

Diploma in Light Vehicle Maintenance and Repair Principles at SCQF Level 5 and Level 7 (5380-15/17)

January 2020 Version 2.0

Qualification Handbook

Qualification at a glance

Subject area	Light Vehicle Maintenance and Repair
City & Guilds number	5380
Age group `approved	16-18, 19+
Entry requirements	None
Assessment	Online multiple choice tests (graded Pass, Merit, Distinction) and assignments (graded Pass)
Approvals	Automatic approval available
Support materials	Centre handbook SmartScreen
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds number	Accreditation number
Diploma in Light Vehicle Maintenance and Repair Principles at SCQF Level 5	5380-15	R171 04
Diploma in Light Vehicle Maintenance and Repair Principles at SCQF Level 7	5380-17	R172 04

Version and date	Change detail	Section
1 September 2019		
2 January 2020	Unit 108 and 163 added to the unit list	Units

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1 Introduction

This document tells you what you need to do to deliver the qualifications:

Area	Description
Who are the qualifications for?	<p>Candidates wanting to develop some of the key skills and understanding in motor vehicle systems.</p> <p>Successful candidates will have the basic skills needed to apply for an automotive apprenticeship or similar engineering pathway. These qualifications could also be used as an 'interest' course for a wide range of learners.</p>
What do the qualifications cover?	<p>It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the automotive industry.</p>
What opportunities for progression are there?	<p>They allow candidates to progress into employment or to the following City & Guilds qualifications:</p> <p>SCQF Level 5:</p> <ul style="list-style-type: none">• 5380-17 Diploma in Light Vehicle Maintenance and Repair Principles at SCQF Level 7• 5310-15 SVQ in Light Vehicle Maintenance and Repair at SCQF Level 5 <p>SCQF Level 7:</p> <ul style="list-style-type: none">• 5310-17 SVQ in Light Vehicle Maintenance and Repair at SCQF Level 7• ILM management and leadership qualifications.
Who did we develop the qualifications with?	<p>These qualifications were developed in collaboration with the Institute of the Motor Industry (IMI), the sector skills council for the automotive retail industry and other awarding organisations.</p>

Structure

To achieve the **Diploma in Light Vehicle Maintenance and Repair Principles at SCQF Level 5** learners must be achieve all mandatory units and a minimum of 1 optional group from the optional units. Some units require learners to successfully complete an online multiple choice test or assignment. Details can be found in later sections of this Handbook and in the assessment requirements section of each individual unit.

City & Guilds unit number	Unit title	SCQF level	SCQF credit value
Mandatory			
5380-001	Skills in Health, Safety and Good Housekeeping in the Automotive Environment	5	7
5380-003	Skills in Supporting Job Roles in the Automotive Work Environment	6	5
5380-004	Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	5	7
5380-051	Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment	5	3
5380-053	Knowledge of Support for Job Roles in the Automotive Work Environment	6	3
5380-054	Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	5	4
5380-101	Skills in Routine Light Vehicle Maintenance	5	2
5380-102	Skills in Removing and Replacing Light Vehicle Engine Units and Components	5	5
5380-103	Skills in Removing and Replacing Light Vehicle Electrical Units and Components	5	5
5380-104	Skills in Removing and Replacing Light Vehicle Chassis Units and Components	5	5
5380-151	Knowledge of Routine Light Vehicle Maintenance	5	3
5380-152	Knowledge of Light Vehicle Engine Mechanical, Lubrication and Cooling System Units and Components	5	3
5380-153	Knowledge of Light Vehicle Electrical Units and Components	5	6
5380-154	Knowledge of Light Vehicle Chassis Units and Components	5	6
5380-162	Knowledge of Light Vehicle Transmission and Driveline Units and Components	5	6
5380-172	Knowledge of Light Vehicle Fuel, Ignition, Air and Exhaust System Units and Components	5	3

Optional Groups			
Optional Group 1			
5380-058	Knowledge of how to Identify and Agree Motor Vehicle Customer Service Needs	6	5
5380-008	Skills to Identify and Agree Motor Vehicle Customer Service Needs	6	5
Optional Group 2			
5380-155	Knowledge of Inspecting Light Vehicles Using Prescribed Methods	5	4
5380-105	Skills in Inspecting Light Vehicles using Prescribed Methods	5	4
Optional Group 3			
5380-164	Knowledge of Overhauling Light Vehicle Engine Units	7	4
5380-114	Skills in Overhauling Light Vehicle Engine Mechanical Units	7	4
Optional Group 4			
5380-173	Knowledge of Overhauling Light Vehicle Transmission Units	7	4
5380-122	Skills in Overhauling Light Vehicle Transmission Units	7	4
Optional Group 5			
5380-182	Knowledge of Overhauling Light Vehicle Steering and Suspension Units	7	4
5380-132	Skills in Overhauling Light Vehicle Steering and Suspension Units	7	4
Optional Group 6			
5380-112	Skills in Removing and Replacing Light Vehicle Transmission and Driveline Units and Components	5	5
Optional Group 7			
5380-268	Knowledge of Removing and Fitting Basic Light Vehicle Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Vehicle Body Panels	5	2
5380-218	Skills in Removing and Fitting of Basic Light Vehicle Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Vehicle Body Panels	5	3

To achieve the **Diploma in Light Vehicle Maintenance and Repair Principles at SCQF Level 7** learners must be achieve all mandatory units and a minimum of 1 optional group from the optional units below. Some units require learners to successfully complete an online multiple choice test or assignment. Details can be found in later sections of this Handbook and in the assessment requirements section of each individual unit.

City & Guilds unit number	Unit title	SCQF level	SCQF credit value
Mandatory			
5380-001	Skills in Health, Safety and Good Housekeeping in the Automotive Environment	5	7
5380-003	Skills in Supporting Job Roles in the Automotive Work Environment	6	5
5380-004	Skills in Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	5	7
5380-051	Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment	5	3
5380-053	Knowledge of Support for Job Roles in the Automotive Work Environment	6	3
5380-054	Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment	5	4
5380-107	Skills in Diagnosing and Rectifying Light Vehicle Engine Faults	7	5
5380-108	Skills in Diagnosing and Rectifying Light Vehicle Chassis System Faults	7	5
5380-157	Knowledge of Diagnosis and Rectification of Light Vehicle Engine Faults	7	6
5380-158	Knowledge of Diagnosis and Rectification of Light Vehicle Chassis Faults	7	6
5380-163	Knowledge of Diagnosis and Rectification of Light Vehicle Transmission and Driveline Faults	7	6
5380-406	Skills in Diagnosing and Rectifying Vehicle Auxiliary Electrical Faults	7	5
5380-456	Knowledge of Diagnosis and Rectification of Vehicle Auxiliary Electrical Faults	7	6
Optional			
Optional Group 1			
5380-056	Knowledge of how to Make Learning Possible Through Demonstrations and Instruction	7	5
5380-006	Skills in how to Make Learning Possible Through Demonstrations and Instruction	7	5

Optional Group 2			
5380-058	Knowledge of how to Identify and Agree Motor Vehicle Customer Service Needs	6	5
5380-008	Skills to Identify and Agree Motor Vehicle Customer Service Needs	6	5
Optional Group 3			
5380-155	Knowledge of Inspecting Light Vehicles Using Prescribed Methods	5	4
5380-105	Skills in Inspecting Light Vehicles using Prescribed Methods	5	4
Optional Group 4			
5380-164	Knowledge of Overhauling Light Vehicle Engine Units	7	4
5380-114	Skills in Overhauling Light Vehicle Engine Mechanical Units	7	4
Optional Group 5			
5380-173	Knowledge of Overhauling Light Vehicle Transmission Units	7	4
5380-122	Skills in Overhauling Light Vehicle Transmission Units	7	4
Optional Group 6			
5380-182	Knowledge of Overhauling Light Vehicle Steering and Suspension Units	7	4
5380-132	Skills in Overhauling Light Vehicle Steering and Suspension Units	7	4
Optional Group 7			
5380-113	Skills in Diagnosing and Rectifying Light Vehicle Transmission and Driveline Faults	7	5
Optional Group 8			
5380-268	Knowledge of Removing and Fitting Basic Light Vehicle Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Vehicle Body Panels	5	2
5380-218	Skills in Removing and Fitting of Basic Light Vehicle Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Vehicle Body Panels	5	3

2 Centre requirements

Approval

Centres already approved to offer the Diploma in Light Vehicle Maintenance & Repair Principles at SCQF Level 5 (4390-12/42) will be automatically approved to register and certificate candidates on the 5380-15 (unless the centre is already subject to sanctions).

Centres already approved to offer the Diploma in Light Vehicle Maintenance & Repair Principles at SCQF Level 7 (4390-13/43) will be automatically approved to register and certificate candidates on the 5380-17 (unless the centre is already subject to sanctions).

To offer these qualifications, new centres will need to gain both centre and qualification approval. Please refer to the *City & Guilds Centre Manual* for further information.

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

Resource requirements

Physical resources and site agreements

Centres must have access to sufficient equipment in the college, training centre or workplace to ensure candidates have the opportunity to cover all of the practical activities.

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- be occupationally competent or technically knowledgeable in the area(s) for which they are delivering training and/or have experience of providing training. This knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

Assessor and verifiers

While the Assessor/Verifier (A/V) units are valued as qualifications for centre staff, they are not currently a requirement for this qualification.

Continuing professional development (CPD)

Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments

Learner entry requirements

City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that learners have the potential and opportunity to gain the qualifications successfully.

Please note that for funding purposes, candidates should not be entered for a qualification of the same type, content and level as that of a qualification they already hold.

Age restrictions

City & Guilds cannot accept any registrations for candidates under 16 as these qualifications are not approved for under 16s.

3 Delivering the qualification

Initial assessment and induction

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

- if the candidate has any specific training needs,
- support and guidance they may need when working towards their qualifications.
- any units they have already completed, or credit they have accumulated which is relevant to the qualifications.
- the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification[s], their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Support materials

The following resources are available for these qualifications:

Description	How to access
Centre handbook	www.cityandguilds.com/automotive
Practical assessment workbook	www.cityandguilds.com/automotive
Exam Success book (TL024390)	www.cityandguilds.com
SmartScreen	www.smartscreen.co.uk

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, **Learning Assistant**, an easy-to-use and secure online tool to support and evidence learners' progress towards achieving qualifications. Further details are available at: www.cityandguilds.com/eportfolios.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate. *Recording forms* are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre. Amendable (MS Word) versions of the forms are available on the City & Guilds website.

4 Assessment

Summary of assessment methods

City & Guilds has written the following assessments to use with this qualification:

- Assignments (practical assessment workbooks) comprising of practical tasks and knowledge based questions to cover all learning outcomes. Graded Pass only.
- Online multiple choice tests graded as Pass, Merit, and Distinction.

These assessments are carried out in centres and must be completed to current industry standards and practice.

Full details of the assessment requirements relating to these qualifications can be obtained directly from the Institute of the Motor Industry (IMI) <http://www.motor.org.uk>

Assessment Types

City & Guilds unit	SCQF Level	Unit title	Assessment method
001	Level 5	Skills in health, safety and good housekeeping in the automotive environment	Assignment
003	Level 6	Skills in supporting job roles in the automotive work environment	Assignment
004	Level 5	Skills in materials, fabrication, tools and measuring devices used in the automotive environment	Assignment
006	Level 7	Skills in how to make learning possible through demonstrations and instruction	Assignment
008	Level 6	Skills to identify and agree motor vehicle customer service needs	Assignment
051	Level 5	Knowledge of health, safety and good housekeeping in the automotive environment	Assignment
053	Level 6	Knowledge of support for job roles in the automotive work environment	Assignment
054	Level 5	Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment	Assignment
056	Level 7	Knowledge of how to make learning possible through demonstrations and instruction	Assignment
058	Level 6	Knowledge of how to identify and agree motor vehicle customer service needs	Assignment
101	Level 5	Skills in routine light vehicle maintenance	Assignment
102	Level 5	Skills in removing and replacing light vehicle engine units and components	Assignment
103	Level 5	Skills in removing and replacing light vehicle electrical units and components	Assignment
104	Level 5	Skills in removing and replacing light vehicle chassis units and components	Assignment
105	Level 5	Skills in inspecting light vehicles using prescribed methods	Assignment
107	Level 7	Skills in diagnosing and rectifying light vehicle engine faults	Assignment
108	Level 7	Skills in diagnosing and rectifying light vehicle chassis system faults	Assignment
112	Level 5	Skills in removing and replacing light vehicle driveline units and components	Assignment
113	Level 7	Skills in diagnosing and rectifying light vehicle transmission and driveline faults	Assignment
114	Level 7	Skills in overhauling light vehicle engine mechanical units	Assignment
122	Level 7	Skills in overhauling light vehicle transmission units	Assignment

132	Level 7	Skills in overhauling light vehicle steering and suspension units	Assignment
151	Level 5	Knowledge of routine light vehicle maintenance	Multiple choice test
152	Level 5	Knowledge of light vehicle engine mechanical, lubrication and cooling system units and components	Multiple choice test
153	Level 5	Knowledge of light vehicle electrical units and components	Multiple choice test
154	Level 5	Knowledge of light vehicle chassis units and components	Multiple choice test
155	Level 5	Knowledge of inspecting light vehicles using prescribed methods	Multiple choice test
157	Level 7	Knowledge of diagnosis and rectification of light vehicle engine faults	Multiple choice test
158	Level 7	Knowledge in diagnosis and rectification of light vehicle chassis faults	Multiple choice test
162	Level 5	Knowledge of light vehicle transmission and driveline units and components	Multiple choice test
163	Level 7	Knowledge of diagnosis and rectification of light vehicle transmission and driveline faults	Multiple choice test
164	Level 7	Knowledge of overhauling light vehicle engine units	Multiple choice test
172	Level 5	Knowledge of light vehicle fuel, ignition, air and exhaust system units and components	Multiple choice test
173	Level 7	Knowledge of overhauling light vehicle transmission units	Multiple choice test
182	Level 7	Knowledge of overhauling light vehicle steering and suspension units	Multiple choice test
218	Level 5	Skills in removing and fitting of basic light vehicle mechanical, electrical and trim (MET) components and non permanently fixed vehicle body panels	Assignment
268	Level 5	Knowledge of removing and fitting basic light vehicle mechanical, electrical and trim (MET) components and non permanently fixed vehicle body panels	Multiple choice test
406	Level 7	Skills in diagnosing and rectifying vehicle auxiliary electrical faults	Assignment
456	Level 7	Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults	Multiple choice test

Time constraints

The following must be applied to the assessment of this qualification:

- Candidates must complete their assessments within their registration period.

5 Units

Availability of units

These units each have the following:

- City & Guilds reference number
- title
- SCQF level
- credit value
- unit aim
- relationship to NOS
- learning outcomes which are comprised of a number of assessment criteria
- unit range.

Unit 001

Skills in health, safety and good housekeeping in the automotive environment

Level:	5
Credit value:	7
Relationship to NOS:	This unit is linked to G1 Contribute to Housekeeping in Motor Vehicle Environment and G2 Reduce Risks to Health and Safety in the Motor Vehicle Environment.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	<p>This unit will enable the learner to develop the skills required to:</p> <ul style="list-style-type: none"> • carry out day to day work area cleaning, clearing away, dealing with spillages and disposal of waste, used materials and debris. • identify hazards and risks in the automotive environment and complying with relevant legislation and good practice. • work safely at all times within the automotive environment, both as an individual and with others.

Learning outcome	The learner will:
1	be able to use correct personal and vehicle protection within the automotive work environment
Assessment criteria	
The learner can:	
1.1	select and use personal protective equipment throughout activities. To include appropriate protection of: <ol style="list-style-type: none"> a. eyes b. ears c. head d. skin e. feet f. hands g. lungs
1.2	select and use vehicle protective equipment throughout all activities.

Learning outcome	The learner will:
2	be able to carry out effective housekeeping practices in the automotive work environment
Assessment criteria	
The learner can:	
2.1	select and use cleaning equipment which is of the right type and suitable for the task
2.2	use utilities and appropriate consumables, avoiding waste
2.3	use materials and equipment to carry out cleaning and maintenance duties in allocated work areas, following automotive work environment policies, schedules and manufacturers' instructions
2.4	perform housekeeping activities safely and in a way which minimizes inconvenience to customers and staff.
2.5	keep the work area clean and free from debris and waste materials
2.6	keep tools and equipment fit for purpose by regular cleaning and keeping tidy
2.7	dispose of used cleaning agents, waste materials and debris to comply with legal and workplace requirements.

Learning outcome	The learner will:
3	be able to recognise and deal with dangers in order to work safely within the automotive workplace
Assessment criteria	
The learner can:	
3.1	name and locate the responsible persons for health and safety in their relevant workplace
3.2	identify and report working practices and hazards which could be harmful to themselves or others
3.3	carry out safe working practices whilst working with equipment, materials and products in the automotive environment
3.4	rectify health and safety risks encountered at work, within the scope and capability of their job role.

Learning outcome	The learner will:
4	be able to conduct themselves responsibly
Assessment criteria	
The learner can:	
4.1	show personal conduct in the workplace which does not endanger the health and safety of themselves or others
4.2	display suitable personal presentation at work which ensures the health and safety of themselves and others at work.

Unit 003

Skills in supporting job roles in the automotive work environment

Level:	6
Credit value:	5
Relationship to NOS:	This unit is linked to G3 Maintain Working Relationships in the Motor Vehicle Environment.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim	This unit will help the learner develop the skills required to keep good working relationships with all colleagues and customers in the automotive work environment by using effective communication and support.

Learning outcome	The learner will:
1	be able to work effectively within the organisational structure of the automotive work environment
Assessment criteria	
The learner can:	
1.1	respond promptly and willingly to requests for assistance from customers and colleagues
1.2	refer customers and colleagues to the correct person should requests fall outside their responsibility and capability.

Learning outcome	The learner will:
2	be able to obtain and use information in order to support their job role within the automotive work environment
Assessment criteria	
The learner can:	
2.1	select and use legal and technical information, in an automotive work environment.

Learning outcome	The learner will:
3	be able to communicate with and support colleagues and customers effectively within the automotive work environment
Assessment criteria	
The learner can:	
3.1	use methods of communication with customers and colleagues which meet their needs
3.2	give customers and colleagues accurate information
3.3	make requests for assistance from or to customers and colleagues clearly and courteously.

Learning outcome	The learner will:
4	be able to develop and keep good working relationships in the automotive work environment
Assessment criteria	
The learner can:	
4.1	contribute to team work by initiating ideas and co-operating with customers and colleagues
4.2	treat customers and colleagues in a way which shows respect for their views and opinions
4.3	make and keep achievable commitments to customers and colleagues
4.4	inform colleagues promptly of anything likely to affect their own work.

Unit 004

Skills in materials, fabrication, tools and measuring devices used in the automotive environment

Level:	5
Credit value:	7
Relationship to NOS:	This unit is linked to G4 Use of hand tools and equipment in motor vehicle engineering.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	<p>This unit helps the learner to develop the skills required for:</p> <ul style="list-style-type: none">• the correct selection, care and use of key hand tools and measuring devices for modification, fabrication and repair in the automotive environment• the correct preparation and use of common work environment equipment• the correct selection and fabrication of materials used when modifying and repairing• the correct application of automotive engineering fabrication and fitting principles.

Learning outcome	The learner will:
1	be able to select, maintain and use hand tools and measuring devices in the automotive environment
Assessment criteria	
The learner can:	
1.1	select, maintain and use suitable hand tools safely when fabricating and fitting in the automotive workplace
1.2	select, maintain and use suitable measuring devices safely when fabricating and fitting in the automotive environment
1.3	select, maintain and use suitable PPE for fabrication, repair and fitting in the automotive environment
1.4	select, maintain and use suitable electrical measuring tools safely when repairing vehicles and components.

Learning outcome	The learner will:
2	be able to prepare and use common workshop equipment
Assessment criteria	
The learner can:	
2.1	use suitably maintained workshop equipment safely
2.2	use correct interpretation of 'safe working load' on lifting and supporting equipment
2.3	report any faulty or damaged tools and equipment to the relevant persons clearly and promptly
2.4	store work tools and equipment in a safe manner which permits ease of access and identification for use.

Learning outcome	The learner will:
3	be able to select materials when fabricating, modifying and repairing vehicles and fitting components
Assessment criteria	
The learner can:	
3.1	select and use appropriate materials whilst constructing, fitting, modifying or repairing vehicles and components.

Learning outcome	The learner will:
4	be able to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components
Assessment criteria	
The learner can:	
4.1	use correct procedures when: <ul style="list-style-type: none"> a. filing b. tapping threads c. cutting plastics and metals d. drilling plastics and metals e. fitting
4.2	use appropriate techniques when fabricating, repairing and modifying vehicles and components
4.3	select and use: <ul style="list-style-type: none"> a. gaskets b. seals c. sealants d. fittings and fasteners
4.4	apply modification and repair techniques to automotive electrical circuits
4.5	select and use locking, fixing and fastening devices.

Unit 006

Skills in how to make learning possible through demonstrations and instruction

Level:	7
Credit value:	5
Relationship to NOS:	This unit is linked to G6 Enable Learning through Demonstration and Instruction.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit covers the skills needed in order to carry out demonstrations and instruction which will help the learner to learn. It includes demonstrating equipment, showing skills, giving instruction, deciding when to use demonstration or instruction, potential of technology based learning, checking on learners' progress and giving feedback.

Learning outcome	The learner will:
1.	be able to demonstrate skills and methods to learners
Assessment criteria	
The learner can:	
1.1	perform demonstrations based on an analysis of the skills needed and the order in which they must be learned
1.2	perform demonstrations that are accurate and realistic
1.3	perform structured demonstrations so that the learner can get the most out of it
1.4	perform demonstrations whilst encouraging learners to ask questions and get explanation at appropriate stages in the demonstration
1.5	provide positive feedback to learners whilst they are being given the opportunity to practise the skills that have been demonstrated
1.6	perform additional demonstrations of skills being taught to reinforce learning
1.7	perform demonstrations in a safe environment which also allows learners to see clearly
1.8	respond to the needs of the learners during demonstrations
1.9	reduce distractions and disruptions as much as possible.

Learning outcome	The learner will:
2.	be able to instruct learners
Assessment criteria	
<p>The learner can:</p> <ul style="list-style-type: none"> 2.1 implement instruction which is matched to the needs of learners 2.2 use identified learning outcomes which can be achieved through instruction 2.3 perform instruction, ensuring that the manner, level and speed of the instruction encourages learners to take part 2.4 perform instruction whilst regularly checking that the learners understand and adapt instruction as appropriate 2.5 give learners positive feedback on the learning experience and the outcomes achieved 2.6 carry out a review with the learners to identify anything that prevented learning and adapt instruction as appropriate. 	

Unit 008

Skills to identify and agree motor vehicle customer service needs

Level:	6
Credit value:	5
Relationship to NOS:	This unit is linked to G8 Identify and Agree the Motor Vehicle Customer Needs.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit is about the skills required to: gain information from customers on their perceived needs; give advice and information and agree a course of action; contract for the agreed work and complete all necessary records and instructions.

Learning outcome	The learner will:
1	be able to obtain relevant information from the customer
Assessment criteria	
The learner can:	
1.1	obtain and interpret sufficient, relevant information, from the customer to make an assessment of their needs
1.2	clarify customer and vehicle needs by referring to vehicle data and operating procedures.

Learning outcome	The learner will:
2	be able to provide relevant information to the customer
Assessment criteria	
The learner can:	
2.1	provide customers with accurate, current and relevant advice and information, in a form that the customer will understand
2.2	demonstrate techniques which encourage customers to ask questions and seek clarification during conversation.

Learning outcome	The learner will:
3	be able to agree work undertaken with the customer
Assessment criteria	
The learner can:	
3.1	summarise and record work agreed with the customer, before accepting the vehicle
3.2	implement confirmation of the agreement by ensuring customer understanding.

Learning outcome	The learner will:
4	be able to ensure recording systems are implemented correctly
Assessment criteria	
The learner can:	
4.1	use recording systems which are accurate and complete, in the required format and signed by the customer where necessary
4.2	perform the next stage in the process by passing on completed records to the correct person promptly
4.3	demonstrate correct procedures for customer approval where the contracted agreement is likely to be exceeded.

Unit 051

Knowledge of health, safety and good housekeeping in the automotive environment

Level:	5
Credit value:	3
Relationship to NOS:	This unit is linked to G1 Contribute to Housekeeping in Motor Vehicle Environment and G2 Reduce Risks to Health and Safety in the Motor Vehicle Environment.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of: <ul style="list-style-type: none">• routine maintenance and cleaning of the automotive environment and using resources economically• health and safety legislation and duties of everyone in the motor vehicle environment. It will provide an appreciation of significant risks in the automotive environment and how to identify and deal with them. Once completed the learner will be able to identify hazards and evaluate and reduce risk.

Learning outcome	The learner will:
1 understand the correct personal and vehicle protective equipment to be used within the automotive environment	
Assessment criteria	
The learner can	
1.1	explain the importance of wearing the types of PPE required for a range automotive repair activities
1.2	identify vehicle protective equipment for a range of repair activities
1.3	describe vehicle and personal safety considerations when working at the roadside.

Learning outcome	The learner will:
2	understand effective housekeeping practices in the automotive environment
Assessment criteria	
The learner can	
2.1	describe why the automotive environment should be properly cleaned and maintained
2.2	describe requirements and systems which may be put in place to ensure a clean automotive environment.
2.3	describe how to minimise waste when using utilities and consumables
2.4	state the procedures and precautions necessary when cleaning and maintaining an automotive environment
2.5	describe the selection and use of cleaning equipment when dealing with general cleaning, spillages and leaks in the automotive environment
2.6	describe procedures for correct disposal of waste materials from an automotive environment
2.7	describe procedures for starting and ending the working day which ensure effective housekeeping practices are followed.

Learning outcome	The learner will:
3	understand key health and safety requirements relevant to the automotive environment
Assessment criteria	
The learner can	
3.1	list the main legislation relating to automotive environment health and safety
3.2	describe the general legal duties of employers and employees required by current health and safety legislation
3.3	describe key, current health and safety requirements relating to the automotive environment
3.4	describe why workplace policies and procedures relating to health and safety are important.

Learning outcome	The learner will:
4	understand about hazards and potential risks relevant to the automotive environment
Assessment criteria	
The learner can	
4.1	identify key hazards and risks in an automotive environment
4.2	describe policies and procedures for reporting hazards, risks, health and safety matters in the automotive environment
4.3	state precautions and procedures which need to be taken when working with vehicles, associated materials, tools and equipment
4.4	identify fire extinguishers in common use and which types of fire they should be used on
4.5	identify key warning signs and their characteristics that are found in the vehicle repair environment
4.6	state the meaning of common product warning labels used in an automotive environment.

Learning outcome	The learner will:
5 understand personal responsibilities	
Assessment criteria	
The learner can	
5.1	explain the importance of personal conduct in maintaining the health and safety of the individual and others
5.2	explain the importance of personal presentation in maintaining health safety and welfare.

Unit 051

Knowledge of health, safety and good housekeeping in the automotive environment

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Economic use of resources

- a. Consumable materials eg grease, oils, split pins, locking and fastening devices.

Requirement to maintain work area effectively

- a. Cleaning tools and equipment to maximise workplace efficiency.
- b. Requirement to carry out the housekeeping activities safely and in a way that minimises inconvenience to customers and staff.
- c. Risks involved when using solvents and detergents.
- d. Advantages of good housekeeping.

Spillages, leaks and waste materials

- a. Relevance of safe systems of work to the storage and disposal of waste materials.
- b. Requirement to store and dispose of waste, used materials and debris correctly.
- c. Safe disposal of special / hazardous waste materials.
- d. Advantages of recycling waste materials.
- e. Dealing with spillages and leaks.

Basic legislative requirements

- a. Provision and Use of Work Equipment Regulations 1992
- b. Provision and Use of Work Equipment Regulations 1998 as applied to power presses
- c. Pressure Systems and Transportable Gas Containers Regulations 1989
- d. Electricity at Work Regulations 1989
- e. Noise at Work Regulations 1989
- f. Manual Handling Operations Regulations 1992
- g. Health and Safety (Display Screen Equipment) Regulations 1992
- h. Abrasive Wheels Regulations 1970
- i. The Lifting Operations and Lifting Equipment Regulations 1998
Work at Height Regulations 2005.

Routine maintenance of the workplace

- a. Trainee's personal responsibilities and limits of their authority with regard to work equipment.
- b. Risk assessment of the workplace activities and work equipment.
- c. Workplace person responsible for training and maintenance of workplace equipment.
- d. When and why safety equipment must be used.
- e. Location of safety equipment.
- f. Particular hazards associated with their work area and equipment.
- g. Prohibited areas.
- h. Plant and machinery that trainees must not use or operate.
- i. Why and how faults on unsafe equipment should be reported.
- j. Storing tools, equipment and products safely and appropriately.
- k. Using the correct PPE.
- l. Following manufacturers' recommendations.
- m. Location of routine maintenance information e.g. electrical safety check log.

Legislation relevant to Health and Safety

- a. HASAWA
- b. COSHH
- c. EPA
- d. Manual Handling Operations Regulations 1992
- e. PPE Regulations 1992.

General regulations to include an awareness of:

- a. Health and Safety (Display Screen Equipment) Regulations 1992
- b. Health and Safety (First Aid) Regulations 1981
- c. Health and Safety (Safety Signs and Signals) Regulations 1996
- d. Health and Safety (Consultation with Employees) Regulations 1996
- e. Employers Liability (Compulsory Insurance) Act 1969 and Regulations 1998
- f. Confined Spaces Regulations 1997
- g. Noise at Work Regulations 1989
- h. Electricity at Work Regulations 1989
- i. Electricity (Safety) Regulations 1994
- j. Fire Precautions Act 1971
- k. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1985
- l. Pressure Systems Safety Regulations 2000
- m. Waste Management 1991
- n. Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002
- o. Control of Asbestos at Work Regulations 2002.

Legislative duties

- a. The purpose of a Health and Safety Policy.
- b. The relevance of the Health and Safety Executive.
- c. The relevance of an initial induction to Health and Safety requirements at your workplace.
- d. General employee responsibilities under the HASAWA and the consequences of non-compliance.
- e. General employer responsibilities under the HASAWA and the consequences of non-compliance.
- f. The limits of authority with regard to Health and Safety within a personal job role.
- g. Workplace procedure to be followed to report Health and Safety matters.

Precautions to be taken when working with vehicles, workshop materials, tools and equipment including electrical safety, pneumatics and hydraulics

- a. Accessing and interpreting safety information.
- b. Seeking advice when needed.
- c. Seeking assistance when required.
- d. Reporting of unsafe equipment.
- e. Storing tools, equipment and products safely and appropriately.
- f. Using the correct PPE.
- g. Following manufacturers' recommendations.
- h. Following application procedures e.g. hazardous substances.
- i. The correct selection and use of extraction equipment.

PPE to include:

- a. Typical maintenance procedures for PPE equipment to include:
 - i. typical maintenance log
 - ii. cleaning procedures
 - iii. filter maintenance
 - iv. variation in glove types
 - v. air quality checks.
- b. Choice and fitting procedures for masks and air breathing equipment.
- c. Typical workplace processes which would require the use of PPE to include:
 - i. welding
 - ii. sanding and grinding
 - iii. filling
 - iv. panel removal and replacement
 - v. drilling
 - vi. cutting
 - vii. chiselling
 - viii. removal of broken glass
 - ix. removal of rubber seals from fire damaged vehicles
 - x. removal of hypodermic needles
 - xi. servicing activities
 - xii. roadside recovery.
- d. Unserviceable PPE.

- e. PPE required for a range automotive repair activities. To include appropriate protection of:
 - i. eyes
 - ii. ears
 - iii. head
 - iv. skin
 - v. feet
 - vi. hands
 - vii. lungs.

Fire and extinguishers

- a. Classification of fire types.
- b. Using a fire extinguisher effectively.
- c. Types of extinguishers:
 - i. foam
 - ii. dry powder
 - iii. CO2
 - iv. water
 - v. fire blanket.

Action to be taken in the event of a fire to include:

- a. The procedure as:
 - i. raise the alarm
 - ii. fight fire only if appropriate
 - iii. evacuate building
 - iv. call for assistance.

Product warning labels to include:

- a. Reasons for placing warning labels on containers.
- b. Warning labels in common use
 - i. toxic
 - ii. corrosive
 - iii. poisonous
 - iv. harmful
 - v. irritant
 - vi. flammable
 - vii. explosive.

Warning signs and notices

- a. Colours used for warning signs:
 - i. red
 - ii. blue
 - iii. green.
- b. Shapes and meaning of warning signs:
 - i. round
 - ii. triangular
 - iii. square.
- c. The meaning of prohibitive warning signs in common use.
- d. The meaning of mandatory warning signs in common use.
- e. The meaning of warning notices in common use.
- f. General design of safe place warning signs.

Hazards and risks to include:

- a. The difference between a risk and a hazard.
- b. Potential risks resulting from:
 - i. the use and maintenance of machinery or equipment
 - ii. the use of materials or substances
 - iii. accidental breakages and spillages
 - iv. unsafe behaviour
 - v. working practices that do not conform to laid down policies
 - vi. environmental factors
 - vii. personal presentation
 - viii. unauthorised personnel, customers, contractors etc entering the work premises
 - ix. working by the roadside
 - x. vehicle recovery.
- c. The employee's responsibilities in identifying and reporting risks within their working environment.
- d. The method of reporting risks that is outside own limits of authority.
- e. Potential causes of:
 - i. fire
 - ii. explosion
 - iii. noise
 - iv. harmful fumes
 - v. slips
 - vi. trips
 - vii. falling objects
 - viii. accidents whilst dealing with broken down vehicles.

Personal responsibilities

- a. The purpose of workplace policies and procedures on:
 - i. the use of safe working methods and equipment
 - ii. the safe use of hazardous substances
 - iii. smoking, eating , drinking and drugs
 - iv. emergency procedures
 - v. personal appearance.
- b. The importance of personal appearance in the control of health and safety.

Action to be taken in the event of colleagues suffering accidents

- a. The typical sequence of events following the discovery of an accident such as:
 - i. make the area safe
 - ii. remove hazards if appropriate i.e. switch off power
 - iii. administer minor first aid
 - iv. take appropriate action to re-assure the injured party
 - v. raise the alarm
 - vi. get help
 - vii. report on the accident.
- b. Typical examples of first aid which can be administered by persons at the scene of an accident:
 - i. check for consciousness
 - ii. stem bleeding
 - iii. keep the injured person's airways free
 - iv. place in the recovery position if injured person is unconscious
 - v. issue plasters for minor cuts
 - vi. action to prevent shock i.e. keep the injured party warm
 - vii. administer water for minor burns or chemical injuries
 - viii. wash eyes with water to remove dust or ingress of chemicals (battery acid)
 - ix. need to seek professional help for serious injuries.
- c. Examples of bad practice which may result in further injury such as:
 - i. moving the injured party
 - ii. removing foreign objects from wounds or eyes
 - iii. inducing vomiting
 - iv. straightening deformed limbs

Unit 053

Knowledge of support for job roles in the automotive work environment

Level:	6
Credit value:	3
Relationship to NOS:	This unit is linked to G3 Maintain Working Relationships in the Motor Vehicle Environment.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of how to keep good working relationships with all colleagues in the automotive work environment by using effective communication and support skills.

Learning outcome	The learner will:
1 understand key organisational structures, functions and roles within the automotive work environment	
Assessment criteria	
The learner can:	
1.1 identify the purpose of the different sections of a typical automotive work environment	
1.2 explain organisational structures and lines of communication within the automotive work environment	
1.3 explain levels of responsibility within specific job roles in an automotive workplace. To include:	
a. trainee	
b. skilled technician	
c. supervisor	
d. manager.	

Learning outcome	The learner will:
2	understand the importance of obtaining, interpreting and using information in order to support their job role within the automotive work environment
Assessment criteria	
The learner can:	
2.1	explain the importance of different sources of information in an automotive work environment
2.2	explain how to find, interpret and use relevant sources of information
2.3	describe the main legal requirements relating to the vehicle, including road safety requirements
2.4	explain the importance of working to recognised procedures and processes
2.5	explain when replacement units and components must meet the manufacturers' original equipment specification
2.6	explain the purpose of how to use identification codes.

Learning outcome	The learner will:
3	understand the importance of different types of communication within the automotive work environment
Assessment criteria	
The learner can:	
3.1	explain where different methods of communication would be used within the automotive environment
3.2	explain the factors which can determine their choice of communication
3.3	explain how the communication of information can change with the target audience to include informed and uninformed people.

Learning outcome	The learner will:
4	understand communication requirements when carrying out vehicle repairs in the automotive work environment
Assessment criteria	
The learner can:	
4.1	explain how to report using written and verbal communication
4.2	explain the importance of documenting information relating to work carried out in the automotive environment
4.3	explain the importance of working to agreed timescales.

Learning outcome	The learner will:
5	understand how to develop good working relationships with colleagues and customers in the automotive workplace
Assessment criteria	
<p>The learner can:</p> <ul style="list-style-type: none"> <li data-bbox="194 367 1241 434">5.1 describe how to develop positive working relationships with colleagues and customers <li data-bbox="194 443 1139 477">5.2 explain the importance of developing positive working relationships <li data-bbox="194 486 1177 519">5.3 explain the importance of accepting other peoples' views and opinions <li data-bbox="194 528 1369 589">5.4 explain the importance of making and honouring realistic commitments to colleagues and customers. 	

Unit 053

Knowledge of support for job roles in the automotive work environment

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

The structure of a typical vehicle repair business

- a. How these areas relate to each other within the business:
 - i. body shop
 - ii. vehicle repair workshop
 - iii. paint shop
 - iv. valeting
 - v. vehicle parts store
 - vi. main office
 - vii. vehicle sales
 - viii. reception.

Sources of information:

- a. other staff
- b. manuals
- c. parts lists
- d. computer software and the internet
- e. manufacturer
- f. diagnostic equipment.

Communication requirements when carrying out vehicle repairs

- a. Locating and using correct documentation and information for:
 - i. recording vehicle maintenance and repairs
 - ii. vehicle specifications
 - iii. component specifications
 - iv. oil and fluid specifications
 - v. equipment and tools
 - vi. identification codes.
- b. Procedures for:
 - i. referral of problems
 - ii. reporting delays
 - iii. additional work identified during repair or maintenance
 - iv. keeping others informed of progress.

- c. Methods of communication:
 - i. verbal
 - ii. signs and notices
 - iii. memos
 - iv. telephone
 - v. electronic mail
 - vi. vehicle job card
 - vii. notice boards
 - viii. SMS text messaging
 - ix. letters.
- d. Organisational and customer requirements:
 - i. importance of time scales to customer and organization
 - ii. relationship between time and costs
 - iii. meaning of profit.
- e. Choice of communication
 - i. distance
 - ii. location
 - iii. job responsibility.
- f. Importance of maintaining positive working relationships:
 - i. morale
 - ii. productivity
 - iii. company image
 - iv. customer relationships
 - v. colleagues.

Unit 054

Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment

Level:	5
Credit value:	4
Relationship to NOS:	This unit is linked to G4 Use of hand tools and equipment in Motor Vehicle Engineering.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	<p>This unit enables the learner to develop an understanding of:</p> <ul style="list-style-type: none">• the correct selection, care and use of key hand tools and measuring devices for modification, fabrication and repair in the automotive environment• the correct preparation and use of common work environment equipment• the correct selection and fabrication of materials used when modifying and repairing• the correct application of automotive engineering fabrication and fitting principles.

Learning outcome	The learner will:
1	understand how to select, use and care for hand tools and measuring devices in the automotive environment
Assessment criteria	
The learner can:	
1.1	identify and explain the use of common types of hand tools used for fabricating and fitting in the automotive environment
1.2	identify and explain the use of common measuring devices used for fabrication and fitting in the automotive environment
1.3	describe, within the scope of their responsibilities, how to select, prepare and maintain hand tools, measuring devices and PPE used for fabrication, repair and fitting in the automotive environment
1.4	state the limitations of common hand tools and measuring devices used for fabricating, repair and fitting in the automotive workplace
1.5	explain how common hand tools and measuring devices used for fabricating, repair and fitting in the automotive environment should be stored and maintained
1.6	identify common electrical measuring tools used in the repair of vehicles and components
1.7	explain the preparation and safe and correct use of common electrical tools when measuring voltage, current and resistance.

Learning outcome	The learner will:
2	understand how to prepare and use common workshop equipment
Assessment criteria	
The learner can:	
2.1	describe the preparation and safe use of workshop equipment
2.2	explain the term: safe working load.

Learning outcome	The learner will:
3	understand how to select materials when fabricating, modifying and repairing vehicles and fitting components
Assessment criteria	
The learner can:	
3.1	describe the properties, application and limitations of ferrous and non-ferrous metals, including their safe use
3.2	describe the properties, application and limitations of common non-metallic materials, including their safe use
3.3	define common terms relating to the properties of materials

Learning outcome	The learner will:
4	understand how to apply automotive engineering, fabrication and fitting principles when modifying and repairing vehicles and components
Assessment criteria	
<p>The learner can:</p> <p>4.1 describe how to tap threads, file, cut and drill plastics and metals when modifying or repairing vehicles</p> <p>4.2 describe how to measure, mark out, shape and join materials when fabricating</p> <p>4.3 describe the selection and fitting procedures of the following:</p> <ul style="list-style-type: none"> a. gaskets and seals b. sealants and adhesives c. fittings and fasteners d. electrical circuit components <p>4.4 identify locking, fastening and fixing devices</p> <p>4.5 state the importance of current operating specifications for limits, fits and tolerances in the automotive environment.</p>	

Unit 054

Knowledge of materials, fabrication, tools and measuring devices used in the automotive environment

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Common types of hand tools used for fabricating and fitting in the automotive workplace to include:

- a. files
- b. hacksaws and snips
- c. hammers
- d. screwdrivers
- e. pliers
- f. spanners
- g. sockets
- h. punches
- i. types of drill and drill bits
- j. taps and dies
- k. stud removers
- l. marking out tools.

Common measuring devices used for fabrication and fitting in the automotive environment. To include:

- a. rule or tape
- b. callipers
- c. feeler gauge
- d. volume measures
- e. micrometer
- f. dial gauges
- g. torque wrenches
- h. depth gauges

Common electrical measuring tools used in the repair of vehicles and components. To include:

- a. ammeter
- b. voltmeter
- c. ohmmeter
- d. multi-meter.

Common electrical terms when measuring:

- a. voltage
- b. current
- c. resistance.

Workshop equipment (including appropriate PPE) to include:

- a. hydraulic jacks
- b. axle stands
- c. pillar drills
- d. air tools
- e. vehicle lifts
- f. cranes
- g. hoists
- h. electrical power tools.

The properties, application and limitations to include safe use of ferrous and non-ferrous metals used when constructing, modifying and repairing vehicles and components.

Materials to include:

- a. carbon steels
- b. alloy steels
- c. cast iron
- d. aluminium alloys
- e. brass
- f. copper
- g. lead.

Properties, application and limitations (to include safe use) of non-metallic materials used when constructing, modifying and repairing vehicles and components. Materials to include:

- a. glass
- b. plastics (inc. GRP)
- c. Kevlar
- d. rubber.

Terms relating to the properties of materials to include:

- a. hardness
- b. toughness
- c. ductility
- d. elasticity
- e. tenacity
- f. malleability
- g. plasticity.

Unit 056

Knowledge of how to make learning possible through demonstrations and instruction

Level:	7
Credit value:	5
Relationship to NOS:	This unit is linked to G6 Enable Learning through Demonstration and Instruction.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of how to carry out demonstrations and instruction which will help the learner to learn. It includes demonstrating equipment, showing skills, giving instruction, deciding when to use demonstration or instruction, potential of technology based learning, checking on learners' progress and giving feedback.

Learning outcome	The learner will:
1.	understand the nature and role of demonstrations and instruction
Assessment criteria	
The learner can:	
1.1	classify the separate areas of demonstrations which encourage learning
1.2	identify which types of learning are best achieved and supported through demonstrations
1.3	explain how to identify and use different learning opportunities
1.4	explain how to structure demonstrations and instruction sessions
1.5	explain how to choose from a range of demonstration techniques.

Learning outcome	The learner will:
2.	understand the principles and concepts of demonstration and instruction
Assessment criteria	
The learner can:	
2.1	describe how to put learners at ease and encourage them to take part
2.2	justify the choice between demonstration and instruction as a learning method
2.3	explain how to identify individual learning needs
2.4	clarify which factors are likely to prevent learning and how to overcome them
2.5	explain how to check learners' understanding and progress
2.6	explain how to choose and prepare appropriate materials
2.7	explain the separate areas of instructional techniques which encourage learning
2.8	describe which types of learning are best achieved and supported through instruction.

Learning outcome	The learner will:
3.	understand the external factors influencing human resource development
Assessment criteria	
The learner can:	
3.1	explain how to make sure everybody acts in line with health, safety and environmental protection, legislation and best practice
3.2	analyse developments in technology based learning and new ways of delivery.

Unit 056

Knowledge of how to make learning possible through demonstrations and instruction

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Separate areas of demonstration which encourage learning to include:

- a. Demonstration is particularly applicable to learning manual skills.
- b. Learning to do something usually involves:
 - i. purpose - the aim or objective
 - ii. procedure - the most effective way of completing the task
 - iii. practice - all skills require practice to improve
- c. Practical tasks are more quickly learnt through demonstration.
- d. Emphasis is required to body movements when demonstrating.
- e. The demonstrator should encourage learners to ask questions.
- f. Emphasis should be placed upon key points whilst demonstrating.
- g. Any demonstration should ensure that all safety aspects are covered.

Types of learning which are best achieved and supported through demonstrations to include:

- a. Types of learning:
 - i. Psychomotor - measurement of manual skill performance
 - ii. Cognitive - learning involving thought processes
 - iii. Affective - demonstration of feelings, emotions or attitudes.
- b. Demonstration - involves learning to do something (Psychomotor Domain).
- c. Combination of instruction and practical demonstrations are very effective means of learning practical skills.

How to structure demonstration and instruction sessions to include:

- a. Before the demonstration and/or instruction ensure that the following good practice is recognised:
 - i. identify key points
 - ii. relate theoretical underpinning knowledge to key points
 - iii. rehearse to ensure that all equipment is working
 - iv. ensure all students can see even small equipment and processes
 - v. time the demonstration
 - vi. consider how to make students participate
 - vii. consider how to emphasise safe working practices.
- b. During the demonstration and/or instruction good practice is to:
 - i. give a clear introduction
 - ii. identify any tools/equipment
 - iii. determine the current audience level of knowledge
 - iv. complete the demonstration correctly (do not show how not to do it)

- v. stress key points and show links between them
- vi. monitor safety aspects
- vii. check learner understanding.
- c. After the demonstration (if possible)
 - i. enable the audience to practise the techniques
 - ii. provide feedback on their performance.

How to identify individual learning needs

- a. Diagnose the learning needs of your audience to include:
 - i. what competencies they already have
 - ii. what experience they have of the subject area
 - iii. what competencies they need to achieve
 - iv. what demonstration techniques are best suited to their needs
 - v. how you will assess their needs have been met.

What factors are likely to prevent learning, to include:

- a. language barriers
- b. physical barriers
- c. specialist knowledge
- d. pace of learning
- e. method of delivery
- f. environmental factors
- g. teaching styles
- h. dyslexia.

How to check learner's understanding and progress

- a. Questionnaires.
- b. Verbal questioning.
- c. Observation.
- d. Assessment.
- e. Role play.
- f. Projects/assignments.
- g. Multi-choice questions.
- h. Simulation.
- i. Tests.

How to organise information and prepare materials

- a. Identify the course aim.
- b. Identify the subject aim.
- c. Identify the lesson aim.
- d. Complete a lesson plan - plan the teaching.
- e. Identify a series of 'cues' to be used during the lesson.
- f. Logically organise the information.
- g. Use suitable resources and equipment to maximise learning opportunities.
- h. Assess the learner's progress and understanding.

Instructional techniques

- a. Types of instructional techniques to include:
 - i. lectures
 - ii. handouts
 - iii. team teaching
 - iv. peer teaching
 - v. discussion – individual, group and peer
 - vi. question and answer
 - vii. Multimedia
 - viii. seminars
 - ix. case studies
 - x. project/assignments.

Environmental factors that affect learning

- a. Environmental factors that should be considered before demonstration/instruction to include:
 - i. loud noises
 - ii. bright colours
 - iii. bright lights
 - iv. strong smells
 - v. atmosphere
 - vi. temperature
 - vii. classroom seating
 - viii. classroom layout
 - ix. bright lights.

Health and safety factors that affect learning

- a. Health and safety factors that should be considered before demonstration/instruction to include:
 - i. assessment of risk and hazards
 - ii. condition of electrical/electronic equipment
 - iii. position of cables and wires
 - iv. safety of equipment used in demonstration/instruction
 - v. condition of classroom equipment/furniture/structure
 - vi. suitable protective clothing/equipment.

Analysis of demonstration/instruction

- a. Analysis of demonstration/instruction to include:
 - i. feedback from students
 - ii. feedback from colleagues
 - iii. organisational quality assessment
 - iv. feedback from external organisations
 - v. awarding body requirements.

Developments in learning

To include:

- a. multimedia based materials
- b. web based materials
- c. interactive materials.

How to choose and prepare appropriate materials.

To include:

- a. putting information in order
- b. deciding whether the language used is appropriate
- c. type of material i.e. paper and technology based.

Unit 058

Knowledge of how to identify and agree motor vehicle customer service needs

Level:	6
Credit value:	5
Relationship to NOS:	This unit is linked to G8 Identify and Agree the Motor Vehicle Customer Needs.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of how to gain: information from customers on their perceived needs; give advice and information and agree a course of action; contract for the agreed work and complete all necessary records and instructions.

Learning outcome	The learner will:
	1. understand legislative and organisational requirements and procedures
Assessment criteria	
The learner can:	
1.1 describe the fundamental legal requirements of current consumer legislation and the consequences of their own actions in respect of this legislation	
1.2 describe the content and limitations of company and product warranties for the vehicles dealt with by their company	
1.3 explain the limits of their own authority for accepting vehicles	
1.4 explain the importance of keeping customers informed of progress	
1.5 describe their workplace requirements for the completion of records	
1.6 explain how to complete and process all the necessary documentation.	

Learning outcome	The learner will:
2. understand how to communicate and care for customers	
Assessment criteria	
The learner can:	
2.1 explain how to communicate effectively with customers	
2.2 describe how to adapt their language when explaining technical matters to non-technical customers	
2.3 explain how to use effective questioning techniques	
2.4 describe how to care for customers and achieve customer satisfaction.	

Learning outcome	The learner will:
3. understand company products and services	
Assessment criteria	
The learner can:	
3.1 describe the range of options available to resolve vehicle problems	
3.2 describe the range and type of services offered by their company	
3.3 explain the effect of resource availability upon the receipt of customer vehicles and the completion work	
3.4 explain how to access costing and work completion time information.	

Unit 058

Knowledge of how to identify and agree motor vehicle customer service needs

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Organisational requirements

- a. Explain the organisation's terms and conditions applicable to the acceptance of customer vehicles.
- b. Explain the content and limitations of vehicle and component warranties for the vehicles dealt with by your organisation.
- c. Detail what, if any, limits there are to the authority for accepting vehicles.
- d. Detail why it is important to keep customers advised of progress and how this is achieved within the organisation.
- e. Detail the organisation's procedures for the completion and processing of documentation and records, including payment methods and obtaining customer signatures as applicable.

Principles of customer communication and care

- a. First Impressions.
- b. Listening skills – 80:20 ratio.
- c. Eye contact and smiling.
- d. Showing interest and concern.
- e. Questioning techniques and customer qualification.
- f. Giving clear non-technical explanations.
- g. Confirming understanding (statement/question technique, reflective summary).
- h. Written communication – purpose, content, presentation and style.
- i. Providing a high quality service – fulfilling (ideally exceeding) customer expectations within agreed time frames.
- j. Obtaining customer feedback and corrective actions when dissatisfaction expressed.
- k. Dealing with complaints.

Company products and services

- a. Service standards
 - i. national
 - ii. manufacturer
 - iii. organisational.
- b. The range and type of services offered by the organisation.
 - i. diagnostic
 - ii. servicing
 - iii. repair
 - iv. warranty
 - v. MOT testing
 - vi. fitment of accessories/enhancements
 - vii. internal.
- c. The courses of action available to resolve customer problems:
 - i. the extent and nature of the work to be undertaken
 - ii. the terms and conditions of acceptance
 - iii. the cost
 - iv. the timescale
 - v. required payment methods.
- d. The effect of resource availability upon the receipt of customer vehicles and the completion of work:
 - i. levels and availability of equipment
 - ii. levels and availability of technicians
 - iii. workshop loading systems.
- e. How to access costing and work completion time information:
 - i. manuals
 - ii. computer based.

Vehicle information systems, servicing and repair requirements

- a. Accessing technical data including diagnostics.
- b. Servicing to manufacturer requirements/standards.
- c. Repair/operating procedures.
- d. MOT standards/requirements.
- e. Quality controls – interim and final.
- f. Requirements for cleanliness of vehicle on return to customer.
- g. Handover procedures.

Consumer legislation to include:

- a. consumer protection
- b. sale of goods
- c. data protection
- d. product liability
- e. health and safety
- f. discrimination.

Unit 101

Skills in routine light vehicle maintenance

Level:	5
Credit value:	2
Relationship to NOS:	This unit is linked to LV01 Carry Out Routine Light Vehicle Maintenance.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to develop skills they can carry out light vehicle routine maintenance, adjustments and replacement activities as part of the periodic servicing of vehicles.

Learning outcome	The learner will:
1	be able to work safely when carrying out light vehicle routine maintenance
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings throughout all light vehicle routine maintenance activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate)

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support light vehicle routine maintenance activities including: <ul style="list-style-type: none"> a. vehicle technical data b. maintenance procedures c. legal requirements
2.2	use technical information to support light vehicle inspection activities

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for carrying out routine maintenance
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the correct tools and equipment in the way specified by manufacturers when carrying out routine maintenance

Learning outcome	The learner will:
4	be able to carry out light vehicle routine maintenance
Assessment criteria	
The learner can:	
4.1	carry out light vehicle maintenance using prescribed methods, adhering to the correct specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved inspection methods b. recognised researched inspection methods c. health and safety requirements
4.2	carry out adjustments, replacement of vehicle components and replenishment of consumable materials following the manufacturer's current specification
4.3	ensure the examination methods identify accurately any vehicle system and or component problems falling outside the maintenance schedule are specified.
4.4	ensure any comparison of the vehicle against specification accurately identifies any: <ul style="list-style-type: none"> a. differences from the vehicle specification b. vehicle appearance and condition faults c. variation from legal requirements
4.5	use suitable testing methods to evaluate the performance of all replaced and adjusted components and systems accurately.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 102

Skills in removing and replacing light vehicle engine units and components

Level:	5
Credit value:	5
Relationship to NOS:	This unit is linked to LV02 Skills in removing and replacing light vehicle engine units and components
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate they can remove and replace light vehicle engine system components. It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	The learner will:
1	be able to work safely when carrying out removal and replacement activities
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings throughout all light vehicle engine unit and component removal and replacement activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate)

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support light vehicle engine unit and component removal and replacement activities including: <ol style="list-style-type: none"> a. vehicle technical data b. removal and replacement procedures c. legal requirements
2.2	use technical information to support light vehicle engine unit and component removal and replacement activities

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for removal and replacement of light vehicle engine systems
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the correct tools and equipment in the way specified by manufacturers to remove and replace light vehicle engine systems

Learning outcome	The learner will:
4	be able to carry out removal and replacement of light vehicle engine mechanical, lubrication and cooling units and components
Assessment criteria	
The learner can:	
4.1	remove and replace the light vehicle's engine systems and components, adhering to the correct specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved removal and replacement methods b. recognised researched repair methods c. health and safety requirements.
4.2	ensure that replaced light vehicle engine units and components conform to the vehicle operating specification and any legal requirements
4.3	use suitable testing methods to evaluate the performance of the reassembled system
4.4	ensure that the reassembled light vehicle engine systems performs to the vehicle operating specification and meets any legal requirements.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 103

Skills in removing and replacing light vehicle electrical units and components

Level:	5
Credit value:	5
Relationship to NOS:	This unit is linked to LV03 Remove and Replace Light Vehicle Electrical Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to develop skills to remove and replace light vehicle engine system components. It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	The learner will:
1	be able to work safely when carrying out removal and replacement activities
Assessment criteria	
The learner can	
1.1	use suitable personal protective equipment and vehicle coverings when working on light vehicle electrical systems and components
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate)

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can	
2.1	select suitable sources of technical information to support light vehicle electrical unit and component removal and replacement activities including: <ul style="list-style-type: none"> a. vehicle technical data b. removal and replacement procedures c. legal requirements
2.2	use technical information to support light vehicle electrical unit and component removal and replacement activities.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can	

- 3.1 select the appropriate tools and equipment necessary for removal and replacement of motor vehicle electrical system components
- 3.2 ensure that equipment has been calibrated to meet manufacturers' and legal requirements
- 3.3 use the tools and equipment in the way specified by manufacturers to remove and replace motor vehicle electrical systems.

Learning outcome	The learner will:
4	be able to carry out removal and replacement of light vehicle electrical units and components.
Assessment criteria	
The learner can	
4.1	remove and replace the motor vehicle's electrical systems and components, adhering to the specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved removal and replacement methods b. recognised researched repair methods c. health and safety requirements
4.2	ensure that replacement motor vehicle electrical units and components conform to the vehicle operating specification and any legal requirements
4.3	use suitable testing methods to evaluate the performance of the reassembled system
4.4	ensure that the reassembled motor vehicle electrical systems perform to the vehicle operating specification and meet any legal requirements.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 104

Skills in removing and replacing light vehicle chassis units and components

Level:	5
Credit value:	5
Relationship to NOS:	This unit is linked to LV04 Remove and Replace Light Vehicle Chassis Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to develop skills to remove and replace light vehicle steering, suspension and braking units (including wheels and tyres). It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	The learner will:
1	be able to work safely when carrying out removal and replacement activities
Assessment criteria	
The learner can	
1.1	use suitable personal protective equipment and vehicle coverings throughout all light vehicle chassis unit and component removal and replacement activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can	
2.1	select suitable sources of technical information to support light vehicle chassis unit and component removal and replacement activities including: <ul style="list-style-type: none"> a. vehicle technical data b. removal and replacement procedures c. legal requirements
2.2	use technical information to support light vehicle chassis unit and component removal and replacement activities.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can	

3.1	select the appropriate tools and equipment necessary for removal and replacement of light vehicle chassis systems including: <ol style="list-style-type: none"> a. steering b. suspension c. braking d. wheels and tyres
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the correct tools and equipment in the way specified by manufacturers to remove and replace light vehicle chassis systems.

Learning outcome	The learner will:
4	be able to carry out removal and replacement of light vehicle chassis units and components
Assessment criteria	
The learner can	
4.1	remove and replace the light vehicle's chassis systems and components, adhering to the correct specifications and tolerances for the vehicle and following: <ol style="list-style-type: none"> a. the manufacturer's approved removal and replacement methods b. recognised researched repair methods c. health and safety requirements.
4.2	ensure that replacement light vehicle chassis units and components conform to the vehicle operating specification and any legal requirements
4.3	use suitable testing methods to evaluate the performance of the reassembled system
4.4	ensure that the reassembled light vehicle chassis system performs to the vehicle operating specification and meets any legal requirements.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 105

Skills in inspecting light vehicles using prescribed methods

Level:	5
Credit value:	4
Relationship to NOS:	This unit is linked to LV05 Inspect Light Vehicles using Prescribed Inspection Methods and LV06 Inspect Light Vehicles.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to develop skills to carry out a range of light vehicle inspections on vehicles using a variety of prescribed testing and inspection methods.

Learning outcome	The learner will:
1	be able to work safely when carrying out light vehicle inspections using prescribed methods
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings throughout all light vehicle inspection activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support light vehicle inspection activities including: <ul style="list-style-type: none"> a. vehicle technical data b. inspection procedures c. legal requirements
2.2	use technical information to support light vehicle inspection activities.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for carrying out a range of inspections on light vehicle systems
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the correct tools and equipment in the way specified by manufacturers when carrying out a range of inspections on light vehicle systems.

Learning outcome	The learner will:
4	be able to carry out light vehicle inspections using prescribed methods
Assessment criteria	
The learner can:	
4.1	carry out light vehicle inspections using prescribed methods, adhering to the correct specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved inspection methods b. recognised researched inspection methods c. health and safety requirements
4.2	ensure that inspected light vehicle conforms to the vehicle operating specification and any legal requirements
4.3	ensure any comparison of the vehicle against specification accurately identifies any: <ul style="list-style-type: none"> a. differences from the vehicle specification b. vehicle appearance and condition faults
4.4	use suitable testing methods to evaluate the performance of the inspected systems.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 107

Skills in diagnosing and rectifying light vehicle engine faults

Level:	7
Credit value:	5
Relationship to NOS:	This unit is linked to LV07 Diagnose and Rectify Light Vehicles Engine and Component Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate they can diagnose and rectify light vehicle engine mechanical, electrical, hydraulic and fluid systems faults. It also covers the evaluation of performance of the replaced or repaired units and systems. This includes SI, CI, Hybrid and Alternative fuel vehicles.

Learning outcome	The learner will:
1.	be able to work safely when carrying out light vehicle engine diagnostic and rectification activities
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when using light vehicle diagnostic methods and carrying out rectification activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	Prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2.	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support light vehicle diagnostic and rectification activities including: <ul style="list-style-type: none"> a. vehicle technical data b. diagnostic test procedures
2.2	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of light vehicle engine system faults.

Learning outcome	The learner will:
3.	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for diagnostic and rectification activities
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the equipment required, correctly and safely throughout all light vehicle engine diagnostic and rectification activities.

Learning outcome	The learner will:
4.	be able to carry out light vehicle engine diagnosis, rectification and test activities
Assessment criteria	
The learner can:	
4.1	use diagnostic methods that are relevant to the symptoms presented
4.2	evaluate their assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately
4.3	carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> a. manufacturers' instructions b. recognised researched repair methods c. health and safety requirements
4.4	ensure all repaired or replacement components and units conform to the vehicle operating specification and any legal requirements
4.5	adjust components and units correctly to ensure that they operate to meet system requirements
4.6	use testing methods that are suitable for assessing the performance of the system rectified
4.7	ensure the rectified light vehicle engine system performs to the vehicle operating specification and any legal requirements.

Learning outcome	The learner will:
5.	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 108

Skills in diagnosing and rectifying light vehicle chassis system faults

Level:	7
Credit value:	5
Relationship to NOS:	This unit is linked to LV08 Diagnose and Rectify Light Vehicle Chassis System Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate they can diagnose and rectify light vehicle braking steering and suspension systems faults. It also covers the evaluation of performance of the replaced or repaired units and systems. This includes SI, CI, Hybrid and Alternative fuel vehicles.

Learning outcome	The learner will:
1.	be able to work safely when carrying out light vehicle diagnostic and rectification activities
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when using light vehicle diagnostic methods and carrying out rectification activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	Prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2.	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support light vehicle diagnostic and rectification activities including: a. vehicle technical data b. diagnostic test procedures
2.2	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of light vehicle chassis system faults.

Learning outcome	The learner will:
3.	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for diagnostic and rectification activities
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the equipment required, correctly and safely throughout all light vehicle chassis diagnostic and rectification activities.

Learning outcome	The learner will:
4.	be able to carry out light vehicle chassis diagnosis, rectification and test activities
Assessment criteria	
The learner can:	
4.1	use diagnostic methods that are relevant to the symptoms presented
4.2	evaluate their assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately
4.3	carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> a. manufacturers' instructions b. recognised researched repair methods c. health and safety requirements
4.4	ensure all repaired or replacement components and units conform to the vehicle operating specification and any legal requirements
4.5	adjust components and units correctly to ensure that they operate to meet system requirements
4.6	use testing methods that are suitable for assessing the performance of the system rectified
4.7	ensure the rectified light vehicle chassis system performs to the vehicle operating specification and any legal requirements.

Learning outcome	The learner will:
5.	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 112

Skills in removing and replacing light vehicle transmission and driveline units and components

Level:	5
Credit value:	5
Relationship to NOS:	This unit is linked to LV12 Remove and Replace Light Vehicle Driveline Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to develop skills in removing and replacing light vehicle transmission and driveline units. It also covers the evaluation of performance of the replaced units and systems.

Learning outcome	The learner will:
1	be able to work safely when carrying out removal and replacement activities
Assessment criteria	
The learner can	
1.1	use suitable personal protective equipment and vehicle coverings throughout all light vehicle transmission and driveline unit and component removal and replacement activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can	
2.1	select suitable sources of technical information to support light vehicle transmission and driveline unit and component removal and replacement activities including: <ul style="list-style-type: none"> a. vehicle technical data b. removal and replacement procedures c. legal requirements
2.2	use technical information to support light vehicle transmission and driveline unit and component removal and replacement activities.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can	
3.1	select the appropriate tools and equipment necessary for removal and replacement of light vehicle transmission and driveline systems
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the correct tools and equipment in the way specified by manufacturers to remove and replace light vehicle transmission and driveline systems.

Learning outcome	The learner will:
4	be able to carry out removal and replacement of light vehicle transmission and driveline units and components
Assessment criteria	
The learner can	
4.1	remove and replace the light vehicle's transmission and driveline systems and components, adhering to the correct specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved removal and replacement methods b. recognised researched repair methods c. health and safety requirements
4.2.	ensure that replacement light vehicle transmission and driveline units and components conform to the vehicle operating specification and any legal requirements
4.3.	use suitable testing methods to evaluate the performance of the reassembled system
4.4.	ensure that the reassembled light vehicle transmission and driveline system performs to the vehicle operating specification and meets any legal requirements.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
<p>The learner can</p> <p>5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required</p> <p>5.2 make suitable and justifiable recommendations for cost effective repairs</p> <p>5.3 record and report any additional faults noticed during the course of their work promptly in the format required.</p>	

Unit 113

Skills in diagnosing and rectifying light vehicle transmission and driveline faults

Level:	7
Credit value:	5
Relationship to NOS:	This unit is linked to LV13 Diagnose and Rectify Light Vehicle Transmission and Driveline System Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate they can diagnose and rectify light vehicle gearboxes, hubs and bearings, driveline shafts, clutches, differentials and final drive unit faults. It also covers the evaluation of performance of the replaced or repaired units and systems. This includes SI, CI, Hybrid and Alternative fuel vehicles.

Learning outcome	The learner will:
1.	be able to work safely when carrying out light vehicle transmission and driveline diagnostic and rectification activities
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when using light vehicle diagnostic methods and carrying out rectification activities
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.2	Prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2.	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support light vehicle diagnostic and rectification activities including: <ul style="list-style-type: none"> a. vehicle technical data b. diagnostic test procedures
2.2	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of light vehicle transmission and driveline system faults.

Learning outcome	The learner will:
3.	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for diagnostic and rectification activities
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the equipment required, correctly and safely throughout all light vehicle transmission and driveline diagnostic and rectification activities

Learning outcome	The learner will:
4.	be able to carry out light vehicle transmission and driveline diagnosis, rectification and test activities
Assessment criteria	
The learner can:	
4.1	use diagnostic methods that are relevant to the symptoms presented
4.2	evaluate dismantled sub-assemblies for their condition and suitability for repair or replacement
4.3	carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> a. manufacturers' instructions b. recognised researched repair methods c. health and safety requirements
4.4	ensure all repaired or replacement components and units conform to the vehicle operating specification and any legal requirements
4.5	adjust components and units correctly to ensure that they operate to meet system requirements
4.6	use testing methods that are suitable for assessing the performance of the system rectified
4.7	ensure the light vehicle transmission and driveline system rectified performs to the vehicle operating specification and any legal requirements.

Learning outcome	The learner will:
5.	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 114

Skills in overhauling light vehicle engine mechanical units

Level:	7
Credit value:	4
Relationship to NOS:	This unit is linked to LV11 Overhaul Light Vehicle Mechanical Units.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate skills in overhauling engines. It also covers the evaluation of performance of the overhauled units and systems.

Learning outcome	The learner will:
1	be able to work safely when overhauling light vehicle engine mechanical units
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when overhauling light vehicle engine units
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support the overhauling of light vehicle engine units including: <ul style="list-style-type: none"> a. vehicle technical data b. overhauling procedures c. legal requirements
2.2	use technical information to support the overhauling of light vehicle engine units.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for overhauling light vehicle engine units
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the tools and equipment in the way specified by manufacturers to overhaul light vehicle engine units.

Learning outcome	The learner will:
4	be able to carry out the overhauling of light vehicle engine mechanical units
Assessment criteria	
The learner can:	
4.1	carry out all overhauling of light vehicle engine mechanical units, adhering to the specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved overhauling methods b. recognised researched repair methods c. health and safety requirements.
4.2	sure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul
4.3	inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform
4.4	use testing methods that comply with the manufacturer's requirements
4.5	adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements.
4.6	ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 122

Skills in overhauling light vehicle transmission units

Level:	7
Credit value:	4
Relationship to NOS:	This unit is linked to LV11 Overhaul Light Vehicle Mechanical Units.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate skills in overhauling gearboxes and final drive assemblies. It also covers the evaluation of performance of the overhauled units and systems.

Learning outcome	The learner will:
1	be able to work safely when overhauling light vehicle transmission units
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when overhauling light vehicle transmission units
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support the overhauling of light vehicle transmission units including: <ul style="list-style-type: none"> a. vehicle technical data b. overhauling procedures c. legal requirements
2.2	use technical information to support the overhauling of light vehicle transmission units.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for overhaul of light vehicle transmission systems
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the tools and equipment in the way specified by manufacturers to overhaul light vehicle transmission units.

Learning outcome	The learner will:
4	be able to carry out the overhauling of light vehicle transmission units
Assessment criteria	
The learner can:	
4.1	carry out all overhauling of light vehicle transmission units, adhering to the specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved overhauling methods b. recognised researched repair methods c. health and safety requirements
4.2	ensure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul
4.3	inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform
4.4	use testing methods that comply with the manufacturer's requirements
4.5	adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements
4.6	ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 132

Skills in overhauling light vehicle steering and suspension units

Level:	7
Credit value:	4
Relationship to NOS:	This unit is linked to LV11 Overhaul Light Vehicle Mechanical Units.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate skills in overhauling steering and suspension units. It also covers the evaluation of performance of the overhauled units and systems.

Learning outcome	The learner will:
1	be able to work safely when overhauling light vehicle steering and suspension units
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings when overhauling light vehicle steering and suspension units
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support the overhauling of light vehicle steering and suspension units including: a. vehicle technical data b. overhauling procedures c. legal requirements
2.2	use technical information to support the overhauling of light vehicle steering and suspension units.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for overhauling light vehicle steering and suspension units
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the tools and equipment in the way specified by manufacturers for overhauling light vehicle steering and suspension units.

Learning outcome	The learner will:
4	be able to carry out the overhauling of light vehicle steering and suspension units
Assessment criteria	
The learner can:	
4.1	carry out all overhauling of light vehicle steering and suspension units, adhering to the specifications and tolerances for the vehicle and following: <ul style="list-style-type: none"> a. the manufacturer's approved overhauling methods b. recognised researched repair methods c. health and safety requirements.
4.2	ensure the assessment of the dismantled unit identifies accurately its condition and suitability for overhaul
4.3	inform the relevant person(s) promptly where an overhaul is uneconomic or unsatisfactory to perform
4.4	use testing methods that comply with the manufacturer's requirements
4.5	adjust the unit's components correctly where necessary to ensure that they operate to meet the vehicle operating requirements
4.6	ensure the overhauled units and assemblies conform to the vehicle operating specification and any legal requirements.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 151

Knowledge of routine light vehicle maintenance

Level:	5
Credit value:	3
Relationship to NOS:	This unit is linked to LV01 Carry Out Routine Light Vehicle Maintenance.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of conducting routine maintenance, adjustment and replacement activities as part of the periodic servicing of light vehicles.

Learning outcome	The learner will:
1	Understand how to carry out routine light vehicle maintenance
Assessment criteria	
The learner can:	
1.1 explain how to conduct a scheduled light vehicle routine examination and assessment against the vehicle manufacturer's specification	
1.2 identify the assessment methods used to check for conformity	
1.3 Identify the different systems to be inspected while carrying out light vehicle routine maintenance	
a. engine	
b. chassis	
c. wheels and tyres	
d. transmission and driveline	
e. electrical and electronic	
f. exterior vehicle body	
g. vehicle interior	
1.4 describe the procedures used for checking the condition and serviceability of light vehicle units and components	
1.5 describe the procedures for checking and replenishing fluid levels	
1.6 describe the procedures for checking and replacing lubricants and fluids	
1.7 identify adjustments that need to be carried out on a light vehicle routine maintenance	
1.8 explain the procedure for reporting cosmetic damage to vehicle components and units outside normal service items	
1.9 identify the operating specifications for the systems being checked while carrying out light vehicle routine maintenance.	

Learning outcome	The learner will:
2	Understand the importance of carrying out light vehicle maintenance
Assessment criteria	

The learner can:

- 2.1 describe the requirements of correct maintenance in order to maintain the vehicle in a roadworthy and legal condition
- 2.2 describe the importance of correct maintenance for warranty purposes
- 2.3 describe the hazards associated with high energy electrical vehicle components.

Unit 151

Knowledge of routine light vehicle maintenance

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

- a. Vehicle maintenance, inspection and adjustment and record finding.
- b. Vehicle inspection techniques used in routine maintenance including:
 - i. aural
 - ii. visual and functional assessments on engine
 - iii. engine systems
 - iv. chassis systems
 - v. wheels and tyres
 - vi. transmission system
 - vii. electrical and electronic systems
 - viii. exterior vehicle body
 - ix. vehicle interior.
- c. The procedures used for inspecting the condition and serviceability of the following:
 - i. filters
 - ii. drive belts
 - iii. wiper blades
 - iv. brake linings
 - v. pads
 - vi. tyres
 - vii. lights.
- d. Preparation and appropriate use of equipment to include:
 - i. test instruments
 - ii. emission equipment
 - iii. wheel alignment
 - iv. beam setting equipment
 - v. tyre tread depth gauges.
- e. Procedures for checking and replenishing fluid levels:
 - i. oil
 - ii. water
 - iii. hydraulic fluids.
- f. Procedures for checking and replacement of lubricants:
 - i. replace oil filters
 - ii. check levels
 - iii. types of oil
 - iv. cleanliness
 - v. disposal of old oil and filters.
- g. Procedures for carrying out adjustments on vehicle systems or components:
 - i. clearances
 - ii. settings
 - iii. alignment
 - iv. operational performance (engine idle, exhaust gas).

- h. Procedures for checking electrical systems:
 - i. operation
 - ii. security
 - iii. performance.
- i. Importance and process of detailed inspection procedures:
 - i. following inspection checklists
 - ii. checking conformity to manufacturer's specifications
 - iii. UK and European legal requirements.
- j. Importance and process of completing all relevant documentation relating to routine maintenance:
 - i. inspection records
 - ii. job cards
 - iii. vehicle repair records
 - iv. in-vehicle service history.
- k. The need to use vehicle protection prior to repair. Requirements and methods used for protecting:
 - i. vehicle body panels
 - ii. paint surfaces
 - iii. seats
 - iv. carpets and floor mats.
- l. The need to check the vehicle following routine maintenance.
- m. The need to inspect the vehicle following routine maintenance:
 - i. professional presentation of vehicle
 - ii. customer perceptions.
- n. The checks of vehicle following routine maintenance:
 - i. removal of oil and grease marks
 - ii. body panels
 - iii. paint surfaces
 - iv. seats
 - v. carpets and floor mats
 - vi. re-instatement of components.

Unit 152

Knowledge of light vehicle engine mechanical, lubrication and cooling system units and components

Level:	5
Credit value:	3
Relationship to NOS:	This unit is linked to LV02 Remove and Replace Light Vehicle Engine Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of conducting routine maintenance, adjustment and replacement activities as part of the periodic servicing of light vehicles.

Learning outcome	The learner will:
1	understand how the main light vehicle engine mechanical systems operate
Assessment criteria	
The learner can	
1.1	identify light vehicle engine mechanical system components
1.2	describe the construction and operation of light vehicle engine mechanical systems <ol style="list-style-type: none"> four stroke spark ignition compression ignition rotary
1.3	compare key light vehicle engine mechanical system components and assemblies against alternatives to identify differences in construction and operation
1.4	identify the key engineering principles that are related to light vehicle engine mechanical systems <ol style="list-style-type: none"> compression ratios cylinder capacity power torque
1.5	state common terms used in light vehicle engine mechanical system design <ol style="list-style-type: none"> tdc bdc stroke bore.

Learning outcome	The learner will:
2	understand how light vehicle engine lubrication systems operate
Assessment criteria	
The learner can	
2.1	identify light vehicle engine lubrication system components
2.2	describe the construction and operation of light vehicle engine lubrication components and systems <ul style="list-style-type: none"> a. full flow b. by pass c. wet sump d. dry sump
2.3	compare key light vehicle engine lubrication system components and assemblies to identify differences in construction and operation
2.4	identify the key engineering principles that are related to light vehicle engine lubrication systems <ul style="list-style-type: none"> a. classification of lubricants b. properties of lubricants c. methods of reducing friction
2.5	state common terms used in light vehicle engine lubrication system design.

Learning outcome	The learner will:
3	understand how light vehicle engine cooling, heating and ventilation systems operate
Assessment criteria	
The learner can	
3.1	identify light vehicle engine cooling, heating and ventilation system components
3.2	describe the construction and operation of light vehicle engine cooling, heating and ventilation systems
3.3	compare key light vehicle engine cooling, heating and ventilation system components and assemblies against alternatives to identify differences in construction and operation
3.4	identify the key engineering principles that are related to light vehicle engine cooling, heating and ventilation systems <ul style="list-style-type: none"> a. heat transfer b. linear and cubical expansion c. specific heat capacity d. boiling point of liquids
3.5	state common terms used in key light vehicle engine cooling, heating and ventilation system design.

Learning outcome	The learner will:
4	understand how to check, replace and test light vehicle engine mechanical, lubrication and cooling systems system units and components
Assessment criteria	
<p>The learner can</p> <ul style="list-style-type: none"> 4.1 describe how to remove and replace engine mechanical, lubrication and cooling system units and components 4.2 describe common types of testing methods used to check the operation of engine mechanical, lubrication and cooling systems and their purpose 4.3 describe how to test and evaluate the performance of replacement units against vehicle specification 4.4 identify common faults found in light vehicle engine mechanical, lubrication and cooling systems and their causes 4.5 describe the hazards associated with high energy electrical vehicle components. 	

Unit 152 Knowledge of light vehicle engine mechanical, lubrication and cooling system units and components

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Engines

- a. Engine types and configurations:
 - i. inline
 - ii. flat
 - iii. vee
 - iv. four-stroke cycle and two-stroke cycle for spark ignition and compression ignition engines
 - v. naturally aspirated and turbo-charged engines
 - vi. hybrid fuel engines.
- b. Relative advantages and disadvantages of different engine types and configurations.
- c. Engine components and layouts:
 - i. single (OHC) and multi camshaft (DOHC)
 - ii. single and multi cylinder (2, 4, 6, 8 cylinder types).
- d. Cylinder head layout and design, combustion chamber and piston design.
- e. Calculate compression ratios from given data.
- f. The procedures used when inspecting engines.
- g. The procedures to assess:
 - i. serviceability
 - ii. wear
 - iii. condition
 - iv. clearances
 - v. settings
 - vi. linkages
 - vii. joints
 - viii. fluid systems
 - ix. adjustments
 - x. operation and functionality
 - xi. security.
- h. Symptoms and faults associated with mechanical engine operation:
 - i. poor performance
 - ii. abnormal or excessive mechanical noise
 - iii. erratic running
 - iv. low power
 - v. exhaust emissions
 - vi. abnormal exhaust smoke
 - vii. unable to start
 - viii. exhaust gas leaks to cooling system

- ix. exhaust gas leaks.

Lubrication

- a. The advantages and disadvantages of wet and dry systems.
- b. Engine lubrication system:
 - i. splash and pressurised systems
 - ii. pumps
 - iii. pressure relief valve
 - iv. filters
 - v. oil ways
 - vi. oil coolers.
- c. Terms associated with lubrication and engine oil:
 - i. full-flow
 - ii. hydrodynamic
 - iii. boundary
 - iv. viscosity
 - v. multi-grade
 - vi. natural and synthetic oil
 - vii. viscosity index
 - viii. multi-grade.
- d. The requirements and features of engine oil:
 - i. operating temperatures
 - ii. pressures
 - iii. lubricant grades
 - iv. viscosity
 - v. multi-grade oil
 - vi. additives
 - vii. detergents
 - viii. dispersants
 - ix. anti-oxidants inhibitors
 - x. anti-foaming agents
 - xi. anti-wear
 - xii. synthetic oils
 - xiii. organic oils
 - xiv. mineral oils.
- e. Symptoms and faults associated with lubrication systems:
 - i. excessive oil consumption
 - ii. oil leaks
 - iii. oil in water
 - iv. low or excessive pressure
 - v. oil contamination.
- f. The procedures used when inspecting lubrication system.

Cooling, Heating and Ventilation

- a. The components, operating principles, and functions of engine cooling systems.
- b. Procedures used to remove, replace and adjust cooling system components:
 - i. cooling fans and control devices
 - ii. header tanks, radiators and pressure caps
 - iii. heater matrices and temperature control systems
 - iv. expansion tanks hoses, clips and pipes
 - v. thermostats impellers and coolant

- vi. ventilation systems.
- c. The preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement.
 - i. system pressure testers
 - ii. pressure cap testers
 - iii. hydrometer, or anti-freeze testing equipment
 - iv. chemical tests for the detection of combustion gas.
- d. The layout and construction of internal heater systems.
- e. The controls and connections within internal heater system.
- f. Symptoms and faults associated with cooling systems:
 - i. water leaks
 - ii. water in oil
 - iii. internal heating system: efficiency, operation, leaks, controls, air filtration, air leaks and contamination
 - iv. excessively low or high coolant temperature.
- g. The procedures used when inspecting:
 - i. internal heating system
 - ii. cooling system.

General

- a. The preparation, testing and use of tools and equipment used for:
 - i. dismantling
 - ii. removal and replacement of engine units and components.
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removal and replacing engine units and components.
- c. The importance of logical and systematic processes.
- d. The inspection and testing of engine units and components.
- e. The preparation of replacement units for re-fitting or replacement.
- f. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance and safety requirements.
- g. Refitting procedures.
- h. The inspection and testing of units and system to ensure compliance with manufacturer's, legal and performance requirements.
- i. The inspection and re-instatement of the vehicle following repair to ensure customer satisfaction:
 - i. cleanliness of vehicle interior and exterior
 - ii. security of components and fittings
 - iii. re-instatement of components and fittings.

Unit 153

Knowledge of light vehicle electrical units and components

Level:	5
Credit value:	6
Relationship to NOS:	This unit is linked to LV03 Remove and Replace Light Vehicle Electrical Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of the principles, construction and operation and testing methods of common electrical and electronic systems and components. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

Learning outcome	The learner will:
1	understand light vehicle electrical and electronic principles
Assessment criteria	
1.1	identify electrical symbols and units found in light vehicle circuits
1.2	describe how to interpret simple light vehicle wiring diagrams
1.3	describe the operation of key light vehicle circuit protection devices and why these are necessary
1.4	describe earthing principles and earthing methods
1.5	identify the use of different cables and connectors used in light vehicle circuits
1.6	describe the operation of electrical and electronic sensors and actuators and their application
1.7	describe the key electrical and electronic control principles that are related to light vehicle electrical circuits
1.8	state common terms used in light vehicle electrical circuits.

Learning outcome	The learner will:
2	understand how light vehicle batteries, starting and charging systems operate
Assessment criteria	
The learner can	
2.1	identify light vehicle batteries, starting and charging system components
2.2	describe the construction and operation of light vehicle batteries, starting and charging system components
2.3	describe how to remove and replace batteries, starting and charging system units and components
2.4	compare light vehicle batteries, starting and charging system components and assemblies against alternatives to identify differences in construction and operation
2.5	state common terms used in conjunction with light vehicle batteries, starting and charging systems.

Learning outcome	The learner will:
3	understand how light vehicle auxiliary electrical systems operate
Assessment criteria	
The learner can	
3.1	identify light vehicle auxiliary system components
3.2	describe the construction and operation of light vehicle auxiliary systems. Auxiliary systems to include: <ul style="list-style-type: none"> a. lighting b. wiper c. security and alarm d. comfort and convenience e. information and entertainment f. parking assistance g. electric window h. monitoring and instrumentation
3.3	compare key light vehicle auxiliary system components and assemblies against alternatives to identify differences in construction and operation
3.4	state common terms used in light vehicle auxiliary system design.

Learning outcome	The learner will:
4	understand how to check, replace and test light vehicle electrical systems and components
Assessment criteria	
The learner can	
4.1	describe how to remove and replace light vehicle electrical system units and components
4.2	describe common types of testing methods used to check the operation of light vehicle electrical systems and components and their purpose
4.3	explain how to test and evaluate the performance of replacement units against specifications
4.4	identify common faults found in light vehicle electrical systems and components
4.5	describe the hazards associated with high energy electrical vehicle components.

Unit 153

Knowledge of light vehicle electrical units and components

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Electrical/electronic principles

- a. Electrical units:
 - i. volt (electrical pressure)
 - ii. ampere (electrical current)
 - iii. ohm (electrical resistance)
 - iv. watt (power).
- b. The requirements for an electrical circuit:
 - i. battery
 - ii. cables
 - iii. switch
 - iv. current consuming device
 - v. continuity.
- c. The direction of current flow and electron flow.
- d. Series and parallel circuits to include:
 - i. current flow
 - ii. voltage of components
 - iii. volt drop
 - iv. resistance
 - v. the effect on circuit operation of open circuit component(s).
- e. Earth and insulated return systems.
- f. Cable sizes and colour codes.
- g. Different types of connectors, terminals and circuit protection devices.
- h. Common electrical and electronic symbols.
- i. The meaning of:
 - i. short circuit
 - ii. open circuit
 - iii. bad earth
 - iv. high resistance
 - v. electrical capacity.
- j. The principles of vehicle electronic systems and components.

- k. Interpret vehicle wiring diagrams to include:
 - i. vehicle lighting
 - ii. auxiliary circuits
 - iii. indicators
 - iv. starting and charging systems.
- l. Function and construction of electrical components including:
 - i. circuit relays
 - ii. bulb types
 - iii. fan and heater
 - iv. circuit protection.
- m. The safety precautions when working on electrical and electronic systems to include:
 - i. disconnection and connection of battery
 - ii. avoidance of short circuits
 - iii. power surges
 - iv. prevention of electric shock
 - v. protection of electrical and electronic components
 - vi. protection of circuits from overload or damage.
- n. The set-up and use of:
 - i. digital and analogue multi-meters
 - ii. voltmeter
 - iii. ammeter
 - iv. ohmmeter
 - v. oscilloscope
 - vi. manufacturer's dedicated test equipment.
- o. Electrical and electronic checks for electrical and electronic systems to include:
 - i. connections
 - ii. security
 - iii. functionality
 - iv. performance to specifications
 - v. continuity, open circuit
 - vi. short circuit
 - vii. high resistance
 - viii. volt drop
 - ix. current consumption
 - x. output patterns (oscilloscope).
- p. Symptoms and faults associated with electrical and electronic systems to include:
 - i. high resistance
 - ii. loose and corroded connections
 - iii. short circuit
 - iv. excessive current consumption
 - v. open circuit
 - vi. malfunction
 - vii. poor performance
 - viii. battery faults to include flat battery
 - ix. failure to hold charge
 - x. low state of charge
 - xi. overheating
 - xii. poor starting.

Battery and charging

- a. The construction and operation of vehicle batteries including:
 - i. low maintenance and maintenance free
 - ii. lead acid and nickel cadmium types
 - iii. cells
 - iv. separators
 - v. plates
 - vi. electrolyte.
- b. The operation of the vehicle charging system:
 - i. alternator
 - ii. rotor
 - iii. stator
 - iv. slip ring
 - v. brush assembly
 - vi. three phase output
 - vii. diode rectification pack
 - viii. voltage regulation
 - ix. phased winding connections
 - x. cooling fan
 - xi. alternator drive system.

Starting

- a. The layout, construction and operation of engine starting systems: inertia and pre-engaged principles.
- b. The function and operation of the following components:
 - i. inertia and pre-engaged starter motor
 - ii. starter ring gear
 - iii. pinion
 - iv. starter solenoid
 - v. ignition/starter switch
 - vi. starter relay (if appropriate)
 - vii. one-way clutch (pre-engaged starter motor).

Lighting

- a. Function and construction of electrical components including:
 - i. front and tail lamps
 - ii. main and dip beam headlamps
 - iii. fog and spot lamps
 - iv. lighting and dip switch
 - v. directional indicators.
- b. The circuit diagram and operation of components for:
 - i. side and tail lamps
 - ii. headlamps
 - iii. interior lamps
 - iv. fog and spot lamps
 - v. direction indicators.
- c. The statutory requirements for vehicle lighting when using a vehicle on the road.
- d. Headlamp adjustment and beam setting.

Auxiliary systems

- a. Function and construction of electrical components including:
 - i. central door locking
 - ii. anti theft devices
 - iii. manual locking and dead lock systems
 - iv. window winding
 - v. demisting systems
 - vi. door mirror operation mechanisms
 - vii. interior lights and switching
 - viii. sun roof operation.
- b. The circuit diagram and operation of components for:
 - i. central door locking
 - ii. anti theft devices
 - iii. manual locking and dead lock systems
 - iv. window winding
 - v. demisting systems
 - vi. door mirror operation mechanisms
 - vii. sun roof operation.
- c. Comfort and convenience systems to include:
 - i. heated seats
 - ii. electrically adjusted seats
 - iii. heated screens
 - iv. electric mirrors
 - v. heating
 - vi. climate control
 - vii. air conditioning.

General

- a. The preparation, testing and use of:
 - i. tools and equipment
 - ii. electrical meters and equipment used for dismantling
 - iii. removal and replacement of electrical and electronic systems and components.
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removal of and replacing electrical and electronic components and systems.
- c. The importance of logical and systematic processes.
- d. Preparation of replacement units for re-fitting or replacement electrical and electronic components and systems.
- e. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.
- f. Refitting procedures.
- g. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- h. Inspection and re-instatement of the vehicle following repair to ensure:
 - i. customer satisfaction
 - ii. cleanliness of vehicle interior and exterior
 - iii. security of components and fittings
 - iv. re-instatement of components and fittings.

Unit 154

Knowledge of light vehicle chassis units and components

Level:	5
Credit value:	6
Relationship to NOS:	This unit is linked to LV04 Remove and Replace Light Vehicle Chassis Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of the construction and operation of common steering, suspension and braking systems (including wheels and tyres). It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

Learning outcome	The learner will:
1	understand how light vehicle steering and suspension systems operate
Assessment criteria	
The learner can	
1.1 identify light vehicle steering and suspension system components	
1.2 describe the construction and operation of light vehicle steering and suspension systems	
1.3 compare key light vehicle steering and suspension system components and assemblies against alternatives to identify differences in construction and operation	
1.4 identify the key engineering principles that are related to light vehicle steering and suspension systems	
a. steering angles	
b. hydraulic forces	
c. stress and strain	
1.5 state common terms used in light vehicle steering and suspension system design.	

Learning outcome	The learner will:
2	understand how light vehicle braking systems operate
Assessment criteria	
The learner can	
2.1	identify light vehicle braking system components
2.2	describe the construction and operation of light vehicle braking systems
2.3	compare key light vehicle braking system components and assemblies against alternatives to identify differences in construction and operation
2.4	identify the key engineering principles that are related to light vehicle braking systems
	<ul style="list-style-type: none"> a. laws of friction b. hydraulics c. pneumatics d. properties of fluids e. properties of air f. braking efficiency
2.5	state common terms used in light vehicle braking system design.

Learning outcome	The learner will:
3	understand how light vehicle wheel and tyre systems operate
Assessment criteria	
The learner can	
3.1	identify light vehicle wheel and tyre components
3.2	describe the construction and operation of light vehicle wheels and tyres
3.3	compare key light vehicle wheel and tyre components and assemblies against alternatives to identify differences in construction and operation
3.4	identify the key engineering principles that are related to light vehicle wheel and tyre systems
	<ul style="list-style-type: none"> a. friction b. un-sprung weight c. dynamic and static balance
3.5	state common terms used in light vehicle wheel and tyre design.

Learning outcome	The learner will:
4	understand how to check, replace and test light vehicle chassis units and components
Assessment criteria	
The learner can	
4.1	describe how to remove and replace chassis units and components
4.2	describe common types of testing methods used to check the operation of chassis units and components and their purpose
4.3	explain how to evaluate the performance of replacement units against vehicle specification
4.4	identify common faults found in light vehicle chassis units and components
4.5	describe the hazards associated with high energy electrical vehicle components.

Unit 154

Knowledge of light vehicle chassis units and components

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Steering

- a. The action and purpose of steering geometry:
 - i. castor angle
 - ii. camber angle
 - iii. kingpin or swivel pin inclination
 - iv. negative offset
 - v. wheel alignment (tracking) (toe in and toe out)
 - vi. toe out on turns
 - vii. steered wheel geometry.
- b. The following terms associated with steering:
 - i. Ackerman principle
 - ii. slip angles
 - iii. self-aligning torque oversteer and understeer
 - iv. neutral steer.
- c. The components and layout of hydraulic power steering systems:
 - i. piston and power cylinders
 - ii. drive belts and pumps
 - iii. hydraulic valve (rotary, spool and flapper type)
 - iv. hydraulic fluid.
- d. The advantages of power assisted steering.
- e. The operation of hydraulic power steering.
- f. The principles of electronic power steering systems.
- g. The procedures used for inspecting the serviceability and condition of:
 - i. manual steering
 - ii. power steering.
- h. Steering system defects to include:
 - i. uneven tyre wear
 - ii. wear on outer edge of tyre
 - iii. wear on inner edge of tyre
 - iv. uneven wear
 - v. flats on tread
 - vi. steering vibrations
 - v. wear in linkage
 - vi. damage linkage
 - vii. incorrect wheel alignment
 - viii. incorrect steering geometry.

Suspension

- a. The layout and components of suspension systems:
 - i. non-independent suspensions
 - ii. independent front suspension (IFS)
 - iii. independent rear suspension (IRS)
 - iv. hydraulic
 - v. hydro-pneumatic
 - vi. rigid axle types.
- b. The operation of suspension systems and components:
 - i. leaf and coil springs
 - ii. torsion bar
 - iii. rubber springs
 - iv. Macpherson strut system
 - v. hydraulic
 - vi. hydro-pneumatic
 - vii. hydraulic dampers
 - viii. trailing arms
 - ix. wish bones
 - x. ball joints
 - xi. track control arms
 - xii. bump stops
 - xiii. anti-roll bars
 - xiv. stabiliser bars
 - xv. swinging arms
 - xvi. parallel link
 - xvii. swinging half-axles
 - xviii. transverse link
 - xix. semi-swinging arms.
- c. The advantages of different systems including:
 - i. non-independent
 - ii. independent suspension (IFS)
 - iii. independent suspension (IRS)
 - iv. hydraulic
 - v. hydro-pneumatic
 - vi. rigid axle.
- d. The principles of electronic suspensions systems.
- e. The forces acting on suspension systems during braking, driving and cornering.
- f. The methods of locating the road wheels against braking, driving and cornering forces.
- g. The methods of controlling cornering forces by fitting anti-roll torsion members.
- h. Suspension terms:
 - i. rebound
 - ii. bump
 - iii. float
 - iv. dive
 - v. pitch
 - vi. roll
 - vii. compliance.
- i. The procedures used for inspecting the serviceability and condition of the suspension system

- j. Suspension system defects:
 - i. wheel hop
 - ii. ride height (unequal and low)
 - iii. wear
 - iv. noises under operation
 - v. fluid leakage
 - vi. excessive travel
 - vii. excessive tyre wear
 - viii. bounce
 - ix. poor vehicle handling
 - x. worn dampers
 - xi. worn joints
 - xii. damaged linkages.

Brakes

- a. The construction and operation of drum brakes:
 - i. leading and trailing shoe construction
 - ii. self-servo action
 - iii. automatic adjusters
 - iv. backing plates
 - v. parking brake system.
- b. The construction and operation of disc brakes:
 - i. disc pads
 - ii. calliper
 - iii. brake disc
 - iv. ventilated disc
 - v. disc pad retraction
 - vi. parking brake system
 - vii. electrical and electronic components
 - viii. wear indicators and warning lamps.
- c. The construction and operation of the hydraulic braking system:
 - i. single and dual line layout
 - ii. master cylinders
 - iii. wheel cylinders
 - iv. disc brake calliper and pistons
 - v. brake pipe
 - vi. brake servo
 - vii. warning lights
 - viii. parking brakes
 - ix. equalising valves.
- d. The principles and components of electronic ABS systems, electrical and electronic components.
- e. The requirements and hazards of brake fluid:
 - i. boiling point
 - ii. hygroscopic action
 - iii. manufacturer's change periods
 - iv. fluid classification and rating
 - v. potential to damage paint surfaces.

- f. Terms associated with mechanical and hydraulic braking systems:
 - i. braking efficiency
 - ii. brake fade
 - iii. brake balance
 - iv. ABS.
- g. The procedures used for inspecting the serviceability and condition of the braking system.
- h. Braking system defects:
 - i. worn shoes or pads
 - ii. worn or scored brake surfaces
 - iii. abnormal brake noises
 - iv. brake judder
 - v. fluid contamination of brake surfaces
 - vi. fluid leaks
 - vii. pulling to one side
 - viii. poor braking efficiency
 - ix. lack of servo assistance
 - x. brake drag
 - xi. brake grab
 - xii. brake fade.

Wheel and tyres

- a. The construction of different types of tyre:
 - i. radial
 - ii. cross ply
 - iii. bias belted
 - iv. tread patterns
 - v. tyre mixing regulations
 - vi. tyre applications.
- b. Tyre markings:
 - i. tyre and wheel size markings
 - ii. speed rating
 - iii. direction of rotation
 - iv. profile
 - v. load rating
 - vi. ply rating
 - vii. tread-wear indicators.
- c. Wheel construction:
 - i. light alloy
 - ii. pressed steel and wire wheels
 - iii. flat-edge and double hump rims.
- d. Types of wheel bearing arrangements:
 - i. non-driving.
- e. Types of bearing used for wheel bearing arrangements:
 - i. roller
 - ii. taper roller
 - iii. needle
 - iv. ball and plain.
- f. The procedures used for inspecting the serviceability and condition of:
 - i. tyres & wheels
 - ii. bearings.

- g. The defects associated with tyres and wheels:
 - i. abnormal tyre wear
 - ii. cuts
 - iii. side wall damage
 - iv. wheel vibrations
 - v. tyre noise (squeal during cornering)
 - vi. tyre over heating (low pressure)
 - vii. tread separation.

General

The procedures for dismantling, removal and replacement of chassis system components

- a. The preparation:
 - i. testing and use of tools and equipment
 - ii. electrical meters and equipment used for dismantling
 - iii. removing and replacing chassis systems and components.
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removing and replacing chassis systems and components.
- c. The importance of logical and systematic processes.
- d. The inspection and testing of chassis systems and components.
- e. The preparation of replacement units for re-fitting or replacement of chassis systems or components.
- f. Identify the reasons why replacement components and units must meet the original specifications (OES):
 - i. warranty requirements
 - ii. to maintain performance
 - iii. safety requirements.
- g. Refitting procedures.
- h. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- i. The inspection and re-instatement of the vehicle following repair to ensure customer satisfaction:
 - i. cleanliness of vehicle interior and exterior
 - ii. security of components and fittings
 - iii. re-instatement of components and fittings.

Unit 155

Knowledge of inspecting light vehicles using prescribed methods

Level:	5
Credit value:	4
Relationship to NOS:	This unit is linked to LV05 Inspect Light Vehicles using Prescribed Inspection Methods and LV06 Inspect Light Vehicles.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of carrying out a range of inspections on light vehicles using a variety of prescribed testing and inspection methods.

Learning outcome	The learner will:
1	understand how to carry out inspections on light vehicles using prescribed methods
Assessment criteria	
The learner can:	
1.1	explain the difference between the various prescribed light vehicle inspection methods to include: a. pre-work b. post-work c. pre-delivery d. maintenance inspection (brake, seasonal and tyre)
1.2	identify the different systems to be inspected when using the prescribed inspection methods
1.3	identify the procedures involved in carrying out the systematic inspection of the prescribed inspection methods on light vehicles
1.4	identify correct conformity of vehicle systems and condition on light vehicle inspections
1.5	compare test and inspection results against light vehicle specification and legal requirements
1.6	explain how to record and complete the inspection results in the format required
1.7	identify the recommendations that can be made based on results of the light vehicle inspections
1.8	explain the implications of failing to carry out light vehicle inspections activities correctly
1.9	explain the implications of signing workplace documentation and vehicle records
1.10	explain the procedure for reporting cosmetic damage to light vehicle components and units outside normal inspection items
1.11	describe the hazards associated with high energy electrical vehicle components

Unit 155

Knowledge of inspecting light vehicles using prescribed methods

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Pre and post work vehicle inspections and record findings

- a. PPE and vehicle protection relating to:
 - i. vehicle body panels
 - ii. paint surfaces
 - iii. seats
 - iv. carpets and floor mats prior to conduction vehicle inspections.
- b. Pre and post work vehicle inspection procedures:
 - i. aural
 - ii. visual and functional assessments on engine
 - iii. engine systems
 - iv. chassis systems
 - v. wheels and tyres
 - vi. transmission system
 - vii. electrical and electronic systems
 - viii. exterior vehicle body
 - ix. vehicle interior.
- c. The methods for carrying out inspections for: damage, corrosion, fluid leaks, wear, security, mounting security and condition to include:
 - i. engines and engine systems
 - ii. chassis systems
 - iii. brakes
 - iv. steering
 - v. suspension
 - vi. wheels
 - vii. tyres
 - viii. body panels
 - ix. electrical and electronic systems and components
 - x. vehicle seating and vehicle interior
 - xi. vehicle instrumentation
 - xii. driver controls.
- d. Check conformity to manufacturer's specifications and legal requirements.
- e. Completion of documentation to include:
 - i. inspection records
 - ii. job cards
 - iii. vehicle records.
- f. Make recommendations based on results of vehicle inspections.
- g. The checks necessary to ensure customer satisfaction for:
 - i. vehicle body panels
 - ii. paint surfaces
 - iii. seats
 - iv. carpets and floor mats following pre or post vehicle inspections.
- h. Prepare and use appropriate inspection equipment and tools.
- i. Inspection procedures following inspection checklists.

Unit 157

Knowledge of diagnosis and rectification of light vehicle engine faults

Level:	7
Credit value:	6
Relationship to NOS:	This unit is linked to LV07 Diagnose and Rectify Light Vehicles Engine and Component Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of diagnosis and rectification of engine mechanical, electrical, hydraulic and fluid systems. It also covers light vehicle engine systems and the evaluation of their performance.

Learning outcome	The learner will:
1.	understand how the light vehicle engine systems operate
Assessment criteria	
The learner can:	
1.1	explain the construction and operation of light vehicle engine systems to include: <ul style="list-style-type: none">a. SI fuel systemsb. CI fuel systemsc. ignition systemsd. engine managemente. valve mechanismsf. pressure charged induction systemsg. exhaust emission reduction systemsh. heating, ventilation and cooling
1.2	explain the interaction between electrical, electronic and mechanical components within light vehicle engine systems
1.3	explain how electrical systems interlink and interact, including multiplexing and fibre optics
1.4	compare light vehicle engine system components and assemblies against alternatives to identify differences in construction and operation
1.5	identify the engineering principles that are related to light vehicle engine systems <ul style="list-style-type: none">a. volumetric efficiencyb. flame travel, pre ignition and detonationc. fuel propertiesd. composition of carbon fuelse. combustion processf. legal requirements for exhaust emissions.

Learning outcome	The learner will:
2.	understand how to diagnose and rectify faults in light vehicle engine systems
Assessment criteria	
The learner can:	
2.1	describe how to analyse symptoms and causes of faults found in light vehicle engine systems to include: <ul style="list-style-type: none"> a. engine mechanical components b. ignition systems c. fuel systems d. engine management system e. pressure charged induction systems f. heating, ventilation and cooling
2.2	explain systematic diagnostic techniques used in identifying engine system faults
2.3	explain how to examine, measure and make suitable adjustments to the components including: <ul style="list-style-type: none"> a. settings b. input and output values c. voltages d. current consumption e. resistance f. output patterns with oscilloscope g. pressures h. condition i. wear and performance
2.4	explain how to carry out the diagnosis and rectification activities in order to correct the faults in the light vehicle engine systems
2.5	explain how to select, prepare and use diagnostic and rectification equipment for light vehicle engine systems
2.6	explain how to evaluate and interpret test results found in diagnosing light vehicle engine system faults against vehicle manufacturer specifications and settings
2.7	explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance
2.8	describe the hazards associated with high energy electrical vehicle components.

Unit 157

Knowledge of diagnosis and rectification of light vehicle engine faults

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Single and multi-point petrol injection systems

- a. The operation and construction of single and multi-point injection systems including:
 - i. types of air flow sensor
 - ii. fuel supply system
 - iii. fuel pump
 - iv. filter
 - v. fuel regulator
 - vi. injectors
 - vii. sequential injection
 - viii. continuous injection
 - ix. semi-continuous injection
 - x. electronic control unit (ECU)
 - xi. injector pulse width
 - xii. sensors.
- b. The operation of each system under various operating conditions including:
 - i. cold starting
 - ii. warm up
 - iii. hot starting
 - iv. acceleration
 - v. deceleration
 - vi. cruising
 - vii. full load.
- c. Engine speed limiting and knock sensing.

Engine management

- a. The function and purpose of engine management systems.
- b. The difference between analogue, digital, programmable and non-programmable systems.
- c. Open loop and closed loop control, types of input and output devices.
- d. The function and operation of digital components and systems.
- e. The operation of engine management systems under various conditions.

Valve mechanisms

- a. The reasons for variable valve timing and multi-valve arrangements and the effect on performance.
- b. Layout of multi-valve arrangements, components, operation and drive arrangements.
- c. Construction features and operation of variable valve timing engines and electronic control.

Pressure charged induction systems

- a. The meaning of volumetric efficiency; explain the effect of volumetric efficiency on engine performance, torque and power.
- b. The methods used to improve volumetric efficiency:
 - i. variable valve timing
 - ii. turbo-charging
 - iii. supercharging
 - iv. intercoolers.
- c. The operation of turbo-chargers and the purpose of:
 - i. turbo-charging
 - ii. supercharging
 - iii. intercoolers
 - iv. waste gates
 - v. exhaust gas recirculation.
- d. Advantages and disadvantages of pressure charging induction systems.

Terms associated with combustion

- a. Flame travel, pre-ignition and detonation.
- b. Fuel properties:
 - i. octane rating
 - ii. flash point
 - iii. fire point
 - iv. volatility
 - v. composition of petrol and diesel fuels
 - vi. hydro-carbon content.
- c. Composition of carbon fuels (petrol and diesel):
 - i. % hydrogen and carbon
 - ii. composition of air
 - iii. % oxygen
 - iv. % nitrogen
- d. Combustion process for spark ignition and compression ignition engines:
 - i. air fuel ratio
 - ii. lambda ratio
 - iii. stoichiometric ratio.

- e. The by-products of combustion for different engine conditions and fuel mixtures:
 - i. CO
 - ii. CO₂
 - iii. O
 - iv. N
 - v. H₂O
 - vi. NO_x.
- f. Describe the legal requirements for exhaust emissions;
 - i. MOT requirements
 - ii. EURO 3
 - iii. 4 & 5 regulations.

Assessment, repair and restoration of mechanical engine components

- a. How engine mechanical components are assessed and measured for wear and serviceability:
 - i. cylinder bores
 - ii. cylinder heads
 - iii. crankshaft journals
 - iv. valve faces
 - v. valve guides
 - vi. valve seats
 - vii. camshafts
- b. The methods used for the repair and restoration of engine components.

Cooling, heating and ventilation

- a. The components, operating principles, and functions of engine cooling systems.
- b. Procedures used to remove, replace and adjust cooling system components:
 - i. cooling fans and control devices
 - ii. header tanks, radiators and pressure caps
 - iii. heater matrices and temperature control systems
 - iv. expansion tanks hoses, clips and pipes
 - v. thermostats impellers and coolant
 - vi. ventilation systems.
- c. The preparation and method of use of appropriate specialist equipment used to evaluate system performance following component replacement:
 - i. system pressure testers
 - ii. pressure cap testers
 - iii. hydrometer, or anti-freeze testing equipment
 - iv. chemical tests for the detection of combustion gas.
- d. The layout and construction of internal heater systems.
- e. The controls and connections within internal heater system.

- f. Symptoms and faults associated with cooling systems:
 - i. water leaks
 - ii. water in oil
 - iii. internal heating system: efficiency, operation, leaks, controls, air filtration, air leaks and contamination
 - iv. excessively low or high coolant temperature.
- g. The procedures used when inspecting
 - i. internal heating system
 - ii. cooling system.

Air conditioning systems

- a. The operation of air conditioning components including:
 - i. compressors
 - ii. condensers
 - iii. receivers
 - iv. dryers
 - v. connections
 - vi. valves
 - vii. hoses
 - viii. thermostats
 - ix. refrigerants.
- b. The layout and operation of air conditioning systems.

Climate control systems

- a. Identify components used in climate control systems including:
 - i. sensors
 - ii. speed controls
 - iii. control systems
 - iv. servomotors
 - v. electronic components.
- b. The layout of climate control systems.
- c. The operation of climate control system.

Symptoms and faults in engine mechanical systems and components

- a. Symptoms and faults related to:
 - i. worn cylinders
 - ii. cylinder liners
 - iii. pistons
 - iv. piston rings
 - v. crankshaft
 - vi. camshaft
 - vii. bearings
 - viii. cylinder head and gasket
 - ix. valves
 - x. valve seats and valve guides
 - xi. cambelts
 - xii. lubrication system and components
 - xiii. oil pump
 - xiv. relief valve
 - xv. filter
 - xvi. turbo-charger
 - xvii. supercharger.

Diagnosis of faults in engine mechanical systems and components

- a. Interpret information for:
 - i. diagnostic tests
 - ii. manufacturer's vehicle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. legal requirements.
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.
- c. Systematic assessment, testing and inspection of engine components and systems including:
 - i. mechanical system & component condition
 - ii. engine balance
 - iii. power balance
 - iv. performance and operation
 - v. wear
 - vi. run out
 - vii. alignment.
- d. Use of appropriate tools and equipment including:
 - i. compression gauges
 - ii. leakage testers
 - iii. cylinder balance tester
 - iv. pressure gauges
 - v. micrometers
 - vi. vernier gauges.
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result and values with vehicle manufacturer's specifications and settings.
- g. The procedures for dismantling, components and systems and the use of appropriate equipment and procedures.

- h. Assess, examine and measure components including:
 - i. settings
 - ii. values
 - iii. condition
 - iv. wear and performance of components and systems.
- i. Probable faults:
 - i. malfunctions
 - ii. incorrect settings
 - iii. wear.
- j. Rectification or replacement procedures.
- k. Evaluate operation of components and systems following diagnosis and repair to confirm system performance.

Faults and symptoms in ignition systems

- a. Ignition system failure or malfunctions including:
 - i. no spark
 - ii. misfiring
 - iii. backfiring
 - iv. cold or hot starting problems
 - v. poor performance
 - vi. pre-ignition
 - vii. detonation
 - viii. exhaust emission levels
 - ix. fuel consumption
 - x. low power
 - xi. unstable idle speed.

Faults and symptoms in electronic petrol and diesel injection systems

- a. Petrol and diesel injection system failures or malfunctions including:
 - i. cold or hot starting problems
 - ii. poor performance
 - iii. exhaust emissions
 - iv. high fuel consumption
 - v. erratic running
 - vi. low power
 - vii. unstable idle speed.

Faults and symptoms in engine management systems

- a. Engine management system failure or malfunctions including:
 - i. misfiring
 - ii. backfiring
 - iii. cold or hot starting problems
 - iv. poor performance
 - v. pre-ignition
 - vi. detonation
 - vii. exhaust emission levels
 - viii. fuel consumption
 - ix. low power
 - x. unstable idle speed.

Diagnosis of faults in electronic ignition, petrol and diesel injection and engine management systems

- a. Locate and interpret information for:
 - i. diagnostic tests
 - ii. manufacturer's vehicle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. fault codes
 - vii. legal requirements.
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.
- c. Conduct systematic assessment, testing of engine systems including:
 - i. component condition and performance
 - ii. component settings
 - iii. component values
 - iv. electrical and electronic values
 - v. system performance and operation
 - vi. use of appropriate tools and equipment including gauges
 - vii. multi-meter
 - viii. breakout box
 - ix. oscilloscope
 - x. diagnostic tester
 - xi. manufacturer's dedicated equipment
 - xii. exhaust gas analyser
 - xiii. fuel flow meter
 - xiv. pressure gauges.
- d. Evaluate and interpret test results from diagnostic testing.
- e. Compare test result, values and fault codes with vehicle manufacturer's specifications and settings.
- f. The procedures for dismantling, components and systems using appropriate equipment.

- g. Assess, examine and measure components including:
 - i. settings
 - ii. input and output values
 - iii. voltages
 - iv. current consumption
 - v. resistance
 - vi. output patterns with oscilloscope
 - vii. condition
 - viii. wear and performance of components and systems.
- h. Identify probable faults and indications of:
 - i. faults
 - ii. malfunctions
 - iii. incorrect settings
 - iv. wear
 - v. values
 - vi. inputs and outputs
 - vii. fault codes.
- i. Rectification or replacement procedures.
- j. Evaluation and the operation of components and systems following diagnosis and repair to confirm system performance.

Faults and symptoms in vehicle comfort systems

- a. System failure, malfunction or ineffectiveness of internal heating system, air conditioning system or climatic control system including:
 - i. leaks
 - ii. abnormal noise
 - iii. ineffective operation
 - iv. failure to operate
 - v. control faults
 - vi. inadequate operation.

Diagnosis of faults in vehicle comfort systems

- a. Locate and interpret information for:
 - i. diagnostic tests
 - ii. manufacturer's vehicle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. fault codes
 - vii. legal requirements.
- b. The preparation of tools and equipment for use in diagnostic testing and assessment.

- c. Conduct systematic assessment and testing of comfort systems including:
 - i. component condition and performance
 - ii. component settings
 - iii. component values
 - iv. electrical and electronic values
 - v. system performance and operation
 - vi. drive belts
 - vii. controls
 - viii. compressors
 - ix. condensers
 - x. receivers
 - xi. dryers
 - xii. connections
 - xiii. valve
 - xiv. hoses
 - xv. thermostats and refrigerants
 - xvi. sensors
 - xvii. speed controls
 - xviii. control systems
 - xix. servomotors.
- d. Use of appropriate tools and equipment including:
 - i. pressure gauges
 - ii. multi-meter
 - iii. breakout box
 - iv. oscilloscope
 - v. diagnostic tester
 - vi. manufacturer's dedicated equipment
 - vii. flow meter.
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result, values and fault codes with vehicle manufacturer's specifications and settings.
- g. How to dismantle, components and systems using appropriate equipment and procedures.
- h. How to assess, examine and measure components including: settings, input and output values, voltages, current consumption, resistance, output patterns with oscilloscope, pressures, condition, wear and performance of components and systems.
- i. Identification of probable faults and indications of faults, malfunctions, incorrect settings, wear, values, inputs and outputs, fault codes, pressures and leaks.
- j. Rectification or replacement procedures.
- k. Evaluation and operation of components and systems following diagnosis and repair to confirm system performance.

Unit 158

Knowledge of diagnosis and rectification of light vehicle chassis faults

Level:	7
Credit value:	6
Relationship to NOS:	This unit is linked to LV08 Diagnose and Rectify Light Vehicle Chassis System Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of diagnosis and rectification of braking steering and suspension systems. It also covers light vehicle chassis systems and the evaluation of their performance.

Learning outcome	The learner will:
1.	understand how the light vehicle chassis systems operate
Assessment criteria	
The learner can:	
1.1	explain the construction and operation of light vehicle chassis systems to include: <ol style="list-style-type: none"> a. electronic braking b. front and rear wheel geometry c. four wheel steer d. hydraulic power steering e. electronic power steering f. self levelling suspension g. ride control system
1.2	explain the interaction between electrical, electronic and mechanical components within light vehicle chassis systems
1.3	explain how light vehicle chassis electrical systems interlink and interact, including multiplexing
1.4	compare light vehicle chassis system components and assemblies against alternatives to identify differences in construction and operation
1.5	identify the engineering principles that are related to light vehicle chassis systems <ol style="list-style-type: none"> a. inertia force, mass and acceleration b. laws of friction c. statics (springs and torsion bars) d. hydraulic machines.

Learning outcome	The learner will:
2.	understand how to diagnose and rectify faults in light vehicle chassis systems
Assessment criteria	
The learner can:	
2.1	explain symptoms and causes of faults found in light vehicle chassis systems
2.2	explain systematic diagnostic techniques used in identifying chassis system faults
2.3	explain how to examine, measure and make suitable adjustments to the components
2.4	explain how to carry out the diagnosis and rectification activities in order to correct the faults in the light vehicle chassis systems
2.5	explain how to select, prepare and use diagnostic and rectification equipment for light vehicle chassis systems
2.6	explain how to evaluate and interpret test results found in diagnosing light vehicle chassis system faults against vehicle manufacturer specifications and settings
2.7	explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance
2.8	describe the hazards associated with high energy electrical vehicle components.

Unit 158

Knowledge in diagnosis and rectification of light vehicle chassis faults

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Electrical and electronic principles of light vehicle chassis systems

- a. The operation of electrical and electronic systems and components related to light vehicle chassis systems including:
 - i. ECU
 - ii. sensors and actuators
 - iii. electrical inputs
 - iv. voltages
 - v. oscilloscope patterns
 - vi. digital and fibre optic principles.
- b. The interaction between the electrical/electronic system and mechanical components of chassis systems.
- c. Electronic and electrical safety procedures.

Operation of electronic ABS and EBD braking systems

- a. Layout of:
 - i. ABS and EBD braking systems
 - ii. anti-lock braking
 - iii. anti-skid control systems
 - iv. warning systems.
- b. Operation of:
 - i. hydraulic and electronic control units
 - ii. wheel speed sensors
 - iii. load sensors
 - iv. hoses
 - v. cables and connectors.
- c. Advantage of ABS and EBD braking systems over conventional braking systems.
- d. The relationship and interaction of ABS braking with and other vehicle systems – traction control.

Steering geometry for light vehicle applications

- a. Non-steered wheel geometry settings.
- b. Front/rear wheel geometry:
 - i. castor
 - ii. camber
 - iii. kingpin or swivel pin inclination
 - iv. negative offset
 - v. wheel alignment (tracking)
 - vi. toe in and toe out
 - vii. toe out on turns and steered wheel geometry
 - viii. Ackerman principle
 - ix. slip angles
 - x. self-aligning torque
 - xi. oversteer and understeer
 - xii. neutral steer.
- c. The operation and layout of rear and four wheel steering.
- d. The construction and operation of power assisted steering systems:
 - i. hydraulic system
 - ii. power cylinders
 - iii. drive belts and pumps
 - iv. hydraulic valve (rotary, spool and flapper type).
- e. The operation of:
 - i. electronic power steering systems (EPS)
 - ii. electrical and electronic components.

Components and operation of self-levelling suspension

- a. The components, construction and operation of a self levelling suspension system.
- b. The operation of self-levelling suspension system under various conditions:
 - i. self-energising
 - ii. pump operated self-levelling suspension.

Operation of fitting ride-controlled systems

- a. The reasons for fitting ride controlled systems.
- b. The operation of driver controlled and ride controlled systems.

Symptoms and faults in braking systems

- a. Symptoms and faults associated with conventional braking systems, ABS, and EBD systems:
 - i. mechanical
 - ii. hydraulic
 - iii. electrical and electronic systems
 - iv. fluid leaks
 - v. warning light operation
 - vi. poor brake efficiency
 - vii. wheel locking under braking.

Diagnosis and faults in braking systems

- a. Locate and interpret information for:
 - i. diagnostic tests
 - ii. vehicle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. fault codes
 - vii. legal requirements.
- b. Prepare equipment for use in diagnostic testing.
- c. Conduct systematic testing and inspection of:
 - i. braking system
 - ii. ABS
 - iii. EBD
 - iv. mechanical
 - v. hydraulic
 - vi. electrical and electronic systems.
- d. Using appropriate tools and equipment including:
 - i. multi-meters
 - ii. oscilloscope
 - iii. pressure gauges.
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result and values with vehicle manufacturer's specifications and settings.
- g. How to dismantle, components and systems using appropriate equipment and procedures.
- h. Assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
- i. Probable faults, malfunctions, incorrect settings.
- j. Rectification or replacement procedures.
- k. Operation of systems following diagnosis and repair to confirm operation and performance.

Symptoms and faults associated with steering systems

- a. Symptoms and faults associated with steering systems:
 - i. mechanical
 - ii. hydraulic
 - iii. electrical and electronic
 - iv. steering boxes (rack and pinion, worm and re-circulating ball)
 - v. steering arms and linkages
 - vi. steering joints and bushes
 - vii. idler gears
 - viii. bearings
 - ix. steering columns (collapsible and absorbing)
 - x. power steering system.

Diagnosis and faults in steering systems

- a. Locate and interpret information for:
 - i. diagnostic tests
 - ii. vehicle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. fault codes
 - vii. legal requirements.
- b. How to prepare equipment for use in diagnostic testing.

- c. Conduct systematic testing and inspection of:
 - i. steering systems
 - ii. mechanical
 - iii. hydraulic
 - iv. electrical and electronic systems
 - v. power steering system.
- d. Using appropriate tools and equipment including:
 - i. multi-meters
 - ii. oscilloscope
 - iii. pressure gauges
 - iv. wheel alignment equipment
 - v. steering geometry equipment.
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result and values with vehicle manufacturer's specifications and settings.
- g. How to dismantle, components and systems using appropriate equipment and procedures.
- h. Assess, examine and evaluate the:
 - i. operation
 - ii. settings
 - iii. values
 - iv. condition and performance of components and systems.
- i. Probable faults, malfunctions, and incorrect settings.
- j. Rectification or replacement procedures.
- k. Operation of systems following diagnosis and repair to confirm operation and performance.

Symptoms and faults associated with suspension systems

- a. Symptoms and faults associated with suspension systems:
 - i. mechanical
 - ii. hydraulic
 - iii. electrical and electronic
 - iv. conventional
 - v. self-levelling and ride controlled suspension systems
 - vi. ride height (unequal and low)
 - vii. wear
 - viii. noises under operation
 - ix. fluid leakage
 - x. excessive travel
 - xi. excessive tyre wear.

Diagnosis and faults in suspension systems

- a. Locate and interpret information for:
 - i. diagnostic tests
 - ii. vehicle and equipment specifications
 - iii. use of equipment
 - iv. testing procedures
 - v. test plans
 - vi. fault codes
 - vii. legal requirements.
- b. How to prepare equipment for use in diagnostic testing.

- c. How to conduct systematic testing and inspection of:
 - i. suspension systems
 - ii. mechanical
 - iii. hydraulic
 - iv. electrical and electronic systems
 - v. conventional
 - vi. self-levelling and ride controlled suspension systems.
- d. Using appropriate tools and equipment including:
 - i. multi-meters
 - ii. oscilloscope
 - iii. pressure gauges
 - iv. alignment equipment
 - v. geometry equipment.
- e. Evaluate and interpret test results from diagnostic testing.
- f. Compare test result and values with vehicle manufacturer's specifications and settings.
- g. How to dismantle, components and systems using appropriate equipment and procedures.
- h. Assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
- i. Probable faults, malfunctions and incorrect settings.
- j. Rectification or replacement procedures.
- k. Operation of systems following diagnosis and repair to confirm operation and performance.

Measurements on components to include:

- a. settings
- b. input and output values
- c. voltages
- d. current consumption
- e. resistance
- f. output patterns with oscilloscope
- g. pressures
- h. condition
- i. wear and performance.

Unit 162

Knowledge of light vehicle transmission and driveline units and components

Level:	5
Credit value:	6
Relationship to NOS:	This unit is linked to LV12 Remove and Replace Light Vehicle Driveline Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of the construction and operation of common transmission and driveline systems. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

Learning outcome	The learner will:
1	understand how light vehicle clutch systems operate
Assessment criteria	
The learner can	
1.1 identify light vehicle clutch system components	
1.2 describe the construction and operation of light vehicle clutch systems	
1.3 compare key light vehicle clutch system components and assemblies against alternatives to identify differences in construction and operation	
1.4 identify the key engineering principles that are related to light vehicle clutch systems to include:	
a. principles of friction	
b. principle of levers	
c. torque transmission	
1.5 state common terms used in light vehicle clutch system design.	

Learning outcome	The learner will:
2	understand how light vehicle manual gearbox systems operate
Assessment criteria	
The learner can	
2.1	identify light vehicle manual gearbox system components
2.2	describe the construction and operation of light vehicle manual gearbox systems.
2.3	compare key light vehicle manual gearbox system components and assemblies against alternatives to identify differences in construction and operation
2.4	identify the key engineering principles that are related to light vehicle manual gearbox systems
	a. gear ratios
	b. torque multiplication
2.5	state common terms used in light vehicle manual gearbox system design.

Learning outcome	The learner will:
3	understand how light vehicle driveline systems operate
Assessment criteria	
The learner can	
3.1	identify light vehicle driveline components
3.2	describe the construction and operation of light vehicle driveline systems
3.3	compare key light vehicle driveline components and assemblies against alternatives to identify differences in construction and operation
3.4	identify the key engineering principles that are related to light vehicle driveline systems
	a. final drive and overall gear ratios
	b. simple stresses
3.5	state common terms used in light vehicle driveline design.

Learning outcome	The learner will:
4	understand how to check, replace and test transmission and driveline units and components
Assessment criteria	
The learner can	
4.1	describe how to remove and replace transmission and driveline system units and components
4.2.	describe common types of testing methods used to check the operation of transmission and driveline systems and their purpose
4.3	explain how to evaluate the performance of replacement units against vehicle specification
4.4	identify common faults found in light vehicle transmission and driveline systems and their causes
4.5	describe the hazards associated with high energy electrical vehicle components.

Unit 162

Knowledge of light vehicle transmission and driveline units and components

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

The operation of clutch operating systems

- a. Clutch operating mechanisms
 - i. pedal and lever
 - ii. hydraulic operated
 - iii. mechanical
 - iv. cable operated
 - v. hydraulic components
 - vi. master cylinder
 - vii. slave cylinder
 - viii. hydraulic pipes
 - ix. electrical and electronic components (fluid level indicators).

The operation of friction clutches

- a. The reasons for fitting a clutch.
- b. The construction and operation of:
 - i. hydraulically and cable operated clutches
 - ii. coil spring clutches
 - iii. diaphragm spring clutches
 - iv. single plate clutches
 - v. multi plate clutches.

The operation of manual gearboxes

- a. The reasons for fitting gearboxes, to provide neutral, reverse, torque multiplication.
- b. Different gearbox types: transverse and inline layouts.
- c. The layout and construction of gears and shafts for 4, 5 and 6 speed gearbox designs, sliding mesh, constant mesh and synchromesh gearboxes reverse gear.
- d. The construction and operation of:
 - i. gear selection linkages
 - ii. selector forks and rods
 - iii. detents and interlock mechanisms
- e. The construction and operation of synchromesh devices.
- f. The arrangements for gearbox bearings:
 - i. bushes
 - ii. oil seals
 - iii. gaskets and gearbox lubrication
 - iv. speedometer drive
- g. The electrical and electronic components including reverse lamp switch
- h. Calculate gear ratios and driving torque for typical gearbox specifications.

The operation of driveline components

- a. The layout and construction of propshafts and drive shafts used in front wheel, rear wheel and four-wheel drive systems.

- b. The reasons for using flexible couplings and sliding joints in transmissions systems.
- c. The reason for using constant velocity joints in drive shafts incorporating steering mechanisms.
- d. The construction and operation of:
 - i. universal joints
 - ii. sliding couplings
 - iii. constant velocity joints
- e. The simple stresses applied to shafts: torsional, bending and shear.
- f. The construction and operation of:
 - i. final drive units
 - ii. crown wheel & pinion
 - iii. bevel
 - iv. hypoid and helical gears
 - v. differential gears
 - vi. sun & planet gears
 - vii. lubricants
 - viii. lubrication bearings and seals
 - ix. limited slip differential.
- g. The reasons for fitting a differential.
- h. Calculate final drive gear ratios.
- i. Calculate the overall gear ratio from given data (gearbox ratio x final drive ratio).

The testing and inspection techniques used for light vehicle transmission systems

- a. The techniques and procedures used for inspecting and testing clutches and clutch mechanisms including:
 - i. clearances
 - ii. pedal and lever settings
 - iii. cables & linkages
 - iv. hydraulic system
 - v. leaks
 - vi. adjustments
 - vii. travel.
- b. The techniques and procedures used for inspecting and testing gearboxes including:
 - i. leaks
 - ii. gear selection
 - iii. synchromesh operation
 - iv. abnormal noise.
- c. The techniques and procedures used for inspecting and testing drive line systems (prop & drive shafts, couplings) including:
 - i. security
 - ii. serviceability of rubber boots
 - iii. leaks
 - iv. alignment
 - v. balance weights (where applicable).
- d. The techniques used when inspecting and testing final drive systems including:
 - i. fluid levels
 - ii. leaks
 - iii. noise.

The faults and symptoms associated with vehicle transmissions systems

- a. The faults and symptoms associated with transmission systems:
 - i. clutch faults
 - ii. gearbox faults
 - iii. drive line faults (propshaft, drive shaft, universal and constant velocity joints)
 - iv. universal joint alignment

- v. final drive faults.
- b. Faults and symptoms to include mechanical, electrical and hydraulic systems.

The procedures for dismantling, removal and replacement of transmission units and components

- a. The preparation, testing and use of tools and equipment, electrical meters and equipment used for dismantling removing and replacing transmission systems and components.
- b. appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removing and replacing transmission systems and components
- c. The importance of logical and systematic processes.
- d. The inspection and testing of transmission systems and components
- e. The preparation of replacement units for re-fitting or replacement of transmission systems or components.
- f. The reasons why replacement components and units must meet the original specifications (OES):
 - i. warranty requirements
 - ii. to maintain performance
 - iii. safety requirements.
- g. Refitting procedures.
- h. The inspection and testing of units and system to ensure compliance with manufacturer's, legal and performance requirements.
- i. The inspection and re-instatement of the vehicle following repair to ensure customer satisfaction:
 - i. cleanliness of vehicle interior and exterior
 - ii. security of components and fittings
 - iii. re-instatement of components and fittings.

Types of wheel bearing arrangements:

- i. driven wheels
- ii. fully floating
- iii. three quarter floating
- iv. semi floating axles.

Unit 163

Knowledge of diagnosis and rectification of light vehicle transmission and driveline faults

Level:	7
Credit value:	6
Relationship to NOS:	This unit is linked to LV13 Diagnose and Rectify Light Vehicle Transmission and Driveline System Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of diagnosis and rectification of light vehicle gearboxes, hubs and bearings, driveline shafts, clutches, differentials and final drive units. It also covers the evaluation of performance of the systems.

Learning outcome	The learner will:
1.	understand how the light vehicle transmission and driveline systems operate
Assessment criteria	
The learner can:	
1.1	explain the construction and operation of light vehicle transmission and driveline systems
1.2	explain the interaction between electrical, electronic and mechanical components within light vehicle transmission and driveline systems
1.3	explain how electrical systems interlink and interact, including multiplexing
1.4	compare light vehicle transmission and driveline system components and assemblies against alternatives to identify differences in construction and operation
1.5	identify the engineering principles that are related to light vehicle transmission and driveline systems
	a. friction
	b. torque transmission
	c. materials
	d. fluids and energy
	e. potential and kinetic energy.

Learning outcome	The learner will:
2.	understand how to diagnose and rectify faults in light vehicle transmission and driveline systems
Assessment criteria	
The learner can:	
2.1	explain the symptoms and causes of faults found in light vehicle transmission and driveline systems
2.2	explain systematic diagnostic techniques used in identifying transmission and driveline system faults

- 2.3 explain how to examine, measure and make suitable adjustments to components
- 2.4 explain how to carry out the rectification activities in order to correct the faults in light vehicle transmission and driveline systems
- 2.5 explain how to select, prepare and use diagnostic and rectification equipment for light vehicle transmission and driveline systems
- 2.6 explain how to evaluate and interpret test results found in diagnosing light vehicle transmission and driveline system faults against vehicle manufacturer specifications and settings
- 2.7 explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance
- 2.8 describe the hazards associated with high energy electrical vehicle components.

Unit 163

Knowledge of diagnosis and rectification of light vehicle transmission and driveline faults

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Electrical and electronic principles related to light vehicle transmission systems

- a. The operation of electrical and electronic systems and components related to light vehicle transmission systems including:
 - i. ECU
 - ii. sensors and actuators
 - iii. electrical inputs and outputs
 - iv. voltages
 - v. oscilloscope patterns
 - vi. digital and fibre optic principles.
- b. The interaction between the electrical/electronic system, hydraulic system and mechanical components of the transmission systems.
- c. Electronic and electrical safety procedures.

The operation of light vehicle clutches and fluid couplings

- a. The construction and operation of friction clutches (coil spring, diaphragm) including single and twin clutch designs.
- b. The construction and operation of fluid couplings including:
 - i. fluid flywheel
 - ii. torque converter (torque multiplication, efficiency)
 - iii. benefits of fluid couplings
 - iv. benefits of torque converter over fluid flywheel.

The operation of light vehicle transmissions and driveline systems

- a. The construction and operation of manual gearboxes:
 - i. 4, 5 and 6 speed gearboxes
 - ii. gear arrangements
 - iii. shaft and bearing arrangements
 - iv. synchromesh devices
 - v. interlock mechanisms
 - vi. linkages
 - vii. overdrive
 - viii. lubrication.
- b. The construction and operation of automatic gearboxes including hydraulic and electronic control systems: operations of epicyclic gears (sun, planet, annulus and carrier), method for achieving different gear ratios using epicyclic gearing; hydraulic control systems, components and operation; electronic control system, components and operation.
- c. The construction and operation of continuously variable transmissions (CVT) and the benefits of this type of gearbox design.
- d. The construction and operation of the sequential manual gearbox (SMG).
- e. The construction and operation of final drive systems including:
 - i. conventional crown wheel and pinion

- ii. differential gears
- iii. limited slip differential.
- f. The construction and operation of light vehicle 4 wheel drive systems including third differential and differential locks.
- g. The operation of light vehicle traction control systems and launch control.
- h. The construction and operation of light vehicle hub arrangements.
- i. The construction and operation of:
 - i. drive shafts
 - ii. prop shafts including flexible joints and couplings
 - iii. universal joints
 - iv. constant velocity joints
 - v. sliding joints.

Symptoms and faults in light vehicle transmissions and drive-line systems

- a. Clutch and coupling faults:
 - i. abnormal noises
 - ii. vibrations
 - iii. fluid leaks
 - iv. slip
 - v. judder
 - vi. grab
 - vii. failure to release.
- b. Gearbox faults:
 - i. abnormal noises
 - ii. vibrations
 - iii. loss of drive
 - iv. difficulty engaging or disengaging gears
 - v. automatic gear box types
 - vi. abnormal noises
 - vii. vibrations
 - viii. loss of drive
 - ix. failure to engage gear
 - x. failure to disengage gear
 - xi. leaks
 - xii. failure to operate
 - xiii. incorrect shift patterns
 - xiv. electrical and electronic faults.
- c. Final drive faults:
 - i. abnormal noises
 - ii. vibrations
 - iii. loss of drive
 - iv. oil leaks
 - v. failure to operate
 - vi. electrical and electronic faults.
- d. Drive-lines and couplings:
 - i. abnormal noises
 - ii. vibrations
 - iii. loss of drive.

Faults in light vehicle transmission systems

- a. Interpret information for diagnostic tests, vehicle and equipment specifications, use of equipment, testing procedures, test plans, fault codes and legal requirements.
- b. How to prepare equipment for use in diagnostic testing.

- c. How to conduct systematic testing and inspection of transmission system, mechanical, hydraulic, electrical and electronic systems using appropriate tools and equipment including, multimeter, oscilloscope and pressure gauges.
- d. How to carry out workshop based and road testing of vehicle and transmission system.
- e. Evaluate and interpret test results from diagnostic and/or road testing.
- f. Compare test result and values with vehicle manufacturer's specifications and settings.
- g. How to dismantle, components and systems using appropriate equipment and procedures.
- h. Assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
- i. Probable faults, malfunctions and incorrect settings.
- j. Rectification or replacement procedures.
- k. Operation of systems following diagnosis and repair to confirm operation and performance. Measurements on components to include:
 - i. settings
 - ii. input and output values
 - iii. voltages
 - iv. current consumption
 - v. resistance
 - vi. output patterns with oscilloscope
 - vii. pressures
 - viii. condition
 - ix. wear and performance.

Unit 164

Knowledge of overhauling light vehicle engine units

Level:	7
Credit value:	4
Relationship to NOS:	This unit is linked to LV11 Overhaul Light Vehicle Mechanical Units.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of the construction, operation and overhaul of engine units.

Learning outcome	The learner will:
1	understand how to overhaul light vehicle engine units
Assessment criteria	
The learner can:	
1.1 identify light vehicle engine unit components	
1.2 describe the construction and operation of light vehicle engine units	
1.3 explain how to prepare, use and assess all of the overhauling equipment	
1.4 explain how light vehicle engine units are dismantled, overhauled and reassembled	
1.5 explain common symptoms, causes and faults found in light vehicle engine units	
1.6 explain methods used to identify engine unit faults	
1.7 explain how to examine, measure and make suitable adjustments to light vehicle engine components	
1.8 explain how to evaluate and interpret test results found in diagnosing light vehicle engine unit faults and compare with manufacturers' specifications and settings	
1.9 explain how to evaluate the operation of components and systems following overhauling units to confirm system performance	
1.10 describe the hazards associated with high energy electrical vehicle components.	

Unit 164

Knowledge of overhauling light vehicle engine units

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

How the units and assemblies being overhauled operate

- a. Identify unit components.
- b. Understand unit construction.
- c. Describe unit operation.

How units are dismantled and reassembled

- a. The dismantling procedure.
- b. Tools and equipment used for stripping and rebuilding units and assemblies.
- c. Methods of safe storage for removed components during overhaul activities.
- d. The process for assessing the condition of sub-assemblies including:
 - i. fit
 - ii. tolerances
 - iii. permitted limits.
- e. The rebuild procedure for units and assemblies.
- f. Adjustment procedures during re-assembly.

Unit and assembly testing and evaluation procedures

- a. Appropriate testing and evaluation procedures prior to dismantling units.
- b. Appropriate testing and evaluation procedures of components after dismantling units.
- c. How to use overhauling and test equipment for the task.
- d. The cost-benefit relationship between reconditioning, repair and replacement of components within units.
- e. How to test and evaluate the performance of the overhauled units against the operating specification.
- f. How to interpret test results.
- g. Adjustment procedures during final evaluation.

Faults associated with units and assemblies being overhauled

- a. Causes of faults and failures within units and assemblies.
- b. The faults associated with units and assemblies.
- c. How to make adjustments to meet final specification after testing and evaluation of assembled units and assemblies.

The procedures for dismantling, removal and replacement of units and components

- a. The preparation, testing and use of:
 - i. tools and equipment
 - ii. removal and replacement of electrical and electronic systems and components.
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removal and replacing electrical and electronic components and systems.
- c. The importance of logical and systematic processes.
- d. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.
- e. Refitting procedures.
- f. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- g. Inspection and re-instatement of the vehicle following repair to ensure:
 - i. customer satisfaction
 - ii. cleanliness of vehicle interior and exterior
 - iii. security of components and fittings
 - iv. re-instatement of components and fittings
 - v. cancelling of any fault codes and warning lights.

Unit 172

Knowledge of light vehicle fuel, ignition, air and exhaust system units and components

Level:	5
Credit value:	3
Relationship to NOS:	This unit is linked to LV02 Remove and Replace Light Vehicle Engine Units and Components.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of the construction and operation of common fuel, ignition, air and exhaust systems. It also covers the procedures involved in the removal and replacement of system components and the evaluation of their performance.

Learning outcome	The learner will:
1	understand how light vehicle engine fuel systems operate
Assessment criteria	
The learner can	
1.1	identify light vehicle engine fuel system components
1.2	describe the construction and operation of light vehicle engine fuel systems <ol style="list-style-type: none">multi point injectionsingle point injection
1.3	compare key light vehicle engine fuel system components and assemblies against alternatives to identify differences in construction and operation
1.4	identify the key engineering principles that are related to light vehicle engine fuel systems <ol style="list-style-type: none">properties of fuelscombustion processesexhaust gas constituents
1.5	state common terms used in light vehicle engine fuel system design.

Learning outcome	The learner will:
2	understand how light vehicle engine ignition systems operate
Assessment criteria	
The learner can	
2.1	identify light vehicle engine ignition system components
2.2	describe the construction and operation of light vehicle engine ignition systems <ul style="list-style-type: none"> a. distributor ignition systems b. distributor less ignition systems
2.3	compare key light vehicle engine ignition system components and assemblies against alternatives to identify differences in construction and operation
2.4	identify the key engineering principles that are related to light vehicle engine ignition systems <ul style="list-style-type: none"> a. flame travel b. ignition timing
2.5	state common terms used in key light vehicle engine ignition system design.

Learning outcome	The learner will:
3	understand how light vehicle engine air supply and exhaust systems operate
Assessment criteria	
The learner can	
3.1	identify light vehicle engine air supply and exhaust system components
3.2	describe the construction and operation of light vehicle engine air supply and exhaust systems <ul style="list-style-type: none"> a. supercharging b. turbocharging c. exhaust gas recirculation (egr) d. secondary air injection e. catalytic converters
3.3	compare key light vehicle engine air supply and exhaust system components and assemblies against alternatives to identify differences in construction and operation
3.4	identify the key engineering principles that are related to light vehicle engine air supply and exhaust systems <ul style="list-style-type: none"> a. sound absorption b. reduction of harmful emissions
3.5	state common terms used in key light vehicle engine air supply and exhaust system design.

Learning outcome	The learner will:
4	understand how to check, replace and test light vehicle engine fuel system units and components
Assessment criteria	
<p>The learner can</p> <p>4.1 describe how to remove and replace engine fuel, air supply and exhaust system units and components</p> <p>4.2 describe common types of testing methods used to check the operation of engine fuel, air supply and exhaust systems and their purpose</p> <p>4.3 explain how to evaluate the performance of replacement units against vehicle specification</p> <p>4.4 explain common faults found in light vehicle fuel, air supply and exhaust systems and their causes</p> <p>4.5 describe the hazards associated with high energy electrical vehicle components.</p>	

Unit 172

Knowledge of light vehicle fuel, ignition, air and exhaust system units and components

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Fuel - Petrol

- a. The function and layout of petrol injection systems:
 - i. single and multi-point systems
 - ii. injection components
 - iii. injection pump
 - iv. pump relay
 - v. injector valve
 - vi. air flow sensor
 - vii. throttle potentiometer
 - viii. idle speed control valve
 - ix. coolant sensor
 - x. MAP and air temperature sensors
 - xi. mechanical control devices
 - xii. electronic control units.
- b. The operation of single and multi-point petrol injection systems and components:
 - i. injection pump
 - ii. pump relay
 - iii. injector valve
 - iv. air flow sensor
 - v. throttle potentiometer
 - vi. idle speed control valve
 - vii. coolant sensor
 - viii. MAP and air temperature sensors
 - ix. electronic control units
 - x. fuel pressure regulators
 - xi. fuel pump relays
 - xii. lambda exhaust sensors
 - xiii. flywheel and camshaft sensors
 - xiv. air flow sensors (air flow meter and air mass meter)
 - xv. EGR valve.
- c. The procedures used when inspecting petrol system.

Fuel – Diesel

- a. The layout and construction of inline and rotary diesel systems.
- b. The principles and requirements of compression ignition engines:
 - i. combustion chambers (direct and indirect injection).
- c. The function and operation of diesel fuel injection components:
 - ii. fuel filters
 - iii. sedimenters
 - iv. injectors
 - v. injector types (direct and indirect injection)
 - vi. single
 - vii. multi-hole and pintle nozzle types
 - viii. governors
 - ix. fuel pipes
 - x. glow plugs
 - xi. cold start devices.
 - xii. fuel cut-off solenoid.
- d. The purpose and operation of:
 - i. turbochargers
 - ii. construction
 - iii. use of inter-coolers.
- e. Explain the procedures for injection pump timing and bleeding the system.
- f. The procedures used when inspecting diesel system.

Fuel

- a. The meaning of terms related to:
 - i. hydro-carbon fuels
 - ii. volatility
 - iii. calorific value
 - iv. flash point
 - v. octane value
 - vi. cetane value.
- b. The composition of hydro-carbon fuels:
 - i. % hydrogen and carbon in petrol and diesel fuels.
- c. The composition of air (% nitrogen, oxygen), % of oxygen.
- d. The chemically correct air/fuel ratio for petrol engines as 14.7:1 (lambda 1, stoichiometric ratio).
- e. Weak and rich air/fuel ratios for petrol engines.
- f. Exhaust composition and by-products for chemically correct, rich and weak air/fuel ratios of petrol engines:
 - i. water vapour (H₂O)
 - ii. nitrogen (N)
 - iii. carbon monoxide (CO)
 - iv. carbon dioxide (CO₂)
 - v. carbon (C)
 - vi. hydrocarbon (HC)
 - vii. oxides of nitrogen (NO_x, NO₂, NO) and particulates.
- g. The relative advantages and disadvantages of diesel and petrol engines.

- h. Symptoms and faults associated with fuel systems
 - i. diesel fuel system: air in fuel system, water in fuel, filter blockage, leaks, difficult starting, erratic running, excessive smoke (black, blue, white), engine knock, turbocharger faults
 - ii. petrol injection system: leaks, erratic running, excessive smoke, poor starting, poor performance, poor fuel economy, failure to start, exhaust emissions, running-on, excessive fuel consumption and surging.

Ignition

- a. The layout of electronic ignition systems, advantages over conventional systems (points).
- b. Electronic ignition circuits and components:
 - i. LT Circuit
 - ii. battery
 - iii. ignition switch
 - iv. electronic trigger devices
 - v. capacitor
 - vi. HT Circuit
 - vii. spark plugs (reach, heat range, electrode features and electrode polarity)
 - viii. rotor arm
 - ix. distributor (if applicable)
 - x. distributor cap
 - xi. ignition leads
 - xii. ignition coil
 - xiii. ignition timing advance system.
- c. The operation electronic system components:
 - i. amplifiers
 - ii. triggering systems
 - iii. inductive pick-ups
 - iv. hall generators
 - v. optical pulse generators
 - vi. control units.
- d. The operation of amplifier units.
- e. Ignition terminology:
 - i. dwell angle
 - ii. dwell time
 - iii. dwell variations
 - iv. advance and retard of ignition timing
 - v. static and dynamic ignition timing.
- f. The operation of electronic ignition systems under various conditions and loads to include:
 - i. engine idling
 - ii. during acceleration
 - iii. under full load
 - iv. cruising
 - v. overrun
 - vi. cold starting.

- g. The principles of engine management systems:
 - i. closed loop system
 - ii. integrated ignition
 - iii. injection systems
 - iv. sensors.
- h. The procedures used when inspecting:
 - i. ignition system
 - ii. engine management
 - iii. sensors.
- i. Symptoms and faults associated with ignition system operation:
 - i. Failure to start hot or cold, erratic running, poor performance, misfire, exhaust emissions misfiring and ignition noise (pinking).

Air supply and exhaust systems

- a. The construction and purpose of air filtration systems.
- b. The operating principles of air filtration systems.
- c. The construction and purpose of the exhaust systems.
- d. The operating principles of the systems.
- e. Exhaust system design to include silencers and catalytic converters.
- f. The procedures used when inspecting induction, air filtration and exhaust systems.
- g. Symptoms and faults associated with air and exhaust systems:
 - i. exhaust gas leaks
 - ii. air leaks.

General

- a. The preparation, testing and use of tools and equipment used for:
 - i. dismantling
 - ii. removal and replacement of engine units and components.
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removal and replacing engine units and components.
- c. The importance of logical and systematic processes.
- d. The inspection and testing of engine units and components.
- e. The preparation of replacement units for re-fitting or replacement.
- f. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance and safety requirements.
- g. Refitting procedures.
- h. The inspection and testing of units and system to ensure compliance with manufacturer's, legal and performance requirements.
- i. The inspection and re-instatement of the vehicle following repair to ensure customer satisfaction:
 - i. cleanliness of vehicle interior and exterior
 - ii. security of components and fittings
 - iii. re-instatement of components and fittings.

Unit 173

Knowledge of overhauling light vehicle transmission units

Level:	7
Credit value:	4
Relationship to NOS:	This unit is linked to LV11 Overhaul Light Vehicle Mechanical Units.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of the construction, operation and overhaul of gearboxes and final drive assemblies.

Learning outcome	The learner will:
1	understand how to overhaul light vehicle gearbox and final drive units
Assessment criteria	
The learner can:	
1.1 identify light vehicle gearbox and final drive unit components	
1.2 describe the construction and operation of light vehicle gearbox and final drive units	
1.3 explain how to prepare, use and assess all of the overhauling equipment	
1.4 explain how light vehicle gearbox and final drive units are dismantled, overhauled and reassembled	
1.5 explain common symptoms, causes and faults found in light vehicle gearbox and final drive units	
1.6 explain methods used to identify gearbox and final drive unit faults	
1.7 explain how to examine, measure and make suitable adjustments to light vehicle gearbox and final drive components	
1.8 explain how to evaluate and interpret test results found in diagnosing light vehicle gearbox and final drive unit faults and compare with manufacturers' specifications and settings	
1.9 explain how to evaluate the operation of components and systems following overhauling units to confirm system performance	
1.10 describe the hazards associated with high energy electrical vehicle components.	

Unit 173

Knowledge of overhauling light vehicle transmission units

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

How the units and assemblies being overhauled operate

- a. Identify unit components.
- b. Understand unit construction.
- c. Describe unit operation.

How units are dismantled and reassembled

- a. The dismantling procedure.
- b. Tools and equipment used for stripping and rebuilding units and assemblies.
- c. Methods of safe storage for removed components during overhaul activities.
- d. The process for assessing the condition of sub-assemblies including:
 - i. fit
 - ii. tolerances
 - iii. permitted limits.
- e. The rebuild procedure for units and assemblies.
- f. Adjustment procedures during re-assembly.

Unit and assembly testing and evaluation procedures

- a. Appropriate testing and evaluation procedures prior to dismantling units.
- b. Appropriate testing and evaluation procedures of components after dismantling units.
- c. How to use overhauling and test equipment for the task.
- d. The cost-benefit relationship between reconditioning, repair and replacement of components within units.
- e. How to test and evaluate the performance of the overhauled units against the operating specification.
- f. How to interpret test results.
- g. Adjustment procedures during final evaluation.

Faults associated with units and assemblies being overhauled

- a. Causes of faults and failures within units and assemblies.
- b. The faults associated with units and assemblies.
- c. How to make adjustments to meet final specification after testing and evaluation of assembled units and assemblies.

The procedures for dismantling, removal and replacement of units and components

- a. The preparation, testing and use of:
 - i. tools and equipment
 - ii. removal and replacement of electrical and electronic systems and components.
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removal and replacing electrical and electronic components and systems.
- c. The importance of logical and systematic processes.
- d. Preparation of replacement units for re-fitting or replacement electrical and electronic components and systems.
- e. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.
- f. Refitting procedures.
- g. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- h. Inspection and re-instatement of the vehicle following repair to ensure:
 - i. customer satisfaction
 - ii. cleanliness of vehicle interior and exterior
 - iii. security of components and fittings
 - iv. re-instatement of components and fittings
 - v. cancelling of any fault codes and warning lights.

Unit 182

Knowledge of overhauling light vehicle steering and suspension units

Level:	7
Credit value:	4
Relationship to NOS:	This unit is linked to LV11 Overhaul Light Vehicle Mechanical Units.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of the construction and operation and overhaul of steering and suspension units.

Learning outcome	The learner will:
1	understand how to overhaul light vehicle steering and suspension units
Assessment criteria	
The learner can:	
1.1 identify light vehicle steering and suspension unit components	
1.2 describe the construction and operation of light vehicle steering and suspension units	
1.3 explain how to prepare, use and assess all of the overhauling equipment	
1.4 explain how light vehicle steering and suspension units are dismantled, overhauled and reassembled	
1.5 explain common symptoms, causes and faults found in light vehicle steering and suspension units	
1.6 explain methods used to identify steering and suspension unit faults	
1.7 explain how to examine, measure and make suitable adjustments to light vehicle steering and suspension components	
1.8 explain how to evaluate and interpret test results found in diagnosing light vehicle steering and suspension unit faults and compare with manufacturers' specifications and settings	
1.9 explain how to evaluate the operation of components and systems following overhauling units to confirm system performance	
1.10 describe the hazards associated with high energy electrical vehicle components.	

Unit 182

Knowledge of overhauling light vehicle steering and suspension units

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

How the units and assemblies being overhauled operate

- a. Identify unit components.
- b. Understand unit construction.
- c. Describe unit operation.

How units are dismantled and reassembled

- a. The dismantling procedure.
- b. Tools and equipment used for stripping and rebuilding units and assemblies.
- c. Methods of safe storage for removed components during overhaul activities.
- d. The process for assessing the condition of sub-assemblies including:
 - i. fit
 - ii. tolerances
 - iii. permitted limits.
- e. The rebuild procedure for units and assemblies.
- f. Adjustment procedures during re-assembly.

Unit and assembly testing and evaluation procedures

- a. Appropriate testing and evaluation procedures prior to dismantling units.
- b. Appropriate testing and evaluation procedures of components after dismantling units.
- c. How to use overhauling and test equipment for the task.
- d. The cost-benefit relationship between reconditioning, repair and replacement of components within units.
- e. How to test and evaluate the performance of the overhauled units against the operating specification.
- f. How to interpret test results.
- g. Adjustment procedures during final evaluation.

Faults associated with units and assemblies being overhauled

- a. Causes of faults and failures within units and assemblies.
- b. The faults associated with units and assemblies.
- c. How to make adjustments to meet final specification after testing and evaluation of assembled units and assemblies.

The procedures for dismantling, removal and replacement of electrical and electronic units and components

- a. The preparation, testing and use of:
 - i. tools and equipment
 - ii. removal and replacement of electrical and electronic systems and components.
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removal and replacing electrical and electronic components and systems.
- c. The importance of logical and systematic processes.
- d. Preparation of replacement units for re-fitting or replacement electrical and electronic components and systems.
- e. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.
- f. Refitting procedures.
- g. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- h. Inspection and re-instatement of the vehicle following repair to ensure:
 - i. customer satisfaction
 - ii. cleanliness of vehicle interior and exterior
 - iii. security of components and fittings
 - iv. re-instatement of components and fittings
 - v. cancelling of any fault codes and warning lights.

Unit 218

Skills in removing and fitting of basic light vehicle mechanical, electrical and trim (MET) components and non permanently fixed vehicle body panels

Level:	5
Credit value:	3
Relationship to NOS:	This unit is linked to BP18 Remove and Fit Basic Motor Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Motor Vehicle Body Panels.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit allows the learner to demonstrate they can carry out a range of removal and fitting of basic mechanical, electrical and trim (MET) components and non-permanently fixed light vehicle body panels. It also covers the evaluation of the operation of the components when fitted.

Learning outcome	The learner will:
1	be able to work safely when carrying out removal and fitting of basic MET components and non-permanently fixed light vehicle body panels
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings throughout all light vehicle removal and fitting of basic MET components and non-permanently fixed light vehicle body panels
1.2	work in a way which minimises the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	prepare the vehicle systems and work area for safe working procedures (where appropriate).

Learning outcome	The learner will:
2	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support light vehicle removal and fitting activities including: <ul style="list-style-type: none"> a. vehicle technical data b. removal and fitting procedures c. legal requirements
2.2	use technical information to support light vehicle removal and fitting activities.

Learning outcome	The learner will:
3	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for carrying out removal and fitting of basic MET components and non-permanently fixed light vehicle body panels
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the correct tools and equipment in the way specified by manufacturers when carrying out removal and fitting of basic MET components and non-permanently fixed light vehicle body panels.

Learning outcome	The learner will:
4	be able to carry out removal and fitting of basic MET components and non-permanently fixed light vehicle body panels
Assessment criteria	
The learner can:	
4.1	remove and fit basic MET components and non-permanently fixed light vehicle body panels
4.2	ensure that the removal and fitting of basic MET components and non-permanently fixed light vehicle body panels conforms to the vehicle operating specification and any legal requirements
4.3	ensure no damage occurs to other components when carrying out removal and fitting of basic MET components and non-permanently fixed light vehicle body panels
4.4	ensure all components and panels are stored safely and in the correct location.

Learning outcome	The learner will:
5	be able to record information and make suitable recommendations
Assessment criteria	
<p>The learner can:</p> <ul style="list-style-type: none"> 5.1 produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required 5.2 make suitable and justifiable recommendations for cost effective repairs 5.3 record and report any additional faults noticed during the course of their work promptly in the format required. 	

Unit 268

Knowledge of removing and fitting of basic light vehicle mechanical, electrical and trim (MET) components and non permanently fixed vehicle body panels

Level:	5
Credit value:	2
Relationship to NOS:	This unit is linked to BP18 Remove and Fit Basic Motor Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Motor Vehicle Body Panels.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of carrying out a range of removal and fitting of basic mechanical, electrical and trim (MET) components and non-permanently fixed light vehicle body panels. It also covers the evaluation of the operation of the components when fitted.

Learning outcome	The learner will:
1	understand how to carry out removal and fitting of basic light vehicle mechanical electrical and trim (MET) components
Assessment criteria	
The learner can:	
<ul style="list-style-type: none"> 1.1 identify the procedures involved in carrying out the systematic removal and fitting of basic light vehicle MET components to the standard required including: <ul style="list-style-type: none"> a. bumpers b. headlamp units c. road wheels d. batteries e. bonnet and boot trim f. interior trim components g. exterior trim components 1.2 identify the procedures involved in working with supplementary safety systems when fitting basic light vehicle MET components 1.3 identify the procedures involved in working with gas discharge headlamp systems when fitting basic light vehicle MET components 1.4 explain the methods and procedures for storing removed light vehicle MET components 1.5 identify the different types of fastenings and fixings used when removing and fitting light vehicle MET components 1.6 explain the reasons for the use of different types of fastenings and fixings used in light vehicle MET components 1.7 explain the procedures, methods and reasons for ensuring correct alignment of light vehicle MET components 1.8 identify the quality checks that can be used to ensure correct alignment and operation of light vehicle MET components 1.9 identify correct conformity of vehicle systems against light vehicle specification and legal requirements on completion 1.10 explain the procedure for reporting cosmetic damage to light vehicle MET components and units. 	

Learning outcome	The learner will:
2	understand how to carry out removal and fitting of basic light vehicle non permanently fixed vehicle body panels
Assessment criteria	
<p>The learner can:</p> <ul style="list-style-type: none"> 2.1 identify the procedures involved in carrying out the systematic removal and fitting of basic light vehicle non-welded, non-structural body panels to the standard required including: <ul style="list-style-type: none"> a. wings b. doors c. bonnets d. boot lids and tailgates e. bumper bars, covers and components 2.2 identify the procedures involved in working with supplementary safety systems when fitting basic light vehicle non-welded, non-structural body panels 2.3 explain the methods and procedures for storing removed light vehicle non-welded, non-structural body panels 2.4 identify the different types of fastenings and fixings used when removing and fitting light vehicle non-welded, non-structural body panels 2.5 explain the reasons for the use of different types of fastenings and fixings used in light vehicle non-welded, non-structural body panels 2.6 explain the procedures, methods and reasons for ensuring correct alignment of light vehicle non-welded, non-structural body panels 2.7 identify the quality checks that can be used to ensure correct alignment and operation of light vehicle non-welded, non-structural body panels 2.8 identify correct conformity of vehicle systems against light vehicle specification and legal requirements on completion 2.9 explain the procedure for reporting cosmetic damage to light vehicle non-welded, non-structural body panels. 	

Unit 268

Knowledge of removing and fitting of basic light vehicle mechanical, electrical and trim (MET) components and non permanently fixed vehicle body panels

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

Describe procedures to prevent damage to the vehicle, components and contents when removing, storing and refitting basic MET components

- a. The methods that can be used to protect undamaged items to ensure they are removed and refitted without causing unnecessary damage:
 - i. bumpers
 - ii. headlamp units
 - iii. road wheels
 - iv. batteries
 - v. bonnet and boot trim
 - vi. interior trim components
 - vii. exterior trim components.
- b. The procedures for the correct storage of vehicle contents.
- c. The process for the reporting of extra damage and items that may have broken when removed or refitted.

The processes involved when handling batteries

- a. The procedure for the removal, storage and refitting of lead acid batteries.
- b. The procedure for the disposal of lead acid batteries.
- c. Battery checks:
 - i. electrolyte
 - ii. discharge
 - iii. specific gravity.
- d. The charging process and procedures:
 - i. trickle charge
 - ii. normal charge
 - iii. boost / start.
- e. The health and safety issues involved when charging (explosive gasses).

Types of clips and fixings

- a. The following types of clips and identify reasons and limitations for their use:
 - i. speed
 - ii. 'c'
 - iii. 'd'
 - iv. 'j' type captive nut
 - v. 'r'
 - vi. 'u' type captive nut
 - vii. cable clip
 - viii. trim clips.
- b. The following types of fixings and identify reasons and limitations for their use:
 - i. pop rivet
 - ii. plastic rivet
 - iii. plastic capture nut
 - iv. nut and bolt
 - v. soulder bolt
 - vi. 'Nyloc' type nuts
 - vii. washers
 - viii. 'Spring' type washers
 - ix. self tapping screws and bolts
 - x. quick release plastic trim fastenings
 - xi. trim tapes
 - xii. adhesives and sealers.

The processes involved when carrying out quality checks

- a. Items that may have been 'workshop' soiled and describe processes for rectifying:
 - i. door cards
 - ii. seats
 - iii. carpets
 - iv. boot and bonnet trims
- b. Methods for checking gaps.
- c. The process for checking and aligning headlamps:
 - i. address handling procedures for halogen bulbs
 - ii. address handling and health and safety issues relating to xenon bulbs and systems.
- d. Operational checks and rectification methods to include:
 - i. lights
 - ii. washers and wipers
 - iii. SRS systems (checking not rectification)
 - iv. charging system (checking not rectification)
 - v. horn
 - vi. fluid levels
 - vii. interior switches
 - viii. operation of door lock mechanisms.

Removing and Fitting Non-Structural Body Panels

- a. Find, interpret and use sources of information applicable to the removal and fitting of basic non welded non-structural body panels.
- b. Select check and use all the tools and equipment required to remove and fit basic non welded non-structural body panels including:
 - i. hinge pin removers
 - ii. spanners
 - iii. screwdrivers.
- c. The different types of mechanical fixings for non welded non-structural body panels and when and why they should be used including:
 - i. bolts
 - ii. self tapping bolts
 - iii. speed nuts
 - iv. washers.
- d. The correct procedures and processes for removing and fitting of non-welded non-structural body panels.
- e. The need for correct alignment of panels and methods to achieve this:
 - i. aperture gaps
 - ii. alignment of panel features
 - iii. best fit of components to panels
 - iv. vehicle geometry
 - v. operation of openings such as doors, tailgates, bonnets etc.
- f. The types of quality control checks that can be used to ensure correct alignment and contour of panels and operation of components to manufacturer's specification.
- g. The method of storing removed panels and the importance of storing them correctly.

Unit 406

Skills in diagnosing and rectifying vehicle auxiliary electrical faults

Level:	7
Credit value:	5
Relationship to NOS:	This unit is linked to AE06 Diagnose and Rectify Motor Electrical Units and Component Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit will help the learner to develop the skills required to demonstrate they can diagnose and rectify automotive vehicle auxiliary electrical system faults. It also covers the evaluation of performance of the replaced or repaired units and systems. This includes SI, CI, Hybrid and Alternative fuel vehicles.

Learning outcome	The learner will:
1.	be able to work safely when carrying out automotive vehicle auxiliary electrical diagnostic and rectification activities
Assessment criteria	
The learner can:	
1.1	use suitable personal protective equipment and vehicle coverings throughout when carrying out auxiliary electrical diagnostic and rectification activities
1.2	work in a way which minimizes the risk of damage or injury to the vehicle, people and the environment (including waste disposal)
1.3	Prepare the vehicle systems and work area for safe working procedures (where appropriate)

Learning outcome	The learner will:
2.	be able to use relevant information to carry out the task
Assessment criteria	
The learner can:	
2.1	select suitable sources of technical information to support automotive vehicle diagnostic and rectification activities including: <ol style="list-style-type: none"> a. vehicle technical data b. diagnostic test procedures
2.2	use sufficient diagnostic information in a systematic way to enable an accurate diagnosis of automotive auxiliary electrical system faults.

Learning outcome	The learner will:
3.	be able to use appropriate tools and equipment
Assessment criteria	
The learner can:	
3.1	select the appropriate tools and equipment necessary for diagnostic and rectification activities
3.2	ensure that equipment has been calibrated to meet manufacturers' and legal requirements
3.3	use the equipment required, correctly and safely throughout all automotive auxiliary electrical diagnostic and rectification activities.

Learning outcome	The learner will:
4.	be able to carry out automotive vehicle auxiliary electrical diagnosis, rectification and test activities
Assessment criteria	
The learner can:	
4.1	use diagnostic methods that are relevant to the symptoms presented
4.2	evaluate your assessment of dismantled sub-assemblies and identify their condition and suitability for repair or replacement accurately
4.3	carry out all diagnostic and rectification activities following: <ul style="list-style-type: none"> a. manufacturers' instructions b. recognised researched repair methods c. health and safety requirements
4.4	ensure all repaired or replacement components and units conform to the vehicle operating specification and any legal requirements
4.5	adjust components and units correctly to ensure that they operate to meet system requirements
4.6	use testing methods that are suitable for assessing the performance of the system rectified
4.7	ensure the rectified automotive auxiliary electrical system performs to the vehicle operating specification and any legal requirements.

Learning outcome	The learner will:
5.	be able to record information and make suitable recommendations
Assessment criteria	
The learner can:	
5.1	produce work records that are accurate, complete and passed to the relevant person(s) promptly in the format required
5.2	make suitable and justifiable recommendations for cost effective repairs
5.3	record and report any additional faults noticed during the course of their work promptly in the format required.

Unit 456

Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults

Level:	7
Credit value:	6
Relationship to NOS:	This unit is linked to AE06 Diagnose and Rectify Motor Electrical Units and Component Faults.
Assessment requirements specified by a sector or regulatory body:	This unit was developed by the IMI, the sector skills council for the automotive retail industry. All assessments have been developed in accordance with the IMI Assessment Requirements.
Aim:	This unit enables the learner to develop an understanding of diagnosis and rectification of vehicle auxiliary electrical systems and their units. It also covers the evaluation of performance of the systems. This includes SI, CI, Hybrid and Alternative fuel vehicles.

Learning outcome	The learner will:
1.	understand vehicle electrical and electronic principles
Assessment criteria	
The learner can:	
1.1	explain the principles of electrical inputs, outputs, voltages and oscilloscope patterns, digital and fibre optics
1.2	explain the principles of sensor inputs, computer processing and actuator outputs
1.3	identify sensor types (passive and active)
1.4	identify the electrical principles that are related to light vehicle electrical circuits.

Learning outcome	The learner will:
2.	understand how light vehicle auxiliary electrical systems operate
Assessment criteria	
The learner can:	
2.1	identify advanced automotive auxiliary electrical system components
2.2	explain the construction and operation of automotive auxiliary electrical systems
2.3	explain the interaction between electrical, electronic and mechanical components within the system defined
2.4	explain the operation of the electrical and electronic systems for electric, hybrid and alternative fuel vehicles including regenerative braking systems
2.5	explain how electrical systems interlink and interact, including multiplexing and fibre optics
2.6	compare automotive auxiliary electrical system components and assemblies against alternatives to identify differences in construction and operation.

Learning outcome	The learner will:
3.	understand how to diagnose and rectify faults in auxiliary electrical systems
Assessment criteria	
The learner can:	
3.1	explain the symptoms and causes of faults found in automotive auxiliary electrical systems
3.2	explain systematic diagnostic techniques used in identifying automotive auxiliary electrical system faults
3.3	explain how to examine, measure and make suitable adjustments to components
3.4	explain how to carry out the rectification activities in order to correct the faults in the automotive auxiliary electrical systems
3.5	explain how to select, prepare and use diagnostic and rectification equipment for automotive auxiliary electrical systems
3.6	explain how to evaluate and interpret test results found in diagnosing automotive auxiliary electrical system faults against vehicle manufacturer specifications and settings
3.7	explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance.

Unit 456

Knowledge of diagnosis and rectification of vehicle auxiliary electrical faults

Supporting information

Candidates will be assessed on the assessment criteria as specified within the unit. The following information has been provided by IMI SSC and is included to support centres in terms of teaching and delivery.

The electrical principles that are related to light vehicle electrical circuits:

- Ohms law
- Voltage
- Power
- Current (AC and DC)
- Resistance
- Magnetism
- Electromagnetism and electromagnetic induction
- Digital and fibre optic principles
- Electrical units and symbols
- Electrical and electronic terminology
- Relevant electrical safety.

Battery and charging

- a. The construction and operation of vehicle batteries including:
 - i. low maintenance and maintenance free
 - ii. lead acid and nickel cadmium types
 - iii. cells
 - iv. separators
 - v. plates
 - vi. electrolyte.
- b. The operation of the vehicle charging system:
 - i. alternator
 - ii. rotor
 - iii. stator
 - iv. slip ring
 - v. brush assembly
 - vi. three phase output
 - vii. diode rectification pack
 - viii. voltage regulation
 - ix. phased winding connections
 - x. cooling fan
 - xi. alternator drive system.

Starting

- a. The layout, construction and operation of engine starting systems: inertia and pre-engaged principles.
- b. The function and operation of the following components:
 - i. inertia and pre-engaged starter motor
 - ii. starter ring gear
 - iii. pinion
 - iv. starter solenoid
 - v. ignition/starter switch
 - vi. starter relay (if appropriate)
 - vii. one-way clutch (pre-engaged starter motor).

Lighting systems and technology

- a. Lighting systems should include:
 - i. Xenon lighting
 - ii. gas discharge lighting
 - iii. ballast system
 - iv. LED
 - v. intelligent front lighting
 - vi. blue lights
 - vii. complex reflectors
 - viii. fibre optic
 - ix. optical patterning.

Lighting circuits and the relationship between each circuit

- a. Circuits must include:
 - i. sidelights including number plate lights and marker lights
 - ii. dipped beam
 - iii. main beam
 - iv. dim/dip
 - v. indicators and hazard lights
 - vi. high intensity and fog light.

Common faults and testing methods associated with external lighting system

- a. Fault diagnosis for:
 - i. lighting systems failing to operate correctly
 - ii. switches
 - iii. relays
 - iv. bulbs failing to operate.

The operating principles of external lighting systems and multiplexing systems

- a. To include all external lighting systems and a good knowledge of multiplexing systems.

The different types of electric windows and mirror systems and components

- a. Components should include:
 - i. window
 - ii. mirror motors
 - iii. multi-functional switches
 - iv. relays
 - v. total closure modules.

The function of component parts in the electric window and mirror systems

- a. Components must include:
 - i. motors
 - ii. relays

- iii. interfaces
- iv. modules
- v. switches.

The operating principles of electric windows and mirror systems

- a. Operating principles of the following:
 - i. motors
 - ii. interfaces
 - iii. switches
 - iv. modules.

Common faults and testing methods associated with electric windows and mirror systems

- a. Fault diagnosis for:
 - i. electric windows failing to open or close
 - ii. electric mirrors fail to adjust
 - iii. slow operation on both systems.

The different types of screen heating systems and components

- a. Systems must include:
 - i. heated front screens
 - ii. heated rear screens
 - iii. heated mirrors.

The function and operating principles of components for heated screen and mirror systems

- a. Components must include:
 - i. front and rear screen elements
 - ii. mirror elements
 - iii. time control relays
 - iv. multifunction relays and switches.

Common faults and testing methods associated with heated screen and mirror systems

- a. Faults must include:
 - i. screen elements not operating
 - ii. timer relays not operating and staying on permanently.

The different types of I.C.E. systems and components

- a. Systems and components must include:
 - i. radio CD and multi play units
 - ii. DVD players
 - iii. MP3 players
 - iv. speakers
 - v. aerial systems
 - vi. amplifiers
 - vii. V.D.U. screens
 - viii. Satellite Navigation
 - ix. communication units.

The function of components in I.C.E. systems

- a. Systems include:
 - i. radios
 - ii. CD players
 - iii. video players

- iv. DVD players
- v. aerial systems
- vi. speakers
- vii. amplifiers
- viii. VDU screens
- ix. mobile communication units.

The operating principles of I.C.E. systems

- a. Operation of entertainment systems speaker and aerial systems.

Common faults and testing methods associated with I.C.E. systems

- a. Faults to include:
 - i. entertainment and navigation units not operating
 - ii. speaker, aerial and amplifier systems not functioning correctly
 - iii. excessive radio interference (suppression)
 - iv. use of diagnostic computers and systems.

The different types of integrated security/warning systems and components

- a. Components to include:
 - i. control units
 - ii. alarm modules
 - iii. audible warning units
 - iv. immobiliser units
 - v. sensing units
 - vi. horn
 - vii. audible warning speakers.

The function of component parts in integrated security and warning systems

- a. Components to include
 - i. control units
 - ii. alarm modules
 - iii. audible warning units
 - iv. interior sensing systems
 - v. immobiliser units
 - vi. relays
 - vii. LEDs
 - viii. horns.

The operating principles of integrated security and warning systems

- a. Operation of alarm systems and audible warning units.

The relevant legislation relevant to security and warning systems

- a. Find and apply all relevant legislation for the fitment and use of security and warning systems.

Common faults and testing methods associated with security and warning systems

- a. Components to include:
 - i. control units
 - ii. audible warning units
 - iii. immobiliser units
 - iv. horns
 - v. relays
 - vi. LEDs

- vii. wiring
- viii. connections and protection devices
- ix. removal and refitting procedures
- x. using computer diagnostics to identify faults
- xi. use of manufacturer's diagnostic equipment.

The different wiper system components

- a. Components must include:
 - i. wiper motors
 - ii. washer motors
 - iii. wiper linkage
 - iv. multifunction relays
 - v. headlamp wash/wipe.

The function of component wiper and washer components

- a. Components and systems must include:
 - i. wiper motors
 - ii. intermittent wash wipe relays
 - iii. parking systems .

The operating principles, faults and testing methods of wiper and washer systems

- a. Principles, fault diagnosis and testing for:
 - i. wiper motors failing
 - ii. damaged linkages
 - iii. incorrect operation of intermittent and parking systems
 - iv. earth faults
 - v. control unit failure .

The different heater, cooling system components and air con.

- a. Components include:
 - i. heater motors
 - ii. speed rheostats
 - iii. switches
 - iv. valves
 - v. radiator cooling fan motors
 - vi. relays
 - vii. air conditioning units.

The function of component heater, cooling parts and air conditioning

- a. Components include:
 - i. heater motors
 - ii. rheostats
 - iii. valves
 - iv. switches
 - v. relays
 - vi. cooling fan motors
 - vii. air conditioning units
 - viii. thermostatic switches.

The operating principles of heater, cooling systems and air conditioning

- a. Principles to include:
 - i. conduction
 - ii. convection
 - iii. radiation
 - iv. circulation
 - v. boiling points
 - vi. states of matter (Gas, liquid, solid)
 - vii. temperature control
 - viii. antifreeze mixtures
 - ix. heat transfer.

Common faults and testing methods associated with heater, cooling systems and air conditioning

- a. Fault diagnosis for:
 - i. heater motor failing to operate on all/one speed
 - ii. radiator cooling fan not operating
 - iii. valves
 - iv. relays
 - v. switches not operating
 - vi. electrical related faults on the air conditioning system.

The different types of locking system components

- a. Door locking actuators, solenoids, deadlocking actuators, anti-theft modules and boot release solenoids.

The function of component parts in the locking system

- a. Solenoids, actuators (electrical and pneumatic), multifunctional relays, anti-theft modules and release systems.

The operating principles of locking systems

- a. Doors and cabs.

Common faults and testing methods associated with locking systems

- a. Door locking actuators, solenoids, connections, wiring, relays, and protection devices/fuses.

The different types of Supplementary Restraint and Airbag systems

- a. Components include:
 - i. control units
 - ii. sensors
 - iii. seat belt pretensioners
 - iv. airbag assemblies
 - v. wiring systems
 - vi. warning systems.

The function of component parts in the Supplementary Restraint and Airbag systems

- a. Components include:
 - i. control units
 - ii. interfaces
 - iii. sensors
 - iv. airbag units
 - v. pretensioners.

The operating principles of Supplementary Restraint and Airbag systems

- a. Operation of the sensors.
- b. Operation of the airbag unit.
- c. Operation of the various types of pretension.
- d. Safe handling procedures and regulations.

Common faults and testing methods associated Supplementary Restraint and Airbag systems

- a. Fault diagnosis for Airbag and SRS faults:
 - i. fault code identification
 - ii. wiring faults
 - iii. component failure
 - iv. earth problems
 - v. sensor faults.

How to examine, measure and make suitable adjustments to components:

- a. Settings
- b. Input and output values
- c. Voltages
- d. Current consumption
- e. Resistance
- f. Input and output patterns with oscilloscope (including frequency and duty cycle
- g. measurements)
- h. Condition
- i. Wear and performance

How to select, prepare and use diagnostic and rectification equipment for automotive auxiliary electrical systems:

- a. Voltmeters
- b. Ammeters
- c. Ohmmeters
- d. Multi-meters
- e. Battery testing equipment
- f. Dedicated and computer based diagnostic equipment
- g. Oscilloscopes.

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.

City & Guilds Centre Manual contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. 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
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- Regulatory Arrangements for the Qualifications and Credit Framework (2008)
- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

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

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

- **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.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification. Specifically, the document includes sections on:

- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

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Useful contacts

UK learners

General qualification information

E: learnersupport@cityandguilds.com

International learners

General qualification information

E: intcg@cityandguilds.com

Centres

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

E: centresupport@cityandguilds.com

Single subject qualifications

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

E: singlesubjects@cityandguilds.com

International awards

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

E: intops@cityandguilds.com

Walled Garden

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

E: walledgarden@cityandguilds.com

Employer

Employer solutions including, Employer Recognition: Endorsement, Accreditation and Quality Mark, Consultancy, Mapping and Specialist Training Delivery

E: business@cityandguilds.com

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