handle horses and identify any health and fitness problems. All farriers must be registered, and today there are more than 2,600 in the UK.

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.

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 Blacksmithing is a qualification that has:

- Total Qualification Time: 600 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 mandatory units and one optional unit in the qualification.

Pearson BTEC Level 2 Technical Diploma in Blacksmithing				
Unit number	Unit title	GLH	Type	How assessed
1	Health and Safety in Blacksmithing	30	Mandatory	Internal
2	Metallurgy and Heat Treatment	45	Mandatory	Internal
3	Forging Processes	60	Mandatory	Internal
4	Welding and Thermal Cutting Processes	45	Mandatory	Internal
5	Freehand and Technical Drawing	30	Mandatory	Internal
6	Fabrication Techniques	60	Optional	Internal
7	Forge Work Construction Techniques	60	Optional	Internal
8	Horse Biology and Handling	60	Optional	Internal
9	Research, Design and Make Blacksmith Products	90	Mandatory	Internal Synoptic

This qualification has 83% mandatory content and 25% optional content.

These qualifications are not eligible for performance tables in England.

Qualification and unit content

Pearson has developed the content of this qualification in collaboration with employers 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.

83% of the content in this qualification is 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 given 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 in this 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 this qualification in, 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.

Internal assessment

Units 1, 2, 3, 4, 5, 6, 7, 8 and 9 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 internally-assessed units at Pass grade or above to achieve the qualification. For further information on internal assessment, including resubmissions, see *Section 6 Internal assessment*.

Language of assessment

Assessment of the internally-assessed units for this qualification will be available in English. All learner work must be in English. A learner taking the qualification may be assessed in British Sign Language where it is permitted for the purpose of reasonable adjustment. For information on reasonable adjustments see *Section 7 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 9 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
- project(s), exercise(s) and/or assessment(s)/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 masterclasses or guest lectures
- industry practitioners operating as 'expert witnesses' who 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 blacksmithing sector and should contribute significantly to at least one mandatory unit.

In all the units we have provided suggestions on how employers could become involved in the delivery and/or assessment of this qualification.

These are suggestions only and there will be other possibilities at local level. Centres may choose to use other approaches but must ensure that they 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 8 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 internal unit in the specification is set out in a similar way.

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.

Internally-assessed units

Section	Explanation
Unit number	The number is in a sequence for the qualification.
Unit title	This is the formal title of the unit and appears on certificates.
Level	All units are at Level 2 on the national framework.
Unit type	This says if the unit is mandatory or optional for the qualification. See <i>Section 2 Qualification structure</i> for details.
Assessment type	This says how the unit is assessed – i.e. whether it is internal or synoptic internal. See <i>Section 2 Qualification structure</i> for details.
GLH	Units have a GLH value of 60 and 30. 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.

Section	Explanation
Assessment criteria	Each learning aim has assessment criteria to explain the achievement required to obtain Pass, Merit and Distinction grades.
Essential information for assessment decisions	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.
Assessment activity	This section provides information, suggested scenarios and tasks for summative assessment activities.
Further information for tutors and assessors	The section gives you information to support the delivery and assessment of the unit.
Delivery guidance	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.
Essential resources	Any specific resources that you need to be able to teach and assess are listed in this section. For information on support resources see <i>Section 10 Resources and support</i> .
Links to other units	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.
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.

Legislation cited in the units is current at time of publication. The most recent legislation should be taught and assessed internally.

Units

This section contains all the units developed for this qualification.

Unit 1: Health and Safety in Blacksmithing	11
Unit 2: Metallurgy and Heat Treatment	23
Unit 3: Forging Processes	37
Unit 4: Welding and Thermal Cutting Processes	51
Unit 5: Freehand and Technical Drawing	64
Unit 6: Fabrication Techniques	75
Unit 7: Forge Work Construction Techniques	87
Unit 8: Horse Biology and Handling	99
Unit 9: Research, Design and Make Blacksmith Products	111

Unit 1: Health and Safety in Blacksmithing

Level: **2**

Unit type: **Mandatory**

Assessment type: **Internal**

Guided learning hours: **30**

Unit in brief

Learners will develop an understanding of health and safety practices including laws and regulations that need to be applied and followed in the blacksmithing industry.

Unit introduction

Unsafe incidents in the workplace can result in litigation, injuries, loss of work or even fatalities, so understanding and practising health and safety procedures is critical to the blacksmithing industry – where being aware of your own and the safety and that of others is essential.

In this unit, you will be introduced to the law and regulations that relate to blacksmithing and your health and safety roles and responsibilities. You will learn how to recognise common hazards, produce appropriate risk assessments and be able to work safely in the industry with minimal supervision. The safe working elements of this unit will be delivered alongside the practical aspects, such as forging, welding, toolmaking, fabrication and horse handling, of units in this qualification that cover work practice.

This unit is particularly important in all areas of workshop and site-based practical work for the blacksmith, metalworker and farrier.

Learning aims

In this unit you will:

- A** Understand roles and responsibilities in the blacksmith's workplace
- B** Explore the risks and hazards that occur when carrying out blacksmithing practices
- C** Demonstrate safe working practices in the workplace.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand roles and responsibilities in the blacksmith's workplace	A1 Roles and responsibilities A2 Health and safety legislation and relevant regulations	A health and safety workbook documenting HSE website, information on various laws, regulations, good practice, PPE, emergency equipment and procedures and signage.
B Explore the risks and hazards that occur when carrying out blacksmithing practices	B1 Identify hazards and risks in the blacksmith's workplace B2 Identify safety control measures and incident reporting	
C Demonstrate safe working practices in the workplace	C1 Carry out a risk assessment C2 Working safely in work areas	Complete a written risk assessment of a process and equipment. Observation records of safe working. Work process sheets, including how safe working practices are demonstrated.

Key teaching areas in this unit include:

Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Safe use of machinery and tools in the workshop • Use of appropriate PPE • Safe work process • Recognising health and safety law and regulation • Risk assessment writing and incident reporting 	<ul style="list-style-type: none"> • Control measures • Hazard recognition and risk assessment • Machinery set-up and operation procedures • Recognition of hazards • Understanding lines of communication • Recognising roles and responsibilities • Reporting procedures • Health and safety law and regulation 	<ul style="list-style-type: none"> • Communication • Self-management and development • Working with others

Unit content

Knowledge and sector skills

Learning aim A: Understand roles and responsibilities in the blacksmith's workplace

A1 Roles and responsibilities

Learners will develop an understanding of the different roles and responsibilities relating to health and safety in the blacksmith's workplace and make connections between the roles.

- Health and Safety Executive (HSE):
 - its legislative powers in the workplace
 - roles and responsibilities of the:
 - employer, e.g. with particular reference to their responsibilities to the employee
 - employee, e.g. with particular reference to their own safe working and relationship to their employer
 - public, e.g. who is responsible for the public's safety in the blacksmithing workshop or on site
 - self-employed, e.g. how do the self-employed blacksmith's responsibilities differ from those of the employed?

A2 Health and safety legislation and relevant regulations

Learners will develop an understanding of how relevant UK legislation and regulations affect the responsibilities of those working in the blacksmith's workplace and how they influence health and safety practices.

- Relevant legislation and regulations:
 - Health and Safety at Work etc. Act 1974
 - Provision and Use of Work Equipment Regulations (PUWER) 1998
 - Control of Substances Hazardous to Health (COSHH) 2002
 - workplace safety and welfare
 - fire precautions
 - first aid at work
 - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013
 - electricity at work
 - manual handling operations
 - personal protective equipment (PPE)
 - work and display screen equipment
 - the Work at Height Regulations 2005.

Learning aim B: Explore the risks and hazards that occur when carrying out blacksmithing practices

Learners will be able to recognise hazards, risks and the safety control measures that are required as part of the blacksmith's working practices such as forging, welding and fabricating and in the context of relevant legislation and regulation.

B1 Identify hazards and risks in the blacksmith's workplace

- Office, e.g. use of VDU equipment, posture/ergonomics, lighting.
- Blacksmithing workshop, e.g. clothing, behaviour, traps, noise, fume/gas, impact, poison (ingestion, absorption), burns (heat, chemical), slips, trips, falls, electrocution, fire, explosion, manual handling, contamination.
- On site in public and private areas, e.g. clothing, behaviour, traps, noise, fume/gas, impact, poison (ingestion, absorption), burns (heat, chemical), slips, trips, falls, electrocution, fire, explosion, manual handling, contamination, working at height/depth, public proximity/interference.

B2 Identify safety control measures and incident reporting

- Training and supervision, e.g. induction process.
- Work procedures, e.g. organised method of work.
- Incident reporting, e.g. dangerous occurrences and whether they lead to injury or not.
- PPE, e.g. use of PPE for welding, such as: eye shade, goggles, boots, overalls, helmet.
- Guarding, maintaining a safe working distance from moving machine parts, e.g. drill spindle guard.
- Warning systems and emergency stops, e.g. fire alarm, power supply cut-off switch, quick stop mechanism on machines.
- Emergency procedures, e.g. fire evacuation procedure.
- Fire control, e.g. extinguishers, housekeeping, explosive and flammable materials.
- Noise attenuation, e.g. ear muffs, noise absorption panels in the ceiling.
- Ultraviolet light, e.g. weld shade types and screens.
- Electricity, e.g. voltage reduction in machines, residual current device (RCD), portable appliance testing (PAT), CE marking.
- Lifting equipment, e.g. safe working loads for lifting gear.
- Working at height, e.g. when using scaffolds, ladders and lifts.
- Use of materials and consumables, e.g. when handling, storing.
- Ventilation and extraction systems, e.g. when welding (generating fumes), forging (generating dust).
- Notices and labelling (mandatory and advisory), e.g. mandatory eye protection PPE, mandatory noise reduction PPE, emergency-exit notices, fire extinguishers.

Learning aim C: Demonstrate safe working practices in the workplace

C1 Carry out a risk assessment

Learners will recognise and understand the purpose of a method statement and carry out a risk assessment for blacksmithing practices.

- Hazards, risks and controls for blacksmithing processes and equipment.
- Risk assessments: method of measuring the effectiveness of control measures for hazard and risk.
- Method statement: a risk-management tool that describes methods of work; it gives information such as contact details of client and site staff, work processes/job outlines, staff responsibilities, lines of communication, site map, equipment, emergency procedures, work certificates, COSHH data and relevant risk assessments, environmental issues and their control, site access and egress.

C2 Working safely in work areas

Learners will apply safe working practices when carrying out practical activities such as forging, welding, machining and grinding in workshop areas.

- Working safely:
 - risk assessments – use completed risk assessments to inform activities/tasks
 - use of appropriate PPE
 - use of appropriate safe working practices when forging, welding and fabricating
 - work type and methods to include forge work (e.g. forging, forming, cutting, joining), welding (e.g. joining, cutting), fabrication (e.g. cutting, bending, joining) horse handling (e.g. restraint, handling, leading, trotting)
 - safe set up, use and shut down of tools and machinery
 - following emergency procedures where appropriate, e.g. demonstrate awareness of fire drill
 - appropriate behaviours, e.g. take part in work induction and training, demonstrate awareness of personal safety and the safety of others, effective and appropriate communication with work colleagues, other professionals and the public.

Transferable skills

Communication

- Communicating effectively with responsible persons using written reporting procedures and/or verbally.
- Understanding lines of communication.

Self-management and development

- Develop skills over time and become more aware of the working environment and its hazards.

Working with others

- Work safely with others as an individual, within a group or as part of a team in the workshop.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand roles and responsibilities in the blacksmith's workplace		
A.P1 Outline key employer and employee roles and responsibilities with reference to health and safety requirements.	A.M1 Explain the roles and responsibilities with reference to current health and safety legislation and regulation.	A.D1 Analyse the powers of the Health and Safety Executive with regard to roles and responsibilities of the workforce, hazards, accidents or dangerous occurrences in the workplace.
A.P2 Outline key points of relevant health and safety legislation and regulations related to blacksmithing practices.		
Learning aim B: Explore the risks and hazards that occur when carrying out blacksmithing practices		
B.P3 Identify the risks and hazards that can occur when carrying out blacksmithing practices.	B.M2 Explain the effectiveness of safety measures put in place to control risks and hazards during blacksmithing practices.	B.D2 Analyse the effectiveness of the safety measures in place for risks and hazards, justifying their need, to ensure safe blacksmithing practices.
B.P4 Identify the safety measures needed to control risks and hazards during blacksmithing practices.		
Learning aim C: Demonstrate safe working practices in the workplace		
C.P5 Produce a basic risk assessment for specific blacksmithing work, ensuring safe working practices.	C.M3 Produce a detailed risk assessment when carrying out specific blacksmithing work, ensuring appropriate safety practices are applied.	C.D3 Produce a comprehensive risk assessment for specific blacksmithing work, ensuring safe and effective working practices are applied.
C.P6 Carry out safe blacksmithing working practices.		

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will:

- demonstrate comprehensive understanding of the powers held by the Health and Safety Executive (HSE) with reference to enforcement notices in the event of, for example dangerous machinery, dangerous occurrence, accidents causing injury or death and the legal ramifications of non-compliance by the workforce and others
- compare and contrast the impact of the Health and Safety Executive (HSE) on different blacksmithing roles and key responsibilities, e.g. employer, employee, general public
- demonstrate a robust understanding of key UK legislation, regulations and the impact they have on working practices
- make relevant connections between workshop practices and health and safety requirements with reference to specific blacksmithing work types and methods such as welding, forging and cutting.

For merit standard, learners will:

- demonstrate understanding of the powers held by the Health and Safety Executive (HSE), with reference to the roles and responsibilities of employers, employees and the general public
- make connections between UK legislation, regulations and health and safety requirements in the blacksmith's place of work, e.g. workshop, studio
- demonstrate understanding of health and safety requirements and workshop practices with reference to methods such as welding, forging, and cutting.

For pass standard, learners will:

- demonstrate basic understanding of the powers held by the Health and Safety Executive (HSE) with reference to the roles and responsibilities of employers, employees and the general public
- outline relevant health and safety legislations and regulations with reference to working practices and practical activities
- outline health and safety requirements with reference to workshop methods such as welding, forging, and cutting.

Learning aim B

For distinction standard, learners will:

- demonstrate an in-depth understanding of the hazards and associated risks that can occur during blacksmithing processes and practices
- describe in detail the associated control measures such as induction processes, organisation of work and appropriate use of PPE, to avoid accident and injury
- compare and contrast the different control measures that are used during blacksmithing processes and practices with reference to named types of measures and why and how they are used
- demonstrate comprehensive understanding of incident reporting when applying control measures during blacksmithing practices
- present work using comprehensive and well-selected examples to support findings.

UNIT 1: HEALTH AND SAFETY IN BLACKSMITHING

For merit standard, learners will:

- describe hazards and associated risks with reference to examples of blacksmithing processes and practices
- describe in detail the importance and effectiveness of control measures and incident reporting processes used to minimise risks, discussing the advantages and disadvantages of applying different types of control measures
- present work using detailed examples to support findings.

For pass standard, learners will:

- outline hazards and the associated risks with reference to examples of blacksmithing processes and practices
- outline appropriate control measures and incident reporting processes used for limiting and eliminating the risks associated with blacksmithing processes and practices
- present work using examples to support findings.

Learning aim C

For distinction standard, learners will:

- produce risk assessment(s) for a minimum of two blacksmithing processes and practices from the following: forging, welding, fabricating and associated equipment, using correct terminology
- provide detailed information on the associated hazards and risks with regard to selected blacksmithing processes and practices, giving suggested control measures, justifying choices
- work independently, applying safe working practice in all work areas.

For merit standard, learners will:

- produce risk assessment(s) for a minimum of two blacksmithing processes and practices from the following: forging, welding, fabricating and associated equipment, using correct terminology describe associated hazards and risks and control measures
- work with minimal assistance, using safe working practices in work areas.

For pass standard, learners will:

- produce an appropriate risk assessment for specific practical blacksmithing process and practice from the following: forging, welding, fabricating and associated equipment, using correct terminology
- outline the associated hazards and risks with regard to a practical blacksmithing process and practice
- work with some assistance, using safe working practices in work areas, e.g. demonstrating correct use of correct PPE, safe set up, operation and shut down of equipment and good housekeeping.

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

Your firm has a commission to remove, repair and replace some gates and railings at a stately home run by English Heritage. During the repair process you are required to carry out welding on some broken components. For this you need to complete a risk assessment.

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

The scenario can be adjusted by changing the specified work type for the risk assessment.

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.

<p>Introduction to unit Unit overview and assessment plan. The importance of health and safety in and around the blacksmith workshop. Suggested time: about 1 hour.</p>
<p>Activity: Workshop questionnaire General workshop inductions, workshop mapping of emergency exits, health and safety signage, emergency evacuation procedures, emergency equipment, first aid, incident reporting, location of risk assessments etc. Suggested time: about 4 hours.</p>
<p>Activity: Hazard identification General workshop walk through, noting hazards and control measures. Suggested time: about 1 hour.</p>
<p>Activity: Health and safety workbook Introduction to the Health and Safety at Work etc. Act – online research of HSE website and completion of a workbook. Suggested time: about 6 hours.</p>
<p>Activity: Practical health and safety Workshop based and implemented at appropriate times during the delivery of workshop units – process, technique, materials and safe set up and shut down of machinery, individual and team working, housekeeping. Suggested time: about 12 hours.</p>
<p>Activity: Method statement and risk assessments Introduction to risk assessments followed by a group activity of writing method statements and risk assessments. Suggested time: about 2 hours.</p>

Essential resources

For this unit, learners will need access to:

- health and safety PPE
- workshops and work areas.

Links to other units

This unit has strong links to:

- Unit 2: Metallurgy and Heat Treatment
- Unit 3: Forging Processes
- Unit 4: Welding and Thermal Cutting Processes
- Unit 5: Freehand and Technical Drawing
- Unit 6: Fabrication Techniques
- Unit 7: Forge Work Construction Techniques
- Unit 8: Horse Biology and Handling
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- guest speakers
- workplace visits.

Unit 2: Metallurgy and Heat Treatment

Level: **2**

Unit type: **Mandatory**

Assessment type: **Internal**

Guided learning hours: **45**

Unit in brief

Learners will develop the skills and knowledge needed to be able to understand the production and properties of ferrous materials to effectively heat-treat forgings and tools in plain carbon steels.

Unit introduction

Blacksmiths are the only craftspeople that commonly make tools both for their own use and for other industries. This means that they need a working understanding of ferrous metallurgy and effective heat-treatment methods.

In this unit, you will learn about iron and steel. You will investigate ferrous metal properties, as related to the plain carbon steel phase diagrams, to support a better understanding of the effects of work and heat on the metals. You will learn how to recognise faults and carry out and use forge processes, hand tools and equipment safely. You will apply effective heat treatments to produce fit-for-purpose blacksmith hand tools.

You will be given the opportunity to understand and practise forging and heat-treatment processes to produce hand tools as commonly used in the blacksmith industry.

On completion of this unit, you will have the knowledge and experience needed to enter a working forge and confidently produce specialist hand tooling. You will be able to apply your skills to job roles in the blacksmithing sector such as blacksmith, general metalworker, welder/fabricator and farrier.

Learning aims

In this unit you will:

- A** Understand iron and steel metallurgy for effective forging process and heat treatments
- B** Understand heat treatments for iron and plain carbon steels
- C** Produce forge tools with appropriate heat treatment.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand iron and steel metallurgy for effective forging process and heat treatments	A1 Properties of materials A2 Plain carbon steel phase diagram	Learners will produce worksheets outlining the carbon phase diagram, material properties, test methods and appropriate heat treatments as applied to materials and toolmaking. Responses to questions during a question and answer session between the tutor and learners, to ascertain underpinning knowledge.
B Understand heat treatments for iron and plain carbon steels	B1 Test methods and applications for iron and plain carbon steel B2 Effects of work, heating, cooling, carbon and oxygen on iron and steel B3 Understand heat treatments of plain carbon steel and their purpose	
C Produce forge tools with appropriate heat treatment	C1 Understand tool design requirements C2 Tools and equipment for making blacksmithing tools C3 Safely produce tools by forging with appropriate heat treatment	Portfolio of practical evidence, including photographs. Observation of practical heat treatment and tool production. Reports on and records of investigations. Worksheets to show evidence of heat treatment and toolmaking. Responses to questions during a questions and answer session between the tutor and learners, to ascertain underpinning knowledge.
Key teaching areas in this unit include:		
Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Safe use of machinery and tools in the workshop • Use of appropriate PPE • Safe work process • Heat treatment • Toolmaking 	<ul style="list-style-type: none"> • Metallurgy • Tool types • Heat treating iron and steel 	<ul style="list-style-type: none"> • Communication • Developing practical and technical skills • Problem solving • Working with others

Unit content

Knowledge and sector skills

Learning aim A: Understand iron and steel metallurgy for effective forging process and heat treatments

A1 Properties of materials

Learners will understand the general properties of materials with reference to iron and steel.

- Iron and steel properties:
 - malleability – ability to be hammered, pressed or rolled into shape
 - ductility – ability to be drawn or pulled into shape
 - hardness – ability to resist indentation or scratching
 - toughness – ability to resist load without fracture
 - strength – ability to resist force before deforming
 - compression – squeezing force
 - tension – bending or pulling force
 - elasticity – ability to absorb force and return to its original shape up to its elastic limit
 - elastic limit – the point at which an elastic material become permanently deformed
 - plasticity – the ability to be easily shaped or moulded.
- Common iron and steel alloying elements:
 - common alloying elements:
 - carbon
 - chromium
 - vanadium
 - tungsten
 - nickel
 - molybdenum
 - Effects of common alloying elements on defined iron and steel properties:
 - hardness
 - toughness
 - corrosion
 - malleability
 - ductility.

A2 Plain carbon steel phase diagram

Learners will develop an understanding of how iron and steel change with temperature and carbon content, using a plain carbon steel phase diagram between 0%–1.7% carbon.

- Difference between state and form:
 - solid
 - liquid
 - gas
 - plasma
 - allotropic at critical or transformation temperatures.
- Types of iron/steel atomic and microstructures:
 - iron (ferrite)
 - carbon
 - iron carbide(cementite)
 - pearlite
 - austenite
 - martensite.

UNIT 2: METALLURGY AND HEAT TREATMENT

- Difference between face-centred cubic lattice and body-centred cubic lattice in relation to ferrite and austenite.
- The effects of carbon on iron:
 - eutectic ranges (hypoeutectic range, eutectic point, hypereutectic range)
 - melting points
 - critical/transformation temperature ranges
 - critical/transformation temperatures, i.e. upper and lower temperatures related to microstructure and carbon content
 - the effects of carbon on ferrite/austenite phases and temperatures.

Learning aim B: Understand heat treatments for iron and plain carbon steels

B1 Test methods and applications for iron and plain carbon steel

Learners will understand the appropriate test methods for types of iron and steel, e.g. iron, mild steel, medium carbon steel, high carbon steel.

- Workshop test methods:
 - spark test – recognition of spark trails to evaluate indicative carbon content
 - ring sound – change of pitch indicative of relative hardness when compared with known samples
 - nick break test – visual of internal grain structure
 - examination of grain type (annealed grain, normalised grain, giant grain growth)
 - hardness tests, e.g. Brinell/Rockwell, scratch test.
- How percentage of carbon content affects the working properties of iron/steel in relation to, e.g. hardness, toughness, elasticity, melting points, ductility, malleability strength – types of iron/plain carbon steel (iron/low carbon steel/medium carbon steel/ high carbon steel) and examples of common usage, e.g. rivets, general fabrications, springs, wear resistance, impact tools, cutting tools.

B2 Effects of work, heating, cooling, carbon and oxygen on iron and steel

- Effects of heating and cooling on grain size, microstructure and composition, e.g. normalising, annealing, hardening, tempering:
 - quenching media (brine, water, oil, air, thermal insulators)
 - relative speed of quench and its effects.
- Effects of rate of flow and volume of liquid.
- Heating and cooling in relation to its microstructure, time and temperature, e.g. hardening, tempering, annealing, re-crystallisation, giant grain growth, normalising.
- Hot and cold working, (hammering, bending, twisting, dishing, punching, upsetting, fullering), e.g. grain deformation, work hardening, stress cracking, sectional changes.
- Carbon and oxygen, e.g. de-carburisation/oxidation/burning/carburisation (cementation).
- Recognition of faults within the metal structure and their causes, e.g. shakes, inclusions, oxidation, fold flaws, irregular/incomplete heat treatment, irregular/distorted grain structure.

B3 Understand heat treatments of plain carbon steel and their purpose

- Annealing, e.g. softening for cold work, cutting, machining, and stress relieving.
- Normalising, e.g. stress relieving, restoring normal grain size and physical properties.
- Hardening, e.g. increasing elasticity and/or hardness.
- Tempering, e.g. stress relieving hardened materials.
- Cementation method (case hardening), e.g. increasing surface carbon content of iron or low carbon steels (wear resistance).
- Quenching/cooling media and application methods:
 - brine – fast quench for maximum hardness
 - water – hard quench used for most hardening (less stressful than brine)
 - oils – various grades used to balance toughness and hardness
 - air – used to restore normal grain size, structure and hardness
 - thermal insulation materials, e.g. slaked lime, wood ash, sand, vermiculite granules, thermal blankets – used to slow cooling to fully remove stress or change grain size to allow for cold working of hard materials
 - temperature-controlled furnaces or ovens – as for thermal insulation materials but more controllable and predictable.
- Understand the effects of section size (surface area to volume ratio), carbon content of steel, quench media type, rate of flow and volume of quench media with relation to the effectiveness of quench.
- Recognition methods used to measure critical/transformation and tempering temperature, e.g. heat colour, use of magnet, pyrometer.
- Heat treatment faults:
 - crack types, e.g. water line, oxygen, shrinkage, burn
 - burns
 - flaws, e.g. bends, distortion.
- Uneven or incorrect heat treatment:
 - appropriate simple workshop tests for effective heat treatment:
 - file (scratch test) the sample to ascertain relative hardness/toughness
 - Does the tool distort, blunt or crack during test use?
 - visual, e.g. examine for burns, cracks and flaws.

Learning aim C: Produce forge tools with appropriate heat treatment**C1 Understand tool design requirements**

- Rodded and handheld tools, e.g. hammers, tongs, punches, top and bottom tools, chisels.
- Hammers, e.g. cross/straight peen, flat face, ball peen, ball face, leaf, sledge, hand.
- Hot punches, e.g. taper, parallel, slot, slitter, round, oval, square, oblong.
- Chisel types, i.e. cold, hot, curved, straight.
- Tong varieties, such as:
 - fire tongs
 - anvil tongs
 - pliers
 - open mouth
 - close mouth.

UNIT 2: METALLURGY AND HEAT TREATMENT

- Tong bit types and their common uses, such as:
 - flat (holding, flat bar or plate)
 - round/hollow (holding round sections)
 - square/diamond (holding/gripping square sections)
 - side (holding the material at a point along its length)
 - bolt (holding a material with an upset end)
 - scroll (adjusting scrolls)
 - bow (closing collars and/or forming scrolls)
 - lugged (for holding larger sections).
- Appropriate heat treatments relating to being fit for purpose as applied to production process requirements, end use and material type.
- Use of material data sheets to inform material choice – material working characteristics, heat treatment, health and safety information (Control of Substances Hazardous to Health) (COSHH).
- Materials as appropriate, e.g. iron, low carbon steel, medium carbon steels, high carbon steel.

C2 Tools and equipment for making blacksmithing tools

- Hand tools such as:
 - tongs
 - hammers
 - punches
 - chisels
 - top and bottom tools (rodded or spring).
- Equipment such as:
 - forge hearth
 - anvil
 - leg vice
 - power hammer
 - press
 - swage block.

C3 Safely produce tools by forging with appropriate heat treatment

- Tools, e.g.:
 - hot chisel
 - cold chisel
 - handheld hot punch, e.g. round taper, square taper
 - centre punch
 - rodded top tool
 - bolster plate
 - drift
 - tongs, e.g. flat bits, hollow bits, scroll pliers.
- Heat treatments, e.g.:
 - annealing
 - normalising
 - hardening
 - tempering
 - case hardening.
- Materials, e.g.:
 - mild steel
 - medium carbon steel, e.g. EN9
 - high carbon steel.

Transferable skills

Communication

- Written reporting on heat treatment and metal type tests.

Developing practical and technical skills

- Developing toolmaking and heat treatment skills and knowledge.

Problem solving

- Analysing metal and heat treatment test faults.
- Using design skills to make tools.

Working with others

- Safe working in a workshop environment.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand iron and steel metallurgy for effective forging process and heat treatments		
A.P1 Describe the properties of iron and steel, common alloying elements and their effects.	A.M1 Explain the effects of temperature and alloying elements on the properties and microstructure of iron and steel, with reference to a specified tool and the plain carbon steel phase diagram.	AB.D1 Justify materials selection and appropriate test methods and heat treatments, with reference to specified tools, using the plain carbon steel phase diagram and alloying elements.
A.P2 Describe the areas of the plain carbon steel phase diagram and the microstructure of iron and steel.		
Learning aim B: Understand heat treatments for iron and plain carbon steels		
B.P3 Describe appropriate workshop test methods when investigating iron and plain carbon steel.	B.M2 Explain how the effects of work, heating, cooling, carbon and oxygen may influence the results of workshop test methods and heat treatments on iron and steel, with reference to a specified tool.	
B.P4 Describe the effects of work, heating, cooling, carbon and oxygen on the microstructure of iron and steel.		
B.P5 Describe appropriate heat treatments for plain carbon steel.		
Learning aim C: Produce forge tools with appropriate heat treatment		
C.P6 Outline the requirements for specific tool designs.	C.M3 Carry out competent selection and appropriate uses of tools and equipment, producing handheld tools accurately to tolerance and heat treatment.	C.D2 Competently carry out selection and use of methods, tools and equipment, accurately producing a tool with a punched eye, to an agreed design and using an appropriate heat treatment.
C.P7 Use appropriate methods, tools and equipment when making specified tools with correct heat treatments.		

Essential information for assessment decisions

Learning aims A and B

For distinction standard, learners will:

- demonstrate comprehensive understanding of how alloying elements and the plain carbon steel phase diagram are used to decide on material selection for a specified tool (this can be applied to the tool produced for C.D2)
- demonstrate comprehensive understanding and justify appropriate heat treatments with specific reference to carbon content, melting points, alloying elements and the property changes at the eutectic point, critical/transformation temperatures
- show comprehensive understanding and justify appropriate safe cooling rates and temper colour selections as applied to carbon content and intended tool type and function.

For merit standard, learners will:

- explain the effects of work, heating, cooling, alloying elements and oxygen on the choice of test method as well as the results, with reference to microstructure and properties of iron and steel, using the carbon steel phase diagram
- explain how heat treatments on iron and steel are influenced by the effects of work, heating, cooling, carbon and oxygen
- give a detailed outline of an appropriate material (e.g. plain carbon steel), test method and heat treatment for a specified tool.

For pass standard, learners will:

- describe the properties of a minimum of six iron and steel examples
- demonstrate basic understanding of how the plain carbon steel phase diagram is used by identifying the areas of the carbon steel phase diagram – melting points, critical transformation temperatures, eutectic ranges and associated microstructures.
- outline a minimum of one of the effects of work, heating, cooling, carbon and oxygen on iron/steel
- describe appropriate methods to test for grain size and type, hardness and carbon content in iron and plain carbon steel
- describe the heat treatments for restoring the grain structure, softening material for cold working, hardening and tempering
- describe the effects of at least four common alloying elements on the properties of iron and steel.

Learning aim C

For distinction standard, learners will:

- present an agreed design for a punched eye tool
- work independently and accurately selecting and using correct methods, tools and heat treatments (with reference to the plain carbon steel phase diagram) to produce the specified tool with clean, crisp profiles and surface characteristics
- apply a complex heat treatment (with reference to the plain carbon steel phase diagram) to a minimum of three selected hand tools, involving post-forging stress relief, hardening and tempering.

UNIT 2: METALLURGY AND HEAT TREATMENT

For merit standard, learners will:

- select appropriate materials, design requirements and explain heat treatments (with reference to the plain carbon steel phase diagram) for plain carbon steels for a minimum of three specified hand tools
- apply appropriate heat treatments (with reference to the plain carbon steel phase diagram) consisting of the following – annealing, normalising, hardening and tempering, cementation method
- work with minimal assistance to produce the specified tools accurately, using correct heat treatment (with reference to the plain carbon steel phase diagram) with only minor defects such as wastage, section distortion, bends or kinks.

For pass standard, learners will:

- demonstrate appropriate workshop methods to test iron and plain carbon steels (to include iron, mild steel, medium carbon steel and high carbon), using appropriate physical samples and report forms
- apply heat treatments (with reference to the plain carbon steel phase diagram) for plain carbon steel – annealing, normalising, hardening and tempering, cementation method
- recognise the following tools, their uses and design requirements for a minimum of:
 - two hammers
 - four hot punches
 - two chisel types
 - three tong varieties
 - five tong bit types
- produce examples, observation and test records for tests and heat treatments
- use tools, methods and equipment safely
- apply appropriate heat treatments when producing the following tools:
 - hot cut
 - hot punch
 - cold punch or cut tool, e.g. centre punch, cold chisel
 - case-hardened tool
 - pair of tongs
- produce tools without excessive wastage, section distortion, bends, kinks, burns, flaws and galls.

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

Toolmaking is an essential skill in the blacksmith's craft and your manager has given you the task of designing and producing specific forge tools for a large commission.

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

Alternative specified materials, tools and/or observed heat treatments can be used for any practical retake assessment. For knowledge assessments learners can apply their understanding of the plain carbon steel phase diagram by proposing appropriate heat treatments.

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.

<p>Introduction to unit The importance of metallurgy in the blacksmith's craft and introduction to the properties of materials. Suggested time: about 1 hour.</p>
<p>Activity: Carbon phase diagram Lectures and learner/group research. Suggested time: about 3 hours.</p>
<p>Activity: Materials testing Workshop-produced samples and reporting. Suggested time: about 2.5 hours.</p>
<p>Activity: Heat treatment and forging tool steel Centre punch – introduction, demonstration and skills practice. Suggested time: about 2.5 hours.</p>
<p>Activity: Tool recognition Workshop tool research and questionnaire. Suggested time: about 1 hour.</p>
<p>Activity: Basic tong making Flat bit anvil tong making – introduction, demonstration and skills practice. Suggested time: about 3 hours.</p>
<p>Activity: Toolmaking Introduction, demonstration and skills practice.</p> <ul style="list-style-type: none"> • Hot cut. • Hot punch. • Case-hardened tool. <p>Suggested time: about 5 hours.</p>

Essential resources

For this unit, learners will need access to:

- a suitably equipped forge workshop
- tool steels
- hardening and tempering media.

Links to other units

This unit has strong links to:

- Unit 1: Health and Safety in Blacksmithing
- Unit 3: Forging Processes
- Unit 4: Welding and Thermal Cutting Processes
- Unit 5: Freehand and Technical Drawing
- Unit 6: Fabrication Techniques
- Unit 7: Forge Work Construction Techniques
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- business materials as exemplars
- visiting specialist lecturers.

Unit 3: Forging Processes

Level: **2**

Unit type: **Mandatory**

Assessment type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners will develop the knowledge and techniques of fire control, forging, forming, cutting and joining. These techniques are the basis of all blacksmithing skills and are the core of the craft of the blacksmith.

Unit introduction

Fire control and forging processes are used to shape and join hot metal. They are the foundation of the blacksmithing skills used to create forged metal objects such as decorative gates and tools. This unit introduces the knowledge and techniques that are the basis of all blacksmithing skills.

You will develop the knowledge and skills required to work safely when controlling a forge hearth and for using the forging processes to shape, cut and join metal. These skills include: recognition and safe use of common forge tools and equipment, control of the forge hearth and forging heats, including knowledge of fuels and areas of the fire.

On completion of this unit, you will have the knowledge and experience to be able to enter a working forge and confidently use a forge hearth, undertaking core blacksmithing forge processes. You will be able to apply your skills to job roles in the blacksmithing sector, such as blacksmith, general metalworker, welder/fabricator and farrier.

Learning aims

In this unit you will:

- A** Understand heating methods and fire control during forging processes
- B** Carry out hot forging and forming techniques
- C** Carry out hot cutting and joining techniques.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand heating methods and fire control during forging processes	A1 Fuel types and their properties A2 Forge hearth, furnace and gas torch design A3 Forging heats and their uses	Learners will produce worksheets and written evidence, with information on fuels, types of equipment (hearth, furnace and gas torch) and heats used for forging processes.
B Carry out hot forging and forming techniques	B1 Forging and forming tools and equipment B2 Forging and forming techniques	Practical evidence of working to specification. Observation of practical forging, forming, hot cutting and joining techniques. Reports and records of investigations.
C Carry out hot cutting and joining techniques	C1 Tools and equipment C2 Cutting and joining techniques	Worksheets to show evidence of selection of tools, equipment and practical skills and techniques used in forging processes. Written evidence of tool recognition for forging and forming, and cutting and joining.
Key teaching areas in this unit include:		
Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> Working to specification Safe work practice Use of appropriate PPE Working in a forge environment 	<ul style="list-style-type: none"> Hearth control Tool recognition 	<ul style="list-style-type: none"> Communication Problem solving Working with others

Unit content

Knowledge and sector skills

Learning aim A: Understand heating methods and fire control during forging processes

A1 Fuel types and their properties

Learners will examine the types and characteristics of various fuels.

- Solid fuel types, e.g. coke, coal, charcoal.
- Gas fuel types, e.g. oxygen and propane, oxygen and acetylene, air and propane.
- Characteristics – heat value, ease of use, modes of supply, relative cost.

A2 Forge hearth, furnace and gas torch design

- Solid fuel hearth design:
 - side blast
 - bottom blast
 - advantages and disadvantages, with reference to ease of operation, control of areas of the fire efficiency, accessibility and portability.
- Gas fuel systems – furnaces and gas torches:
 - furnace design
 - propane and air furnace
 - forced air blast and Venturi systems
 - lining types and their properties (reflective, refractive)
 - advantages and disadvantages, with reference to ease of operation, control of areas of the fire, efficiency, accessibility and portability.
- Gas heating torch design:
 - oxygen and propane
 - oxygen and acetylene
 - advantages and disadvantages, with reference to ease of operation, control of areas of the fire efficiency, accessibility and portability.

A3 Forging heats and their uses

- Visual identification:
 - visible heat colours and related temperatures (white, yellow, orange, red, black) for, e.g. forging, bending, punching, surface finishing, forge welding, point of scale formation, brush cleaning
 - spot and long heats for, e.g. point bending, long bends, punching, twisting, fire welding, upsetting
 - maximum and minimum forging heats recognised by colour for material types (iron, common plain carbon steels).
- Areas of the fire:
 - oxidising
 - neutral
 - reducing/carburising.
- Fuel air mix and its effects on heating areas:
 - recognition, control and effects of reducing (carburising), neutral and oxidising areas.
- Effects of excess air, excess time and overheating on iron and plain carbon steel, e.g. scaling, wastage, oxidation/burning, grain growth, melting.

UNIT 3: FORGING PROCESSES

- Efficient fire control methods for the solid fuel forge hearth to include:
 - fire size
 - air blast control
 - pre-heating of solid fuel.
- Safe start up, operation and shut down of the solid fuel hearth – equipment checks, fire lighting, hearth control systems, pre-heating of fuel and fire maintenance, safe shut-down procedures.

Learning aim B: Carry out hot forging and forming techniques**B1 Forging and forming tools and equipment**

- Hand tools, such as:
 - tongs of appropriate type to safely hold hot material when forging
 - hand hammers for forging and bending operations, e.g. ball face, cross peen, ball peen, sledgehammer (for smith and striker work), soft mallet (leather, copper, wood)
 - top and bottom tools for forging, bending operations, e.g. sett hammers and blocks, flatter, swages, fullers, handheld, wire handled, hafted and spring, twisting wrenches, scroll wrench and anvil horns, dishing blocks.
- Forge workshop equipment such as:
 - anvil, e.g. for most hand forging operations
 - leg vice, e.g. for holding stock and tools
 - power hammer, e.g. for forging heavy sections
 - solid fuel forge hearth for heating
 - swage block, e.g. for swaging, bending.

B2 Forging and forming techniques

Learners will develop the skills and techniques needed to carry out forging and forming techniques with reference to given specifications.

- Working to specifications, such as:
 - workshop samples, e.g. copying examples of forged elements' written specifications, e.g. written description containing information such as material type, product type, tolerances, finish/surface quality
 - drawings, e.g. blacksmith, fabrication and engineering drawings
 - templates, e.g. bending jigs, sheet steel profiles.
- Forging techniques, such as:
 - drawing down, e.g. stretching material along its length by forging
 - setting down, e.g. creating a sudden change in section
 - spreading, e.g. widening and thinning material from thicker stock
 - upsetting, e.g. shortening and thickening material
 - transitions, e.g. distance of change in material section
 - set points, e.g. point of sudden change in material section
 - section changes, e.g. creating different sections by forging
 - fullering, e.g. using shaped tools to create accurate shaped setts or bends in material
 - swaging, e.g. using tools with shaped depressions to shape material.
- Use forming techniques, such as:
 - bending, e.g. folding or curving in relation to the mean line of the material
 - twisting, e.g. rotating the material in relation to the mean line
 - dishing, e.g. depressing the surface of sheet material to create a hollow form.

- Control forging and forming faults, such as:
 - burns
 - flaws
 - galls
 - irregular or deformed sections
 - bends
 - twists
 - kinks.
- Safe working practices when forging and forming metal:
 - use of PPE, e.g. boots, safety glasses, fire-resistant clothing, ear protection.
- Safe forging and forming techniques with reference to appropriate risk assessment, e.g. cooling off tools and materials, awareness of others, correct use of cutting and joining tools.
- Equipment and tool checks to include:
 - excessive wear
 - faults
 - damage.

Learning aim C: Carry out hot cutting and joining techniques

C1 Tools and equipment

Learners will use tools and equipment to carry out cutting and joining techniques.

- Hand tools, such as:
 - tongs of appropriate type to safely hold hot material when punching and cutting
 - hammers for cutting and punching operations, e.g. hand hammers, sledge hammer(for smith and striker work)
 - top and bottom tools, e.g. taper punches (round, square, slot, slitter), chisels (straight, curved), hot set/sate, drifts, soft cutting plates, bolsters, snaps, monkeys, headers, hold fasts/dogs, handheld, wire handled, hafted and spring.
- Equipment, such as:
 - anvil, e.g. for most hand forging operations
 - leg vice, e.g. for holding stock and tools
 - power hammer, e.g. for striking top cutting tools
 - solid fuel forge hearth for heating, e.g. spot heating when punching
 - swage block, e.g. for punching.

C2 Cutting and joining techniques

Learners will develop the skills and techniques needed to carry out hot cutting and joining with reference to given specifications.

- Working to specification, such as:
 - workshop samples, e.g. copying examples of cut and joined elements
 - written specifications, e.g. written description containing information such as material type, product type, tolerances, finish/surface quality
 - drawings, e.g. blacksmith, fabrication and engineering drawings
 - templates, e.g. hole templates.
- Marking out to include:
 - placement
 - allowances (stretch, shrinkage).
- Hot cutting techniques:
 - punching and drifting, e.g. round, slot (oval, oblong), square
 - chiselling, e.g. slitting, splitting, straight, curved, sloping, upright.

UNIT 3: FORGING PROCESSES

- Control cutting faults, such as:
 - drag, i.e. use of correct heat, sharp tools
 - profile of cut, i.e. cut type (sloping/upright), control of ragging and distortion
 - hole placement, size and shape, i.e. dimensions, position in the stock, profile
 - wastage, i.e. over stretching/overworking, overheating, burning.
- Hot joining techniques:
 - riveting, i.e. rivet types (dome head), heading allowances for hot and cold riveting
 - forge welding, e.g. straight scarf, collar, lap, faggot, fluxes, conditions for welding.
- Control joining faults, such as:
 - distortion of the joint components
 - profile material after welding, i.e. allowing for wastage and stretch
 - control hole placement, size and shape, i.e. dimensions, position in the stock, profile
 - control of wastage, i.e. over stretching/overworking, overheating, burning.
- Safe working practices when cutting and joining metal:
 - use of PPE, e.g. boots, safety glasses, fire-resistant clothing, ear protection
 - safe cutting and joining techniques with reference to appropriate risk assessment, e.g. cooling off tools and materials, awareness of others, correct use of cutting and joining tools
 - equipment and tool checks to include:
 - excessive wear
 - faults
 - damage.

Transferable skills

Communication

- Writing reports – process sheets.

Problem solving

- Working to specification.

Working with others

- Safe working practice in a workshop environment.
- Use of appropriate PPE.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand heating methods and fire control during forging processes		
A.P1 Describe fuel types for use with solid fuel forge, gas furnace and gas heating torch.	A.M1 Explain the fuels used in relation to the design of forges, furnaces and gas heating torches, with reference to the heat produced.	A.D1 Analyse the fuel types used in relation to the design of forges, furnaces and gas heating torches, with reference to types of heat produced, comparing and contrasting the factors that influence the types of heating equipment used.
A.P2 Describe the key features and functions of forging heats and areas of the fire.		
Learning aim B: Carry out hot forging and forming techniques		
B.P3 Select and use forging tools and equipment safely to forge metal.	B.M2 Carry out appropriate selection of tools and equipment, and use forging and forming techniques effectively in response to the specification.	B.D2 Confidently and competently carry out selection of correct tools, and equipment, and accurate application of forging and forming techniques in response to the specification.
B.P4 Select and use forming tools and equipment safely to form metal.		
Learning aim C: Carry out hot cutting and joining techniques		
C.P5 Select and use cutting tools and equipment safely to cut metal.	C.M3 Carry out appropriate selection of tools and equipment and use cutting and joining techniques effectively in response to the specification.	C.D3 Confidently and competently carry out selection of correct tools, and equipment, and accurate application of cutting and joining techniques in response to the specification.
C.P6 Select and use joining tools and equipment safely to join metal.		

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will:

- compare and contrast the characteristics of different fuel types used with forges, furnaces and heating torches with reference to types of heat produced and uses
- compare the characteristics of a minimum of two solid and one gaseous fuel with regard to heat value, ease of use, modes of supply and relative cost, with reference to appropriate examples
- present the advantages and disadvantages of the solid fuel hearth, gas furnace and gas torch, using examples with regard to access, control, efficiency and function
- present work to a high standard using correct terminology and presentation techniques.

For merit standard, learners will:

- present the names of fuel types used with forges, furnaces and heating torches, with reference to heat produced
- provide information on two solid and one gaseous fuel with regard to heat value, ease of use, modes of supply and relative cost
- describe in detail the effects of the areas of fire – oxidising, neutral, carburising/reducing
- describe the effects of excess air, excess time and overheating on iron and plain carbon steel
- present information on efficient fire control methods for solid fuel, gas furnaces and gas torch with reference to fuel air mix and control systems
- describe in detail the differences in lining types for the gas furnace and their effects on heating, i.e. reflective and refractive
- show understanding of a gas furnace design for either forced air blast or venture systems, covering control systems and air/gas delivery
- show understanding of a solid fuel hearth design for either bottom or side blast, covering control systems and air delivery
- present work to a satisfactory standard using correct terminology.

For pass standard, learners will:

- outline a minimum of four different fuel types and their properties for solid and gaseous fuels
- identify forging heats, i.e. white, yellow, orange, red, black and give one use for each
- identify the areas of the fire – oxidising, neutral, carburising/reducing and their effects
- describe the design of a solid fuel hearth – side blast or bottom blast
- describe safe start up, operation and shut down of the solid fuel hearth
- describe efficient fire control methods
- present work with appropriate use of terminology.

Learning aim B

For distinction standard, learners will:

- confidently select and use appropriate tools and equipment confidently, when carrying out forging and forming techniques
- forge and form metal without burns flaws and galls with clean, crisp sections, minimal surface imperfections and scaling
- work independently, accurately and safely, to/or exceeding specification requirements.

UNIT 3: FORGING PROCESSES

For merit standard, learners will:

- select appropriate selection of tools and equipment for forging and forming
- forge and form metal with minimal section distortion, bends, twists, kinks, burns flaws and galls
- carry out a minimum of four forging techniques from the following – setting down, swaging, fullering, drawing down, upsetting and spreading
- carry out a minimum of two forming techniques from the following – bending, twisting, dishing
- work with minimal assistance, to specification requirements.

For pass standard, learners will:

- demonstrate understanding of forging and forming tools and equipment and their uses with reference to:
 - a minimum of six different tong types
 - a minimum of three hand hammers
 - a minimum of six top and bottom tools
- describe aspects of general forge workshop equipment and their uses for forging and forming techniques, all of the following:
 - anvil
 - blacksmith leg vice
 - swage block
- select correct tools and equipment for forging and forming
- carry out one forming and two forging techniques
- safely forge and form metal without excessive (i.e. still fit for purpose) section distortion, bends, twists, kinks, burns flaws and galls, using hand tools and equipment safely
- work with some assistance, to specification requirements.

Learning aim C

For distinction standard, learners will:

- confidently select and use appropriate tools and equipment confidently, when carrying out cutting and joining techniques
- cut and join metal without burns, flaws and galls with clean, crisp sections, minimal surface imperfections, wastage and scaling
- work independently, accurately and safely, to/or exceeding specification requirements.

For merit standard, learners will:

- select appropriate tools and equipment for cutting and joining
- cut and join metal with minimal section distortion, bend kinks, burns flaws and galls. Cutting and joining techniques, to include:
 - punching and drifting a minimum of two types of hole; round, slot (oval, oblong), square. tools, allowances for stretch/shrinkage
 - chiselling a minimum of two cut types – slitting, splitting, straight, curved, sloping, upright
 - riveting, i.e. rivet types (dome head), heading allowances for hot and cold riveting, tools
 - forge welding, a minimum of two weld types – straight scarf, collar, lap, faggot, fluxes, conditions for welding, allowances for stretch and material wastage
- work safely with minimal assistance, to specification requirements.

For pass standard, learners will:

- demonstrate basic understanding of the tools and equipment used for cutting and joining tools and equipment appropriate to task and their uses:
 - a minimum of eight top and bottom tools from the following: taper punches (round, square, slot, slitter) chisels (straight, curved), hot sate, drifts, cutting plates, bolsters, snaps, monkeys, headers, handheld, wire handled, hafted and spring
- demonstrate understanding of general forge workshop equipment and their uses for cutting and joining techniques from all of the following:
 - anvil
 - blacksmith leg vice
 - swage block
- select correct tools and equipment for cutting and joining
- carry out two cutting and two joining techniques
- safely cut and join metal without excessive (i.e. still fit for purpose) section distortion, bends, kinks, burns flaws and galls, using hand tools and equipment safely
- work safely with some assistance, to specification requirements.

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

A client has come into the forge and asked for a mirror frame to be made for a present for a family member. The client has provided a sketch of the frame that she wants and your boss has produced a working drawing of the frame showing split work, riveted corners and a forge-welded flower that has chisel detailing for you to work to.

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

Your boss has come into the forge and asked you to make, for a job that is about to start, a specific size of hollow bit bolts tongs with fire-welded reins.

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

Unit overview, using examples of blacksmithing tools, equipment and processes.

Suggested time: 1 hour.

Activity: The forge hearth

Tutor demonstration and learner practice of safe set up, operation and shut down of the forge hearth.

Use of scrap materials of different type, for example iron, mild steel, tool steel, high carbon steel to test heat ranges and fire control.

Suggested time: about 2 hours.

Activity: Forging and forming practice

Produce a series of basic forging and forming samples in different light sections, e.g. section sets and changes, points, rings, eyes, figure 8. Cut off and repeat. With associated process sheets describing process tools and materials used.

Suggested time: about 8 hours.

Activity: Cutting and punching sample

Tie ring – produce tie bar with upset end – punched and drifted hole and chisel split on the other end with bent split ring attached through the hole. With associated process sheets describing process tools and materials used.

Suggested time: about 4 hours.

Activity: Controlled punching sample

Produce cross-rail sample for a gate or railing with multiple holes of differing sizes and process, and investigate accuracy of placement and amounts of stretch, shrinkage/wastage etc., associated with each process.

Suggested time: about 4 hours.

UNIT 3: FORGING PROCESSES

Essential resources

For this unit, learners will need access to:

- a suitably equipped forge workshop
- blacksmithing materials and hand tools.

Links to other units

This unit has strong links to:

- Unit 1: Health and Safety in Blacksmithing
- Unit 2: Metallurgy and Heat Treatment
- Unit 4: Welding and Thermal Cutting Processes
- Unit 5: Freehand and Technical Drawing
- Unit 6: Fabrication Techniques
- Unit 7: Forge Work Construction Techniques
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- guest speakers
- business materials as exemplars.

Unit 4: Welding and Thermal Cutting Processes

Level: **2**

Unit type: **Mandatory**

Assessment type: **Internal**

Guided learning hours: **45**

Unit in brief

Learners will develop the knowledge and skills needed to be able to set up and carry out selected welding and thermal cutting processes.

Unit introduction

Welding and thermal cutting processes are frequently used in metalwork manufacturing and engineering. It is essential to ensure that welded joints and cuts meet recognised industry quality requirements within selected British BS EN ISO 9606 standards.

In this unit, you will be given the opportunity to develop knowledge and understanding of welding and thermal cutting processes used in industry. You will develop an understanding of the importance of workshop safety and the safe use of hand tools, machinery, welding and cutting equipment as well as knowledge of processes and materials.

You will develop skills in interpreting written, graphical and verbal instructions while carrying out practical tasks. You will develop an understanding of welding specifications and drawings, applying them to processes such as fusion welding, distortion control, thermal cutting and quality control methods to selected BS EN ISO 9606 standards.

This unit gives you the skills that are essential for progression to industries such as blacksmithing, fabricating, welding and farriery. They also allow you to progress to other metalworking industries such as working with sheet metal, structural steel fabrication, agricultural and motor vehicle repairs.

Learning aims

In this unit you will:

- A** Understand welding and thermal cutting processes with regard to methods, equipment and materials in the metalworking industry
- B** Carry out a selected thermal cutting process for shaping, cutting and stock removal of metals
- C** Carry out a selected welding process for joining metals in the metalworking industry.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand welding and thermal cutting processes with regard to methods, equipment and materials in the metalworking industry	A1 Thermal cutting processes A2 Welding processes	Written assignments that test underpinning knowledge of thermal cutting and welding processes. Workbooks with pictorial content identifying, for example, faults, equipment and materials. Oral question and answer session between the tutor and learners on thermal cutting and welding processes.
B Carry out a selected thermal cutting process for shaping, cutting and stock removal of metals	B1 Preparation for thermal cutting process B2 Thermal cutting process	Worksheets/books/portfolios recording and reporting on, for example process, materials, settings, sample test results and specifications.
C Carry out a selected welding process for joining metals in the metalworking industry	C1 Preparation for welding process C2 Welding process	Practical weld and cutting test samples, along with accompanying test report records. Observations of practical work and authenticated photographic evidence.
Key teaching areas in this unit include:		
Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Safe use of hand tools and machinery • Safe use of welding and cutting equipment • Carry out set welding and cutting tasks • Carry out testing methods • Able to understand and apply welding and thermal cutting specifications • Measuring and marking out • Produce welds and cuts to selected BS EN ISO 9606 standards • Safe handling and use of consumables and materials 	<ul style="list-style-type: none"> • Able to identify weld and thermal cut defects • Able to identify destructive and non-destructive tests on welds • Able to identify consumables, materials tools and equipment • Set up, operation and shut down of tools and equipment • Safe working in a welding workshop environment 	<ul style="list-style-type: none"> • Communication • Problem solving • Self-management and development • Thinking skills/adaptability • Working with others

Unit content

Knowledge and sector skills

Learning aim A: Understand welding and thermal cutting processes with regard to methods, equipment and materials in the metalworking industry

A1 Thermal cutting processes

Learners will develop an understanding of thermal cutting processes, cut types and working to specification.

- Types of thermal cutting tools and equipment and their uses:
 - plasma arc – suitable for cutting ferrous and non-ferrous materials of various sizes, used mainly in the workshop
 - the chemistry of plasma arc, e.g. creation of a superheated plasma stream to melt conductive metals
 - oxy fuel – suitable for cutting ferrous materials (iron, steel, cast iron, some steel alloys) and which can be used in the workshop or on site
 - the chemistry of oxy fuel metal cutting, e.g. use of the exothermic reaction of oxidation and excess oxygen to promote the process, oxidation of material rather than melting
 - safe set up, operation and shut down of equipment
 - cutting attachments – circle cutter, motorised straight line cutter, templates, straight edge, angled edge
 - materials and consumables – recognition, storage and use
 - cutting speeds and their effects on cut quality
 - defects and control methods
 - cut profile/angle – upright, bevelled
 - cut types – straight, curved, irregular
 - health and safety issues and their control when thermal cutting, e.g. in relation to storage and use of gases
 - working to specifications, dimensions, tolerances.
- Quality control in thermal cutting:
 - examination methods (visual observation of cut quality to recognise defects)
 - defect recognition:
 - cutting speed too slow – melted and rounded top edge
 - cutting speed too fast – top edge not sharp and may be undercut
 - pre-heating flame too low – rough gouging
 - pre-heating flame too high – rounded top edge with melted metal falling into kerf
 - nozzle too high – excessive melting of top edge
 - irregular torch travel – uneven drag lines.
- Types of cut (only in the flat position):
 - curved (upright profile)
 - straight (upright profile and bevelled profile)
 - irregular shaped (to drawing or templates, cut profile as specified).

UNIT 4: WELDING AND THERMAL CUTTING PROCESSES

A2 Welding processes

Learners will develop an understanding of the four main types of welding processes, manual metal arc welding (MMA), metal active gas shielded welding (MAG), tungsten inert gas shielded welding (TIG), oxyacetylene gas welding.

- Welding process:
 - manual metal arc welding (MMA) – suitable for welding materials 3 mm and above, can join mild steel, stainless steel, cast iron, high tensile steel and dissimilar metals and can also be used for hard-facing materials
 - metal active shielded gas welding (MAG) – suitable for welding thin sheet and thick plate mainly in mild steel, has the advantage of being the quickest of the processes so is much used in production steel work
 - tungsten inert gas welding (TIG) – suitable for thick and thin plate in mild steel, stainless steel and aluminium, produces high-quality welds with minimum distortion and contamination issues and can be used to join a variety of materials
 - oxyacetylene gas welding – suitable for thin and thick plate in mild steel, high tensile steel, cast iron, stainless steel aluminium, copper, bronze and lead.
- Process types and common industry applications:
 - MAG and TIG are welding processes mainly suitable for workshop or sheltered use because of the requirement to maintain a gas shield for the hand torch tip
 - MMA can be used in the workshop and is also the most common on-site welding process because of its portability and ability to weld different materials in difficult conditions
 - oxyacetylene welding is used for on-site work and in the workshop and can also be used to weld many dissimilar materials, as well as for soldering, brazing and lead welding.
- Understand the application of a selected welding process for welding in different positions:
 - materials, consumables, tools and equipment – recognition, storage and use
 - safe set up, operation and shut down of equipment
 - flat and horizontal positions
 - joint types – butt and fillet
 - distortion control – tack welding, clamping, restraint, wedges, strong backs, pre-setting, pre-heating, sequence welding, e.g. back-step and skip welding
 - consumables, materials, tools and equipment
 - distortion control
 - testing methods (visual, destructive, non-destructive, recording results)
 - health and safety issues and their control when welding – fume, fire/explosion, hot work, ultraviolet light
 - welding symbols
 - specifications, dimensions, tolerances.
- Quality control in welding:
 - weld defects and their causes, e.g. inclusions, poor weld profile, undercut
 - defect recognition
 - visual examination of weld defects
 - destructive testing following visual examinations, to include macro etch to test for penetration, nick break test to test for fusion, bend test to test the strength of the weld and all internal assessments of the weld (welds must be cut open).
- Non-destructive testing following visual examinations, to include dye penetrant testing, magnetic particle to test for surface defects (no cutting of the welds required):
 - recording and reporting weld test results.

Learning aim B: Carry out a selected thermal cutting process for shaping, cutting and stock removal of metals

B1 Preparation for thermal cutting process

- Use specifications, drawings and templates to select and prepare materials.
- Select and safely set up, operate and shut down of equipment for either oxy/fuel or plasma arc cutting.
- Use one thermal cutting process from: oxy-fuel, plasma arc.
- Select, set up and shut down tools and equipment as appropriate to the thermal cutting process:
 - oxy-fuel cutting equipment, e.g. cutting torch, cylinders, different-sized cutting nozzles, oxygen regulator, fuel gas regulator, flashback arresters, hoses, mixer, nozzle cleaners, cutting table with dross catcher, pliers, tongs and cutting jigs/clamps and fume extraction
 - check all oxyacetylene equipment for safety before use:
 - regulators
 - flashback arresters
 - hoses
 - non-return valves
 - torch/mixer unit
 - nozzles
 - check cylinders and equipment for any leaks
 - set gas pressures
 - select appropriate nozzle size
 - extraction
 - plasma arc cutting equipment, e.g. plasma unit, leads, cutting torch, cutting table with dross catcher, compressor, pliers, tongs and cutting jigs/clamps and fume extraction
 - check plasma arc cutting equipment for safety before use:
 - plasma unit
 - set voltage
 - set air pressure
 - check tip for wear or damage
 - check shroud for condition and position
 - all leads
 - plasma torch
 - compressor and airline
 - extraction.

B2 Thermal cutting process

- Learners will apply a selected thermal cutting process using a range of techniques.
- Manage consumables, tools and equipment, e.g. storage, set up, handling, use, shut down.
- Use thermal cutting equipment to produce cuts to specification and control negative outcomes such as:
 - rounded top edge
 - top edge undercut
 - bad gouging of the surface
 - excessive melting of top edge
 - melted metal falling into the cut (kerf)
 - strongly attached dross congealed on underside of cut
 - irregular, uneven or sloping drag lines

UNIT 4: WELDING AND THERMAL CUTTING PROCESSES

- notched or uneven line of cut
- inaccurate line of cut
- rough cut profile
- incorrect angle of cut.
- Quality control in thermal cutting:
 - visual examination of cut defects
 - recording and reporting weld test results
 - cut profile: upright, bevelled
 - cut types: straight, curved, irregular
 - recognise and control thermal cutting defects
 - specifications to set dimensions, tolerances.
- Types of cuts (only in the flat position):
 - curved (upright profile)
 - straight (upright profile and bevelled profile)
 - irregular shaped (to drawing or templates, upright profile).
- Materials:
 - mild steel
 - minimum thickness 3 mm, maximum 12 mm.
- Health and safety:
 - use safe thermal cutting process
 - risk assessments on specified welding and cutting process
 - safe start-up and shut-down procedures for specified equipment.

Learning aim C: Carry out a selected welding process for joining metals in the metalworking industry

C1 Preparation for welding process

- Recognise welding drawing symbols, e.g. weld position, profile, length.
- Consumable classifications (types) as appropriate for selected welding process, i.e. heat source, fillers, welding shrouding methods.
- Select, set up and shut down tools and equipment as appropriate to the welding process:
 - welding unit
 - electrode holders
 - welding torches
 - return leads
 - clamps
 - gas
 - electrodes
 - filler wires
 - chipping hammer
 - tongs
 - pliers
 - side cutter(snips)
 - wire brush
 - gas nozzle cleaners (reamers)
 - spark lighter
 - gas nozzles.

C2 Welding process

Learners will apply a welding process using a range of techniques.

- Types of weld:
 - butt welds in flat and horizontal positions
 - fillet welds in flat and horizontal positions.
- The welds must be fit for purpose and meet set criteria to selected BS EN ISO 9606 standards:
 - ensure that majority of slag and weld spatters are removed
 - no grinding on the root and face side of the weld
 - test piece to have at least one stop and start in the root run and in the capping run (stop and restart in the root run and capping run are identified)
 - removal of minor imperfections by grinding (except for the capping run, for which only grinding of restarts is allowed)
 - the test piece shall be a minimum of 200 mm in length
 - weld profile and dimensions as specified (determined by process choice), e.g. leg length, throat thickness, profile
 - material type – mild steel
 - material thickness as appropriate for selected process – TIG and oxyacetylene less than 5 mm. MAG and MMA 5 mm and above to a max of 12 mm.
- Quality control in welding:
 - visual examination of welds
 - destructive testing of welds
 - non-destructive testing of welds
 - recording and reporting weld test results.
- Health and safety:
 - safe welding process
 - risk assessments on specified welding and cutting process
 - safe start-up and shut-down procedures for specified equipment
 - safe weld testing when using testing equipment and chemicals.

Transferable skills**Communication**

- Verbal communication, written reports/records, assignments and workbooks, use of pictorials.

Problem solving

- Welding and cutting equipment set up, welding and cutting defects, measuring and marking out correctly.

Self-management and development

- Time management, meet deadlines and work towards achieving higher grades.
- Independent working.

Thinking skills/adaptability

- Planning an activity to complete a task, designing, measuring and marking out, reading drawings and controlling distortion correctly.

Working with others

- Group activities, supporting other learners, one-to-one support.

Assessment criteria

Pass	Merit	Distinction	
Learning aim A: Understand welding and thermal cutting processes with regards to methods, equipment and materials in the metalworking industry			
A.P1 Describe thermal cutting processes with reference to processes and cut types.	A.M1 Explain thermal cutting and welding processes with reference to the quality of the finished cut and weld.	A.D1 Analyse the relationship between thermal cutting and welding processes, and how it affects the quality of the finished weld.	
A.P2 Describe welding processes with reference to processes and weld types.			
Learning aim B: Carry out a selected thermal cutting process for shaping, cutting and stock removal of metals			
B.P3 Carry out appropriate preparation for thermal cutting with reference to specification.	B.M2 Demonstrate effective preparation and use of thermal cutting techniques with accurate reference to specification.	BC.D2 Demonstrate with confidence the preparation and controlled use of safe thermal cutting and welding techniques to produce a construction with accurate reference to specification.	
B.P4 Demonstrate appropriate use of thermal cutting techniques.			
Learning aim C: Carry out a selected welding process for joining metals in the metalworking industry			
C.P5 Carry out appropriate preparation for welding processes with reference to specification.	C.M3 Demonstrate effective preparation and use of welding techniques with accurate reference to specification.		
C.P6 Demonstrate appropriate use of welding techniques.			

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will:

- demonstrate comprehensive understanding of the relationship between thermal cutting and welding processes with reference to examination methods and the quality of the finished product when working to selected BS EN ISO 9606 standards
- present detailed information on the control methods for weld defects, with reference to weld quality, distortion control, for example gap setting, clamping, tack welding, sequence welding
- present detailed information on the control methods for cut defects, with reference to cut quality, distortion control, for example clamping, use of templates, cutting attachments, pre-heating.

For merit standard, learners will:

- demonstrate understanding of different types of welding and thermal cutting processes, explaining why they are suited for common industrial applications, different materials and thicknesses
- present the causes of cut and weld defects, with reference to control methods.

For pass standard, learners will:

- demonstrate understanding of a minimum of two thermal cutting processes, equipment and consumables, with reference to cut profile, cut types, angles, cutting speeds, defects and control methods
- present information on a welding process, equipment and consumables, with reference to flat and horizontal positions, material thickness, butt and fillet joints, defects and control methods.

Learning aims B and C

For distinction standard, learners will:

- independently set up equipment and prepare materials for thermal cutting and welding
- cut out one irregular shape (upright profile) to an agreed template and required quality standard using thermal cutting equipment
- visually assess cuts and welds, identifying any cutting and welding defects and making recommendations for improvement
- competently produce a thermal cut and welded construction using a minimum of three welds to join a minimum of four plates together, in appropriate material sections for selected process, and two different types of joints using the horizontal and flat positions to selected BS EN ISO 9606 standards.

For merit standard, learners will:

- set up equipment and prepare materials for thermal cutting and welding
- cut two curved shapes in two thicknesses to required quality standard using thermal cutting equipment to produce curved cut (upright profile)
- visually assess cuts and welds, explaining any defects
- produce a butt weld flat and (T) fillet horizontal to selected BS EN ISO 9606 standards
- use distortion control methods when welding in the flat and horizontal positions.

UNIT 4: WELDING AND THERMAL CUTTING PROCESSES

For pass standard, learners will:

- safely set up, operate equipment and prepare materials for thermal cutting and welding.
- work from drawings and/or specification
- use thermal cutting to produce one straight bevel cut on plate and produce two straight cuts (upright profile) in two thicknesses, to selected BS EN ISO 9606 standards
- visually assess cut and welds and identify any cutting and welding defects and record evidence
- carry out two destructive and non-destructive testing on welds
- produce one open corner flat weld sample and one (T) fillet weld sample in flat material to selected EN ISO 9606 standards
- use two control methods to control distortion, e.g. tack welding, pre-setting, clamping.

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

Welders often have to update their qualifications by taking regular assessments where they have to produce and then test welds and thermal cut samples. You have been asked to produce cut and weld samples to ensure that your skills are still current and at the correct standard.

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

The cut and weld samples produced for the previous scenario can be varied in thickness and position to allow for fair but varied assessment conditions.

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.

<p>Introduction to unit Outline of the importance of welding and thermal cutting to the blacksmithing industry. Suggested time: about 1 hour.</p>
<p>Activity: Welding health and safety Introduction to welding health and safety and the safe set up practice of welding equipment, consumables and materials. Suggested time: about 2 hours.</p>
<p>Activity: Welding process 1 Practise consistent weld deposition by laying down multiple welds in the flat position on 100 mm square plate to fill the surface and then produce multiple layers. Suggested time: about 3 hours.</p>
<p>Activity: Welding process 2 Select welding process to produce weld samples in one position to selected BS EN ISO 9606 standards, control distortion and work from drawings. Suggested time: about 6 hours.</p>
<p>Activity: Thermal cutting process Thermal cutting, produce curved and straight line cuts to specifications that are fit for purpose. Suggested time: about 8 hours.</p>
<p>Activity: Testing methods Introduction to, and the practice of, safe operation and use of destructive and non-destructive testing methods. Suggested time: about 2 hours.</p>
<p>Activity: Welding representations Introduction to and interpretation of welding drawings, weld symbols, dimensions and tolerances. Suggested time: about 4 hours.</p>

Essential resources

For this unit, learners will need access to:

- appropriately equipped welding and thermal cutting workshop and materials
- BS EN ISO 9606 quality control standards for welding
- BS EN ISO 9606 quality control standards for thermal cutting.

Links to other units

This unit has strong links to:

- Unit 1: Health and Safety in Blacksmithing
- Unit 2: Metallurgy and Heat Treatment
- Unit 3: Forging Processes
- Unit 5: Freehand and Technical Drawing
- Unit 6: Fabrication Techniques
- Unit 7: Forge Work Construction Techniques
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- guest speakers
- business materials as exemplars
- workshop visits.

Unit 5: Freehand and Technical Drawing

Level: **2**

Unit type: **Optional**

Assessment type: **Internal**

Guided learning hours: **30**

Unit in brief

Learners will be introduced to the core drawing skills essential for gaining and communicating dimensional and structural information when making work or when presenting ideas to clients.

Unit introduction

In this unit, you will gain an understanding of the drawing types that are used as part of the design process, in the production of work or to describe products to a client, and develop the ability to produce them. You will learn about freehand and technical drawing and the various conventions that govern the production of drawings, specifications and templates, such as scaling, dimensions, projections, developments, diagrams and general information. You will develop the associated drawing skills, such as using drawing equipment, producing line and tone, and sight sizing.

On completion of this unit, you will be able to produce drawing and visual information that supports the design and making process and be able to communicate ideas or information. You will be able to apply the skills you gain in this unit to job roles in the blacksmithing sector such as blacksmith, general metalworker, welder/fabricator and farrier.

Learning aims

In this unit you will:

- A** Understand the purpose of freehand and technical drawing techniques
- B** Carry out freehand drawing skills used for designing and presentation of ideas
- C** Carry out technical drawing skills used for blacksmithing, engineering and fabrication constructions.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand the purpose of freehand and technical drawing techniques	A1 Freehand drawing A2 Technical drawing	Written evaluation of the reasons for and the relevant merits of freehand, blacksmithing, engineering and fabrication drawing.
B Carry out freehand drawing skills used for designing and presentation of ideas	B1 Materials and equipment B2 Freehand drawing skills and techniques	Portfolio of evidence such as a sketchbook of observed drawings, line and tone experiments. Produce drawings, e.g. engineering, fabrication, and blacksmithing construction drawings.
C Carry out technical drawing skills used for blacksmithing, engineering and fabrication constructions	C1 Materials and equipment C2 Technical drawing skills and techniques	Produce templates, e.g. radial and parallel line.
Key teaching areas in this unit include:		
Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Produce freehand and technical drawing • Understand and use technical drawings 	<ul style="list-style-type: none"> • Understand the purpose of freehand and technical drawing techniques 	<ul style="list-style-type: none"> • Communication • Managing information • Thinking skills/adaptability

Unit content

Knowledge and sector skills

Learning aim A: Understand the purpose of freehand and technical drawing techniques

Learners will explore the purpose of blacksmithing freehand and technical drawing types and methods for designing, constructing and presenting information.

A1 Freehand drawing

- Types:
 - observed, e.g. collecting visual information, exploring surface, shape and composition
 - design sketching, e.g. when exploring a variety of design ideas
 - development of ideas, e.g. when clarifying design intentions, exploring changes to scale, proportion
 - presentation/illustration, e.g. presenting a design in a recognisable format to a client, to accompany a technical drawing that illustrates final construction.
- Methods:
 - sight sizing – transferring observed size, scale onto a drawing
 - perspective – describing perceived shape using 1-, 2- and 3-point perspective
 - use of line, tone and colour – describing shape and surface
 - scaling – drawing objects of differing sizes on paper.

A2 Technical drawing

Learners will investigate visual and technical information, producing workshop specifications and developing templates.

- Types:
 - engineering – orthographic drawing and pictorials
 - fabrication – parallel line, radial line drawing and sheet metal development
 - blacksmithing – construction drawing and accurate representational drawing.
- Methods:
 - drawing layout and title blocks providing supporting information following recognised industrial conventions
 - orthographic drawing – 1st- and 3rd-angle views to accurately convey information on the shape and size of solid objects
 - pictorials – oblique and isometric
 - line precedence and type, following industrial conventions for drawing and dimensioning
 - dimensioning, i.e. types of dimension systems, including illustrating sections
 - parallel line and radial line drawing for sheet metal developments and production of templates.

Learning aim B: Carry out freehand drawing skills used for designing and presentation of ideas

B1 Materials and equipment

- Drawing materials, e.g. ink pens, pastel/chalk, pencils, charcoal, graphite.
- Drawing boards.
- Drawing paper types, to include:
 - cartridge paper for fine detail, sugar paper for tone and surface exploration
 - white, e.g. for most drawing types
 - coloured, e.g. black when using white/grey chalk and or pastels for drawing metal surface colour and tone
 - tracing paper, e.g. for repeating or transferring drawing details.

B2 Freehand drawing skills and techniques

Learners will develop and apply freehand drawing skills and techniques by producing large- and small-scale subjects such as buildings, architectural details, animals and plants.

- Use of line, tone and colour to describe shape, surface and composition.
- Sight-sizing methods:
 - visual comparison of observed details and drawing outcomes
 - grids, e.g. wire frame grids, grids drawn on perspex®
 - fixed observation point, i.e. maintain fixed point and measuring methods to avoid distortion
 - mechanical measuring, e.g. use of pencils or clear plastic rulers to sight along
 - reference lines, i.e. establish cone of vision, vertical centre line and horizontal/eye line, vanishing points.
- Perspective drawing:
 - 1-, 2- and 3-point method of drawing realistic representations of 3-dimensional objects such as architectural details
 - vanishing point, i.e. defining where the various planes of an object would terminate if projected into the distance
 - horizon/sight line, i.e. establishing a line on the drawing where sky meets ground or using eye level to establish viewer position in drawing.
- Presentation drawing, e.g. producing a drawing that gives a realistic representation of a potential product to a client.

Learning aim C: Carry out technical drawing skills used for blacksmithing, engineering and fabrication constructions

C1 Materials and equipment

- Equipment, e.g. compass, squares, rulers, French curves, flexible curves, stencil and circle templates.
- Pencils, e.g. HB, 2H-4H.
- Drawing boards with a fixed or movable parallel bar.
- Drawing paper, i.e. technical drawing paper.

C2 Technical drawing skills and techniques

Learners will learn and develop technical drawing skills by producing examples of engineering, fabrication and blacksmithing drawings or templates.

- Drawing layout and title blocks i.e. an organised drawing layout with additional written information, e.g. title, drawn by, date, drawing version reference, material, scale, drawing projection type.
- Orthographic drawing using 3rd-angle views, i.e. a series of organised flat views that clearly communicate construction information.
- Pictorials using isometric drawings, i.e. accurate set perspective representation of an object or construction.
- Line precedence and type, e.g. thickness, chain, dashed, outline, hidden detail, centres, dimensioning.
- Dimensioning, e.g. parallel, running, chain, circles, radii.
- Sections, i.e. simple (e.g. square, round, oblong), complex (e.g. irregular forged, irregular sheet).
- Parallel line and radial line drawing, e.g. boxes, cylinders and cones.

Transferable skills

Communication

- Communicate information by drawing.

Managing information

- Produce technical and visual information.

Thinking skills/adaptability

- Understand the purpose of freehand and technical drawing techniques.

Assessment criteria

Pass	Merit	Distinction	
Learning aim A: Understand the purpose of freehand and technical drawing techniques			
A.P1 Describe freehand drawing methods and types.	A.M1 Explain freehand and technical drawing methods and types used to capture and produce information with reference to function and purpose.	A.D1 Discuss blacksmithing drawing with reference to the components of freehand, engineering and fabrication drawing when used to communicate artistic and technical information.	
A.P2 Describe technical drawing methods and types.			
Learning aim B: Carry out freehand drawing skills used for designing and presentation of ideas			
B.P3 Identify and select appropriate methods, materials and equipment for freehand drawing.	B.M2 Demonstrate selection of methods, materials and equipment when applying a range of freehand drawing skills and techniques to communicate shape, form and surface quality.	BC.D2 Demonstrate the ability to select methods, materials and equipment to produce a representational blacksmithing drawing effectively with perspective and elevation details, by combining freehand and technical drawing.	
B.P4 Carry out freehand line drawing methods, skills and techniques for large- and small-scale objects.			
Learning aim C: Carry out technical drawing skills used for blacksmithing, engineering and fabrication construction			
C.P5 Identify and select appropriate methods, materials and equipment for technical drawing.	C.M3 Demonstrate selection of methods, materials and equipment when applying a range of technical drawing skills and techniques to produce orthographic and radial line drawings.		
C.P6 Carry out technical drawing methods, skills and techniques using orthographic and parallel line.			

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will:

- present a minimum of two attributes of freehand, engineering and fabrication drawing and how they may be used to produce representational blacksmithing drawings and associated detail drawings, for example a drawing of a gate (blacksmithing drawing, i.e. a combination of freehand and technical) with associated detail drawings of hinge block (engineering drawing) and leaf work (fabrication drawing, i.e. flat template).

For merit standard, learners will:

- explain types of freehand and technical drawing, and the methods used to meet requirements for producing small- and large-scale blacksmithing work, e.g. when collecting visual information, designing, representing final product prior to production, drawings for machined elements, drawings for sheet work and hollow forms.

For pass standard, learners will:

- name and give reasons for two freehand drawing methods from the following: perspective (1-, 2- and 3 point), scaling and sight sizing, and two types of freehand drawing from the following: observed, design sketching and presentation/illustration
- name and give reasons for two technical drawing types from the following: engineering, fabrication and blacksmithing and two technical drawing methods from the following: orthographic drawing (1st and 3rd angle), isometric or oblique pictorials, line precedence, dimensioning, parallel and radial line.

Learning aims B and C

For distinction standard, learners will:

- confidently select appropriate materials, equipment and methods to record and draw objects effectively
- use a variety of appropriate methods, materials and equipment to accurately draw a blacksmithing construction using line, showing measurements, construction details and sections
- produce an accurate blacksmithing presentation drawing with associated detail drawings of a blacksmithing construction, using selected freehand and technical drawing methods.

For merit standard, learners will:

- select appropriate materials and equipment to draw objects
- use sight-sizing methods and perspective to accurately record and draw subjects in line and tone
- use a minimum of two types of drawing media, e.g. pencil, pastel, crayon, a minimum of two paper types, e.g. sugar, technical drawing paper, and a range of equipment, e.g. squares, rulers, compass, circle templates, grids, drawing board, to achieve different effects
- produce an orthographic drawing using 3rd-angle projections and pictorial of a specified multi-component (a minimum of three parts) construction
- use correct line precedence and type to draw outline and hidden details
- produce a minimum of two specified drawing templates of elementary radial line developments
- produce clean and well-presented drawings with accurate and appropriate dimensioning, drawing layout and title blocks.

For pass standard, learners will:

- select and use specified materials and equipment to draw the object
- use sight sizing, perspective and scaling to produce freehand drawings of small- and large-scale objects
- produce observed drawings of simple and complex, small- and large-scale objects
- produce orthographic drawings using 3rd-angle projections and pictorial of a specified single component construction, with a minimum of one hidden detail, e.g. bored hole
- add appropriate dimensioning and sectioning
- produce a minimum of two specified drawing templates of elementary fabrication drawing sheet metal developments, e.g. box and tube
- recognise and use suitable drawing layout and title blocks.

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 design a glazed and forged grill with leaf work and a machined hinge and lock system for a front door. You need to produce drawings of the frame details for the glazier, a presentation drawing for the client and a workshop drawing for the forge and engineering shop.

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

You are given a sample forged and fabricated component and required to produce workshop working drawings and a rendered observed freehand drawing.

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.

<p>Introduction to unit Unit overview and reasons for drawing – a group discussion using examples of different drawing types. Suggested time: about 1 hour.</p>
<p>Activity: Freehand drawing introduction Perspective, eye lines and sight sizing, line drawing practice of room/building. Suggested time: about 2 hours.</p>
<p>Activity: Orthographic drawing introduction Drawing layouts, title blocks and drawing practice of a simple block object using orthographic 3rd-angle projections. Suggested time: about 2 hours.</p>
<p>Activity: Orthographic drawing quiz Use sheet of 3rd-angle projections to produce isometric pictorials. Suggested time: about 1 hour.</p>
<p>Activity: Parallel line Use 90-degree pipe joint sample for learners to measure off and produce appropriate parallel line templates for construction. Suggested time: about 2 hours.</p>

UNIT 5: FREEHAND AND TECHNICAL DRAWING

Essential resources

For this unit, learners will need access to:

- freehand and technical drawing materials
- equipment and facilities.

Links to other units

This unit has strong links to:

- Unit 1: Health and Safety in Blacksmithing
- Unit 2: Metallurgy and Heat Treatment
- Unit 3: Forging Processes
- Unit 4: Welding and Thermal Cutting Processes
- Unit 6: Fabrication Techniques
- Unit 7: Forge Work Construction Techniques
- Unit 8: Horse Biology and Handling
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- design/ideas to contribute to unit assignment/case study/project materials
- business materials as exemplars.

Unit 6: Fabrication Techniques

Level: **2**

Unit type: **Optional**

Assessment type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners will develop the knowledge and skills needed to understand and use tools, materials and processes when making fabricated structures using steel in lightweight sections.

Unit introduction

Fabrication techniques are used by the blacksmith to construct items varying in scale from lamp tops to gazebo roofs. You will gain the skills and knowledge to be able to work confidently using fabrication techniques in metal and to be comfortable in a workshop environment.

You will develop the skills needed to perform a range of practical tasks, including using different forms of steel fabrication sections, such as sheet, thin plate, special- and small bar sections.

You will learn how to select appropriate hand and machine tools to support fabrication techniques and processes and to ensure that they meet the relevant health and safety industry requirements.

On completion of this unit, you will have the knowledge and experience to enable you to go into a working environment and work confidently with different materials, and fabricate products such as canopies, ducting and structural fabrications. You will be able to apply the skills you gain in this unit to job roles in the blacksmithing sector such as blacksmith, welder/fabricator, sheet metal worker, plater and structural fabricator.

Learning aims

In this unit you will:

- A** Understand fabrication materials and their properties
- B** Plan and prepare materials for metalwork fabrication construction
- C** Carry out fabrication techniques for construction.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand fabrication materials and their properties	A1 Material types, their forms of supply and effect on the overall structural properties A2 Construction types and requirements	Written evidence in the form of a research project about material types, properties and forms of supply.
B Plan and prepare materials for metalwork fabrication construction	B1 Preparing materials and planning for fabrication construction B2 Cut materials ready for fabrication	Workbooks/process sheets outlining health and safety, materials, tools, machinery, techniques and processes. Photographic evidence of cut materials. Practical outcomes of cutting materials. Observation sheets and records on safe use of tools and machinery.
C Carry out fabrication techniques for construction	C1 Tools and machinery C2 Fabrication and construction techniques	Workbooks/process sheets outlining health and safety, materials, tools, machinery, techniques and processes. Photographic evidence of their fabrication construction. Practical outcomes of fabrication. Observation sheets and records on safe machine use.

Key teaching areas in this unit include:

Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Health and safety in the workplace • Measuring and marking out materials • Cut and join materials using the correct tools/machinery • Using the correct joining process when making a fabricated structure 	<ul style="list-style-type: none"> • Safe set up of machinery • Correct use of equipment and different techniques • Different types of materials • Different forms of supply for materials • Selecting the correct tools/machinery when fabricating a structure • Working with dimensions, tolerances, working to guidelines while measuring and marking out 	<ul style="list-style-type: none"> • Communication • Managing information • Problem solving • Self-management and development

Unit content

Knowledge and sector skills

Learning aim A: Understand fabrication materials and their properties

Learners will explore how to identify the types of materials used in fabrication using appropriate tests. They will also identify the forms of supply and properties of the materials in order to develop knowledge and understanding of how and why they are used for specific constructions.

A1 Material types, their forms of supply and effect on the overall structural properties

- Types of metals, to include:
 - stainless steel (austenitic)
 - galvanised steel
 - plain carbon steel (mild, spring, tool)
 - copper and its alloys (brass)
 - aluminium.
- Material identification – workshop tests
 - spark test
 - magnet
 - cut and nick break, i.e. visual grain structure
 - colour.
- Forms of supply, such as:
 - special sections, e.g. angle, 'T', Rolled steel joist (RSJ)
 - solid sections, e.g. sheet, plate, bar (round, square, flat).
- Folded and hollow sections, e.g. pipe, box:
 - drawn – wire
 - bright rolled and black rolled
 - extruded.
- How type and form of supply affects structural properties:
 - surface characteristics, e.g. bright, dull
 - hardness/softness
 - weight, e.g. high density (heavy for their size)
 - tensile strength
 - melting point
 - conductor of heat and electricity
 - toughness
 - elasticity
 - malleability and ductility.

A2 Construction types and requirements

Learners will explore examples of construction types to support their understanding of fabrication materials, techniques and construction methods.

- Construction types, e.g.:
 - bridges
 - structural frames
 - buildings
 - benches and chairs.

UNIT 6: FABRICATION TECHNIQUES

- Construction characteristics:
 - load bearing, e.g. supporting applied weight, resisting applied force
 - corrosion resistance, e.g. galvanised, powder coating, paints, shot blasting
 - distortion control, e.g. clamping, tack welding, heat control, stitched welded
 - weight/strength of construction materials, i.e. the correct material and form of supply to make the fabrication.
- Construction methods for ease of use, ability to dismantle, e.g.:
 - welding
 - bolting
 - self-securing.

Learning aim B: Plan and prepare materials for metalwork fabrication construction

Learners will develop the skills and techniques needed for metalwork fabrication, such as responding to a specification, marking out and preparing materials for construction.

B1 Preparing materials and planning for fabrication construction

- Responding to a specification, e.g. drawings, working to templates.
- Select appropriate materials with reference to requirements, e.g. construction type.
- Marking out:
 - marking out materials using tools, to include scriber, centre punch, chalk, blue ink,
 - marking out of one-off components and batch components for efficient use of material, e.g. nesting
 - marking out methods for common profiles, e.g. square, rectangular, circles, curved, angled
 - marking out techniques, e.g. scribing, transferring using chalk from paper template, blueing.
- Use measuring tools such as steel ruler, tape measure, protractor marking liquid.
- Use of datum, e.g. centre marks, centre lines.
- Make allowances for bending and folding.

B2 Cut materials ready for fabrication

Learners will cut the materials that they have marked up using appropriate tools and machinery.

- Tools and machinery, to include:
 - hand tools, such as tin snips, hacksaws, files
 - power tools, such as drills, grinders, sanders
 - machine tools, such as guillotine (hand or powered), pillar drills, band saws, punching, cropping.
- Produce cuts:
 - straight cuts
 - curved cuts
 - round holes.
- Use cutting to include:
 - sawing
 - drilling
 - shearing
 - chiselling.

- Finishing methods:
 - edge filing to remove rags
 - control finishing faults, such as hammer marks, scratches, gouges and dents.
- Health and safety:
 - PPE as per risk assessments, e.g. safety spectacles, safety boots, overalls, ear protection
 - safe machine set up and operation
 - risk assessments.

Learning aim C: Carry out fabrication techniques for construction

Learners will select and use appropriate tools and machinery and apply fabrication skills and techniques to produce fabricated constructions.

C1 Tools and machinery

- Hand tools, such as hammers and stakes.
- Power tools, such as drills, grinders, sanders.
- Machine (hand or power) tools, such as folders, jennies and rolls.

C2 Fabrication and construction techniques

- Types of construction:
 - frames
 - tanks
 - guards
 - hoods
 - canopies.
- Use construction techniques, such as working to specification, setting out, construction order, quality assessment (square, accuracy and finish).
- Use light sheet and metal forming techniques, such as twisting, bending, folding, rolling (curves, cylinders, edges).
- Permanent joining techniques, such as:
 - welding
 - self-securing, e.g. rolled wire edge, grooved seam
 - riveting, e.g. using different rivets, such as pop rivets and blacksmith's rivets, to join different thickness of materials
 - spot welding, e.g. joining two pieces of thin material together.
- Brazing, e.g. joining two dissimilar metals together.
- Gluing, e.g. making templates.
- Use non-permanent (temporary) joining techniques, such as:
 - screwing, e.g. for making wooden templates to hold things in position
 - nuts and bolts, e.g. assembly of temporary structures
 - pins and wedges, e.g. cotter pins, split pins.
- Metal finishing methods such as filing, sanding, buffing.
- Review fabrication and construction techniques in the relation to the finished construction:
 - square and true (control distortion)
 - surface quality
 - joint quality
 - accuracy to specification.

Transferable skills

Communication

- Speaking, listening and making contribution to discussions.
- Speaking with and listening to others, peers and tutors.
- Interpreting and communicating information.

Managing information

- Using information from given tasks on what material is needed. What are the properties and forms of supply of materials? What is the best way of joining an assembly of fabricated structures?
- Reading and understanding of texts, using them to gather information, ideas and opinions.
- Writing assignments.
- Writing effective reports.

Problem solving

- Identifying situations and practical problems in familiar and unfamiliar situations.

Self-management and development

- Demonstrating methods of working safely in the workplace, using the fabrication tools and machinery correctly.
- Measuring and marking out skills.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand fabrication materials and their properties		
A.P1 Describe fabrication materials, properties and forms of supply.	A.M1 Explain the types of materials used to create selected construction types, with reference to properties, forms of supply and construction requirements.	A.D1 Justify the types of materials used to create selected construction types, comparing and contrasting properties, forms of supply and construction methods used.
A.P2 Describe the requirements of construction types.		
Learning aim B: Plan and prepare materials for metalwork fabrication construction		
B.P3 Carry out preparation and planning for fabrication.	B.M2 Demonstrate effective planning and preparation to specification, using appropriate marking out and cutting techniques.	B.D2 Demonstrate competent planning and preparation to specification, confidently performing safe and accurate marking out, cutting and finishing techniques.
B.P4 Demonstrate basic cutting techniques.		
Learning aim C: Carry out fabrication techniques for construction		
C.P5 Demonstrate basic fabrication and construction techniques using appropriate tools and machinery.	C.M3 Demonstrate accurate use of effective fabrication and construction techniques using appropriate tools and machinery, reviewing final construction in relation to accuracy to specification.	C.D3 Demonstrate confident and competent use of fabrication and construction techniques, using appropriate tools and machinery safely, reviewing final construction and making recommendations for improvement.
C.P6 Review final construction, with reference to specification.		

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will be able to:

- show comprehensive understanding of, and justify the types of, materials used for construction requirements, with reference to examples such as an exterior lamp hood, a fuel tank stand
- compare, contrast and justify materials properties and construction methods, e.g. for a construction needing to be light and strong with good corrosion resistance, such as a metal sliding door for a barn
- present work to a high standard, using appropriate presentation techniques and terminology.

For merit standard, learners will be able to:

- explain the types of materials used for construction techniques, with reference to properties and forms of supply, giving a minimum of three types of material and a minimum of three forms of supply
- explain how the materials and forms of supply listed above would perform in a construction when applied to a minimum of two of the construction requirements
- present work using appropriate presentation techniques with relevant terminology.

For pass standard, learners will be able to:

- describe a minimum of two material types and three forms of supply for materials, specific to a minimum of three construction requirements
- present work using appropriate presentation techniques and terminology.

Learning aim B

For distinction standard, learners will be able to:

- demonstrate effective planning and preparations by responding accurately to the specification, making allowances for cut thickness and bends as appropriate
- produce accurate cuts to specification without distortion
- demonstrate control of finish by producing cuts with minimal surface imperfections.

For merit standard, learners will be able to:

- select appropriate materials, tools and machinery and marking out methods appropriate to the specification
- produce accurate cuts to specification with only minor imperfections.

For pass standard, learners will be able to:

- select materials, tools and machinery and measure and mark out materials within specification for the cutting of a minimum of three cuts
- produce a minimum of three different cuts using fabrication techniques.

Learning aim C

For distinction standard, learners will be able to:

- confidently select appropriate construction techniques for the construction of a minimum of two fabricated constructions
- work independently and competently to produce a minimum of two accurate fabricated constructions to specification with no distortion and well finished with minimal surface imperfections
- provide evidence of a minimum of three construction joining techniques and forming techniques

- provide evidence of a minimum of one temporary joining method and a minimum of three permanent joining methods
- give a comprehensive review of a final fabricated construction, assessing its accuracy and making recommendations for improvement.

For merit standard, learners will be able to:

- select appropriate tools and machinery
- use appropriate construction techniques to produce to specification a minimum of two fabricated constructions
- carry out a minimum of three forming techniques, one temporary joining method and one permanent joining method
- produce work accurately to specification with only minor surface defects or distortion
- present a review of a final fabricated construction, assessing its accuracy according to specification.

For pass standard, learners will be able to:

- select appropriate tools and machinery
- demonstrate the safe use of construction techniques and fabrication tools to produce a minimum of two fabricated constructions to the specification. The techniques may not be appropriate
- carry out a minimum of two joining methods and two forming techniques
- produce work to specification with some defects and distortion
- present a review of a final fabricated construction, to include square and true (control distortion), surface quality and joint quality.

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 recently been employed by a metalworking company that covers a wide range of different styles of fabrication. You have been given the job of making a canopy for a customer which is to go into a bespoke kitchen above a cooker. You are responsible for selecting the correct material and the correct machinery and hand tools. To build up your working portfolio, you are required to keep photographic evidence on different stages of the job. You must follow a design specification, which you have been given.

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

Two different fabrications are required to the correct criteria.

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

Learners' work will involve practical assessments and written assessments. Learners can gain experience of working with the appropriate tools and equipment. Learners will benefit from understanding the value of working with sheet and sectional materials in order to produce a quality product.

Suggested time: about 10 hours.

Activity: Different types of material and forms of supply used in the fabrication industry

Learners will be required to know about the metals and forms of supply commonly used in the fabrication process. This is to be delivered through formal lectures, discussion, demonstrations, workshops, off-site visits and independent research.

Suggested time: about 10 hours.

Activity: Marking and cutting needed to meet required fabrications

Learners will deal with the marking and cutting needed to meet the required fabrications. This will be delivered through supervised workshops, and practical and learner research supported by formal classroom activity. This will improve their knowledge and understanding of the tools and equipment used in the industry. Learners will be encouraged to evaluate their performances; this will be reinforced with appropriate, formative tutor feedback.

Suggested time: about 10 hours.

Activity: Bending and forming equipment needed to meet required fabrications

Learners must be able to use fabrication bending and forming equipment safely to meet the required fabrications. Techniques will be discussed, demonstrated and practised in the fabrication workshop to produce quality fabrications in different thickness of mild steel. This will be delivered through supervised practical workshop and supported by formal classroom activities.

Suggested time: about 10 hours.

Activity: Fabrication joining methods

Learners must use fabrication methods to create the required fabrications in different thicknesses of mild steel. Techniques will be discussed, demonstrated and practised in the fabrication workshops to produce quality fabrications. This will be delivered through supervised practical workshops and supported with formal classroom activities.

Suggested time: about 20 hours.

UNIT 6: FABRICATION TECHNIQUES

Essential resources

For this unit, learners will need access to a fabrication workshop and materials.

Links to other units

This unit has strong links to:

- Unit 1: Health and Safety in Blacksmithing
- Unit 2: Metallurgy and Heat Treatment
- Unit 3: Forging Processes
- Unit 4: Welding and Thermal Cutting Processes
- Unit 5: Freehand and Technical Drawing
- Unit 7: Forge Work Construction Techniques
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- guest speakers
- business materials as exemplars.

Unit 7: Forge Work Construction Techniques

Level: **2**

Unit type: **Optional**

Assessment type: **Internal**

Guided learning hours: **60**

Unit in brief

Learners will develop the skills needed to connect forged elements when making multi-component pieces in the blacksmith industry, using joining techniques and framework construction methods.

Unit introduction

Construction techniques are essential processes in the blacksmithing and metalworking industries. This unit will give you the underpinning knowledge and skills for combining blacksmithing methods when making traditionally constructed products such as gates and railings.

In this unit, you will develop knowledge of tools and methods to be able to work to construction specifications. You will carry out forged and mechanical joining techniques such as tenons, collars, wraps, rivets, fire welds, bolts, screws and wedges, involved in framework construction elements such as rails, palings and back plates. You will demonstrate measuring and fitting methods and the use of jigs or templates to shape components. You will also develop an understanding and appreciation of the regulations that apply to architectural ironwork constructions, such as health and safety, building and planning.

On completion of this unit, you will have the knowledge and experience to work in a forge, and will have developed the confidence to use common forge work construction processes. You will be able to apply the skills you gain in this unit to job roles in the blacksmithing sector such as blacksmith, general metalworker, welder/fabricator and farrier.

Learning aims

In this unit you will:

- A** Understand the purpose of forge work construction techniques
- B** Carry out joining techniques for forge work constructions
- C** Carry out framework construction.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand the purpose of forge work construction techniques	A1 Joining techniques A2 Framework constructions A3 Faults and their control	Written evidence documenting joining techniques, construction methods, faults and their control.
B Carry out joining techniques for forge work constructions	B1 Joining tools and equipment B2 Produce blacksmith's joints	Practical joint samples with accompanying test report records. Observation of practical joint production for forge constructions. Work/process sheets to show evidence of selection of tools and equipment and joint production, outlining appropriate quality control measures taken when producing joints. Observation sheets and records on safe use of tools and equipment.
C Carry out framework construction	C1 Framework construction tools and equipment C2 Working to specification C3 Framework construction techniques C4 Safe working practices when constructing basic frameworks	Practical framework construction samples with accompanying test report records. Observation of practical framework construction. Work/process sheets to show evidence of selection of tools and equipment, work methods and framework construction techniques used. Observation sheets and records on safe use of tools and equipment.
Key teaching areas in this unit include:		
Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Safe working • Forging and construction • Working to specification • Measuring 	<ul style="list-style-type: none"> • Calculations – volume, length, angles • Work methods, tools and equipment 	<ul style="list-style-type: none"> • Communication • Problem solving • Thinking skills/adaptability • Working with others

Unit content

Knowledge and sector skills

Learning aim A: Understand the purpose of forge work construction techniques

A1 Joining techniques

- Joint types, to include:
 - forged collars, e.g. flat, profiled
 - wraps
 - rivets, e.g. domed, pan, countersunk, decorated
 - tenons, e.g. straight, upset, offset heel bar
 - forge welds, e.g. branch, cage, box
 - removable fixings, e.g. bolts, screws, wedges.
- Function and purpose with reference to:
 - aesthetics
 - ease of production
 - ease of attachment
 - strength
 - permanent or temporary joint.
- Calculating joint and forging allowances such as:
 - calculating volumes with sectional change
 - stretch when, e.g. punching, heating, cutting or forging
 - bending allowances when, e.g. bending, folding, wrapping
 - shrinkage when, e.g. punching, slitting, cooling or forging
 - drill clearance/thread sizes, i.e. use of drill and tapping charts
 - wastage due to, e.g. oxidation/scaling, compaction
 - rivets and tenon head types for, e.g. dome and countersunk.

A2 Framework constructions

- Framework elements, such as:
 - main frame elements, e.g. uprights, back and front stile, back plates, rails (top, mid, bottom), palings, balusters, dog bars, infills, braces
 - bracing and triangulating methods, e.g. cross/diagonal braces, roundels, gusset plates, heels and upsets on cross-rails, decorative infills such as scrollwork
 - setting out methods, e.g. order of work, use of workshop specifications/working drawings
 - transferring and using working drawings, e.g. using soft chalk to transfer to rusty plate, using a drawing grid
 - fitting and levelling methods, e.g. dogs and clamps, bolting of components prior to, e.g. riveting, jointing sequence to avoid distortion, use of setting out table/flat surface, filing to fit, test fitting (dry fitting) of components before final fixing
 - measuring, e.g. level, length, square, angles, bend length
 - tools, e.g. rulers, measuring tape, soft wire, squares (simple/compound), angle/centre finders, straight edge, level, plumb line/string lines, centre punch, chalk, jigs, Plasticine™
 - methods, e.g. 3:4:5 triangle, comparing diagonals, measuring from datum to avoid compound errors, sighting along length/across frame, running plumb/string lines, using Plasticine to estimate volumes and section changes
 - use of templates, jigs and formers, e.g. for controlled bending, setting angles and profiles, infill setting for size and fit to frame

UNIT 7: FORGE WORK CONSTRUCTION TECHNIQUES

- o regulations that may apply to architectural or externally sited constructions, to include building regulations, planning consents, heritage listings, environmental considerations, health and safety.

A3 Faults and their control

- Problems that can occur with framework constructions such as:
 - o distortion, e.g. from heat expansion, quenching, work hardening, poor fixing sequence, lack of bracing, components or fixing points not forged level/square
 - o incomplete or loose jointing, e.g. poor fit, not square/true
 - o main frame, e.g. not flat, not square, not level, not upright, twisted, sagging due to lack of bracing
 - o lack of strength, e.g. when supporting weight, creating poor stability causing vibration/spring back, when material types or sections are inappropriate
 - o forging and bending, such as section distortion, bend kinks, burns, scaling, flaws and galls.

Learning aim B: Carry out joining techniques for forge work constructions**B1 Joining tools and equipment**

- Hand tools, such as:
 - o tongs
 - o hand hammers
 - o top and bottom tools, e.g. handheld, wire handled, hafted and spring
 - o mandrels to define internal dimensions
 - o files
 - o saws
 - o drills.
- Equipment, such as:
 - o anvil
 - o leg vice
 - o power hammer
 - o forge hearth
 - o swage block
 - o setting-out table
 - o clamps/dogs.

B2 Produce blacksmith's joints

Learners will develop the skills needed to safely produce blacksmith's joints and be able to enhance the quality of joints by considering quality control measures.

- Types of joints, such as:
 - o forged collars (flat, profiled)
 - o wrap
 - o rivets, e.g. domed, pan, countersunk, decorated
 - o tenons, e.g. straight, upset, offset heel bar
 - o forge welds (branch, cage, box)
 - o removable fixings (bolts, screws, wedges).
- Materials to include:
 - o mild steel.

- Quality control:
 - accurate allowances for problems, such as wastage, stretch and shrinkage when:
 - forging, e.g. drawing down, swaging, fullering, upsetting, setting
 - cutting, e.g. punching, chiselling, slitting, sawing, drilling, tapping
 - bending, e.g. bending, folding, wrapping
 - producing clean, crisp sections, e.g. flat and square hammer work, required surface texture, removal of excessive scale and clinker residue, square and evenly shaped sections with clean and clear transitions, control of forging and bending faults, e.g. burns/scaling, flaws, galls, bends, twists, kinks.
- Safe working practices when using joining techniques:
 - use of PPE, e.g. safety spectacles, boots, hearing protection
 - safe working procedures, e.g. cooling out tools and materials, awareness of others, correct use of cutting, joining and construction tools
 - equipment and tool checks to include wear, faults, damage
 - reference to appropriate risk assessments.

Learning aim C: Carry out framework construction

C1 Framework construction tools and equipment

- Hand tools, such as:
 - fitting and levelling tools
 - measuring tools
 - jigs and formers
 - punches
 - files
 - saws
 - chisels.
- Equipment, such as:
 - anvil
 - leg vice
 - power hammer
 - forge hearth
 - swage block
 - clamps/dogs
 - templates
 - setting-out table.

C2 Working to specification

- Use work methods, such as:
 - workshop samples
 - written specifications
 - drawings
 - transferring and using working drawings
 - templates
 - measuring and setting out equipment and processes
 - set datums.

UNIT 7: FORGE WORK CONSTRUCTION TECHNIQUES

C3 Framework construction techniques

- Use appropriate construction techniques, such as:
 - setting-out methods
 - bracing and triangulating methods
 - fitting and levelling methods
 - hole punching and drilling
 - cold and hot fitting methods
 - cutting and filing
 - samples, jigs, templates, formers
 - materials to include mild steel.

C4 Safe working practices when constructing basic frameworks

- use of PPE, e.g. safety spectacles, boots, hearing protection
- safe working procedures, e.g. cooling out tools and materials, awareness of others, correct use of cutting, joining and construction tools
- equipment and tool checks to include wear, faults and damage
- reference to appropriate risk assessments.

Transferable skills**Communication**

- Writing work/process sheets.

Problem solving

- Fault recognition and control.

Thinking skills/adaptability

- Calculating allowances.
- Researching.
- Using skills gained and applying them to differing situations.

Working with others

- Safe workshop practice.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Understand the purpose of forge work construction techniques		
A.P1 Describe common forged and mechanical joint types, their faults and control methods.	A.M1 Explain setting out, joining and fitting methods, and what regulations may apply when making and supplying architectural ironwork.	A.D1 Analyse setting out and quality control methods in framework construction with reference to relevant regulations.
A.P2 Describe common elements and methods of framework constructions, their faults and control methods.		
Learning aim B: Carry out joining techniques for forge work constructions		
B.P3 Identify and select specific tooling and methods for joint types.	B.M2 Demonstrate effective use of techniques to produce joints to specification.	BC.D2 Demonstrate effective techniques confidently to produce joints accurately to specification, producing a well-fitted framework construction, using correct tools and equipment.
B.P4 Safely use joining techniques to produce fit-for-purpose specified joint types.		
Learning aim C: Carry out framework construction		
C.P5 Identify and select specific tooling, construction methods and allowances for framework construction.	C.M3 Demonstrate effective use of techniques to produce a framework to specification.	
C.P6 Safely use construction techniques to produce a fit-for-purpose specified framework.		

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will:

- demonstrate comprehensive understanding of setting out, joining and fitting methods for a specified construction
- describe in detail the need for bracing and triangulation methods in framework constructions
- describe in detail the regulations that may apply to architectural or externally sited constructions.

For merit standard, learners will:

- demonstrate understanding of the order of work required for a specified construction
- explain setting out and fitting methods – why they are important when making framework constructions
- carry out calculations for the allowances of a minimum of two elements and two joints for a specified construction
- describe the regulations that may apply to architectural or externally sited constructions.

For pass standard, learners will:

- demonstrate basic understanding of common forged and mechanical joint types – recognise one of each joint type and describe their construction method for a specified construction
- describe common elements (recognise a minimum of eight framework elements) and methods of framework construction (recognise and describe a minimum of four of the following methods – setting out, drawing transfer, bracing and triangulation, fitting and levelling, templates and jigs, measuring)
- describe common joining technique and framework construction faults from a minimum of four of the following – distortion, stretch, shrinkage, burns/scaling, flaws, galls, bends, twists, kinks, and state one control method for each.

Learning aims B and C

For distinction standard, learners will:

- produce an elementary tightly jointed framework with a minimum of four joint types and a minimum of three framework elements without distortion, incomplete or loose jointing, using correct tools and equipment
- produce clean, crisp sections, e.g. flat and square hammer work, required surface texture, removal of excessive scale and clinker residue, square and evenly shaped sections with clean and clear transitions, demonstrating efficient control of forging and bending faults, e.g. burns/scaling, flaws, galls, bends, twists, kinks
- produce a framework to specification using joining and construction techniques, making accurate allowance for wastage, stretch and shrinkage, using correct tools and equipment
- work independently, effectively and accurately, to forge work construction specification requirements.

For merit standard, learners will:

- carry out appropriate calculations for forging, cutting and bending allowances as appropriate and use joining techniques to produce a minimum of four joints to specification with only minimal section distortion, bend kinks, burns flaws and galls, using blacksmithing hand tools and equipment
- produce elementary framework construction to specification without excessive section distortion, bend kinks, burns flaws and galls, using blacksmithing hand tools and equipment
- calculate allowances and use construction methods, allowances and techniques to produce a specified framework to specification without distortion, incomplete or loose jointing, bend kinks, burns flaws and galls, using blacksmithing hand tools and equipment
- work effectively to meet specified forge work construction specification requirements.

For pass standard, learners will:

- safely use joining techniques to produce a minimum of four specified joint types (one mechanical/three forged) in mild steel without excessive section distortion, bend kinks, burns, flaws and galls, selecting and using specific blacksmithing hand tools and equipment and methods
- safely construct a specified elementary framework of a minimum of three elements without excessive distortion, burns flaws and galls, using specified setting out techniques, hand tools and equipment
- transfer and use a suitable working drawing for use in the forge workshop
- produce a fit-for-purpose construction
- recognise specific tooling, construction methods and allowances for a minimum of three elements of specified framework construction
- work to meet specified forge work construction specification requirements.

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 are making items for a garden-show designer. As part of this, you are making a regular workshop item of a hanging-basket bracket. Your boss has given you the drawings and asked you to make one as a sample.

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

A gallery owner has come into the forge with a drawing and your boss has asked you to produce a picture frame to the drawing provided.

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

Unit overview and online and library research activities, investigating the different joining techniques used in blacksmithing (this activity could be used during a visit to a site of ironwork interest).

Suggested time: about 2 hours.

Activity: Producing basic forged joint types

Following demonstrations, learners produce forged, riveted, collared, fire welded and tenon joints.

Suggested time: about 6 hours.

Activity: Producing basic mechanical joint types

Following demonstrations, learners produce a drilled and tapped bolt joint with a forged decorated bolt.

Suggested time: about 2 hours.

Activity: Workshop calculations

Learners are given a construction drawing, measuring equipment and Plasticine™ and asked to calculate forging, cutting and bending allowances for a specified construction.

Suggested time: about 2 hours.

Activity: Researching frame construction faults

Learners are given a simple construction drawing, and various materials of differing strengths and rigidity, for example paper, card, wood, Meccano®. Learners produce examples of the construction using the various materials and are asked to investigate the problems or solutions that can occur with reference to sagging, distortion, stability. Learners state what differences occur with changing joint design or material type, section size, section shape etc.

Suggested time: about 2 hours.

Activity: Construction project

Following demonstration and teaching of the various elements of forge work construction, learners are given a construction drawing and asked to produce a specified artefact.

Suggested time: about 16 hours.

UNIT 7: FORGE WORK CONSTRUCTION TECHNIQUES

Essential resources

For this unit, learners will need access to a forge workshop and associated tools and equipment.

Links to other units

This unit has strong links to:

- Unit 1: Health and Safety in Blacksmithing
- Unit 2: Metallurgy and Heat Treatment
- Unit 3: Forging Processes
- Unit 4: Welding and Thermal Cutting Processes
- Unit 5: Freehand and Technical Drawing
- Unit 6: Fabrication Techniques
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- guest speakers
- business materials as exemplars.

Unit 8: Horse Biology and Handling

Level: **2**

Unit type: **Optional**

Assessment type: **Internal**

Guided learning hours: **60**

Unit in brief

This unit will give learners an understanding of general horse biology systems, behaviour and conformation, and how they can relate the understanding to carrying out safe handling procedures.

Unit introduction

Anyone working with horses, for example farriers and other professionals, requires thorough knowledge of the horse. This knowledge is gained through the study of basic horse biology and relating it to how horses function. To be able to work safely with horses you need to have an appreciation of how horses behave. Horse behaviour can be improved and managed by using appropriate handling techniques and equipment competently. This is important for the health and safety of both the handler and the horse.

In this unit, you will gain the knowledge and understanding of how a horse functions. You will be introduced to the basic structure of the horse and gain an appreciation of the function of the musculoskeletal, cardiovascular, respiratory and digestive systems, which are interlinked to support horse movement. You will be introduced to the skills required to assess horse behaviour, enabling you to handle horses confidently. You will be able to undertake practical horse observations with relation to conformation and foot care.

On completion of this unit, you will have the knowledge and skills to work safely and confidently with horses and be able to apply your understanding of horse biology. You will be able to apply the skills you gain in this unit to, in particular, the farriery job role within the blacksmithing sector.

Learning aims

In this unit you will:

- A** Understand the structure and function of horse movement
- B** Understand horse systems
- C** Demonstrate safe horse handling and restraint techniques.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Understand the structure and function of horse movement	A1 Skeleton, joints and muscles A2 Structures of the lower leg	Written evidence of muscle types and functions. Drawings and labelled diagrams of skeletal, muscle, tendon, ligament, digital cushion and horny structures. Written evidence of factors affecting movement.
B Understand horse systems	B1 Cardiovascular system B2 Respiratory system B3 Digestive system	Written evidence of cardiovascular, respiratory and digestive system functions. Drawings and labelled diagrams of cardiovascular, respiratory and digestive system structures. Written evidence of how muscle and movement influence the cardiovascular, respiratory and digestive systems.
C Demonstrate safe horse handling and restraint techniques	C1 Preparation for horse handling and restraint C2 Use horse handling and restraint methods C3 Foot-care report	Worksheets to show evidence of selection of equipment and restraint methods used in horse handling. Observation records of practical safe handling and restraint methods. Written foot-care report containing horse information, records and diagrams of observations of conformation and foot characteristics. Written aftercare proposal for the foot.

Key teaching areas in this unit include:

Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Safe horse handling and restraint • Use of appropriate PPE 	<ul style="list-style-type: none"> • Horse structure and systems 	<ul style="list-style-type: none"> • Communication • Managing information • Problem solving • Thinking skills/adaptability

Unit content

Knowledge and sector skills

Learning aim A: Understand the structure and function of horse movement

Learners will develop knowledge of the structure and function of the musculoskeletal system and how it supports horse movement.

A1 Skeleton, joints and muscles

- Skeleton of the horse:
 - major bones or groups of bones of the horse skeleton and the component parts including axial and appendicular skeletons: skull, vertebrae, ribs, scapula, pelvis, major long bones (radius, ulna, femur, fibula)
 - bones of the limb below knee and hock – large metacarpal (hind limb metatarsal), small metacarpals (hind limb small metatarsal), proximal sesamoids, 1st, 2nd and 3rd phalanx, distal sesamoid.
- Structure of joints:
 - ball and socket
 - fixed or fibrous
 - cartilaginous (slightly movable)
 - synovial (freely movable).
- Types of major muscles:
 - muscle fibre types (smooth and striated), to include digestive, cardiac, skeletal
 - voluntary – under direct control of the will, e.g. skeletal muscle
 - involuntary – without conscious control, e.g. heart muscle.
- Functions of skeletal muscle:
 - extensor, e.g. contracts to straighten a joint
 - flexor, e.g. contracts to bend a joint
 - voluntary, e.g. under direct control of the will
 - providing posture support, stability and movement.
- Major skeletal muscles:
 - rhomboideus
 - splenius
 - trapezius
 - latissimus dorsi
 - triceps
 - biceps
 - longissimus dorsi
 - gluteal
 - biceps femoris.

A2 Structures of the lower leg

- Structures of the lower leg:
 - bones below the knee (carpus) and hock (tarsus)
 - tendons (flexor and extensor).
- Major ligament types, e.g. capsular, suspensory, check, interosseous, collateral, annular, sesamoidean.
- Digital cushion.
- Horny structures (periople, horny wall and bars, horny laminae, white line, sole, frog).

Learning aim B: Understand horse systems

Learners will develop knowledge of the horse systems that support movement through blood flow, respiration and digestion.

B1 Cardiovascular system

- Structure and functions of the heart:
 - heart as a transport system
 - cardiac or pumping cycle
 - role of the blood vessels (including arteries, veins and capillaries)
 - components of blood and their function, e.g. transport of nutrients, gases, heat and waste, action and role of blood clotting, defence against disease, differences between arterial and venous blood
 - influence of movement on cardiovascular system.

B2 Respiratory system

- Structure and function of the respiratory system:
 - nostrils and nasal passage allow air into the body
 - pharynx and larynx control passage of air to and from the trachea from the oesophagus
 - trachea diverts air in and out of the lungs
 - lungs, to include bronchi, bronchioles and alveoli, allow for gaseous exchange with the blood.
- Mechanics of breathing and the process of gaseous exchange.
- Factors that control the respiratory rate.
- Normal range in healthy horses and reasons for variation.

B3 Digestive system

- Structure and function of the digestive system:
 - mouth and teeth, e.g. producing saliva and chewing/grinding food
 - pharynx directs food into the oesophagus and protects entrance to the trachea along with the larynx
 - oesophagus allows passage of food into the stomach
 - stomach produces gastric juices (acid) to break down food
 - small intestine uses enzymes to further break down food
 - caecum uses microbes (symbiotically) to aid digestion by breaking down plant fibre (fermentation)
 - large intestine – further absorption of nutrients, reabsorption of water, excretion of body wastes
 - pancreas produces digestive enzymes
 - liver creates bile and is an important organ for maintaining many metabolic functions.
- Process of digestion:
 - chewing and muscular action
 - chemical digestion, to include role of saliva, gastric juices, intestinal juices, pancreatic, juices and bile, fermentation by micro-organisms and absorption
 - excretion.
- Structure of the urinary system:
 - kidneys
 - ureters – tubes to connect the kidneys to the bladder
 - bladder
 - urethra – the tube by which urine exits the body.

- Excretory function of the kidneys and bladder:
 - filtration
 - absorption
 - urine production
 - the storage and release of urine by the bladder.

Learning aim C: Demonstrate safe horse-handling and restraint techniques

Learners will carry out horse-handling and restraint techniques in relation to the role of the farrier.

C1 Preparation for horse handling and restraint

- Before approaching the horse:
 - reasons for restraining horses and the need for restraint:
 - working in close proximity
 - undertaking examination
 - trotting up
 - maintaining control when working with them on the ground.
- Animal welfare considerations:
 - mental condition of horse (recognising signs of stress)
 - controlling stressful conditions:
 - surroundings, e.g. stable, yard, field
 - noise, e.g. cars, tractors, aeroplanes, lorries
 - other horses/people
 - recognising when to seek assistance.
- Selection of personal protective equipment (PPE), e.g. helmet, boots.
- Selection of handling and restraint equipment, to include:
 - bridle
 - head collar
 - lunge line
 - chifney and twitch.

C2 Use horse handling and restraint methods

- Use of equipment and handling restraint methods:
 - bridle, e.g. when riding
 - head collar, e.g. when leading
 - lunge line, e.g. when lunging
 - chifney and twitch, e.g. when clipping its coat
 - holding up a leg, e.g. when examining feet, to restrict movement;
 - pinching the skin on the neck, e.g. to act as distraction
 - use of personal protective equipment (PPE)
 - safe and correct use of handling and restraint equipment
 - communication with assistants, i.e. being sure of roles and responsibilities and being aware of the safety of others.
- Behaviour of the handler, to include:
 - body language
 - approaching horse quietly and confidently with handling equipment
 - voice commands
 - identification of horse's body language and behaviour, to include horse's response to handling, physical condition and temperament of horse.

UNIT 8: HORSE BIOLOGY AND HANDLING

- Situations:
 - catching
 - preparing for exercise/warm up
 - trotting up
 - turning out
 - maintenance, e.g. treatment, health checks
 - farrier visit:
 - safe preparation of horse for the working situation, to include handling techniques, methods of restraint, PPE and other equipment
 - requirements, e.g. trimming, shoeing, stud fitting
 - awareness of current foot condition, e.g. overgrown feet, loose shoe, risen clenches, thrush
 - suitable environment to minimise stress and ensure safety during the procedure.

C3 Foot-care report

- Record horse information:
 - owner
 - age
 - breed/type, e.g. Arab, cob, thoroughbred
 - work type, e.g. driving, general riding and eventing
 - body condition, e.g. thin, fat, muscled.
- Record basic horse conformation:
 - hoof pastern axis, e.g. sloping, normal, upright
 - dorsal foot balance, e.g. toe in, toe out, straight, medial, lateral
 - front leg conformation, e.g. base wide, base narrow, toe in, toe out, straight,
 - hind leg, e.g. base wide, base narrow, stood under, upright, cow hocked, wide hocked.
- Record hoof defects as appropriate, such as:
 - overgrowth
 - condition and placement of shoes (if applicable)
 - excessive wear (shoe and/or horn)
 - cracks and splits
 - surface fungal/bacterial infections, i.e. thrush, seedy toe
 - hoof capsule distortion.

Transferable skills**Communication**

- Working with assistants when applying safe horse handling and restraint.

Managing information

- Collecting and reviewing data from observations.

Problem solving

- Analysing data from observations.

Thinking skills/adaptability

- Applying knowledge in differing situations when selecting equipment, methods.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Explore the structure and function of horse movement		
A.P1 Describe the major bones, joint types and muscles of the horse associated with support and movement.	A.M1 Explain the function of the skeleton, joints, muscles and lower leg structures used for providing movement and support to a horse.	A.D1 Analyse the relationship between the skeleton, joints, muscles and lower leg structures and the movement of a horse, with reference to appropriate examples.
A.P2 Describe the structures of the lower leg of a horse.		
Learning aim B: Explore horse systems		
B.P3 Describe major horse systems and their functions.	B.M2 Explain the major horse systems and their functions, with reference to how they support movement.	B.D2 Analyse the different types of major horse systems and their functions, justifying how they support health and movement.
Learning aim C: Demonstrate safe horse-handling and restraint techniques		
C.P4 Identify the methods used when handling and restraining a horse.	C.M3 Select and use horse handling methods effectively and restraint techniques safely when preparing a foot-care report.	C.D3 Carry out safe and confident handling and restraint of horses when preparing foot-care report, justifying use of equipment, methods, approach and outcomes.
C.P5 Select and prepare appropriate horse handling and restraint equipment.		
C.P6 Carry out safe handling and restraint when preparing a foot-care report.		

Essential information for assessment decisions

Learning aim A

For distinction standard, learners will:

- present detailed information on the skeleton, joints and muscles of a horse, and the relationship these have on support, health and movement, with reference to examples of build type and limb position
- explore in detail a minimum of three factors that can affect horse movement and hoof shape, for example joint misalignment and limb position, and provide a minimum of three examples covering ideal and abnormal conformation for both front and hind limb scenarios.

For merit standard, learners will:

- present the names and functions of the horse skeleton, joints and muscles, with reference to movement and support
- describe the differences between moveable and fixed joints, with reference to where they are located on the horse skeleton, their function and purpose
- provide a minimum of two detailed examples (one for hind and one for front) of how flexor and extensor muscle pairs provide movement via tendons joint(s) and skeleton.

For pass standard, learners will:

- recognise a minimum of four of the major bones or groups of bones of the horse skeleton
- provide brief information on a minimum of two joint types of the horse
- provide brief information on the location of the major muscles of the horse associated with support and movement (a minimum of five of the major skeletal muscle)
- provide brief information on the shape and positions of the structures of the lower leg to include:
 - the nine bones below the knee (carpus) and hock (tarsus)
 - tendons (flexor and extensor)
 - major ligaments, e.g. the suspensory plus a minimum of three of the following: capsular, check, inter-osseous, collateral, annular, sesamoidean
 - digital cushion
 - horny structures of the foot, including: periople, wall and bars, horny laminae, white line, sole, frog.

Learning aim B

For distinction standard, learners will:

- provide information and explore in detail the influences that the cardiovascular system, respiratory system and digestive system have on muscle, movement and health, including the following:
 - promoting blood flow, including reference to how movement promotes blood flow from the lower limb via the compression of blood vessels in the foot ('blood pump')
 - excretion – how muscles of the gut move food through the system
 - how muscles use oxygen and nutrients to provide energy
 - muscles in respiration – reference to thoracic muscles, including diaphragm
 - heart and blood system – muscle covering the heart and artery muscle.

For merit standard, learners will:

- provide information and explain in detail how the cardiovascular system, respiratory system and digestive system support movement, including the following:
 - how proteins, starch and fat are broken down by enzymes within a horse's digestive system
 - the horse's normal respiratory rate
 - the processes of breathing and gaseous exchange
 - the components of blood and their functions.

For pass standard, learners will:

- provide brief information on the structure and functions of the:
 - cardiovascular system
 - digestive system
 - respiratory system.

Learning aim C

For distinction standard, learners will:

- work competently and independently, to handle and restrain horses in a minimum of three situations
- provide information on the effectiveness of handling and restraint by comparing tack equipment and methods of restraint used when handling and restraining horses
- provide a comprehensive foot-care report with relevant information on:
 - horse age, breed, work type, body condition
 - limb conformation: lateral hoof pastern axis, dorsal foot balance, front leg and hind leg from the shoulder and pelvis
 - hoof condition and defects – dorsal, lateral and solar
- provide an appropriate and relevant aftercare proposal for the foot.

For merit standard, learners will:

- work with minimal assistance to select and carry out appropriate methods when horse handling and restraining a horse, using appropriate equipment and safety techniques as required
- prepare a foot-care report that includes details of the horse, such as age and breed, limb conformation of the front legs and hind legs below the knee, and hock and condition of the hoof
- provide an aftercare proposal for the foot.

For pass standard, learners will:

- work with some assistance to prepare, fit and use appropriate tack and equipment for handling and restraining horses
- handle horses safely and correctly
- prepare a basic foot-care report with some reference to key features, such as age, breed, limb conformation and hoof conditions.

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 are undertaking an apprenticeship with a farrier. The client's horse has not been shod for some time and you have been asked to report on its general condition, state of the feet and to prepare the horse for initial trot up, evaluation and shoeing.

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

The vet has been called in to examine a horse at a race yard where you are working and you have been tasked with reporting on its drinking and eating every morning and pulse rate during rest and after gallops.

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.

<p>Introduction to unit Unit overview and the importance of equine biology and horse handling to the farrier. Suggested time: about 1 hour.</p>
<p>Activity: The equine skeleton Use of bones and live horse to demonstrate placement of major bone groups and large bones. Suggested time: about 2 hours.</p>
<p>Activity: Demonstrations Dissection of lower limb and foot. Major external and internal structures. Suggested time: about 3 hours.</p>
<p>Activity: Practical horse handling Learners practise safe approach, catching and restraint of horses in a supervised environment. Suggested time: about 4 hours.</p>
<p>Activity: Tack room Equipment and tack recognition – learners practise identification and demonstration. Suggested time: about 1 hour.</p>
<p>Activity: Foot care Group work (horse handling and foot-care reporting) and completion of a foot-care report and foot aftercare plan. Suggested time: about 2 hours.</p>

UNIT 8: HORSE BIOLOGY AND HANDLING

Essential resources

For this unit, learners will need access to:

- an equine stable yard with appropriate horses and handling equipment
- recommended equine specimens (skeletal, dried, dissection).

Links to other units

This unit has links to:

- Unit 5: Freehand and Technical Drawing
- Unit 9: Research, Design and Make Blacksmith Products.

Employer involvement

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

- guest speakers/demonstrators
- business materials as exemplars.

Unit 9: Research, Design and Make Blacksmith Products

Level: **2**

Unit type: **Mandatory**

Assessment type: **Internal Synoptic**

Guided learning hours: **90**

Unit in brief

Learners will understand the process of making products through the use of a design brief. They will research and develop design ideas, leading them to design and make a final blacksmith product, using skills gained from other units of the qualification.

Unit introduction

The work of the blacksmith is to make forged and fabricated objects, tools and components either as part of a single commission or limited production run. This unit is critical to blacksmiths in their work as designer-makers.

In this unit, you will develop an understanding of what is required in a design brief. You will start with how to establish client needs and manage issues that may have an impact on the design process.

You will adopt principles and aspects of research and design that are essential to support the creative process and produce the final product. In addition, you will develop the skills to review the extent to which the final product meets the specification

On completion of this unit, you will have skills that can be used in job roles such as artistic blacksmith, industrial smith, welder fabricator, metalwork designer/specifier and farrier.

Learning aims

- A** Investigate design and development processes in blacksmithing
- B** Create a blacksmithing product
- C** Review the success of design processes and outcomes.

Unit summary

Learning aim	Key teaching areas	Summary of suggested assessment evidence
A Investigate design and development processes in blacksmithing	A1 Establishing context A2 Research methods A3 Design aspects, methods and ideas A4 Creating a design specification A5 Use of design conclusions	Learners produce a portfolio evidencing their research, design and development processes, final product and reflections on success, using evidence appropriate to their specialism. This could include photographs, written records, presentations and witness statements/observations.
B Create a blacksmithing product	B2 Blacksmithing processes and construction techniques B3 Quality	
C Review the success of design processes and outcomes	C1 Review product design processes C2 Review own performance	
Key teaching areas in this unit include:		
Sector skills	Knowledge	Transferable skills/behaviours
<ul style="list-style-type: none"> • Planning • Preparing • Selecting • Blacksmithing skills • Professional behaviour • Costing • Research • (Working to) specifications 	<ul style="list-style-type: none"> • Research methods • Design specifications • Design types • Health and Safety • Design conclusions 	<ul style="list-style-type: none"> • Communication • Preparing for work • Demonstrate thinking skills and show adaptability • Developing practical and technical skills • Problem solving • Management of information • Self-management and development

Unit content

Knowledge and sector skills

Learning aim A: Investigate design and development processes in blacksmithing

A1 Establishing context

Learners will explore and understand how to establish the context for a brief and develop a project proposal.

- The aim, purpose and context of the brief:
 - establish the design intention in relation to a brief
 - as requested by client
 - for personal creative input or development.
- Requirements:
 - to clarify the specifics to be included in the design – aesthetic (style, shape, composition, surface), function (ergonomics, regulations, materials, making process requirements, end use, technical information) and concept (context, communication of ideas).
- Limitations:
 - to clarify the specific limits being placed on the design requirements: budget, time, machinery, materials, processes.

A2 Research methods

Learners will understand research methods and topics, ensuring quality of information.

- Primary research:
 - observational drawing
 - photography
 - video
 - audio recordings
 - annotations.
- Secondary research:
 - internet
 - books
 - periodicals
 - existing product design characteristics.
- Research topics as applicable to design intention:
 - objects
 - sites and locations
 - personal experience
 - natural world
 - societal
 - individual maker's work and design practice
 - arts
 - crafts
 - beliefs
 - science
 - industry
 - architecture
 - history.

UNIT 9: RESEARCH, DESIGN AND MAKE BLACKSMITH PRODUCTS

- Quality:
 - clarity of documented information
 - reliability of sources
 - range of research methods and topics.

A3 Design aspects, methods and ideas

- Statement of intent:
 - communicates initial ideas
 - how initial ideas are intended to be developed
 - how the intended outcomes will be met
 - design intentions are likely to change throughout the process and should be justified with reference to the statement of intent.
- Design aspects:
 - aesthetic (style, shape, composition, surface)
 - function (ergonomics, regulations, materials, making process requirements, end use, technical information)
 - concept (context, communication of ideas).
- Design methods:
 - exploratory drawing
 - producing samples
 - experimenting with materials, processes and techniques
 - producing models
 - producing maquettes
 - using research outcomes
 - testing variations.

A4 Creating a design specification

- Planning documents, sketches, drawings, notes and annotations, digital mock-ups, photographs, designs and model/samples containing the technical information necessary for the production of the final piece, to include:
 - materials, processes and techniques appropriate for production and end use
 - measurements as required for developing a product and material estimations (quantities, forging and bending allowances), tooling requirements – the general workshop equipment and tools required as well as any that may need to be produced to facilitate the production, such as specific hand tools and jigs
 - time estimates – calculating production time of the various elements of research, design and production appropriate to the requirements of the brief.

A5 Use of design conclusions

- Produce workshop drawings and specifications including any information (written or pictorial) that is necessary for the making of the design outcome.
- Produce a job-specific tool.
- Source job-specific tools, equipment and material requirements.

Learning aim B: Create a blacksmithing product**B1 Blacksmithing processes and construction techniques**

- Blacksmithing processes and techniques required by the design:
 - forging
 - forming
 - cutting
 - joining.
- Construction techniques:

- o preparation
- o setting out
- o relevant construction order.

B2 Quality

- Applying workshop surface finishes required by the design:
 - o wire brushing
 - o grinding
 - o polishing
 - o oiling using an organic oil:
 - hot
 - cold
 - o waxing using a mineral or organic wax:
 - hot
 - cold
 - o painting – applying an undercoat and top coat:
 - opaque paint
 - clear lacquer.
- Specifying sub contract finishes required by the design:
 - o hot-dip galvanising
 - o metal spraying
 - o electro-polishing
 - o electro-plating
 - o powder coating.

Learning aim C: Review the success of design processes and outcomes

C1 Review product design processes

- Documentation of design process and outcomes:
 - o introductory statement of intent or brief
 - o clear sequence of the design process
 - o documentation of research and design process
 - o evaluation and justification of design decisions
 - o design specifications
 - o the importance of clear photographs of ongoing work and final outcomes showing visual information: scale, construction details, joints and surface finish.
- Determining the success of design processes e.g. interpreting the design brief, design progression through research, creation of design specification.
- Determining the success of design outcomes e.g. use of design conclusions, specification alterations, efficiency of process choices management of quality issues – refining products through trial and error.

Transferable skills

Communication

- Interpreting client brief into a project proposal for creation of a blacksmithing product that meets design brief requirements.

Preparing for work

- Undertaking research activities and preparing work schedules for creation of a blacksmithing product.

Demonstrate thinking skills and show adaptability

- Trialling and refining ideas, processes and techniques to create a blacksmithing product that meets design brief requirements.

Developing practical and technical skills

- Demonstrating methods of blacksmithing processes and construction techniques to create a blacksmithing product.

Problem Solving

- Investigating materials, techniques and processes to create a blacksmithing product that meets design brief requirements.

Managing information

- Collecting and using information from primary and secondary sources to inform design and development.

Assessment criteria

Pass	Merit	Distinction
Learning aim A: Investigate design and development processes in blacksmithing		
A.P1 Identify customer requirements from the given brief.	A.M1 Produce an effective design specification to meet customer requirements in the given brief.	A.D1 Produce a comprehensive design specification justifying its suitability in meeting customer requirements in the given brief.
A.P2 Carry out research to meet the customer requirements in the given brief.		
A.P3 Produce a simple design specification to meet the customer requirements in the given brief.		
Learning aim B: Create a Blacksmithing product		
B.P4 Select and prepare materials, tools and equipment for a simple blacksmithing product to meet customer requirements.	B.M2 Produce an effective blacksmithing product using the appropriate materials, tools and equipment to meet customer requirements.	B.D2 Produce a high-quality blacksmithing product using the appropriate materials, tools and equipment to meet customer requirements.
B.P5 Create a simple blacksmithing product to meet customer requirements.		
Learning aim C: Review the success of design processes and outcomes		
C.P6 Identify strengths and areas for improvement of the design processes and outcomes in meeting customer requirements.	C.M3 Review the success of design processes and outcomes in meeting customer requirements.	C.D3 Review success of aspects of design processes and outcomes in meeting client requirements, designing a plan for improvement.

Essential information for assessment decisions

Learners must use the practical skills they have gained in other specialist units in order to create a product that responds to a brief. This brief must be provided by the tutor and not devised by learners. Assessment evidence must be independently produced by individual learners.

Learning aim A

For distinction standard, learners will

- carry out comprehensive research of the brief and existing products which are pertinent to the requirements of the brief and used comprehensively to inform initial ideas. They demonstrate assured understanding of the brief.
- prepare a comprehensive detailed design specification which covers all the customer requirements from a given customer brief. The design specification provides a comprehensive statement of intent and how the initial ideas are intended to be developed from research conducted. Learners give full consideration to all the design aspects and methods. They provide accurate details of materials, tools and equipment required. They use various media e.g. models, photographs, to sketch the end product with annotations. They fully justify the variation in materials, tools and equipment, in terms of size and quantity and what they will be used for. Learners include accurate calculations for production time of the various elements of research, design and production appropriate to the requirements of the brief.

For merit standard, learners will

- carry out research of the brief and existing products which are mostly relevant to the requirements of the brief and used competently to inform initial ideas. They demonstrate competent understanding of the brief.
- prepare a relevant design specification which covers most of the customer requirements from a given customer brief. The design specification provides detail of the statement of intent and how the initial ideas are intended to be developed from research conducted. Learners give consideration to most of the design aspects and methods. They provide mostly accurate details of materials, tools and equipment required. They use some media e.g. models, photographs, to sketch the end product with annotations. They justify the variation in the choice of materials, tools and equipment, in terms of size and quantity and what they will be used for. Learners include mostly accurate calculations for production time of the various elements of research, design and production appropriate to the requirements of the brief.

For pass standard, learners will

- list the customer requirements from the given brief. Carry out adequate research of the brief and existing products which are pertinent to the requirements of the brief. They may conduct research into one existing product and use this to inform initial ideas. They demonstrate limited understanding of the brief.
- prepare a simple design specification which lists some of the customer requirements from a given customer brief. The design specification provides a simple statement of intent and a list of how the initial ideas are intended to be developed from research conducted. Learners give some consideration to the design aspects and methods. They give a list of materials, tools and equipment required. They use one media to sketch the end product with some annotations.

Learning aim B**For distinction standard**, learners will:

- select, check and fully prepare all the materials, tools, equipment and processes that will be used in the production of the blacksmithing product.
- develop a final product while demonstrating an assured ability to apply materials, techniques and processes. They creatively address the conceptual, aesthetic and thoroughly addresses the technical requirements of the brief. The final blacksmithing product thoroughly reflects the design specification and is fluent and well-articulated realisation of a sophisticated independent design.

For merit standard, learners will:

- select, check and prepare most of the relevant materials, tools, equipment and processes that will be used in the production of the blacksmithing product. They may need to prepare and gather some while producing on the blacksmithing product.
- develop a final product while demonstrating a competent ability to apply materials, techniques and processes. They effectively address the conceptual, aesthetic and mostly addresses the technical requirements of the brief. The final blacksmithing product mostly reflects the design specification and is consistent and competent realisation of an effective independent design.

For pass standard, learners will:

- select, check and prepare some of the materials, tools and equipment that will be used in the production of the blacksmithing product. They may need to prepare and gather while producing the blacksmithing product.
- develop a final product while demonstrating a generally adequate ability to apply materials, techniques and processes. They generally address the conceptual, aesthetic and partially address the technical requirements of the brief. The final blacksmithing product partially reflects the design specification and is consistent and generally adequate realisation of a sound independent design with some areas of inconsistency.

Learning aim C**For distinction standard**, learners will:

- present an insightful and thorough review of the design process and success of the outcome. They will recognise all areas for improvement and make valid, insightful recommendations. They justify why the processes were used and make insightful suggestions on how alternative approaches could have been used to improve the quality and finish of the finished product. The finished product fully meets the customer requirements.

For merit standard, learners will:

- present a thorough review of the design process and success of the outcome. They will recognise some areas for improvement and make some detailed recommendations. They justify why some of the approaches were incorrectly used and make suggestions on how alternative approaches could have been used to improve the quality and finish of the finished product. The finished product meets most of the customer requirements

For pass standard, learners will:

- list limited strengths and weaknesses of the design process and outcome. The finished product meets some of the customer requirements.

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 it meets the assessment requirements of the unit.

Suggested scenario

You are working as a blacksmith. You have been asked to make a bird feeder for a client.

You will need to interpret the client brief, write it up in your own words as a project proposal and carry out research to explore and realise your ideas creatively. Your ideas must be communicated in a professional manner, using the most appropriate 2D and 3D visual aids to show your design and development processes towards completion of the final product. As a designer-maker, it is important that your product meets the requirements of the client brief, and you must review the success of both your final product and the processes you used to develop and refine your project. When demonstrating your skills, your performance will be observed by your tutor.

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

You are working as a blacksmith. You have been asked to make a sun dial for a client.

You will need to interpret the client brief, write it up in your own words as a project proposal and carry out research to explore and realise your ideas creatively. Your ideas must be communicated in a professional manner, using the most appropriate 2D and 3D visual aids to show your design and development processes towards completion of the final product. As a designer-maker, it is important that your product meets the requirements of the client brief, and you must review the success of both your final product and the processes you used to develop and refine your project. When demonstrating your skills, your performance will be observed by your tutor.

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

Information provided on:

- project theme
- expected outcomes
- methods of research and development that need to be followed
- timescale for the assignment.

Lecture/class discussion – whole class.

Questions and answers.

Suggested time: about 4 hours.

Activity: Project proposal and work schedule

Template provided to learners:

- project proposal
- work schedule.

Learners complete project proposal and work schedule.

They then present project proposals to the group:

- class discussion
- question and answers.

Suggested time: about 10 hours.

Activity: Research

Learners collect and present research for their project proposal.

To include:

- primary and secondary sources
- trips: museums, galleries, exhibitions
- studio work
- one-to-one/group support from tutor.

Learners work from a schedule they have planned and put together for the collection of research.

They then present their research.

- class discussion
- question and answers
- feedback: action plan given to learners for further development; feedback: action plan given to learners for
- further development

Suggested time: about 15 hours.

Activity: Design Development

Learners begin development of design ideas:

- experiments with materials and techniques relevant to the learner's specialism
- one-to-one/group support from tutor.

Learners work from a schedule they have planned and put together for the development of design ideas.

They then present their design ideas.

- design sheets
- samples
- maquettes
- sketch models

feedback: action plan provided to learners for further development.

Suggested time: about 15 hours.

Activity: Development of final product

Development of final piece of work with reference to project proposal:

- studio/workshop
- one-to-one/group support from tutor where appropriate.

Suggested time: about 20 hours.

Activity: Evaluation of final product

Lectures/class discussion questions and answers – whole class:

- presentation techniques
- presentation methods: verbal non-verbal communication
- evaluation: success of work/strengths and weaknesses etc.

Suggested time: about 8 hours.

Activity: Final presentation of finished product

Completion of all work for final presentation/assessment.

Guidance provided from tutor on what needs to be completed.

Suggested time: about 10 hours.

Essential resources

For this unit, learners will need access to:

- Specialist workshops, staffing, technical support and materials as relevant to their specialism.

Links to other units

This unit draws on the knowledge and skills taught in:

- Unit 1: Health and Safety in Blacksmithing
- Unit 2: Metallurgy and Heat Treatment
- Unit 3: Forging Processes
- Unit 4: Welding and Thermal Cutting Processes
- Unit 5: Freehand and Technical Drawing.

Employer involvement

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

- guest speakers
- design/ideas to contribute to unit assignment/case study/project materials
- work experience
- own business materials as exemplars
- support from local business staff as mentors.

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) achieved at least at Level 1
- at least 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 7 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 responding to client briefs, 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 Diploma 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* and *Section 8 Quality assurance* for the requirements for employer involvement.

Support for employer involvement

It is important that you give learners opportunities that are of high quality and that 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 10 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 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 10 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 teamworking and communication, and completing realistic tasks have 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 Pearson BTEC Level 2 Technical Diploma in Blacksmithing is assessed using *internal assessments* which are set and marked by tutors.

We have taken great care to ensure that the assessment method chosen is appropriate to the content of the unit and is 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.

6 Internal assessment

This section gives an overview of the key features of internal assessment and how you, as an approved centre, can offer it effectively. The full requirements and operational information are given in the *Pearson Quality Assurance Handbook* 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 7 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 Quality Assurance Handbook*.

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 Quality Assurance Handbook*.

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 10 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 qualification. 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 they 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 spilt 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 activity
- oral or written presentations with assessor questioning
- work logbooks and 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 document clearly 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 of 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 7 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 (please go to www.btec.co.uk/keydocuments).

7 Administrative arrangements

Introduction

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

Learner registration and entry

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

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

Internal assessments need to be administered carefully to ensure that all learners are treated fairly and that results and certificates 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 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 adjustments 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 and end point assessment policy*.

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 our *Centre guide for dealing with malpractice and maladministration in vocational qualifications*, available on our website.

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. Our *Centre guide for dealing with malpractice and maladministration in vocational qualifications* 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.

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)* (available at www.jcq.org.uk/exams-office/malpractice) with supporting documentation to pqsmalpractice@pearson.com. Where Pearson receives allegations of malpractice from other sources (for example Pearson staff or anonymous informants), the Investigations Team will conduct the investigation directly or may ask the head of centre to assist.

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

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

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

You should be aware that Pearson may need to suspend 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:

- 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 about Pearson vocational qualifications and end point assessment policy*, which is on our website. In the initial stage of any aspect of malpractice, please notify the Investigations Team by email via pqsmalpractice@pearson.com who will inform you of the next steps.

Certification and results

Once a learner has completed all the required units for a qualification, 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

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.

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 and claiming certificates.
- Regulatory policies: our regulatory policies are integral to our approach and explain how we meet internal and regulatory requirements. We review the regulated policies annually to ensure that they remain fit for purpose. Policies related to this qualification include:
 - adjustments for candidates with disabilities and learning difficulties, access arrangements and reasonable adjustments for general and vocational qualifications
 - age of learners
 - centre guidance for dealing with malpractice
 - recognition of prior learning and process.

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

8 Quality assurance

Centre and qualification approval

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

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

Continuing quality assurance and standards verification

On an annual basis, we produce the *Pearson Quality Assurance Handbook*. It contains detailed guidance on the quality processes required to underpin robust assessment, 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.

9 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.

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 *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 taken enough mandatory or optional 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.

Qualification	Available grade range
Diploma	PP to DD

The *Calculation of qualification grade* table, shown further on in this section, shows the minimum thresholds for calculating these grades. The table will be kept under review over the lifetime of the qualification. The most up to date table will be issued on our website.

Pearson will monitor the qualification standard and reserves the right to make appropriate adjustments.

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 details.

Points available for internal units

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

	Unit size		
	30 GLH	45 GLH	60 GLH
U	0	0	0
Pass	8	12	16
Merit	12	18	24
Distinction	16	24	32

Claiming the qualification grade

Subject to eligibility, we will automatically calculate the qualification grade for your learners when the internally-assessed 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

Diploma	
Grade	Points threshold
PP	96
MP	112
MM	128
DM	152
DD	176

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 2018

Example 1: Achievement of a Diploma with a PP grade

Unit	GLH	Type	Grade	Points
1	30	Internal	Pass	8
2	45	Internal	Merit	18
3	60	Internal	Pass	16
4	45	Internal	Pass	12
5	30	Internal	Pass	8
8	60	Internal	Pass	16
9	90	Internal	Pass	24
	360		PP	102

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

Unit	GLH	Type	Grade	Points
1	30	Internal	Merit	12
2	45	Internal	Merit	18
3	60	Internal	Merit	24
4	45	Internal	Distinction	24
5	30	Internal	Distinction	16
8	60	Internal	Distinction	32
9	90	Internal	Distinction	48
	360		DD	174

The learner has sufficient points for a DD grade.

Example 3: Achievement of a Diploma with an Unclassified result

Unit	GLH	Type	Grade	Points
1	30	Internal	Merit	12
2	45	Internal	Merit	18
3	60	Internal	Unclassified	0
4	45	Internal	Pass	12
5	30	Internal	Pass	8
8	60	Internal	Pass	16
9	90	Internal	Distinction	48
	360		U	114

The learner has a U in Unit 3.

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

10 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, 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 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 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 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 **BLACKSMITHING**

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/BTECL2TechBlacksmithing



TeachingLandBasedStudies@pearson.com

Aspire. Do. Achieve. Succeed.