



Government of **Western Australia**
School Curriculum and Standards Authority

AUTOMOTIVE ENGINEERING AND TECHNOLOGY

GENERAL COURSE

Year 12 syllabus

IMPORTANT INFORMATION

This syllabus is effective from 1 January 2017.

Users of this syllabus are responsible for checking its currency.

Syllabuses are formally reviewed by the School Curriculum and Standards Authority on a cyclical basis, typically every five years.

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Rationale

The Automotive Engineering and Technology General course exposes students to the component parts, accessories, systems and technologies of the automotive vehicle. They learn the principles underpinning the operation of vehicle systems and subsystems. They also develop the knowledge and skills needed to service, maintain, and repair these systems. Workshop activities provide them with opportunities to learn about the range of components and materials used in the manufacture of automotive vehicles.

Students plan for, and manage the repair, assembly and manipulation of vehicle systems using computer-assisted technology and adhere to occupational safety and health (OSH) practices and procedures. They also develop effective communication and teamwork skills when developing solutions to the planning and managing of automotive vehicle systems.

The course offers consumer guidance in the areas of car ownership, insurance, buying, financing, maintenance and running costs, as well as career and vocational information related to the automotive vehicle industry. Students develop an awareness of the social responsibilities associated with the use of vehicles and the impact of vehicles on individuals, society and the environment. They learn that vehicles have provided society with a form of personal mobility that a little over a century ago could only have been imagined. This has a dramatic influence on the day-to-day activities of individuals as well as the location and design of cities and towns. Students also examine the infrastructure and requirements for the safe operation of vehicles, including rules and regulations, traffic flow control systems and road design. They analyse repercussions of vehicle production and use, including the resulting pollution of the earth due to the myriad of chemicals used in the manufacture, upkeep and repair of vehicle.

Course outcomes

The Automotive Engineering and Technology General course is designed to facilitate achievement of the following outcomes.

Outcome 1 – Automotive technology process

Students apply a technology process to create or modify products, processes, systems, services or environments to meet human needs and realise opportunities.

In achieving this outcome, students:

- investigate information, needs and opportunities related to automotive design and manipulation of automotive systems
- devise methods to analyse and test automotive systems
- produce solutions and prepare production proposals to manipulate automotive systems
- evaluate the usefulness of the automotive system for the end user.

Outcome 2 – Automotive understandings

Students understand the automotive scientific theory and interrelationships of automotive systems.

In achieving this outcome, students:

- understand the automotive scientific theory and principles of components
- understand the automotive operation of components associated with automotive systems
- understand interactions between automotive vehicle components and subsystems in relation to the manufacture of vehicles, plant and equipment.

Outcome 3 – Automotive technology skills

Students apply organisational, operational and technological skills appropriate to the automotive industry.

In achieving this outcome, students:

- apply the initiative and organisational skills required to manage work activities in a team environment
- apply the operations necessary to achieve solutions to automotive challenges
- select and use tools and equipment safely.

Outcome 4 – Automotive technology in society

Students understand the relationship between automotive technology and the environment.

In achieving this outcome, students:

- understand the impact of automotive technologies on society and the environment
- understand the strategies used for the safety and sustainability of automotive technology in society.

Organisation

This course is organised into a Year 11 syllabus and a Year 12 syllabus. The cognitive complexity of the syllabus content increases from Year 11 to Year 12.

Structure of the syllabus

The Year 12 syllabus is divided into two units which are delivered as a pair. The notional time for the pair of units is 110 class contact hours.

Unit 3

In this unit, students develop an understanding of automotive vehicles as complex inventions used to meet the needs of both the individual and society. They realise a whole industry has evolved around automotive vehicles and the manner in which we service, repair, maintain, refinish, customise and make use of other emerging techniques. Students use rules and regulations associated with the manufacture and use of automotive vehicles to develop, through practical tasks, a finer understanding of how automotive systems operate. They learn about historical and current changes in automotive technology, use of materials and automotive design, and the impact on communities and society.

Unit 4

In this unit, students further develop an understanding of internal combustion engines, including new and emerging types of engines. Students develop knowledge of the underlying mathematical and scientific principles involved in the operation, construction and major subsystems of the two and four stroke internal combustion engines, rotary engines and external combustion engines. Opportunities are provided to further extend their knowledge and skills, by investigating computer-assisted technologies that are used to service, repair and maintain automotive vehicle engines. Students focus on the socioeconomic impact of engine technology on society, careers, occupations and the environment. They explore the rules and regulations governing their use and manufacture. They consider the relationship between engine operation and the types of fuels used, as well as the impact of alternative fuels in the future.

Each unit includes:

- a unit description – a short description of the focus of the unit
- unit content – the content to be taught and learned.

Organisation of content

The course content is the focus of the learning program.

The course content is divided into two content areas:

- Automotive mechanics
 - principles
 - maintenance and repair
 - systems
- Automotive industry
 - rules and regulations
 - social, economic and environmental implications and consequences
 - materials
 - design
 - managing production.

Automotive mechanics

Principles

Students learn about the underpinning scientific, mathematical, geometric and operational principles of automotive vehicles, plant and equipment. They also recognise the role of forces, pressure and friction in vehicles, and their operations. They explore the application of principles, such as hydraulics, four and two stroke combustion cycles, steering systems, wheel castor and camber and power transmission to achieve mechanical advantage, acceleration and power efficiency. They consider elements of chassis construction and alignment, and other essential operations of vehicles. They explore the changes in automotive technologies, carbon fibre composites and plastics which are underpinned by the application of scientific, mathematical, geometric and operational principles over time. Students also consider the representation of principles that underpin automotive operations using scientific diagrams, mathematical relationships and geometrical drawings.

Maintenance and repair

Students explore the specified skills and processes involved in the service, maintenance and repair operations on different engine types, including new and emerging technologies. Students undertake diagnosis, fabrication, machining, overhaul, dent and corrosion repair, and refinishing. They also undertake graphics applications, removal and replacement of panels, repair, maintenance, service and testing, using safe work practices and observing occupational safety and health (OSH) regulations. These processes are completed through the application of hand, machine and process skills. Students explore tools and computer-assisted technology specific to the automotive industry, such as those used in fault diagnosis, repair of equipment, information databases, and testing of automotive systems and their components. They examine the specific methodologies, stipulated parameters and test conditions of different types of performance tests and test to identify repair and maintenance issues.

Systems

Students learn that automotive vehicles consist of many subsystems that work independently to perform their specific purpose, whilst simultaneously providing feedback to other systems that integrate and control functions. They explore how certain automotive vehicle components, parts, equipment, and systems function, operate and interact. Students learn the importance of the role of technology in the ongoing development of automotive systems.

Automotive industry

Rules and regulations

Understanding road design, traffic rules, regulations and operations is fundamental to the safe use of vehicles and to ensure the safety of all road users. Students realise that the development of rules and regulations is in response to society's demands. They explore the implementation of rules and regulations and the use of computer technology in regulating traffic. They explore rules and regulations from a state, national and international perspective. The rules and regulations associated with the design, manufacture, licensing rules and modification of vehicles in relation to standards stipulated in the Australian Design Rules Legislation are also examined. Students recognise the roles of authorities and bodies in the governing activities associated with the automotive industry, including road design and traffic control.

Social, economic and environmental implications and consequences

The social and economic ramifications of the automotive industry are considered from a holistic and societal perspective, as well as an individual perspective. Students explore the trends in automotive styling, size and capacity that have become iconic for particular periods in our history and in our social development. They examine future directions for the automotive industry and the implications for society. They consider the careers and occupations, both directly and indirectly, associated with the automotive industry. Students learn about the automotive industry and consumer protection agencies within the automotive industry, as well as the rights and responsibilities of consumers.

The automotive industry has an impact on natural and man-made environments at the local, national and international levels. Students learn that these factors affect the construction of roads, the environmentally friendly use of materials, manufacturing processes and effluents, greenhouse and ozone-depleting emissions, disposal regimes, salvage operations and recycling programs. Students consider the evolution of the automotive industry and its environmental consequences.

Materials

Students learn that the range of materials used in the manufacture of automotive vehicles changes over time in response to economic, environmental and cultural demands. They learn about the materials used in vehicles, such as metals, plastics, formulated fuels and oils, carbon fibre, fabrics, leather, fibre and paper elements. They recognise that the development of materials, and corresponding advances in technology have seen many substances refined and combined to ensure durability, toughness and strength of the various metals, plastics, ceramics and alloys used in today's modern vehicles. They recognise the use and behaviour of materials in basic fabrication techniques, such as repairing, shaping, welding and casting, are still the basis of any manufacturing process, whether it is manual or automated. Students learn that these techniques are applied in the fabrication of a model or project and may be enhanced by the use of computer-assisted processes.

Design

Students learn about the design and manufacture of automotive vehicles, plant and equipment, in response to design elements, market research, cultural and environmental values, including national and international compliance codes. They explore how shape and body customisation, form, comfort, safety, ergonomics and styling are all essential elements of vehicle design and governed by Australian Design Rules. Students use computer-assisted communication techniques, are involved in the evaluation of successful automotive designs, and engage in teamwork to generate innovative design briefs.

Managing production

Students recognise that designs need to be translated into products and that this requires skilful management of all processes involved in production. They learn that planning is of vital importance in the process of automotive engineering. Additionally, they learn that the planning process involves the selection of components, parts and materials, sequencing operations, ordering of resources and costing arrangements, identifying OSH issues, planning for contingencies, documenting efficient work practices, evaluating the design, considering social and environmental factors, and communicating with others in the production team.

Students explore how management skills assist in the ability to manage projects. Such management skills include time management, cost planning, human and materials resource management, task planning, record-keeping, risk management, sequencing, project analysis, and written and graphical communication skills. They explore computer technologies and their applications in planning and management of production processes and strategies in simulated and mass production lines. Students also explore the economic and environmental issues associated with the planning, production and managing processes and strategies.

Representation of the general capabilities

The general capabilities encompass the knowledge, skills, behaviours and dispositions that may assist students to live and work successfully in the twenty-first century. Teachers may find opportunities to incorporate the capabilities into the teaching and learning program for the Automotive Engineering and Technology General course. The general capabilities are not assessed unless they are identified within the specified unit content.

Literacy

Literacy is important in the study of the Automotive Engineering and Technology General course. Students may access technical information and instructions and automotive technological content through a variety of print, oral, visual, spatial and electronic forms, including data books, texts, computer software, images, and written technical materials. They learn to investigate, interpret, and apply diagnostic and technology principles from a variety of sources to perform complex tasks. They analyse and evaluate information for reliability, relevance and accuracy. They learn to monitor their own language use for accuracy in the use of complex instructions, mechanical principles and technological terms for clarity of ideas, processes and explanations of mechanical activities and evaluation of automotive systems and products.

Numeracy

Numeracy is fundamental in calculating and evaluating mechanical systems, performance and technology processes. Students develop their understanding and skills of numeracy while undertaking tasks to diagnose, test and evaluate mechanical systems. Common and specific theory continues to be studied to forge greater

understanding of the scientific, mathematical and technical concepts that explain how mechanical systems function efficiently.

Information and communication technology capability

Information and communication technology (ICT) capability is important in all stages of the diagnostics and reporting. Students use digital tools and strategies to locate, access, process and analyse information. They use ICT skills and understandings to investigate and report on automotive systems. Students access information from websites and software programs to develop a greater understanding of the automotive industries. Students use computer aided drawing software and computer control software to diagnose, correct and evaluate mechanical systems.

Critical and creative thinking

Critical and creative thinking is integral to the understanding of automotive engineering development. The engineering principles of automotive technology require critical and creative thinking to maintain efficient vehicular transport and advance to better designed transport systems. Students develop understandings and skills in critical and creative thinking during periods of evaluation of vehicular design, the use of materials and methods of manufacture. During diagnostics, students interrogate and critically assess the performance of mechanical systems. Students identify possible weaknesses in performance, or failures of components, and determine causes. They then design strategies to correct or modify the performance of the mechanical system.

Personal and social capability

Personal and social capability skills are developed and practiced in the Automotive Engineering and Technology General course by students enhancing their communication skills and participating in teamwork. Students have opportunities to work collaboratively during stages of diagnostics and vehicle maintenance. Students develop increasing social awareness through the study of the impact of the use of vehicle and transport systems in society and on the environment.

Ethical understanding

Students have opportunities to understand the diverse perspectives and circumstances that shape transportation processes and technology and the actions and possible motivations of people in the past compared with those of today. Students have opportunities, both independently and collaboratively, to explore the values, beliefs and principles that have influenced past vehicular designs and technological achievements, and the ethical decisions required by global design processes of today.

Intercultural understanding

Students have opportunities to develop an understanding of different contemporary perspectives with regard to transport systems and vehicular use, sources of energy and energy use, and design and technological influences on different groups within society, and how they contribute to individual and group actions in the contemporary world.

Representation of the cross-curriculum priorities

The cross-curriculum priorities address the contemporary issues which students face in a globalised world. Teachers may find opportunities to incorporate the priorities into the teaching and learning program for the Automotive Engineering and Technology General course. The cross-curriculum priorities are not assessed unless they are identified within the specified unit content.

Aboriginal and Torres Strait Islander histories and cultures

Students have opportunities to explore Aboriginal and Torres Strait Islander development and use of automotive technology, and the interconnectedness between technologies and identity, people, culture and country/place.

Asia and Australia's engagement with Asia

Students have opportunities to explore traditional, contemporary and emerging technological achievements in the countries of the Asia region. Students may explore Australia's rich and ongoing engagement with the peoples and countries of Asia to create appropriate products and services to meet personal, community, national, regional and global needs.

Sustainability

Students take action to create more sustainable patterns of living. Students can develop knowledge, understanding and skills necessary to maintain and run a vehicle for effective sustainability.

Students focus on the knowledge, understanding and skills necessary to choose transport systems and technologies with regard to costs and benefits. They evaluate the extent to which the operation and long term performance embrace sustainability. Students reflect on past and current practices, and assess new and emerging technologies from a sustainability perspective.

Unit 3

Unit description

In this unit, students develop an understanding of automotive vehicles as complex inventions used to meet the needs of both the individual and society. They realise a whole industry has evolved around automotive vehicles and the manner in which we service, repair, maintain, refinish, customise and make use of other emerging techniques. Students use rules and regulations associated with the manufacture and use of automotive vehicles to develop, through practical tasks, a finer understanding of how automotive systems operate. They learn about historical and current changes in automotive technology, use of materials and automotive design, and the impact on communities and society.

Unit content

An understanding of the Year 11 content is assumed knowledge for students in Year 12. It is recommended that students studying Unit 3 and Unit 4 have completed Unit 1 and Unit 2.

This unit includes the knowledge, understandings and skills described below.

Automotive mechanics

Principles

- scientific principles
 - chemical and mechanical energy
 - energy conversion
 - power
 - motion
 - friction and lubrication
 - torque
 - pressure
 - their influence in selecting or modifying automotive technologies for improved performance

Maintenance and repair

- demonstrate maintenance, testing and repair/replacement of major components in motor vehicle systems
 - electrical system
 - cooling system
 - fuel and lubrication systems
- perform adjustment of bearings and removal and repair of motor vehicle components, including wheels, body and mechanical parts
- identify and use flow charts and problem-solving skills to diagnose faults in conjunction with the use of specialised tools and equipment
- perform servicing, repair and maintenance requirements of various types of engines
- identify materials and parts required for optimising the performance of various types of engines

- apply safety data information and workshop occupational safety and health (OSH) regulations to both individuals and small groups

Systems

- relationships between the various systems that make up an automotive power plant or vehicle
 - driveline
 - wheels and tyres
 - steering and suspension
 - body and frame construction
 - electrical systems
 - cooling systems
 - hydraulic braking systems

Automotive industry

Rules and regulations

- traffic rules associated with the safe use of vehicles
- specific road traffic control for different types of vehicles

Social, economic and environmental implications and consequences

- relationships between changes in automotive technologies and impacts on communities and society
- current legislation and environmental regulations associated with engine designs and manufacture of automotive technologies
- local and global concerns for:
 - advancements in automotive technologies
 - demands for transport of materials and people
 - environmental sustainability

Materials

- historical perspectives of materials used in the automotive industry, and how they have evolved with changing values and needs of society
- service repair and maintenance of automotive vehicles using computer-assisted techniques and fabrication skills

Design

- elements of design and techniques for generating and communicating design ideas
- historical changes in design of automotive technologies, and their interaction with changing cultural values

Managing production

- prepare and use planning for, and management of small-scale production of prototypes, incorporating design elements underpinned by research and performance testing

Unit 4

Unit description

In this unit, students further develop an understanding of internal combustion engines, including new and emerging types of engines. Students develop knowledge of the underlying mathematical and scientific principles involved in the operation, construction and major subsystems of the two and four stroke internal combustion engines, rotary engines and external combustion engines. Opportunities are provided to further extend their knowledge and skills by investigating computer-assisted technologies that are used to service, repair and maintain automotive vehicle engines. Students focus on the socioeconomic impact of engine technology on society, careers, occupations and the environment. They explore the rules and regulations governing their use and manufacture. They consider the relationship between engine operation and the types of fuels used, as well as the impact of alternative fuels in the future.

Unit content

This unit builds on the content covered in Unit 3.

This unit includes the knowledge, understandings and skills described below.

Automotive mechanics

Principles

- current and emerging scientific principles and developments in automotive operations and technologies
- diagrammatic representations of principles that underpin current automotive components and operations, including:
 - power train
 - steering systems
 - braking systems
- mathematical formula to explain current operations of automotive components, and assist in diagnosis of system performance
 - Torque [τ], $\tau = Fr$
 - Rotational Power [Pr], $P_r = \frac{2\pi}{60} n\tau$
 - Pressure [P] or Stress [σ], $(P) \sigma = \frac{F}{A}$

Maintenance and repair

- flow charts and problem-solving skills to diagnose faults in conjunction with the use of specialised tools and equipment
- service, repair and maintenance requirements of more advanced engines, and the skills, knowledge, materials, parts and equipment needed to optimise performance
- occupational safety and health requirements for different processes and collaborative practices involved in workshop activities

Systems

- identification of technological improvements in systems, subsystems and components in response to performance testing
- identification of advanced systems, subsystems and components that influence development and performance of automotive vehicles

Automotive industry

Rules and regulations

- state and federal authorities and laws relating to servicing, repair and modification of automotive systems

Social, economic and environmental implications and consequences

- future directions of the automotive industry and the implications for society
- alternative materials and power sources used in automotive technology
- new and emerging fuel sources, innovative designs and manufacturing processes that are sustainable on a global scale

Materials

- scenarios for the predicted uses of new and emerging materials selected for their properties and behaviours in the construction and use of automotive technologies

Design

- apply elements of design and techniques for generating and communicating design ideas
- current automotive design rules and regulations that meet needs of new and emerging automotive technologies

Managing production

- apply planning for, and management of small-scale production of prototypes, incorporating design elements underpinned by research and performance testing

School-based assessment

The Western Australian Certificate of Education (WACE) Manual contains essential information on principles, policies and procedures for school-based assessment that needs to be read in conjunction with this syllabus.

Teachers design school-based assessment tasks to meet the needs of students. The table below provides details of the assessment types for the Automotive Engineering and Technology General Year 12 syllabus and the weighting for each assessment type.

Assessment table – Year 12

Type of assessment	Weighting
<p>Response</p> <p>Students apply their knowledge and skills in responding to a series of stimuli or prompts in the following formats: tests, checklists, reports/essays, oral and ICT visual responses.</p>	15%
<p>Investigation and diagnostics</p> <p>Teachers assess student work in which they conduct and communicate investigations or diagnostic tests. The findings can be communicated in any appropriate form or combinations of, written, oral, practical technical report, graphical, multimedia, a folio or journal.</p> <p>Teachers assess how students investigate and diagnose automotive projects and issues past and present, and conceptualise planned projects.</p> <p>Types of evidence can include, observation checklists, evaluation tools (self, peer), journal, design proposal, practical technical reports, and project proposal presented using a range of communication strategies.</p>	20%
<p>Production and assembly</p> <p>Extended automotive project(s) where students control, evaluate and manage processes and projects as necessary.</p> <p>Teachers must assess the student's understandings and competence when using skills in automotive processes, and when managing production processes and plans.</p> <p>Teachers must also assess the completed task or product, and assembly process in terms of performance, manufacturers' specifications, quality and finish.</p> <p>Types of evidence may include assembled components, made products, journal, observation checklists and evaluation tools (self, peer), and on-balance judgements.</p>	50%
<p>Externally set task</p> <p>A written task or item or set of items of 50 minutes duration developed by the School Curriculum and Standards Authority and administered by the school.</p>	15%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units.

The assessment outline must:

- include a set of assessment tasks
- include a general description of each task
- indicate the unit content to be assessed
- indicate a weighting for each task and each assessment type
- include the approximate timing of each task (for example, the week the task is conducted, or the issue and submission dates for an extended task).

All assessment types must be included in the assessment outline at least twice with the exception of the externally set task which only occurs once.

The set of assessment tasks must provide a representative sampling of the content for Unit 3 and Unit 4.

Assessment tasks not administered under test/controlled conditions require appropriate validation/authentication processes.

Externally set task

All students enrolled in the Automotive Engineering and Technology General Year 12 course will complete the externally set task developed by the Authority. Schools are required to administer this task in Term 2 at a time prescribed by the Authority.

Externally set task design brief – Year 12

Time	50 minutes
Format	Written
	Conducted under invigilated conditions
	Typically between two and five questions/items
	Can require students to refer to source material
Content	The Authority informs schools during Term 3 of the previous year of the Unit 3 syllabus content on which the task will be based

Refer to the WACE Manual for further information.

Grading

Schools report student achievement in terms of the following grades:

Grade	Interpretation
A	Excellent achievement
B	High achievement
C	Satisfactory achievement
D	Limited achievement
E	Very low achievement

The teacher prepares a ranked list and assigns the student a grade for the pair of units. The grade is based on the student's overall performance as judged by reference to a set of pre-determined standards. These standards are defined by grade descriptions and annotated work samples. The grade descriptions for the Automotive Engineering and Technology General Year 12 syllabus are provided in Appendix 1. They can also be accessed, together with annotated work samples, through the Guide to Grades link on the course page of the Authority website at www.scsa.wa.edu.au

To be assigned a grade, a student must have had the opportunity to complete the education program, including the assessment program (unless the school accepts that there are exceptional and justifiable circumstances).

Refer to the WACE Manual for further information about the use of a ranked list in the process of assigning grades.

Appendix 1 – Grade descriptions Year 12

A	<p>Response</p> <p>Works independently to prepare detailed and meaningful annotated responses to a task using defined automotive principles and terminology. Uses structured evidence to make comparisons and to present conclusions about the interrelationship between automotive systems and the effect they have on society and the environment.</p>
	<p>Investigation and diagnostics</p> <p>Independently conducts investigations or diagnostic tests and clearly communicates findings in an appropriate form. Documentation provides clear, concise evidence of thorough investigation into the given problem and includes detailed diagnostic steps undertaken. Current and appropriate terminology is used to communicate knowledge and understanding. Includes a detailed evaluation of project processes, including suggestions for improvements to workflows.</p>
	<p>Production and assembly</p> <p>Works independently, applies correct operational procedures and rectifies faults. Assembles components to manufacturer or client specifications and effectively manages time. Produces projects to a high standard of quality and finish. Provides regular and accurate reports with evaluation of ongoing procedures, including modifications derived from evaluation. Organises and uses appropriate tools and equipment to complete tasks. Takes appropriate care of tools and equipment. Recognises hazards, and works with regard for the safety of self and others.</p>
B	<p>Response</p> <p>Prepares annotated responses to a task using automotive principles and terminology. Makes sound comparisons and comes to conclusions about the interrelationship between automotive systems and the effect they have on society and the environment.</p>
	<p>Investigation and diagnostics</p> <p>Conducts investigations or diagnostic tests and communicates findings in an appropriate form. Documentation displays evidence of thorough investigation into the given problem and includes detailed diagnostic steps undertaken. Current and appropriate terminology is used. Includes an evaluation of project processes and suggestions for improvements.</p>
	<p>Production and assembly</p> <p>Applies operational procedures, rectifies faults, and assembles components to manufacturer or client specifications. Produces projects to a high standard of quality and finish. Provides regular reports with evaluation of ongoing procedures, including modifications derived from evaluation and teacher suggestions. Uses appropriate tools and equipment to complete tasks. Takes appropriate care of tools and equipment. Recognises hazards, and works with regard for the safety of self and others.</p>
C	<p>Response</p> <p>With guidance, prepares annotated responses to a task using automotive principles and relevant terminology. Makes simple comparisons with straightforward conclusions about the interrelationship between automotive systems and the effect they have on society and the environment.</p>
	<p>Investigation and diagnostics</p> <p>With guidance, conducts investigations or diagnostic tests and satisfactorily communicates findings in a given form. Documentation displays evidence of investigation into the given problem and includes a list of diagnostic steps undertaken. Relevant terminology is used to communicate knowledge and understanding. With assistance, includes an evaluation of project processes.</p>
	<p>Production and assembly</p> <p>With guidance, applies planned operational procedures to construct products to a satisfactory standard. With assistance, rectifies faults and assembles components. Provides reports with some evaluation of ongoing procedures that includes teacher suggested modifications. With guidance, uses appropriate tools and equipment as required to complete tasks. Takes care of tools and equipment on most occasions. Works with some regard for the safety of self and others.</p>

D	Response Presents incomplete limited annotated responses to a task using basic automotive principles and limited terminology. Makes incomplete comparisons and conclusions about the interrelationship between automotive systems and the effect they have on society and the environment.
	Investigation and diagnostics With direction and supervision, conducts simple investigations or diagnostic tests. Findings are partially completed and communicated in a simple, given form. Documentation displays limited evidence of investigation into the given problem and includes an incomplete list of diagnostic steps undertaken. Uses a limited amount of relevant terminology. Evaluation is mostly incomplete or irrelevant.
	Production and assembly With direction and supervision, applies some planned operational procedures to construct products. With constant assistance, may rectify simple faults and assemble components, but typically not to manufacturer or client specifications. Provides brief or incomplete reports with no evaluation of ongoing procedures. With regular guidance and close supervision, uses simple tools and equipment. Demonstrates little care of tools and equipment. Typically does not recognise hazards and/or takes risks/makes mistakes that lead to unsafe situations for self and others.
E	Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.