



Level 3 Technicals in Engineering 1145-532

March 2018 Version 1.1

Guide to the examination

Version and date	Change detail	Section
1.1 March 2018	<ul style="list-style-type: none">• Corrected exam duration information.	Exam requirements for this qualification

Who is this document for?

This document has been produced for centres who offer **City & Guilds Level 3 Technicals in Engineering**. It gives all of the essential details of the qualification's external assessment (exam) arrangements and has been produced to support the preparation of candidates to take the exam/s.

The document comprises four sections:

1. **Details of the exam.** This section gives details of the structure, length and timing of the exam.
2. **Content assessed by the exam.** This section gives a summary of the content that will be covered in each exam and information of how marks are allocated to the content.
3. **Guidance.** This section gives guidance on the language of the exam, the types of questions included and examples of these, and links to further resources to support teaching and exam preparation.
4. **Further information.** This section lists other sources of information about this qualification and City & Guilds Technical Qualifications.

1. Details of the exam

External assessment

City & Guilds Technical qualifications have been developed to meet national policy changes designed to raise the rigour and robustness of vocational qualifications. These changes are being made to ensure our qualifications can meet the needs of employers and Higher Education. One of these changes is for the qualifications to have an increased emphasis on external assessment. This is why you will see an external exam in each of our Technical qualifications.

An external assessment is an assessment that is set and/or marked by the awarding organisation (ie externally). All City and Guilds Technical qualifications include an externally set and marked exam. This must be taken at the same time by all candidates who are registered on a particular qualification. We produce an exam timetable each year. This specifies the date and time of the exam so you can plan your delivery, revision and room bookings/PC allocation in plenty of time.

The purpose of this exam is to provide assurance that all candidates achieving the qualification have gained sufficient knowledge and understanding from their programme of study and that they can independently recall and draw their knowledge and understanding together in an integrated way. Whilst this may not be new to you, it is essential that your learners are well prepared and that they have time to revise, reflect and prepare for these exams. We have produced a Teaching, Learning, and Assessment guide that is you should refer to alongside the present document ([Teaching, Learning and Assessment Guide](#)). If a learner does not pass the exam at their first attempt, there is only one opportunity to resit the exam, so preparation is essential.

Exam requirements of this qualification

- **Level 3 Engineering** – Theory exam (2 hours).

The exam is graded and a candidate must achieve at least a Pass grade in order to be awarded the qualification. (In addition to the exam, a synoptic assignment must also be completed and passed.) You can find full details of the synoptic assignment in the *Qualification Handbook* and the *Synoptic Assessment Guide* – please see the link to the qualification page at the end of this document.

When does the exam take place?

The exam is offered on two fixed dates in February or May. The exact dates will be published at the start of the academic year in the *Assessments and Exam Timetable* <http://www.cityandguilds.com/delivering-our-qualifications/exams-and-admin>.

At the start of the programme of study, in order to effectively plan teaching and exam preparation, centres should know when the exam will be taking place and allocate teaching time accordingly. Section 2 of this document gives a summary of the content that needs to be covered in order to prepare learners for the exam and full details of this are given in the Qualification Handbook.

Form of exam

The exam for this qualification can be taken on paper (1145-532).

Can candidates resit the exam?

Candidates may resit the exam once only. If a candidate fails the exam both on the first attempt and when resitting it, that candidate has failed the qualification and cannot achieve it in that academic year.

How the exam is structured

Each exam has a total of 60 marks and is made up of:

- approximately 5-7 short answer questions
- 1 extended response question.

Short answer questions are used to confirm **breadth of knowledge and understanding**.

The extended response question is to allow candidates to demonstrate **higher level and integrated understanding** through written discussion, analysis and evaluation. This question also ensures the exam can differentiate between those learners who are 'just able' and those who are higher achieving.

More details about and examples of question types are given in Section 3 of this document.

Assessment Objectives

The exams are based on the following set of assessment objectives (AOs). These are designed to allow the candidate's responses to be assessed across the following three categories of performance:

- **Recollection** of knowledge.
- **Understanding** of concepts, theories and processes.
- **Integrated application** of knowledge and understanding.

In full, the assessment objectives covered by the exam for this qualification are:

Assessment objective	Mark allocation (approx %)
<i>The candidate..</i>	
AO1 Recalls knowledge from across the breadth of the qualification	20%
AO2 Demonstrates understanding of concepts, theories and processes from a range of learning outcomes.	60%
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20%

Booking and taking the exam

All assessments for City & Guilds Technical Exams must be booked through Walled Garden. There is a deadline for booking exams, synoptic assessments and any other centre marked assessments, please refer to the time line to check these dates.

The exam must be taken under the supervision of an invigilator who is responsible for ensuring that it is conducted under controlled conditions. Full details of the conditions under which the exam must be taken can be found in the Joint Council for Qualifications (JCQ) document, [Instructions for Conducting Examinations \(ICE\)](#).

Special consideration

Candidates who are unable to sit the exam owing to temporary injury, illness or other indisposition at the scheduled time may qualify for special consideration. This is a post-examination adjustment that can, in certain circumstances, be made to a candidate's final grade. The Joint Council for Qualifications' guide to the special consideration process can be found at www.jcq.org.uk.

To make a request for special consideration, please contact: policy@cityandguilds.com

Access arrangements

Access arrangements are arrangements that allow candidates with particular requirements, disabilities or temporary illness to take assessments, where appropriate, using their normal way of working. The Joint Council for Qualifications document, *Access Arrangements and Reasonable Adjustments* gives full details and can be downloaded [here](#).

For further information and to apply for access arrangements please see:

[Access arrangements - When and how applications need to be made to City & Guilds](#)
[Applying for access arrangements on the Walled Garden](#)

2. Content assessed by the exam

The exam assesses:

- **Unit 307: Engineering workshop practice**
- **Unit 308: Innovation and new technologies**

The exam assesses a sample of the content of these units. This means that a single exam will **not** cover 100% of the unit content. The full range of content will be assessed over a number of examination series. Details of the coverage of a particular exam paper will **not** be released in advance of the exam itself. Centres should **not** make assumptions about what will be assessed by a particular exam based on what has been covered on previous occasions. In order to be fully prepared for the exam, learners **must** be ready to answer questions on **any** of the content outlined below.

The table below provides an overview of how the qualification's units are covered by the exam and the number of **marks** available per unit (ie **not** the number of *questions* per unit). In preparing candidates for the exam, we recommend that centres take note of the number of marks allocated to each unit and to assign teaching and preparation time accordingly.

In preparing candidates for the exam, centres should refer to the Qualification Handbook which gives full details of each unit/Learning Outcomes. The following is a summary of only that qualification content which is assessed by the exam and **not** a summary of the full content of the qualification.

Unit	Learning outcome	Topics	Number of marks
307 Engineering workshop practice	L01 Understand health and safety requirements in an engineering workshop	1.1 Purpose of current legislation within the engineering industry 1.2 Responsibilities of employers and employees 1.3 Methods of identifying hazards in the workplace 1.4 Safe behaviour in the workplace	12
	L02 Know engineering cutting tools and machines	2.1 Cutting principles 2.2 Cutting by shear tools and machinery 2.3 Chip cutting tools and machinery 2.4 Thermal cutting equipment	4

	LO3 Mark out and cut engineering components	3.1 Marking out tools 3.2 Measuring tools 3.3 Marking out a range of profiles 3.4 Marking out a range of material forms 3.5 Cutting and shaping materials	
	LO4 Use electrical and electronic engineering tools	4.1 Types of cable 4.2 Cable preparation and termination 4.3 Cable loom manufacture 4.4 Fixing components to circuit boards	
	LO5 Assemble engineering components	5.1 Assemble engineering products 5.2 Test an assembled engineered product	
308 Innovation and new technologies	LO1 Understand how innovation and new technologies impact on society and industry	1.1 Benefits of innovation and new technologies 1.2 Enablers in the process of innovation 1.3 Environmental and social impacts	12
	LO2 Understand the need for research and development	2.1 The aim of research and development 2.2 Research and development process	8
	LO3 Understand low-carbon technologies and their impact es	3.1 Low carbon technologies 3.2 Application of low carbon technologies 3.3 Stakeholder and public engagement	12
	LO4 Understand augmented and virtual reality	4.1 Augmented and virtual reality 4.2 Applications of augmented and virtual reality	
	LO5 Understand the impact of digital technologies, cloud computing and the Internet	5.1 Digital technologies and their applications 5.2 Web services and cloud computing	
Total marks for sections:			48 marks

Integration across units*: 12 marks

Total marks for exam: 60 Marks

* *Integration across units*. These marks relate to Assessment Objective 4. These marks are awarded to differentiate between levels of performance by candidates taking the exam. The marks are given for how well a candidate has applied their knowledge, understanding and skills from across the units that make up the qualification in an integrated way to meet the requirements of the exam questions.

3. Guidance

Vocabulary of the exam: use of 'command' verbs

The exam questions are written using 'command' verbs. These are used to communicate to the candidate the type of answer required. Candidates should be familiarised with these as part of their exam preparation.

The following guidance has been produced on the main command verbs used in City & Guilds Technicals exams.

A more detailed version of this table, which also includes the command verbs used in the assignments is published in *City & Guilds Technical Qualifications Teaching, Learning and Assessment* guide.

Command verb	Explanation and guidance
Analyse	Study or examine a complex issue, subject, event, etc in detail to explain and interpret, elements, causes, characteristics etc
Calculate	Work out the answer to a problem using mathematical operations
Compare (... and contrast) (or describe the similarities/differences)	Consider and describe the similarities (and differences) between two or more features, systems, ideas, etc
Define	Give the meaning of, technical vocabulary, terms, etc.
Describe	Give a detailed written account of a system, feature, etc (..the effect of...on...) the impact, change that has resulted from a cause, event, etc (..the process..) give the steps, stages, etc
Differentiate between	Establish and relate the characteristic differences between two or more things, concepts, etc
Discuss	Talk/write about a topic in detail, considering the different issues, ideas, opinions related to it
Distinguish between	Recognise and describe the characteristic differences between two things, or make one thing seem different from another
Evaluate	Analyse and describe the success, quality, benefits, value, etc (of an end product, outcome, etc)
Explain	Make (a situation, idea, process, etc) clear or easier to understand by giving details (..how..) Give the stages or steps, etc in a process, including relationships, connections, etc between these and causes and effects.
Give example(s) illustrate/	Use examples or images to support, clarify or demonstrate, an explanation, argument, theory, etc

Give a rationale	Provide a reason/reasons/basis for actions, decisions, beliefs, etc
Identify	Recognise a feature, usually from a document, image, etc and state what it is
Justify	Give reasons for, make a case for, account for, etc decisions, actions, conclusions, etc, in order to demonstrate why they suitable for or correct or meet the particular circumstances, context
Label	Add names or descriptions, indicating their positions, on an image, drawing, diagram, etc
List	Give as many answers, examples, etc as the question indicates (candidates are not required to write in full sentences)
Name	Give the (technical) name of something
Propose	Present a plan, strategy, etc (for consideration, discussion, acceptance, action, etc).
Select	Choose the best, most suitable, etc, by making careful decisions
State	Give the answer, clearly and definitely
Summarise	Give a brief statement of the main points (of something)

Question types

The following explains, and gives examples of, types of questions used in City & Guilds Technical exams. In preparing candidates to take the exam, it is recommended that you familiarise them with the requirements of each question type so that they can be effective and make best use of the time available when sitting the exam.

- An effective candidate will gauge the type and length of response required from the question and the number of marks available (which is given for each question on the exam paper).
- Short answer questions may not require candidates to write in complete sentences. Extended response questions will require a more developed response.
- Candidates should read the exam paper before attempting to answer the questions and should allocate time proportionate to the number of marks available for each question or section.

Question type:	Example question	Example question:
<p>Short answer questions (restricted response) These are questions which require candidates to give a brief and concise written response. The number of marks available will correspond to the number of pieces of information/examples and the length of response required by the question.</p>	<p>Explain how annealing changes the properties of an aluminium alloy.</p>	<p>Annealing involves heating the alloy and holding it at temperature so that the grains in the metal grow. This makes the alloy softer and easier to work.</p>
<p>Structured Response Questions These are questions that have more than one part (eg a), b), etc.). The overall question is made up of linked, short answer questions which move the candidate through the topic in a structured way. For example, the question will usually start with a 'recall'/'state'/'describe' question followed by an 'explain' to draw out understanding of the topic. They usually have a shared</p>	<p>a) State the mechanical property that has the ability of a material to absorb energy from an impact and plasticity deform without fracturing.</p> <p>b) State the word that means the potential to improve the resistance to penetration of a material by heat treatment.</p>	<p>a) Toughness.</p> <p>b) Hardenability.</p>

introductory 'stem', and the number of marks may increase through the question.

Extended response questions

Extended response questions are those that require the candidate to write a longer written response using sentences and paragraphs. These usually require candidates to discuss, explain, etc. a topic in some detail. The question is often based on a short case study, scenario or other prompt. The level of detail should be gauged from the question and the number of marks available.

Example question

Discuss how the development of virtual reality technologies may affect the design and manufacture of products.

Mark scheme

Indicative content to include:

Examples of parts that may be included in an answer are:

- typical benefits of innovative and new technologies
- enablers in the process of innovation and the creation of new products
- modelling of solutions to problems to ensure solutions made first time
- reduced resource requirements for physical modelling most effective and efficient options
- improved safety, by identifying risk or reducing manufacturing requirements
- types of VR technology and how they may be applied
- any other relevant point.

Band 1 (1 – 4 marks)

Basic – largely descriptive response, based on recall of knowledge, describing the potential application of VR, in design or manufacturing.

Candidates at the top of this level may be characterised by showing some understanding of the benefits of limitations of using VR during design one manufacture.

Example band 1 response

Virtual reality can be used to test design ideas. 3D CAD models can be created and placed in a virtual environment. Wearing VR goggles the designer can then examine the design from any angle he or she wants and turn it around. If the product is made from parts they can also simulate making the product and taking it apart, so they don't need to make a physical prototype.

Band 2 (5 – 8 marks)

Clear – more detailed response covering a range of different potential applications of VR in design and manufacturing and showing understanding of some reasons for its use.

Candidates at the top of this level may be characterised by showing understanding of both the benefits and limitations of using VR during design and manufacturing.

Example band 2 response

VR can be used to create virtual prototypes of design ideas and to simulate the manufacture of products.

During designing, the use of VR means a designer can see in 3D what the design looks like. This can save the cost and time of making a physical prototype can't be tested as it is not made from the material that the final product is made from.

During manufacture, simulations of the process of making a product can allow better ways to make it to be identified. For example, for complicated products this might be identifying the best route that a machine tool should take when cutting or surfacing; or for assembly, testing out different sequences to put the product together. Both of these will increase the rate of manufacture and allow quality issues to be identified and fixed before actual products are made.

Band 3 (9 – 12 marks)

Detailed – fully detailed response showing awareness of a variety of different potential uses of VR in design and manufacturing, showing understanding of the reasons for its use. Benefits and limitations of the use of VR are evaluated, with substantiation of the potential influence and

producing supporting conclusions. Candidates at the top of this level may be characterised by analysing conflicting benefits and limitations of the use of VR and how this may affect design and manufacturing outcomes.

Example band 3 response

VR technologies will potentially have a significant impact on the design and manufacturing of products. By using CAD models, engineers could quickly assess:

- how well parts fit together
- how products will look and function in use (also useful to show clients and customers)
- the most efficient manufacturing tool paths
- the most efficient sequences to assemble products.

Further, these technologies can be fully interactive, meaning that not only can the above things be observed but also the designs can be changed or adjusted in real time. This could greatly reduce the time it takes products to get to market.

However, there are some drawbacks to the use of VR for starters, the models don't use the actual materials. Whilst properties can be modelled, this does not necessarily take account of machining difficulties or the impact of defects or faults on product performance. Whilst VR models do not need the expenditure (or time to purchase) of physical prototypes they still need VR hardware and software, which is currently still pretty expensive.

In summary, VR technologies have great potential as a tool to support design and the planning of manufacturing in the long term, as their cost drops. However, care has to be taken as 'real world' factors such as faults in materials still need to be accounted for to ensure products function as planned.

Examination technique

Candidates with a good understanding of the subject being assessed can often lose marks in exams because they lack experience or confidence in exams or awareness of how to maximise the time available to get the most out of the exam. Here is some suggested guidance for areas that could be covered in advance to help learners improve exam performance.

Before the exam

Although candidates cannot plan the answers they will give in advance, exams for Technical qualifications do follow a common structure and format. In advance of taking the exam, candidates should:

- be familiar with the structure of the exam (ie number and type of questions).
- be aware of the amount of time they have in total to complete the exam.
- have a plan, based on the exam start and finish time for how long to spend on each question/section of the exam.
- be aware of how many marks are available for each question, how much they should expect to write for each question and allow most time for those questions which have the most marks available.

At the start of the exam session

At the start of the exam, candidates:

- should carefully read through the instructions before answering any questions.
- may find it helpful, where possible, to mark or highlight key information such as command words and number of marks available on the question paper.
- identify questions which require an extended written answer and those questions where all or part of the question may be answered by giving bullets, lists etc rather than full sentences.

Answering the questions

Candidates do not have to answer exam questions in any particular order. They may find it helpful to consider, for example:

- tackling first those questions which they find easiest. This should help them get into the 'flow' of the exam and help confidence by building up marks quickly and at the start of the exam.
- tackling the extended answer question at an early stage of the exam to make sure they spend sufficient time on it and do not run out of time at the end of the exam.

Candidates should avoid wasting time by repeating the question either in full or in part in their answer.

Candidates should **always** attempt every question, even questions where they may be less confident about the answer they are giving. Candidates should be discouraged however, from spending too long on any answer they are less sure about and providing answers that are longer and give more detail than should be necessary in the hope of picking up marks. This may mean they have less time to answer questions that they are better prepared to answer.

Extended answer questions

Before writing out in full their answer to extended questions, candidates may find it helpful to identify the key requirements of the question and jot down a brief plan or outline of how they will answer it. This will help clarify their thinking and make sure that they don't get 'bogged down' or provide too much detail for one part of the question at the expense of others.

Towards the end of the exam

Candidates should always set aside time at the end of the exam to read back through and review what they have written in order to make sure this is legible, makes sense and answers the question in full.

If a candidate finds they are running out of time to finish an answer towards the end of the exam, they should attempt to complete the answer in abbreviated or note form. Provided the content is clear and relevant, examiners will consider such answers and award marks where merited.

Further guidance on preparing candidates to take the exam is given in the City & Guilds publication, [Technical Qualifications, Teaching, Learning and Assessment](#) which can be downloaded free of charge from City & Guilds website.

4. Further information

For further information to support delivery and exam preparation for this qualification, centres should see:

City & Guilds

Qualification homepage: www.cityandguilds.com/qualifications-and-apprenticeships/engineering/mechanical/1145-technical-in-engineering#tab=information which includes:

- Qualification handbook
- Synoptic Assignment
- Sample assessments

Technical Qualifications, Resources and Support: www.cityandguilds.com/techbac/technical-qualifications/resources-and-support

Joint Council for Qualifications

Instructions for Conducting Examinations: <http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>