

# Level 2 Technical Award in Vehicle Technology (4292-20)

Version 4.1 (June 2017)

## Qualification Handbook

## Qualification at a glance

<b>Industry area</b>	Automotive
<b>City &amp; Guilds qualification number</b>	4292-20
<b>Age group</b>	14-16 (Key Stage 4)
<b>Entry requirements</b>	Centres must ensure that any pre-requisites stated in the <i>What is this qualification about?</i> section are met.
<b>Assessment</b>	To gain this qualification, candidates must successfully achieve the following assessments: <ul style="list-style-type: none"><li>• One externally set, externally moderated assignment</li><li>• One externally set, externally marked exam, sat under examination conditions</li></ul>
<b>Grading</b>	This qualification is graded Pass/Merit/Distinction/Distinction* For more information on grading, please see Section 6: Grading.
<b>Approvals</b>	This qualification requires full centre and qualification approval
<b>Support materials</b>	Sample assessments Guidance for delivery Guidance on use of marking grids
<b>Registration and certification</b>	Registration and certification of this qualification is through the Walled Garden, and is subject to end dates.
<b>External quality assurance</b>	This qualification is externally quality assured by City & Guilds, and its internally marked assignments are subject to external moderation. There is no direct claim status available for this qualification.

Title and level	GLH	TQT	City & Guilds qualification number	Ofqual accreditation number
Level 2 Technical Award in Vehicle Technology	120	160	4292-20	603/0310/4

Version and Date	Change Detail	Section
3.0 March 2017	Units numbers 201 and 202 have been changed to 220 and 221	Units
4.0 June 2017	Addition of the examination paper based module number	1. Introduction – Assessment requirements and employer involvement 5. Assessment 5. Assessment – exam Specification 7. Grading – Awarding grades and reporting results
	Removal of AO 6-8 from Synoptic Assignments	5. Assessment – Assessment Objectives
	Addition of Provisional Grade Boundaries for the Synoptic Assignment	7. Grading
	Revised Exam Specification, Exam Duration and AO weightings	5. Assessment – Exam Specification
	Branding Changes	Throughout
4.1 September 2017	Updated AO weighting for synoptic assignment	5. Assessment

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# 1 Introduction

## What is this qualification about?

This document tells you what you need to do to deliver the qualification.

Area	Description
Who is the qualification for?	<p>This Level 2 Technical Award in Vehicle Technology allows you to explore the whole automotive industry giving you an introduction not just to the automotive manufacturing sector but the retail motor industry as well.</p> <p>With a practical hands on approach and the application of other GCSEs subjects such as Maths, Physics, Science or Art you will learn how vehicles are designed and how their systems and components work, whether they are cars, vans, motorcycles, trucks or all-terrain vehicles (ATVs).</p>
What does this qualification cover?	<p>You will explore what are the main factors to consider when designing and manufacturing a vehicle and how to choose the right materials as well as their properties.</p> <p>The main principles of Maths, Science and Physics will be applied to understand how the main systems and components of different vehicles operate.</p> <p>There is also a practical section during which you will learn how to use the basic measurement and fabrication tools available in any type of engineering/manufacturing workshop.</p> <p>This qualification covers two main areas:</p> <ul style="list-style-type: none"><li>• Underpinning Principles in Vehicle Technology</li><li>• Vehicle Technology Systems</li></ul>
What knowledge and skills will the student develop as part of this qualification and how might these be of use and value in further studies?	<p>This qualification develops the following knowledge, understanding and skills:</p> <ul style="list-style-type: none"><li>• Vehicle design factors, which will be useful if you decide to continue learning into an engineering and manufacturing discipline in automotive or aerospace</li><li>• what materials are used in vehicle manufacturing, providing an understanding of how their properties have an impact on the manufacturing of any type of components and the scientific principles behind them</li><li>• different power units, chassis, transmissions and drive train layouts aimed at giving you the technology and engineering basics of different vehicle systems</li></ul>

**Area****Description**

- operating principles of electric motors, four stroke cycle, rotary phases and two stroke cycle to encourage you to ask yourself what makes vehicles and systems work and the importance of scientific and technological principles
- how to use measurement and workshop tools for fabrication and repair, providing you the key hand skills required to work in any engineering workshop
- understanding of mathematical and scientific principles of vehicle power, braking, suspension and steering systems, which will enable you to progress into further maths and science learning
- vehicle electrical principles and components and the physics behind their operation which are transferable to other engineering areas.

Your understanding and skills can be developed further through progression to a range of qualifications, such as A Levels or Technical Qualifications in engineering and automotive.

For example:

- City & Guilds Level 2 Technical Certificate in Automotive
- City & Guilds Level 3 Advanced Technical Certificate in the Automotive Industry
- City & Guilds Level 3 Advanced Technical Extended Diploma in the Automotive Industry (720)

You will also find the understanding and skills useful to progress into an Apprenticeship in a variety of occupations in the automotive, retail motor industry or engineering sectors. For example, you could undertake an Apprenticeship to become a motor vehicle service and maintenance technician.

Which subjects will complement this course?

GCSEs in Maths, Physics, Science, Art and Design will complement this qualification.

## Qualification structure

For the Level 2 Technical Award in Vehicle Technology the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
220	Underpinning Principles in Vehicle Technology	60
221	Vehicle Technology Systems	60

## Total Qualification Time

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

Title and level	GLH	TQT
Level 2 Technical Award in Vehicle Technology	120	160

## Assessment requirements

To achieve the **Level 2 Technical Award in Vehicle Technology** candidates must successfully complete **both** mandatory assessment components.

Component number	Title
020 or 520	Level 2 Vehicle Technology - Theory exam (1)*
021	Level 2 Vehicle Technology - Synoptic assignment (1)*

*\*Number of mandatory assessments per assessment type*

## 2 Centre requirements

### Approval

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

### Resource requirements

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

### Centre staffing

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

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

### Physical resources

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

### Internal Quality Assurance

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

### Learner entry requirements

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

### Age restrictions

This qualification is approved for learners aged 14-16.

## 3 Delivering technical qualifications

### Delivering a Technical Award – Key tips

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

#### Taking a holistic approach to delivery

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

#### Engaging with employers to develop links between theory and practice

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

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

#### Use of learning technologies

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

#### Development of learning and thinking skills

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

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

## Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific learning or training needs,
- support and guidance they may need when working towards their qualification,
- the appropriate type and level of qualification.

We recommend that centres provide an introduction so that learners fully understand the requirements of the qualification, their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.

## Support materials

The following resources are available for this qualification:

Description	How to access
Assessment pack	
Guidance for delivery	Available on the qualification pages on the City & Guilds Website: <a href="http://www.cityandguilds.com">www.cityandguilds.com</a>
Guidance on use of marking grids	
Sample assessment material	

## 4 Assessment

### Summary of assessment methods and conditions

Details of the assessments are given in the following table:

Component numbers	Assessment method	Description and conditions
021	Synoptic assignment	<p>The synoptic assignment is <b>externally set, internally marked and externally moderated</b>. The assignment requires candidates to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the content area. Candidates will be judged against the assessment objectives.</p> <p>Assignments will be released to centres as per dates indicated in the Assessment and Examination timetable published on our website.</p> <p>Centres will be required to maintain the security of all live assessment materials. Assignments will be password protected and released to centres through a secure method.</p> <p>There will be one opportunity within each academic year to sit the assignment. Candidates who fail the assignment will have one re-sit opportunity. The re-sit opportunity will be in the next academic year, and will be the assignment set for that academic year once released to centres. If the re-sit is failed, the candidate will fail the qualification.</p> <p>Please note that for externally set assignments City &amp; Guilds provides guidance and support to centres on the marking and moderation.</p>

Component numbers	Assessment method	Description and conditions
020/520	Externally marked exam	<p>The exam is <b>externally set and externally marked</b>, and can be taken either online through City &amp; Guilds computer-based testing platform (020), or as a paper based test (520).</p> <p>The exam is designed to assess the candidate's depth and breadth of understanding across content in the qualification at the end of the period of learning, using a range of question types and will be sat under invigilated examination conditions. See JCQ requirements for details: <a href="http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations">http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations</a></p> <p>The exam specification shows the coverage of the exam across the qualification content.</p> <p>Candidates who fail the exam at the first sitting will have <b>one</b> opportunity to re-sit. If the re-sit is failed the candidate will fail the qualification. For exam dates, please refer to the Assessment and Examination timetable.</p>

### What is synoptic assessment?

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

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

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

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

## How the assignment is synoptic for this qualification

The typical assignment brief could be to complete a series of linked practical tasks that are likely to be encountered in a typical vehicle service and repair centre.

This will require the candidate to prepare for, complete and review service and inspection procedures, making decisions based on the information provided and on barriers encountered. Learners will be required to use correct Personal Protective Equipment (PPE), to complete standard service and inspection forms and to ensure they work safely at all times. Learners will also be expected to use basic fabrication tools to produce products to an acceptable standard.

## External exam for stretch, challenge and integration

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

## Assessment objectives

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

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

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

Assessment objective	Typical expected evidence of knowledge, understanding and skills	Approximate weighting
<b>AO1</b> Recalls knowledge from across the breadth of the qualification.	Identification of key tools and equipment, recall of key principles and formulas, risk assessment process, visual inspection techniques, service procedures, fabrication processes, use of test equipment and hand tools.	15%
<b>AO2</b> Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Vehicle electrical principles, the relationship between electrical and mechanical components, selection of appropriate tools and equipment, parameters for experimentation, properties of materials and components, use of testing procedures.	20%
<b>AO3</b> Demonstrates technical skills from across the breadth of the qualification.	Range of hand skills demonstrated when fabricating, use of test equipment, use of measuring and hand tools, use of servicing equipment, compliance with health and safety.	40%

Assessment objective	Typical expected evidence of knowledge, understanding and skills	Approximate weighting
<b>AO4</b> Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying knowledge and understanding across all tasks, justifying recommendations/approaches taken, application of understanding of procedures, planning of tasks, application of understanding of measurement to test electrical assemblies, application of understanding of material properties and fabrication processes, application of theory to practical tasks.	15%
<b>AO5</b> Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Meeting specific requirements of the task, attention to detail when completing and carrying out inspection and testing, effective workshop practices, checking results and records.	10%

## Examination specification

AO weightings per exam

Assessment objective	Exam weighting (approx. %)
<b>AO1</b> Recalls knowledge from across the breadth of the qualification.	27
<b>AO2</b> Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	53
<b>AO4</b> Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20

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

**Assessment type:** Examiner marked, written exam

**Assessment conditions:** Invigilated examination conditions

**Grading:** X/P/M/D

<b>Exam 020/520</b>	<b>Duration: 2 hours</b>		
<b>Unit</b>	<b>Title</b>	<b>Number of marks</b>	<b>%</b>
220	Underpinning Principles in Vehicle Technology	21	35
221	Vehicle Technology Systems	27	45
N/A	Integration across the units	12	20
<b>Total</b>		<b>60</b>	<b>100</b>

\*These exams are sat under invigilated examination conditions, as defined by the JCQ:

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

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

## 5 Moderation and standardisation of assessment

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

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

### Supervision and authentication of internally assessed work

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

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

### Internal standardisation

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

### Internal appeal

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

Centres cannot appeal the outcome of moderation for individual candidates, only the moderation process itself. A request for a review of the moderation process should be made to [appeals@cityandguilds.com](mailto:appeals@cityandguilds.com)

### Moderation

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

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

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

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

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

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

### **Post-moderation procedures**

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

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

### **Centres retaining evidence**

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

## 6 Grading

### Awarding individual assessments

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

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

### Grade descriptors

#### To achieve a pass, a candidate will be able to

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

#### To achieve a distinction, a candidate will be able to

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

- Achieve an outcome which shows an attention to detail in its planning, development and completion, so that it completely meets or exceeds the expectations of the brief to a high standard.
- Carry out an evaluation in a systematic way, focussing on relevant quality points, identifying areas of development/ improvement as well as assessing the fitness for purpose of the outcome.

### Awarding grades and reporting results

The overall qualification grade will be calculated based on aggregation of the candidate's achievement in each of the assessments for the mandatory units, taking into account the assessments' weighting. The **Level 2 Technical Award in Vehicle Technology (4292-20)** will be reported on a four grade scale: Pass, Merit, Distinction, Distinction\*.

All assessments **must** be achieved at a minimum of Pass for the qualification to be awarded. Candidates who fail to reach the minimum standard for grade Pass for an assessment will not have a qualification grade awarded and will not receive a qualification certificate.

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

Synoptic Assignment	Pass Mark (%)
021	40

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

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

Assessment method	Grade scale	% contribution
Synoptic Assignment	X/P/M/D	60%
Exam	X/P/M/D	40%

Both synoptic assignments and exams are awarded (see 'Awarding individual assessments', at the start of Section 6, above), and candidates' grades converted to points. The minimum points available for each assessment grade is listed in the table below. A range of points between the Pass, Merit and Distinction boundaries will be accessible to candidates. For example a candidate that achieves a middle to high Pass in an assessment will receive between 8 and 10 points, a candidate that achieves a low to middle Merit in an assessment will receive between 12 and 14 points. The points above the minimum for the grade for each assessment are calculated based on the candidate's score in that assessment.

	Pass	Merit	Distinction
Assignment: 60%	6	12	18
Exam: 40%	6	12	18

The candidate's points for each assessment are multiplied by the % contribution of the assessment and then aggregated. The minimum points required for each qualification grade are as follows:

Qualification Grade	Minimum points
Distinction*	20.5
Distinction	17
Merit	11
Pass	6

Candidates achieving Distinction\* will be the highest achieving of the Distinction candidates.

## 7 Administration

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

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

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

- internal quality assurance
- City & Guilds external moderation.

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

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

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

### External quality assurance

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

City & Guilds requires the Head of Centre to

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

### Enquiries about results

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

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

## Re-sits and shelf-life of assessment results

Candidates who have failed an assessment or wish to re-take it in an attempt to improve their grade, can re-sit assessments **once only**. The best result will count towards the final qualification. See guidance on individual assessment types in Section 4.

## Factors affecting individual learners

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

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

## Malpractice

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

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

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

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

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

## Access arrangements and special consideration

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

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

Please refer to the *JCQ access arrangements and reasonable adjustments and Access arrangements - when and how applications need to be made to City & Guilds* for more information. Both are available on the City & Guilds website: <http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments>

## Special consideration

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

Applications for either access arrangements or special consideration should be submitted to City & Guilds by the Examinations Officer at the centre. For more information please consult the current version of the JCQ document, *A guide to the special consideration process*. This document is available on the City & Guilds website: <http://www.cityandguilds.com/delivering-our-qualifications/centre-development/centre-document-library/policies-and-procedures/access-arrangements-reasonable-adjustments>.

## Unit 220 Underpinning Principles in Vehicle Technology

Unit level:	2
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GLH:	60
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### What is this unit about?

The purpose of this unit is for learners to develop an understanding of how maths and science are used in vehicle technology. This will be linked to power units, vehicle braking, suspension and steering. Learners will also be made aware of the materials used in vehicles and understand why they are used. They will also be introduced to vehicle electrical principles, component and circuit testing.

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### Learning outcomes

In this unit, learners will be able to

- 1 Understand mathematical and scientific principles of vehicle systems
- 2 Understand vehicle electrical principles and components

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## Learning outcome

- 1 Understand mathematical and scientific principles of vehicle systems
- 

## Topics

- 1.1 Mathematical automotive applications
- 1.2 Principles of friction
- 1.3 Materials used in vehicles
- 1.4 Fluids in vehicle systems

### Topic 1.1

Terminology and units used for vehicle applications:

- Brake force
- Compression ratio
- Coefficient of friction
- Pressure (cooling system, tyres)
- Gear ratio
- Distance travelled
- Mass
- Speed
- Weight

Understand and use given formulas to calculate:

- Brake force
- Compression ratio
- Coefficient of friction
- Pressure (cooling system, tyres)
- Gear ratio
- Distance travelled
- Mass
- Speed
- Weight

Definition of:

- Vehicle drag
- Drag coefficient.
- Distance travelled
- Mass
- Speed
- Weight

How vehicle design and external accessories can affect drag.

### **Topic 1.2**

The need for and effects of friction under different operating conditions within:

- Brake discs and pads
- Flywheel and clutch
- Mating gear wheels
- Steering joints
- Tyres and road surface

### **Topic 1.3**

Typical uses of different materials in vehicles:

- Metals:
  - Ferrous (cast iron and steel)
  - Non-ferrous (copper and aluminium)
- Non-metals
  - Composites (carbon-fibre)
  - Glass (laminated and toughened)
- Plastics (Thermosetting and thermoplastic)

Properties of materials that make them suitable for use in typical vehicles:

- Ductility
- Elasticity
- Hardness
- Malleability
- Plasticity
- Toughness

Design considerations and factors that affect material choice:

- Manufacturers
  - Cost
  - Suitability
  - Environmental (waste disposal, long term effects, end of life)
- Consumers
  - Preference
  - Bespoke options (including impact on delivery timescales)

### **Topic 1.4**

Properties and behaviours of fluids in vehicle systems:

- Equalisation of pressure (braking system)
- Effects of temperature (braking system, cooling system)

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## Learning outcome

2 Understand vehicle electrical principles and components

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### Topics

2.1 Voltage, current and resistance

2.2 Vehicle electrical components

#### Topic 2.1

The relationship between voltage, current, resistance and continuity in an electrical circuit.

Principles of electrical laws:

- Watts Law
- Ohms Law

Measure and calculate voltage, current and resistance in typical electrical circuits.

Use of tools to measure voltage, current and resistance:

- Multimeter

#### Topic 2.2

Types and purpose of vehicle electrical components:

- Alternator
- Battery
- Headlight lamp
- Headlight unit
- Light switch
- Side/tail/brake light lamp
- Starter motor

## Guidance for delivery

Learning Outcome 1 will need to be taught mainly through classroom based delivery however the inclusion of some demonstration/participation activities should be used to reinforce the principles. There is an opportunity for learners to experiment with different materials and how they react under various conditions. The focus should be on ensuring that the learner can relate the principles to actual vehicle conditions such as tyres on different road surfaces in both wet and dry conditions.

Learners will use their numeracy skills to calculate mathematical applications related to vehicles in Learning Outcome 1. Learners do not need to know the formulas but need to know how to use them and to calculate using them.

Learning Outcome 2 will need to be taught through a mixture of practical and classroom based delivery, focussing on electrical components used for different types of vehicle.

It is important that learners are made aware of any health and safety implications with regards to the practical applications of using various tools and procedures.

## Suggested learning resources

### Books

Science for Motor Vehicle Engineers Published by: Butterworth ISBN: 978-0340645277	Twig
Functional Skills Maths In Context Motor Vehicle Technology Workbook Published by: Nelson-Thornes ISBN: 978-1408518359	Holder
Hillier's Fundamentals of Motor Vehicle Technology (Level 1) Published by: Oxford Press ISBN: 978-1408515181	Hillier
Engineering Materials Published by: Butterworth ISBN: 978-0080966656	Ashby

### Websites

City & Guilds Smartscreen	<a href="https://www.smartscreen.co.uk/">https://www.smartscreen.co.uk/</a>
Skills workshop How stuff works	<a href="http://www.skillsworkshop.org/numeracy">http://www.skillsworkshop.org/numeracy</a> <a href="http://www.howstuffworks.com/">www.howstuffworks.com/</a>

## Unit 221 Vehicle Technology Systems

<b>Unit level:</b>	2
<b>GLH:</b>	60

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### What is this unit about?

The purpose of this unit is to introduce the learner to the various types of vehicle transmissions, drive train layouts and power units, allowing them to understand the underlying operating principles. They will also learn why different layouts and systems are used and why they are selected for certain vehicle applications. Learners will also be given an understanding of the purpose and application of the main braking, suspension and steering system components used on a range of vehicle types. They will understand why the various types of systems and components are used and the requirements for different vehicle applications.

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### Learning outcomes

In this unit, learners will be able to

- 1 Understand typical power units, transmissions and drive train layouts
- 2 Understand the use and operation of power units
- 3 Understand the layout and purpose of chassis systems
- 4 Use precision measurement and workshop tools

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## Learning outcome

- 1 Understand typical power units, transmissions and drive train layouts
- 

## Topics

- 1.1 Power unit and transmission layouts
- 1.2 Drive train layouts

### Topic 1.1

Types of and reasons for the use of power units and transmission layouts used for:

- Light vehicles
- Heavy vehicles
- Motorcycles
- All-Terrain Vehicles (ATVs)

### Topic 1.2

Characteristics and uses of drive train layouts used for:

- Light vehicles
  - Front wheel drive
  - Rear wheel drive
  - Four wheel drive
  - Hybrid drives
- Heavy vehicles
  - Two axle
  - Three axle
  - Four axle
  - Various drive arrangements (single axle, twin axle)
- Motorcycle
  - Chain drive
  - Shaft drive
  - Belt drive
- All-Terrain Vehicles (ATVs)
  - Two wheel drive
  - Four wheel drive

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## Learning outcome

2 Understand the use and operation of power units

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## Topics

2.1 Operating principles of power units

2.2 Reasons for using power units

### Topic 2.1

Power units used for:

- All-Terrain Vehicles (ATVs)
- Heavy vehicles
- Light vehicles
- Motorcycles

Operating principles of:

- Electric motors – electric motor principles (armature, windings and interaction of magnetic fields)
- Four stroke cycle – induction, compression, power and exhaust (spark and compression ignition)
- Rotary phases (spark ignition)
- Two stroke cycle – induction, pre-compression, transfer, exhaust (spark ignition)

### Topic 2.2

Types of power unit:

- Compression ignition engines
- Electric power units
- Spark ignition engines (Petrol and LPG) including rotary

Reasons for using and the limitations of different types of power unit.

Comparison of power, torque, emissions, life and maintenance of different types of power unit:

- Compression ignition engines
- Electrical power units
- Spark ignition engines (Petrol and LPG) including rotary

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## Learning outcome

3 Understand the layout and purpose of chassis systems

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### Topics

3.1 Vehicle chassis system layouts

3.2 Purpose of vehicle chassis system components

#### Topic 3.1

Vehicle chassis system and component layouts

- Heavy vehicle
  - o Heavy vehicle compressed air braking systems (compressor/regulating valves/reservoir/operating valves/actuators/brake shoes/drums/discs)
  - o Heavy vehicle spring suspension (air/leaf springs/shackles/axle/arms)
  - o Heavy vehicle twin steer systems (steering linkage/steering box)
- Light vehicle:
  - o Light vehicle hydraulic braking systems (master cylinder/servo/calipers/pads/shoes/antilock sensors)
  - o Light vehicle parking brake systems (lever/cables/linkage)
  - o Light vehicle independent coil spring suspension (spring/dampers/control arms)
  - o Rack and pinion steering system including Power Assisted Steering (PAS)
- Motorcycle
  - o Motor cycle braking systems (master cylinder/servo/calipers/pads/shoes/antilock sensors)
  - o Motor cycle headstock, forks, swinging arm and dampers

#### Topic 3.2

Purpose of vehicle chassis system components:

- Braking
  - o Air compressors
  - o Brake actuators
  - o Brake calipers
  - o Wheel cylinders
  - o Brake master cylinders
  - o Brake servos
- Steering
  - o Steering gearbox (rack and pinion)
- Suspension
  - o Suspension coil springs
  - o Suspension dampers
  - o Suspension leaf springs

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## Learning outcome

### 4 Use precision measurement and workshop tools

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## Topics

- 4.1 Identify measuring tools
- 4.2 Use of precision measuring tools
- 4.3 Use of workshop tools for fabrication and repair

### Topic 4.1

Types of precision measuring tools:

- Dial test indicator
- External micrometer
- Internal micrometer
- Steel rule
- Tyre pressure gauge
- Tyre tread depth gauge
- Vernier gauge

### Topic 4.2

Use of precision measuring tools to measure:

- Brake disc run-out
- Brake disc thickness and wear
- Cylinder bore wear
- General component dimensions
- Tyre pressures
- Tyre tread depth

### Topic 4.3

Select and use workshop tools for basic fabrication (of small vehicle components such as exhaust and alternator support brackets) and repair (such as broken stud removal and thread repairs):

- Drills and drill bits
- Engineers square
- Files
- Hacksaws
- Marking out tools (marking compound, scriber, rule)
- Sheet metal cutters
- Thread cutters (internal and external)

## Guidance for delivery

Tutors delivering this unit will have the opportunity to ensure that learners have an appreciation of the various roles and responsibilities of those working within the automotive environment. This is expected to include the main roles, duties and responsibilities of those involved. They also need to be aware of the skills that the roles require to enable them to judge their own possible suitability. It is also important that the learner understands how each of the roles interact with each other.

All learning outcomes will need to be taught through a mixture of practical and classroom based delivery. Visits to vehicle repair workshops are encouraged. It is expected that learners should have the opportunity to investigate a range of different vehicle types, where possible this should include all-terrain vehicles, motorcycles, light vehicles and heavy vehicles. They should also have the opportunity to examine how the systems are applied to the different vehicle types and their limitations. It is appreciated that centres may not have the resources to allow access to all of the vehicle types however learners should be given the opportunity to research adequately those they do not have direct access to.

Learners should have the opportunity to work practically to examine the different components and vehicle layouts. To enrich their understanding learners could dismantle and reassemble various vehicle units and components as this would enable them to better understand their construction and operation. They will then be able to recognise common vehicle components and system layouts.

Learning Outcome 4 will need to be taught through a mixture of practical and classroom based delivery, however emphasis needs to be placed on practical application and use. There is an opportunity for learners to experiment with different measuring and fabrication techniques and appreciate how these differ with various tasks and vehicle applications. In Topic 4.2, a number of examples of fabrication and repair activities have been provided. These are representative examples of the types of fabrication and repair activity expected of a learner at this level; learners should be taught to complete a range of fabrication and repair activities using the tools and equipment listed.

Learners should be given the opportunity to evaluate their performance when performing practical tasks. They should consider:

- what went well
- what went less well
- what could be done differently.

It is not expected that centres will have access to the full range of vehicles for practical sessions, however it is expected that the learners will be given the opportunity to inspect as many of the types as possible either in the centre or through visits to industry premises. The practical assessment for this qualification will be sufficiently flexible to allow centres to focus on one particular vehicle type.

## Suggested learning resources

### Books

Hillier's Fundamentals of Motor Vehicle Technology (Level 1) Hillier  
Published by: Oxford Press  
ISBN: 978-1408515181

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Light & Heavy Vehicle Technology Nunney  
Published by: Routledge

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ISBN: 978-0750680370

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Motor Cycle Maintenance

Haynes

Published by: Haynes

ISBN: 978-1844250714

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**Websites**

City & Guilds

<https://www.smartscreen.co.uk/>

Smartscreen

Skills workshop

<http://www.skillsworkshop.org/numeracy>

How stuff works

<https://www.howstuffworks.com/>

## Appendix 1 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on [www.cityandguilds.com](http://www.cityandguilds.com).

### ***City & Guilds Centre Manual***

This document provides guidance for organisations wishing to become City & Guilds approved centres, as well as information for approved centres delivering City & Guilds qualifications. It covers the centre and qualification approval process as well as providing guidance on delivery, assessment and quality assurance for approved centres.

It also details the City & Guilds requirements for ongoing centre and qualification approval, and provides examples of best practice for centres. Specifically, the document includes sections on:

- the centre and qualification approval process
- assessment, internal quality assurance and examination roles at the centre
- registration and certification of candidates
- non-compliance and malpractice
- complaints and appeals
- equal opportunities
- data protection
- management systems
- maintaining records
- internal quality assurance
- external quality assurance.

### ***Our Quality Assurance Requirements***

This document explains the requirements for the delivery, assessment and awarding of our qualifications. All centres working with City & Guilds must adopt and implement these requirements across all of their qualification provision. Specifically, this document:

- specifies the quality assurance and control requirements that apply to all centres
- sets out the basis for securing high standards, for all our qualifications and/or assessments
- details the impact on centres of non-compliance

The **centre homepage** section of the City & Guilds website also contains useful information on

- **Walled Garden:** how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment:** how to register for e-assessments.

## Useful contacts



### UK learners

General qualification information

E: [learnersupport@cityandguilds.com](mailto:learnersupport@cityandguilds.com)

### International learners

General qualification information

E: [intcg@cityandguilds.com](mailto:intcg@cityandguilds.com)

### Centres

Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results

E: [centresupport@cityandguilds.com](mailto:centresupport@cityandguilds.com)

### Single subject qualifications

Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change

E: [singlesubjects@cityandguilds.com](mailto:singlesubjects@cityandguilds.com)

### International awards

Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports

E: [intops@cityandguilds.com](mailto:intops@cityandguilds.com)

### Walled Garden

Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems

E: [walledgarden@cityandguilds.com](mailto:walledgarden@cityandguilds.com)

### Employer

Employer solutions, Mapping, Accreditation, Development Skills, Consultancy

T: +44 (0)121 503 8993

E: [business@cityandguilds.com](mailto:business@cityandguilds.com)

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If you have a complaint, or any suggestions for improvement about any of the services that we provide, email: [feedbackandcomplaints@cityandguilds.com](mailto:feedbackandcomplaints@cityandguilds.com)

## About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

## City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Licence to Practice (land-based qualifications) and Learning Assistant (an online e-portfolio).

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