

# Level 3 Advanced Technical Certificate in the Automotive Industry

**(4292-30)**

May 2019 Version 3.1

**Qualification Handbook**

## Qualification at a glance

<b>Industry area</b>	Transport and Automotive
<b>City &amp; Guilds qualification number</b>	4292
<b>Age group</b>	16-19 (Key Stage 5), 19+
<b>Entry requirements</b>	Centres must ensure that any prerequisites 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>Additional requirements to gain this qualification</b>	Employer involvement in the delivery and/or assessment of this qualification is essential for all candidates and will be externally quality assured.
<b>Grading</b>	This qualification is graded Pass/Merit/Distinction/Distinction* For more information on grading, please see Section 7: Grading.
<b>Approvals</b>	These qualifications require 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	Size (GLH)	TQT	City & Guilds qualification number	Ofqual accreditation number
Level 3 Advanced Technical Certificate in the Automotive Industry	360	600	4292-30	601/7382/8

Version and date	Change detail	Section
1.1 January 2016	Updated purpose statement and updated assessment component titles	1. Introduction
1.2 May 2016	Fixed minor typographical errors	<i>Throughout</i>
	TQT added for qualifications Assessment component titles amended	1. Introduction
	Employer involvement guidance updated throughout	4. Employer involvement
	Summary of assessment methods and conditions	5. Assessment
	Moderation and standardisation of assessment updated throughout	6. Moderation and standardisation of assessment
	Awarding individual assessments Awarding grades and reporting results	7. Grading
	Enquiries about results Re-sits and shelf-life of assessment results Malpractice Access arrangements and special consideration	8. Administration
2.0 February 2017	Exam Specification amended	5. Assessment
	Fixed minor typographical errors	Unit 303
	Minor changes to wording under Topic 2.2 (depth section)	Unit 305
	Minor changes to wording under Topic 1.1 (depth section)	Unit 306
3.0 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
3.1 May 2019	Wording changed regarding retakes	5. Assessment – Summary of assessment methods and conditions  8. Administration – Re-sits and shelf-life of assessment results

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# 1 Introduction

## What is this qualification about?

The following purpose statement relates to the **Level 3 Advanced Technical Certificate in the Automotive Industry (601/7382/8)**.

Area	Description
OVERVIEW	
Who is this qualification for?	<p>This qualification is for you if you are 16 years or older who wants to work in the automotive industry. You will gain the knowledge and skills needed to work as a motor vehicle technician on your vehicle of choice such as cars, vans, trucks or motorcycles.</p> <p>In addition, it will open up opportunities for you to understand other non-technical areas in the industry such as sales or vehicle parts.</p>
What does this qualification cover?	<p>You will study both practical and theoretical aspects of the automotive industry such as:</p> <ul style="list-style-type: none"><li>• The sectors the automotive industry consists of, the different types of business available and how to best run a motor vehicle workshop.</li><li>• The materials that are used in the construction of a vehicle, their properties and the joining methods used during vehicle manufacture.</li><li>• The construction and operation of engine, transmission and chassis systems and their components. The reasons for different types of systems and components and how each of them operates.</li><li>• The electrical and electronic systems that can be found in a vehicle, how they operate and how to diagnose and rectify faults within these systems.</li><li>• How to carry out vehicle inspections and follow servicing procedures safely.</li><li>• How technology can be used to improve vehicle design, safety and driving experience via innovation.</li></ul> <p>Centres and providers work with local employers who will contribute to the knowledge and delivery of the skills required. Employers will provide demonstrations and talks about the industry and where possible work placements will also be provided by the employers. This qualification is ideal preparation for gaining employment in the automotive industry or for further specialist study.</p>
WHAT COULD THIS QUALIFICATION LEAD TO?	

Will the qualification lead to employment, and if so, in which job role and at what level?	The qualification will give you the knowledge and skills to work as a motor vehicle technician on a range of vehicles such as cars, vans, motorcycles, trucks.
Why choose this qualification over similar qualifications?	<p>City &amp; Guilds offers two sizes of Level 3 qualifications in the Automotive Industry: Advanced Technical Certificate (360), Advanced Technical Extended Diploma (720).</p> <p>You would take the Advanced Technical Certificate (360) if you want to develop the core skills and knowledge required by employers in the Retail Motor industry, that is, the aftersales market, to work as a motor vehicle technician on your vehicle of choice such as cars, vans, trucks or motorcycles.</p> <p>If you also want to specialise and develop skills and knowledge to progress into an Apprenticeship in Automotive Engineering/Manufacturing you would take the Advanced Technical Extended Diploma (720). This qualification also covers the process of designing, assembling and manufacturing a vehicle before it goes to the showroom to be sold to the customer.</p>
Will the qualification lead to further learning?	<p>You may wish to progress onto an Advanced Apprenticeship in Vehicle Maintenance and Repair on your vehicle of choice, which allows you to combine working at a manufacturer, dealership or independent garage with typically attending one day a week at college or with a training provider.</p> <p>You may wish to progress onto further learning within a Higher Education Institution. You could take a course such as an Automotive Technology or Motorsports Foundation Degree.</p>

#### WHO SUPPORTS THIS QUALIFICATION?

Employer/Higher Education Institutions	This qualification is supported by The Society of Motor Manufacturers & Traders (SMMT).
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## Qualification structure

For the **Level 3 Advanced Technical Certificate in the Automotive Industry** the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
<b>Mandatory</b>		
301	Properties and applications of materials in the automotive industry	60
302	Automotive servicing and inspection operations	30
303	Automotive business workshop practices	90
304	Automotive mechanical systems	90
305	Automotive electrical and electronic systems	60
306	Automotive technology and future innovation	30
<b>Total hours</b>		360

## Total qualification time (TQT)

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

Title and level	GLH	TQT
Level 3 Advanced Technical Certificate in the Automotive Industry	360	600



## Assessment requirements and employer involvement

To achieve the **Level 3 Advanced Technical Certificate in the Automotive Industry** candidates must successfully complete **both** mandatory assessment components.

Component number	Title
<b>Mandatory</b>	
030 or 530	Level 3 Automotive Industry - Theory exam (1)*
031	Level 3 Automotive Industry - Synoptic assignment (1)*

In addition, candidates **must** achieve the mandatory employer involvement requirement for this qualification **before** they can be awarded a qualification grade. For more information, please see guidance in *Section 4: Employer involvement*.

### Employer involvement

Component number	Title
<b>Mandatory</b>	
830	Employer involvement

*\*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 its assessment.

### 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 16 – 19, 19+.

## 3 Delivering technical qualifications

### 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.

### Employer involvement

Employer involvement is essential to maximise the value of each learner's experience. Centres are required to involve employers in the delivery of technical qualifications at Key Stage 5 and/or their assessment, for every learner. This must be in place or planned before delivery programmes begin in order to gain qualification approval. See *Section 4: Employer involvement* for more detail.

### Support materials

The following resources are available for this qualification:

Description	How to access
Sample assessments	
Guidance for delivery	Available 2016 on the qualification pages on the City & Guilds
Guidance on use of marking grids	Website: <b><a href="http://www.cityandguilds.com">www.cityandguilds.com</a></b>

## 4 Employer involvement

Employer involvement is a formal component of Key Stage 5 Technical qualifications. It does not contribute to the overall qualification grading, but is a mandatory requirement that all learners must meet. As such it is subject to external quality assurance by City & Guilds.

Department for Education (DfE) requirements state:

*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 students and furthers collaboration between the learning and skills sector and industry.*

*[Technical qualifications] must:*

- *require all students to undertake meaningful activity involving employers during their study; and*
- *be governed by quality assurance procedures run by the awarding organisation to confirm that education providers have secured employer involvement for every student.*

Extract from: **Vocational qualifications for 16 to 19 year olds, 2017 and 2018 performance tables: technical guidance for awarding organisations, paragraphs 89-90**

City & Guilds will provide support, guidance and quality assurance of employer involvement.

### Qualification approval

To be approved to offer City & Guilds technicals, centres must provide an Employer Involvement planner and tracker showing how every learner will be able to experience meaningful employer involvement, and from where sufficient and suitable employer representatives are expected to be sourced.

Centres must include in their planner a sufficient range of activities throughout the learning programme that provide a range of employer interactions for learners. Centres must also plan contingencies for learners who may be absent for employer involvement activities, so that they are not disadvantaged.

As part of the approval process, City & Guilds will review this planner and tracker. Centres which cannot show sufficient commitment from employers and/or a credible planner and tracker will be given an action for improvement with a realistic timescale for completion. **Approval will not be given** if employer involvement cannot be assured either at the start of the qualification, or through an appropriate plan of action to address this requirement before the learner is certificated.

### Monitoring and reporting learner engagement

Employer involvement is a formal component of this qualification and is subject to quality assurance monitoring. Centres must record evidence that demonstrates that each learner has been involved in meaningful employer based activities against the mandatory content before claiming the employer involvement component for learners.

Centres must record the range and type of employer involvement each learner has experienced and submit confirmation that all learners have met the requirements to City & Guilds. If a centre cannot provide evidence that learners have met the requirements to achieve the component, then the learner will not be able to achieve the overall Technical Qualification.

### **Types of involvement**

Centres should note that to be eligible, employer involvement activities **must** relate to one or more elements of the mandatory content of this qualification.

As the aim of employer involvement is to enrich learning and to give learners a taste of the expectations of employers in the industry area they are studying, centres are encouraged to work creatively with local employers.

Employers can identify the areas of skills and knowledge in their particular industry that they would wish to see emphasised for learners who may apply to work with them in the future. Centres and employers can then establish the type of input, and which employer representative might be able to best support these aims.

To be of most benefit this must add to, rather than replace the centre's programme of learning.

Some examples of meaningful employer involvement are listed below. Employer involvement not related to the mandatory element of the qualification, although valuable in other ways, does not count towards this element of the qualification.

The DfE has provided the following examples of what does and does not count as meaningful employer involvement, as follows<sup>1,2</sup>:

#### **The following activities meet the requirement for meaningful employer involvement:**

- *students undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification<sup>3</sup>;*
- *students undertake project(s), exercise(s) and/or assessments/examination(s) set with input from industry practitioner(s);*
- *students take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures;*
- *industry practitioners operate as 'expert witnesses' that contribute to the assessment of a student's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification.*

*In all cases participating industry practitioners and employers must be relevant to the industry sector or occupation/occupational group to which the qualification relates.*

#### **The following activities, whilst valuable, do not meet the requirement for meaningful employer involvement:**

- *employers' or industry practitioners' input to the initial design and content of a qualification;*
- *employers hosting visits, providing premises, facilities or equipment;*
- *employers or industry practitioners providing talks or contributing to delivery on employability, general careers advice, CV writing, interview training etc;*

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<sup>1</sup> As extracted from: Vocational qualifications for 16 to 19 year olds  
2017 and 2018 performance tables: technical guidance for awarding organisations

<sup>2</sup>This list has been informed by a call for examples of good practice in employer involvement in the delivery and assessment of technical qualifications - **Employer involvement in the delivery and assessment of vocational qualifications**

<sup>3</sup> **DfE work experience guidance**

- *student attendance at career fairs, events or other networking opportunities;*
- *simulated or provider-based working environments eg hairdressing salons, florists, restaurants, travel agents, small manufacturing units, car servicing facilities;*
- *employers providing students with job references.*

For each employer involvement activity, centres are required to provide evidence of which learners undertook it, e.g. a candidate attendance register. The types of additional evidence required to support a claim for this component will vary depending on the nature of the involvement. E.g. for a guest lecture it is expected that a synopsis of the lecture and register would be taken which each learner and the guest speaker will have signed; expert witnesses will be identified and will have signed the relevant assessment paperwork for each learner they have been involved in assessing; evidence of contribution from employers to the development of locally set or adapted assignments.

### **Quality assurance process**

As the employer involvement component is a requirement for achieving the KS5 Technical qualifications, it is subject to external quality assurance by City & Guilds at the approval stage and when centres wish to claim certification for learners.

Evidence will be validated by City & Guilds before learners can achieve the employer involvement component. Where employer involvement is not judged to be sufficient, certificates cannot be claimed for learners.

### **Sufficiency of involvement for each learner**

It is expected that the centre will plan a range of activities that provide sufficient opportunities for each learner to interact directly with a range of individuals employed in the related industry.

Centres must also provide contingencies for learners who may be absent for part of their teaching, so they are not disadvantaged. Any absence that results in a learner missing arranged activities must be documented. Where learners are unable to undertake all employer involvement activities due to temporary illness, temporary injury or other indisposition, centres should contact City & Guilds for further guidance.

### **Live involvement**

Learners will gain most benefit from direct interaction with employers and/or their staff; however the use of technology (eg the use of live webinars) is encouraged to maximise the range of interactions. Where learners are able to interact in real time with employers, including through the use of technology, this will be classed as 'live involvement'.

It is considered good practice to record learning activities, where possible, to allow learners to revisit their experience and to provide a contingency for absent learners. This is not classed as live involvement however, and any involvement of this type for a learner must be identified as contingency.

### **Timing**

A learner who has not met the minimum requirements cannot be awarded the component, and will therefore not achieve the qualification. It is therefore important that centres give consideration to scheduling employer involvement activities, and that enough time is allotted throughout delivery and assessment of the qualification to ensure that requirements are fully met.

## 5 Assessment

### Summary of assessment methods and conditions

Component numbers	Assessment method	Description and conditions
030/530	Externally marked exam	<p>The exam is <b>externally set and externally marked</b>, and will be taken either online through City &amp; Guilds' computer-based testing platform (030) or as a paper based test (530)</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 a maximum of two opportunities to retake. If the candidate fails the exam three times then they will fail the qualification. (Note: the third and final retake opportunity applies to Level 3 only.)</p> <p>For exam dates, please refer to the Assessment and Examination timetable.</p>
031	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 process.</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 carry out servicing and diagnostics on vehicles of different types and with different characteristics and research and report on types of business within the automotive industry. This will require the candidate to use servicing and inspection skills and apply their knowledge and understanding of how the different systems of a vehicle work together, selecting tools, diagnostic tests and following safe workshop practices. They will need to draw on their skills and knowledge from across the qualification to complete servicing records and vehicle handovers to customers.

## **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, 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	Level 3 Advanced Technical Certificate in the Automotive Industry Typical expected evidence of knowledge, understanding and skills	Approximate weighting
<b>A01</b> Recalls knowledge from across the breadth of the qualification.	Legislation and regulations, roles and responsibilities, use of terminology, Health and Safety considerations, vehicle component location and regular service items and actions, the use of tools and equipment to carry out vehicle servicing and inspections, the various types of businesses and the career paths within them, basic understanding of hybrid power systems.	20%
<b>A02</b> Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Workplace risks assessments, vehicle servicing procedures and safety (MOT) test requirements. Interpretation of vehicle system test results, different business types and career paths within them. Basic understanding of vehicle hybrid power systems.	20%
<b>A03</b> Demonstrates technical skills from across the breadth of the qualification.	Working in a safe manner, carrying out vehicle servicing and safety checks to appropriate specifications, using servicing and test equipment, interpreting test results, use of tools and equipment, use of diagnostic equipment.	30%
<b>A04</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 to a particular scenario/ problem – justifying decisions/approaches taken eg planning process, contingencies, completion of reports, reflection and evaluation.	15%

Assessment objective	Level 3 Advanced Technical Certificate in the Automotive Industry Typical expected evidence of knowledge, understanding and skills	Approximate weighting
<b>A05</b> Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Working in a safe manner, checking work before handing vehicle back to the customer, ensuring vehicle is handed back to the customer in a clean and safe condition, checking details of presentation/assignment, checking the results of diagnostic/servicing tests, re-checking findings.	15%

## Exam specification

AO weightings per Exam

AO	Exam 030/530 weighting (approx. %)
AO1 Recalls knowledge from across the breadth of the qualification.	46
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	39
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	15

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

030/530	Duration: 2 hours and 30 minutes		
Unit	Outcome	Number of marks	%
301	Properties and applications of materials in the automotive industry	14	17.5
302	Automotive servicing and inspection operations	14	17.5
304	Automotive mechanical systems	20	25
305	Automotive electrical and electronic systems	20	25
N/A	Integration across the units	12	15
<b>Total</b>		<b>80</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.

## 6 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<sup>4</sup> the centre is required to conduct internal standardisation to ensure that all work at the centre has been marked to the same standard. It is the Internal Quality Assurer's (IQA's) responsibility to ensure that standardisation has taken place, and that the training includes the use of reference and archive materials such as work from previous years as appropriate.

### **Provision for reworking evidence after submission for marking by the tutor**

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

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

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

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

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<sup>4</sup> For any internally assessed optional unit assignments, the same process must be followed where assessors must standardise their interpretation of the assessment and grading criteria.

## Internal appeal

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

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

## Moderation

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

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

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

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

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

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

## Post-moderation procedures

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

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

### **Centres retaining evidence**

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

## 7 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 3 Advanced Technical Certificate in the Automotive Industry** 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(s) will not have a qualification grade awarded and will not receive a qualification certificate.

The approximate pass grade boundary(ies) for the synoptic assignment(s) in this qualification are:

Synoptic Assignment	Pass Mark (%)
031	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 (031)	X/P/M/D	60%
Exam (030/530)	X/P/M/D	40%

Both synoptic assignments and exams are awarded (see 'Awarding individual assessments', at the start of Section 7, 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
Exam: 40%	6	12	18
Assignment: 60%	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:

<b>Qualification Grade</b>	<b>Points</b>
Distinction*	20.5
Distinction	17
Merit	11
Pass	6

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

## 8 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 secure 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

Re-sits and shelf-life of assessment results Candidates who have failed an exam or wish to re-take it in an attempt to improve their grade, can do so **twice**. The best result will count towards the final qualification. See guidance on individual assessment types in Section 5.

## Factors affecting individual learners

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

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

## Malpractice

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

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

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

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

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

## Access arrangements and special consideration

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

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

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

### **Special consideration**

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

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

## Unit 301

# Properties and applications of materials in the automotive industry

<b>UAN:</b>	K/507/3169
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is for learners to have an appreciation of the materials used in vehicle construction and to develop an understanding of their properties and applications. The unit also covers the structure and behaviour of materials used in vehicle construction.

This unit gives a comprehensive account of the materials used in the manufacturing of vehicles and enables the learner to identify metals, polymers, ceramics and composites that are acceptable for vehicle construction. Learners will understand the effects of heat treatment and its effect on a material's structure.

This unit will enable learners to:

- know why different materials are used
- know how various parts of the vehicle are joined and secured
- know why non-metallic materials are often used

### Learning outcomes

In this unit, learners will:

1. understand the structure, classification and application of materials used in vehicle construction
2. understand properties of materials used in vehicle construction
3. know effects of processing on the structure and behaviour of materials
4. compare methods used to join materials during vehicle construction.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all learning outcomes can be achieved.

### ***Learning outcome 1: Understand the structure, classification and application of materials used in vehicle construction.***

**Topic 1.1:** Types of materials and their characteristics

**Topic 1.2:** Application of materials used in vehicle construction

#### **Topic 1.1:**

Learners will need to describe materials used in vehicle construction and their characteristics:

- ferrous metals - plain, low/medium/high carbon steel, cast iron, alloy steel and stainless steel
- non-ferrous metals - aluminium alloys, copper alloys, gold, titanium and zinc
- plastics - thermoplastic polymeric materials such as: acrylic, polyvinyl chloride (PVC)
- glass
- composite materials such as fibre reinforced (carbon fibre), glass reinforced plastic (GRP).

#### **Topic 1.2:**

Learners will need to identify applications of the materials used in vehicle construction including:

- ferrous eg steel body panels
- non-ferrous eg aluminium engine blocks
- plastics eg dashboard trims
- glass eg tough and laminated for windscreens and windows
- composite eg carbon fibre bumpers, body panels.

### ***Learning outcome 2: Understand properties of materials used in vehicle construction.***

**Topic 2.1:** Mechanical properties of materials

**Topic 2.2:** Physical properties of materials

**Topic 2.3:** Thermal properties of materials

**Topic 2.4:** Electrical and magnetic properties of materials

#### **Topic 2.1:**

Learners will need to identify the mechanical properties of materials used in vehicle construction including:

- ferrous and non-ferrous metals (eg engine blocks, cylinder heads)
- non-metals (eg body panels, smart materials)
- ceramics and glass
- composite materials (eg carbon fibre, Kevlar).

Mechanical properties including:

- strength (tensile, shear, compressive)
- hardness
- toughness
- ductility
- malleability
- elasticity and brittleness.

**Topic 2.2:**

Learners will need to identify the physical properties, such as density, melting temperature and atomic structure of the following materials used in vehicle construction:

- ferrous and non-ferrous metals
- non-metals
- ceramics, glass, and composite materials
- smart materials.

**Topic 2.3:**

Learners will need to identify the thermal properties, such as conductivity and expansivity, of the following materials used in vehicle construction:

- ferrous and non-ferrous metals
- non-metals
- ceramics, glass, and composite materials
- smart materials.

**Topic 2.4:**

Learners will need to identify the electrical and magnetic properties, such as conductivity, resistivity and permeability, of materials used in vehicle construction, including:

- ferrous and non-ferrous metals
- non-metals
- ceramics, glass, and composite materials
- smart materials.

***Learning outcome 3: Know effects of processing on the structure and behaviour of materials.***

**Topic 3.1:** Impact of processing on the structure on metals

**Topic 3.2:** Impact of processing on the structure on non-metals

**Topic 3.1:**

Learners will need to know the effects of processing metals during hot working and cold working. Learners will need to distinguish between the processes of annealing, quench hardening and tempering, case hardening and precipitation hardening.

**Topic 3.2:**

Learners will need to know the effects of processing thermoplastic polymers. They will also need to compare thermosetting polymers and thermoplastic polymers with consideration of:

- recyclability
- mechanical properties and application of each type of thermosetting and thermoplastic polymers - Thermosetting cannot be reshaped or reused once set and thermoplastic can be re-melted into a liquid state.

***Learning outcome 4: Compare methods used to join materials during vehicle construction.***

**Topic 4.1:** Welding methods used in vehicle construction



**Topic 4.2:** Mechanical fixings used in vehicle construction

**Topic 4.3:** Adhesives used in vehicle construction

**Topic 4.1:**

Learners will need to describe types of welding methods used in vehicle construction, also where and why they would be used. The welding types should include:

- spot welding
- MIG welding
- TIG welding
- gas welding to include brazing and soldering.
- plasma arc welding.

**Topic 4.2:**

Learners will need to describe types of mechanical fixing methods used in vehicle construction, also where and why they would be used. The fixing types should include:

- threaded fixings
- non threaded fixings.

**Topic 4.3:**

Learners will need to describe the different types of adhesives used in vehicle construction, also where and why they would be used. The adhesives should include:

- anaerobic
- cyanoacrylate
- epoxy
- plastisol
- polyurethane
- solvent rubber.

## Guidance for delivery

It is important that learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of vehicle types, different types of equipment and working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and vehicle applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

## Suggested learning resources

### Books

Advanced Materials in Automotive Engineering – J Rowe  
Woodhead Publishing, Ltd. (31 Mar 2012)  
ISBN-13: 978-1845695613

Advanced Composite Materials for Automotive Applications: Structural Integrity and Crashworthiness – A Elmarakbi  
Wiley-Blackwell; 1 edition (6 Dec 2013)  
ISBN-13: 978-1118423868

Automotive Engineering: Lightweight, Functional, and Novel Materials – B Cantor  
CRC Press (19 Feb 2008)  
ISBN-13: 978-0750310017

Materials for Engineers and Technicians – R A Higgins  
Newnes; 4 edition (11 Jan 2006)  
ISBN-13: 978-0750668507

Engineering Materials, Volume 1 – R L Timings  
Longman; 2 edition (12 May 1998)  
ISBN-13: 978-0582319288

Engineering Materials, Volume 2 – R L Timings  
Longman; 2 edition (24 July 2000)  
ISBN-13: 978-0582404663

### Websites

- [www.smmmt.co.uk](http://www.smmmt.co.uk)
- [www.f1technical.net](http://www.f1technical.net)
- [www.nationalstemcentre.org.uk](http://www.nationalstemcentre.org.uk)
- [www.smartscreen.co.uk](http://www.smartscreen.co.uk)

## Unit 302

## Automotive servicing and inspection operations

<b>UAN:</b>	D/507/3170
<b>Level:</b>	3
<b>GLH:</b>	30

### What is this unit about?

The purpose of this unit is for learners to develop the skills and knowledge required to carry out vehicle inspection and service procedures. Learners will develop the skills needed to use the required tools and equipment and gain an understanding of the health, safety and environmental considerations included in the relevant legislation.

This unit will enable learners to:

- understand why vehicles require regular maintenance
- know the components and systems that are checked during servicing and vehicle testing
- have an awareness of relevant legislation

### Learning outcomes

In this unit, learners will:

1. know types of vehicle inspection and service
2. understand current legislation covering vehicle inspection and servicing
3. interpret information required to inspect and service vehicles
4. carry out inspections on vehicles using prescribed methods
5. carry out routine vehicle maintenance using prescribed methods.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all learning outcomes can be achieved.

### **Learning outcome 1: Know types of vehicle inspection and service.**

**Topic 1.1:** Types of vehicle inspections and servicing

**Topic 1.2:** Tools for conducting inspections and servicing

**Topic 1.3:** Procedures for carrying out systematic inspection on vehicles

#### **Topic 1.1:**

Learners will need to identify the different types of inspection and servicing that is routinely carried out on vehicles, this should include:

- pre-purchase inspection
- safety inspections
- pre-delivery inspection
- manufacture servicing.

#### **Topic 1.2:**

Learners will need to identify the tools and equipment used to carry out vehicle inspections and services to include:

- hand tools
- vehicle lifting equipment
- test equipment, including:
  - coolant testers
  - brake fluid testers
  - battery testers
  - emission equipment
  - wheel alignment equipment
  - beam setting equipment
  - tyre tread depth gauges.

#### **Topic 1.3:**

Learners will need to identify the methods used for carrying out systematic inspections for each inspection method. This should include identification of damage, corrosion, fluid leaks, wear, insecurity of components, mounting insecurity and condition of:

- engine mechanical systems and components
- chassis systems and components
- vehicle body and panels
- vehicle electrical and electronic systems and components
- vehicle seating and interior.

## **Learning outcome 2: Understand current legislation covering vehicle inspection and servicing.**

**Topic 2.1:** Health and Safety legislation relevant to vehicle inspection and servicing

**Topic 2.2:** Legislation relevant to vehicle inspection and servicing

### **Topic 2.1:**

Learners will need to understand and explain Health and Safety legislation relating to vehicle inspection and servicing. They will also need to describe the general legal duties of employers and employees required by current Health and Safety legislation.

The following is a list of legislative requirements that apply. For purposes of assessment, there is no requirement for detail, but learners must appreciate that there is legislation and the situations where each applies.

Legislative requirements:

- Health and Safety at Work Act
- Control of Substances of Hazardous to Health (COSHH)
- Environmental Protection Act (EPA)
- Manual Handling Operations Regulations
- PPE (Personal Protective Equipment) Regulations
- Provision and Use of Work Equipment Regulations
- Electricity at Work Regulations
- Noise at Work Regulations
- Abrasive Wheel Regulations
- Safe Working Loads.

### **Topic 2.2:**

Learners will need to understand the UK legal requirements for vehicles operating on public highways to include:

- vehicle testing (MOT) requirements
- the Highway Code
- The Road Vehicles (Construction and Use) Regulations.

## **Learning outcome 3: Interpret information required to inspect and service vehicles.**

**Topic 3.1:** Sources of information for the inspection and servicing of vehicles

**Topic 3.2:** Comparing information required for completing inspection and servicing activities

### **Topic 3.1:**

Learners will need to use various sources of information available to support vehicle inspection and servicing activities to include:

- manufacturer's approved inspection methods
- inspection manuals
- vehicle specific technical data, (paper based and electronic)
- manufacturer's websites (recall information and technical support).

### **Topic 3.2:**

Learners will need to compare information obtained from a range of sources and interpret the differences in access and presentation.

Learners will compare advantages and disadvantages of recording methods, for example between electronic and paper based systems.

#### ***Learning outcome 4: Carry out inspections on vehicles using prescribed methods.***

**Topic 4.1:** Carrying out vehicle inspections

**Topic 4.2** Recording information and making recommendations following inspections

##### **Topic 4.1:**

Learners will need to be able to carry out the following vehicle services/inspections:

- pre-purchase inspection
- safety inspections
- pre-delivery inspection
- manufacture servicing.

##### **Topic 4.2:**

Learners will need to produce work records that are accurate, complete and that make suitable and justifiable recommendations for cost effective repairs. All documents produced should be in the correct format and report any additional faults identified during the course of the task.

Learners will be required to record results of inspection activities and compare their results to the manufacturers and legal specifications.

This will include the correct completion of relevant documentation as required (covering both paper based and electronic records)

#### ***Learning outcome 5: Carry out routine vehicle maintenance using prescribed methods.***

**Topic 5.1:** Carrying out vehicle services

##### **Topic 5.1:**

Learners will need to demonstrate vehicle servicing activities to manufacturers recommendations including:

- completing a vehicle service following a servicing schedule
- carrying out correct procedures to check that systems and components conform to manufacturer's specifications.

## Guidance for delivery

It is important that learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of vehicle types, different types of equipment and working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and vehicle applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

## Suggested learning resources

### Books

A Practical Approach to Motor Vehicle Engineering and Maintenance – A Bonnick  
Routledge  
ISBN-13: 978-0080969985

Hillier's Fundamentals of Motor Vehicle Technology – A Hillier  
Nelson Thornes;  
ISBN-13: 978-1408515181

### Websites

- [www.smartscreen.co.uk](http://www.smartscreen.co.uk)

<b>UAN:</b>	H/507/3171
<b>Level:</b>	3
<b>GLH:</b>	90

### **What is this unit about?**

The purpose of this unit is for learners to have an understanding of the operational practices that occur in vehicle maintenance and repair workshops.

The unit covers the range of businesses and various sectors within the industry. The unit will allow the learner to see the need to adopt safe working practices. It will also provide them with an understanding and awareness of the risk of environmental issues. They will be able to understand the importance of, and the different types of, internal and external communication. The learner will also be given an appreciation of the main tools and equipment that are required in vehicle workshops.

This unit will enable learners to:

- know why it is important to adopt correct working procedures
- identify and use different forms of communication
- appreciate why correct disposal of waste is important

### **Learning outcomes**

In this unit, learners will:

1. know business types and sectors within the industry
2. understand safe working practices and organisational responsibilities
3. apply effective communication skills
4. use vehicle workshop tools and equipment safely
5. understand waste disposal management and be aware of possible environmental issues.



## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all learning outcomes can be achieved.

### ***Learning outcome 1: Know business types and sectors within the industry.***

**Topic 1.1:** Business types found within the industry

**Topic 1.2:** Roles of providers within the industry

**Topic 1.3:** Career paths in the industry

#### **Topic 1.1:**

Learners will need to compare types of business and, the career options and skill sets required for roles in each of the following:

- manufacturer owned
- franchised/multi franchised dealer
- independents (after markets)
- self-employed
- specialist.

#### **Topic 1.2:**

Learners will need to describe roles of the various providers in the industry including:

- mechanical and general repair
- accident damage and repair
- recovery operator
- vehicle fast fit
- mobile repairer
- auto electrical specialist
- vehicle restoration.

#### **Topic 1.3**

Learners will need to describe career paths within the industry including:

- mechanical repair apprenticeship through to aftersales (workshop) manager
- sales apprenticeship through to sales manager
- parts apprenticeship through to parts manager
- accident repair apprenticeship through to body shop manager
- accident paint apprenticeship through to body shop manager/estimator
- mechanical repair apprenticeship through to technical trainer.

### ***Learning outcome 2: Understand safe working practices and organisational responsibilities.***

**Topic 2.1:** Employer and employees responsibilities

**Topic 2.2:** Adopting safe working practices

**Topic 2.1:**

Learners will need to be able to understand the various statements made within the regulations and be able to give practical examples from the working environment.

The learner needs to be able to give examples in terms of:

- a safe place of work
- safe equipment
- safe systems and environment
- safe methods of handling and storing
- reporting accidents
- taking reasonable care of their own Health and Safety and that of others.

**Topic 2.2:**

Learners will need to understand the main safety procedures required to prevent injury to themselves and other by:

- using personal protective equipment for skin, eyes and hands
- preventing hair, clothing, etc being caught in machinery and other moving parts and components
- using safety guards where appropriate.

Learners will need to understand the main safety precautions and procedures when carrying out tasks in the work environment in the following situations:

- when working with flammable gases, liquids and harmful substances
- when working on vehicle electrical systems, hybrid vehicles, fuel systems, cooling systems, tyres & wheels, tilting cabs and tipping bodies
- when running engines and manoeuvring vehicles especially in confined spaces
- before working on defective vehicles
- when hoisting, lifting or jacking up vehicles and using support stands
- when drilling, grinding and using compressed air
- when using hand and power tools
- when storing, issuing or handling vehicle parts.

**Learning outcome 3: Apply effective communication skills.**

**Topic 3.1:** Communicating with and supporting customers and colleagues

**Topic 3.2:** Maintaining excellence in customer relationships

**Topic 3.3:** Developing and maintaining good working relationships

**Topic 3.1:**

Learners will need to be able to:

- use methods of communication which meet the needs of customers and colleagues
- explain how to communicate effectively with customers
- describe how to adopt appropriate language when talking to non-technical customers and colleagues
- provide information that is accurate
- request assistance from colleagues at an appropriate time and in the correct manner
- report any anticipated delays to the customer and appropriate colleagues.

**Topic 3.2:**

Learners will need to be able to ensure the correct information is obtained from the customer to ensure that the appropriate work is carried out and to allow accurate diagnosis of vehicle faults.

Learners will also need to understand and carry out a range of communication techniques, such as:

- knowing when to use open and closed question
- correctly using verbal and none verbal methods
- being able to control a conversation
- being aware of vocal tone and speed.

### **Topic 3.3:**

Learners will need to be able to:

- contribute to a team by initiating ideas
- co-operate with customers and colleagues in an appropriate manner
- treat customers and colleagues in a respectful way
- make and keep achievable commitments and know the importance of doing so
- behave in a professional manner.

## ***Learning outcome 4: Use vehicle workshop tools and equipment safely.***

**Topic 4.1:** Using hand tools safely

**Topic 4.2:** Using workshops equipment safely

### **Topic 4.1:**

Learners will need to be able to recognise the various hand tools in general use in vehicle repair workshops, to include:

- spanners – open ended/ring/combo
- sockets, ratchets and extensions
- torque wrenches and angle gauges
- screwdrivers – plain/Phillips/posidrive
- hammers and punches
- pliers
- impact wrenches – compressed air/electric.

Learners will also need to be able to demonstrate the correct and safe use of the hand tools listed above.

### **Topic 4.2:**

Learners will need to be able to recognise the various pieces of workshops equipment and special tools used in vehicle repair workshops, to include:

- portable jacks and support stands
- bearing and shaft pullers and presses
- tyre removal and wheel balancing equipment
- cooling system pressure tester
- cylinder leakage tester
- brake testers
- diagnostic test equipment
- steering and suspension alignment equipment
- exhaust gas analysers/smoke meters.

Learners will need to be able to demonstrate the correct and safe use of the following pieces of workshop equipment:

- portable jacks and support stands
- bearing and shaft pullers and presses
- tyre removal and wheel balancing equipment

- cooling system pressure tester
- cylinder leakage tester.

***Learning outcome 5: Understand waste disposal management and be aware of possible environmental issues.***

**Topic 5.1:** Risks to the environment

**Topic 5.2:** Awareness of legal responsibilities regarding waste disposal

**Topic 5.1:**

Learners will need to be able to identify the following causes of possible environmental damage and understand how to prevent or reduce them:

- emissions from vehicle exhausts and volatile organic compounds
- land contamination from spillages and fluid disposal
- disposal of vehicles, vehicle parts, tyres, batteries, oil, paint, etc.
- water pollution from cleaning vehicles and components.

**Topic 5.2:**

Learners will need to have a knowledge and understanding of the legal responsibilities concerning waste disposal to include:

- environmental responsibilities
- safe storage and disposal of used oil and other liquids
- vehicle valeting cleaning agents and materials.

## Guidance for delivery

It is important that learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of vehicle types, different types of equipment and working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and vehicle applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

## Suggested learning resources

### Books

A Practical Approach to Motor Vehicle Engineering and Maintenance – A Bonnick  
Routledge; 3 edition (26 May 2011)  
ISBN-13: 978-0080969985

Hillier's Fundamentals of Motor Vehicle Technology – A Hillier  
Nelson Thornes; 2 edition (17 Mar 2012)  
ISBN-13: 978-1408515181

### Websites

- [www.smartscreen.co.uk](http://www.smartscreen.co.uk)
- [www.netregs.org.uk/library\\_of\\_topics/pollution\\_prevention\\_guides/vehicle\\_repair\\_\\_maintenance.aspx](http://www.netregs.org.uk/library_of_topics/pollution_prevention_guides/vehicle_repair__maintenance.aspx)
- [www.hse.gov.uk](http://www.hse.gov.uk)

## Unit 304

## Automotive mechanical systems

<b>UAN:</b>	K/507/3172
<b>Level:</b>	3
<b>GLH:</b>	90

### What is this unit about?

The purpose of this unit is for learners to have an understanding of the purpose, construction and operation of the main vehicle mechanical systems and components.

The unit will allow the learner to understand the construction and operation of engine, transmission and chassis systems and their components. It will also allow the learner to appreciate why different designs and operating principles are applied to these systems.

This unit will enable learners to:

- understand why different engine designs are used
- know the purpose of the various vehicle systems
- know how the various vehicle systems operate

### Learning outcomes

In this unit, learners will:

1. know engine layouts, components and operating principles
2. understand the operation and construction of transmission systems
3. understand the operation and construction of chassis systems.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all learning outcomes can be achieved.

### **Learning outcome 1: Know engine layouts, components and operating principles.**

**Topic 1.1:** Engine layouts and types

**Topic 1.2:** Engine terminology

**Topic 1.3:** Engine construction and operation

**Topic 1.4:** Ancillary engine systems

#### **Topic 1.1:**

Learners will need to understand the different types of engine, their design features and reasons for use, to include:

- in-line
- vee
- single and multi cylinders
- spark ignition
- compression ignition
- two stroke and four stroke.

#### **Topic 1.2:**

Learners will need to understand the terminology used in respect of engines, to include:

- top dead centre (T.D.C.)
- bottom dead centre (B.D.C.)
- bore
- stroke
- engine and cylinder capacity
- swept volume
- compression ratio
- valve timing including valve lead, lag and overlap
- pressure charged.

Learners will need to be able to carry out calculations for obtaining:

- swept volume
- compression ratio.

#### **Topic 1.3:**

Learners will need to recognise and understand the construction and purpose of the following engine components:

- cylinder head
- cylinder block
- crankcase
- cylinder liners
- crankshaft
- flywheel
- pistons
- connecting rod
- valves and valve operating mechanisms.

#### **Topic 1.4:**

Learners will need to describe the construction and operation of:

- fuel systems

- ignition systems
- air supply systems
- exhaust systems.

**Learning outcome 2: Understand the operation and construction of transmission systems.**

**Topic 2.1:** Purpose of the transmission system

**Topic 2.2:** Construction and operation of transmission system components and units

**Topic 2.3:** Mathematical skills for clutch, gearbox and drive-line calculations

**Topic 2.1:**

Learners will need to understand the purposes of vehicle transmission systems:

- to provide a smooth take up of drive
- to allow permanent and temporary breaks in the drive
- to provide an increase in torque
- to allow a range of vehicle speeds
- to transmit the drive through various angles.

**Topic 2.2:**

Learners will need to know the purpose, construction and operation of the main transmission components and units:

- single and multi plate clutches:
  - clutch drive and pressure plates
  - clutch operating mechanisms
  - wet and dry clutches
- manual gearboxes:
  - the need for a range of gear ratios
  - gearbox construction and power paths
- automatic gearboxes:
  - fluid drives
  - hydraulic and electronic gear selection
  - types of gearing
  - constantly variable transmission (CVT)
- drive-line:
  - arrangements for front, rear and four wheel drive
  - bearing types and layouts for hubs and shafts
  - chain, belt and sprocket drives.

**Topic 2.3:**

Learners will need to use mathematical skills to calculate:

- clutch torque – (Torque = spring force x coefficient of friction x mean radius x number of friction surfaces)
- gearbox and final drive ratio:
  - simple – (Gear ratio = diameter of driven gear ÷ diameter of driver gear)
  - compound – (Gear ratio = (diameter of driven gear ÷ diameter of driver gear) x (diameter of driven gear ÷ diameter of driver gear))
- torque multiplication – (Torque output = Torque input x gear ratio x efficiency).



### **Learning outcome 3: Understand the operation and construction of chassis systems.**

**Topic 3.1:** Braking systems

**Topic 3.2:** Steering systems

**Topic 3.3:** Suspension systems

#### **Topic 3.1:**

Learners will need to understand the principles that enable braking systems to meet their functional requirements, including:

- role of friction
- use of levers, rods, cables, compressed air and hydraulics to transmit/increase force
- operation of split braking systems
- calculation of brake efficiency
- the effect of weight transfer
- prevention of brake fade and wheel lock.

Learners will need to recognise and be able to state the purpose and working principles of braking system components, to include:

- master cylinders
- brake servos
- brake cylinders and callipers
- brake shoes, drums, pads and discs
- air brake compressor
- air brake chambers
- equalisation valves.

#### **Topic 3.2:**

Learners will need to describe the purposes and functional requirements of the various steering system components as to:

- providing a means of changing vehicle direction with minimum driver effort
- providing a degree of feel without transmitting shock loading to the driver
- achieving minimal tyre slip.

Learners will need to describe the working principles which enable the functional requirements to be met, to include:

- incorporating the Ackermann principle for true rolling motion
- using camber angle and swivel pin inclination for centre point steering
- using caster angle to provide directional stability and self centring steering
- using rake and trail angles to maintain stability and responsiveness
- the need for correct wheel alignment (toe-in and toe-out)
- calculating movement ratio, force ratio and efficiency of various steering gearboxes.

Learners will need to recognise and be able to state the purpose and working principles of the main steering system components, to include:

- steering racks
- steering components
- wheel and column
- steering gearboxes
- assisted steering systems (hydraulic and electrical)

- headstock and forks
- front hubs and bearings.

### Topic 3.3:

Learners will need to compare different types of suspension systems, how they differ and the reasons for using the different types:

- independent
- non-independent.

Learners will need to understand the main purposes and functional requirements of the various systems as to:

- minimising the effects of road surface irregularities
- maintaining wheel contact with the road
- transmitting driving and braking torques
- locating axles
- supporting the sprung weight
- minimising un-sprung weight.

Learners will need to recognise and be able to state the purpose and working principles of suspension system components, to include:

- beam axles
- live axles
- suspension struts
- wishbones
- suspension and spring linkages
- springs (leaf, coil, torsion, rubber, air)
- suspension dampers (telescopic and lever)
- telescopic forks
- telelever and duolever systems
- ball joints and bushes
- anti-roll bars
- bound and rebound stops.

Learners will need to identify and understand:

- different tyre and wheel construction
- tyre speed ratings
- tyre legal requirements
- tyre load indexing.

## Guidance for delivery

It is important that learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of vehicle types, different types of equipment and working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and vehicle applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

## Suggested learning resources

### Books

A Practical Approach to Motor Vehicle Engineering and Maintenance – A Bonnick  
Routledge; 3 edition (26 May 2011)  
ISBN-13: 978-0080969985

Hillier's Fundamentals of Motor Vehicle Technology – A Hillier  
Nelson Thornes; 2 edition (17 Mar 2012)  
ISBN-13: 978-1408515181

Motorcycle Maintenance and Repair – G Stokes  
Heinemann; 1 edition (16 Aug 2012)  
ISBN-13: 978-0435127596

Light and Heavy Vehicle Technology – M Nunney  
Routledge; 4 edition (25 Sep 2006)  
ISBN-13: 978-0750680370

Bosch Automotive Handbook 9<sup>th</sup> Edition –Robert Bosch GmbH  
ISBN: 13: 978-1119032946

### Websites

- [www.smartscreen.co.uk](http://www.smartscreen.co.uk)

## Unit 305

## Automotive electrical and electronic systems

<b>UAN:</b>	M/507/3173
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to develop the learner's knowledge and understanding of vehicle electrical and electronic systems, to enable diagnosis and rectification of faults within these systems. This will enable the learner to gain an in-depth understanding of how the systems operate and have a greater awareness of each components function within electrical systems. It will enable the learner to develop ideas and theories of how faults develop within vehicle electrical systems.

Learners will be able to develop the ability of diagnosing electrical circuits and components faults, therefore developing skills for the learners to be aware of industry requirements.

This unit will enable learners to:

- know where electrical systems are used in vehicles
- know the various components used in vehicle electrical circuits
- know the difference between computer hardware and software as used in vehicles

### Learning outcomes

In this unit, learners will:

1. understand electrical and electronic theory
2. know the principles of multiplex systems
3. understand vehicle computer based processes and components.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all learning outcomes can be achieved.

### ***Learning outcome 1: Understand electrical and electronic theory.***

**Topic 1.1:** Electrical and electronic principles

**Topic 1.2:** Electrical circuits

**Topic 1.3:** Principles and practice of circuit measurements

#### **Topic 1.1**

Learners will need to describe electrical and electronic principles including:

- Ohms law
- static and current electricity
- Watts law
- principles of circuit protection
- electromotive force.

#### **Topic 1.2**

Learners will need to describe the purpose of electrical components and their relationship to electrical circuits including:

- resistors and their characteristics
- diodes and their characteristics
- capacitors and their characteristics
- transistors and their characteristics
- series and parallel circuits
- circuit calculations.

#### **Topic 1.3**

Learners will need to understand the principles and practice of circuit measurements including:

- hazards of working with circuits (eg short circuits, electrical fires, personal injury)
- effects of meters in a circuit (eg checking current draw, volt drop and resistance)
- measurement of resistance, voltage and current (eg using multimeters, inductive clamps, oscilloscopes).

### ***Learning outcome 2: Know the principles of multiplex systems.***

**Topic 2.1:** Principles of multiplexing

**Topic 2.2:** Reasons for using multiplex systems

**Topic 2.3:** Applications of multiplexing - protocols

#### **Topic 2.1**

Learners will need to explain basic principles of multiplexing including:

- bus message rules
- binary coding
- twisted pair
- nodes
- gateways.

### **Topic 2.2**

Learners will need to describe the reasons why multiplex systems are used, taking the following into account:

- cost
- weight
- efficiency/speed of data transfer
- wiring complexity
- ease of installation of ancillaries and accessories (e.g. cruise control, tow bar, information systems).

### **Topic 2.3**

Learners will need to describe applications of multiplexing and associated protocols including:

- high speed data transfer (eg safety related systems (brakes, steering))
- low speed data transfer (eg body electrical systems (locking, windows))
- multimedia data transfer
- part and fully multiplexed vehicles.

## ***Learning outcome 3: Understand vehicle computer based processes and components.***

**Topic 3.1:** Principles of computing

**Topic 3.2:** Physical components of computerised vehicle systems

### **Topic 3.1**

Learners will need to describe computing principles including:

- different types of programming languages used
- differences between numerical and alphanumerical coding (eg hexadecimal coding)
- booting processes/sequence (eg standby compared to sleep mode, logical processing)
- input / outputs (eg Electronic Control Module (ECM) processes, actuators, sensors)
- differences between hardware and software.

### **Topic 3.2**

Learners will need to describe physical components in computerised vehicle systems:

- microprocessors
- memory (eg Random Access Memory (RAM), Read Only Memory (ROM))
- motherboards
- hard drives
- video / Sound cards
- universal serial bus (USB).

## Guidance for delivery

It is important that learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of vehicle types, different types of equipment and working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and vehicle applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

## Suggested learning resources

### Books

Level 1 Principles of Light Vehicle Operations Candidate Handbook (Motor Vehicle Technologies) Heinemann; 1 edition (11 Oct 2011) – G Stoakes  
ISBN-13: 978-0435048150

Level 2 Principles of Light Vehicle Maintenance and Repair Candidate Handbook (Motor Vehicle Technologies) – G Stoakes  
Heinemann; 1 edition (1 Sep 2011)  
ISBN-13: 978-0435048167

Level 3 Diploma Principles of Light Vehicle Technology Candidate Handbook (Motor Vehicle Technologies) – G Stoakes  
Heinemann; 1 edition (4 May 2012)  
ISBN-13: 978-0435075644

Hillier's Fundamentals of Motor Vehicle Technology – A Hillier  
Nelson Thornes; 2 edition (17 Mar 2012)  
ISBN-13: 978-1408515181

Automotive Electrics and Automotive Electronics (Bosch Handbooks) – R Bosch  
Wiley-Blackwell; 5th edition (26 Oct 2007)  
ISBN-13: 978-0470519370

Automotive Handbook – R Bosch  
Society of Automotive Engineers, U.S.; 5th Revised edition (Aug 2000)  
ISBN-13: 978-0768006698

Hillier's Fundamentals of Automotive Electronics: Second Edition – A Hillier  
Nelson Thornes; 2 edition (27 Sep 1996)  
ISBN-13: 978-0748726950

Hillier's Fundamentals of Automotive Electronics Book 2 Sixth Edition – A Hillier  
Nelson Thornes; 2 edition (17 July 2012)  
ISBN-13: 978-1408515372

Bosch Automotive Handbook 9th Edition – Robert Bosch GmbH

ISBN: 13: 978-1119032946

### **Websites**

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



## Unit 306

## Automotive technology and future innovation

<b>UAN:</b>	T/507/3174
<b>Level:</b>	3
<b>GLH:</b>	30

### What is this unit about?

The purpose of this unit is to develop the learner's knowledge and understanding of the technology emerging in the industry. How this technology is used to enhance vehicle safety, design, and the driving experience. Learners should be aware of how technology can reduce cost of ownership through innovation and development. Learners should be aware of how technology has developed in the industry and how environmental issues have affected vehicle technology.

This unit will enable learners to:

- know the alternative power systems used in vehicles
- be aware of the technological innovations that are incorporated in vehicle design
- appreciate how in-vehicle technology can reduce hazards and accidents

### Learning outcomes

In this unit, learners will:

1. understand operating principles of alternative power systems
2. understand principles of lighting and hazard management systems
3. research telemetry and software used in vehicles.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all learning outcomes can be achieved.

### **Learning outcome 1: Understand operating principles of alternative power systems.**

**Topic 1.1** Hydrogen fuel cell vehicles

**Topic 1.2** Electrically powered vehicles

**Topic 1.3** Hybrid vehicle systems

#### **Topic 1.1**

Learners will need to explain the basic system layout of Hydrogen powered vehicles including:

- high pressure hydrogen tank
- fuel cell
- motor
- power control unit
- battery.

Learners will need to identify potential hazards when working on hydrogen powered vehicles including:

- high pressure within fuel systems
- fuel leakage in system
- flammability of hydrogen – exposure to atmosphere
- transfer from storage.

Learners will need to compare the advantages and disadvantages of Hydrogen powered vehicles including:

- advantages - zero emissions
- disadvantages - cost of fuel, Lack for refuelling points, vehicle cost.

#### **Topic 1.2**

Learners will need to identify safety procedures required when working on electrically powered vehicles including:

- general safety procedures
- powering down the system
- isolating battery supplies.

Learners will need to explain how electrical power is stored in batteries and recharged using:

- external charge points
- internal charging.

Learners will need to compare advantages and disadvantages of electric powered vehicles including:

- advantages - zero emissions, government subsidies, reduced noise for driver and passenger, two pedal control, low running costs
- disadvantages - lack of charging points, vehicle cost, safety hazard due to reduced noise level, limited range.

### **Topic 1.3**

Learners will need to be able to describe the basic concept of hybrid vehicles including fuel systems and power generation.

Learners will need to compare advantages and disadvantages of hybrid power systems including:

- advantages – low emissions, extended fuel range
- disadvantages – battery life, charge point availability, cost of repairs.

## ***Learning outcome 2: Understand principles of lighting and hazard management systems.***

**Topic 2.1** Lighting systems used in vehicles

**Topic 2.2** Hazard avoidance concept and systems

### **Topic 2.1**

Learners will need to describe alternative lighting systems for vehicles and their uses including:

- light emitting diodes (LED)
- high intensity discharge (HID)
- adaptive lighting.

### **Topic 2.2**

Learners will need to describe hazard avoidance systems for vehicles and their advantages including:

- night vision systems
- collision avoidance
- lane assistance
- parking assistance
- adaptive cruise control.

Learners will need to compare types of safety systems used in vehicles including:

- active safety systems
- passive safety systems.

## ***Learning outcome 3: Research telemetry and software used in vehicles.***

**Topic 3.1:** Dashboard technology

**Topic 3.2:** Telemetry systems

**Topic 3.3:** Wi-Fi technology for vehicles

### **Topic 3.1**

The learner will need to research types of dashboard technology including:

- touch screens
- active driver displays.

### **Topic 3.2**

Learners will need to describe telemetry systems used in vehicles including:

- tracking systems
- GPS.

### Topic 3.3

Learners will need to describe Wi-Fi technology for vehicles including:

- vehicle integration
- area coverage.

### Guidance for delivery

It is important that learners have a full understanding of the underpinning knowledge of each of the topics. The practical application of this knowledge and understanding in the working environment is very important. Learners must be able to apply their knowledge and understanding to a wide range of vehicle types, different types of equipment and working environments.

Although some of the content may be delivered in a classroom environment, it is important that learners can relate this knowledge and understanding to actual workshop situations, practical tasks and vehicle applications.

It is expected that a range of delivery methods will be used including presentations, internet research and, where applicable, visiting speakers.

### Suggested learning resources

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Heinemann; 1 edition (4 May 2012)  
ISBN-13: 978-0435075644

Hybrid Electric Vehicles. Principles and Applications with Practical Perspectives – M Abul Masrur, Chris Mi, David Wenzhong Gao  
John Wiley & Sons, 1 edition (27 Jun.2011)  
ISBN – 978-0470747735

Hillier's Fundamentals of Motor Vehicle Technology – A Hillier  
Nelson Thornes; 2 edition (17 Mar 2012)  
ISBN-13: 978-1408515181

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ISBN-13: 978-0470519370

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Nelson Thornes; 2 edition (17 July 2012)  
ISBN-13: 978-1408515372

### **Websites**

- [www.smartscreen.co.uk](http://www.smartscreen.co.uk)
- [www.hybridcars.com](http://www.hybridcars.com)
- [www.toyota-global.com](http://www.toyota-global.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

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

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### International learners

General qualification information

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

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### Centres

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

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

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### 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

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

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### International awards

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

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

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### Walled Garden

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

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

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### Employer

Employer solutions, Mapping, Accreditation, Development Skills, Consultancy

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

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## 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 is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

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## City & Guilds

**1 Giltspur Street**

**London EC1A 9DD**

**[www.cityandguilds.com](http://www.cityandguilds.com)**

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