



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

AUTOMOTIVE ENGINEERING AND TECHNOLOGY

General course

Year 11 syllabus

Acknowledgement of Country

Kaya. The School Curriculum and Standards Authority (the Authority) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The Authority acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

Important information

This syllabus is effective from 1 January 2025.

Users of this syllabus are responsible for checking its currency.

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Contents

Contents.....	3
Rationale.....	1
Course outcomes	2
Organisation	3
Structure of the syllabus.....	3
Organisation of content.....	4
Representation of the general capabilities.....	6
Representation of the cross-curriculum priorities	8
Sustainability	8
Unit 1	9
Unit description	9
Unit content.....	9
Unit 2	11
Unit description	11
Unit content.....	11
School-based assessment.....	13
Assessment table – Year 11	13
Grading	14
Appendix 1 – Grade descriptions Year 11	15

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 work health and safety 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 11 syllabus is divided into two units, each of one semester duration, which are typically delivered as a pair. The notional time for each unit is 55 class contact hours.

Unit 1

In this unit, students develop an understanding of automotive vehicles and the basic principles and systems around which automotive vehicles function. Under guidance, they study the different systems of an automotive vehicle, and follow basic rules associated with automotive workshops. They develop skills to check and maintain the safe operation of an automotive vehicle, using the correct selection of tools and safe workshop practices. They examine how the different uses of automotive vehicles have affected our society and the environment.

Unit 2

In this unit, students develop knowledge and skills involved with servicing automotive vehicles for purposes of maintenance and repair, in combination with an understanding of automotive engineering principles. Students develop knowledge and skills involved with the different systems and sub-systems in automotive vehicles for purposes of maintenance and repair. They use work health and safety rules and regulations to plan and manage safe working practices. Students develop an understanding of the different influences automotive technologies have on the society and environment.

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.

Maintenance and repair

Students explore the specific skills and processes involved in the service, maintenance and repair operations on different engine types and vehicle operating systems. Students learn and undertake activities for diagnosis, overhaul, fabrication, machining, dent and corrosion repair, and refinishing of vehicle components. They also undertake tasks of maintenance, service and testing, repair and/or replacement of panels, using safe work practices and observing work health and safety regulations. Students explore tools and computer-assisted technology specific to the automotive industry, such as those used in fault diagnosis, repair 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 work health and safety 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 cross-curriculum priorities 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 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 general capabilities 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 1

Unit description

In this unit, students develop an understanding of automotive vehicles and the basic principles and systems around which automotive vehicles function. Under guidance, they study the different systems of an automotive vehicle, and follow basic rules associated with automotive workshops. They develop skills to check and maintain the safe operation of an automotive vehicle, using the correct selection of tools and safe workshop practices. They examine how the different uses of automotive vehicles have affected our society and the environment.

Unit content

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

Automotive mechanics

Principles

- the scientific principles in relation to automotive functioning
 - Otto cycle
 - reciprocating and rotary motion
 - hydraulics
 - forces
 - mechanical advantage
 - alignment

Maintenance and repair

- apply testing techniques involved with daily/weekly checks and monitoring of the operation of single or multi-cylinder engines
- identify and use tools, equipment, parts and materials used in automotive industry

Systems

- 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

- storage, use and care of tools and machinery
- work health and safety procedures, working safely in the workshop and safe use of prescribed machinery and technologies
- apply the rules associated with the use of vehicles when servicing/ maintenance

Social, economic and environmental implications

- different forms of transportation used in society
- categories of occupations and careers associated with the automotive and affiliated industries
- the impact of materials processing and the effects on the environment and society

Materials

- different types of component materials and their application to various design concepts
- identification and use of fasteners and methods of fitting and fixing materials and components
- understanding of fundamental methods of forming and machining materials for specific needs
- aesthetic and environmental properties of materials in prescribed context

Design

- apply design skills, including:
 - brainstorming
 - investigating and generating ideas
 - fundamentals of communicating design by graphics
 - graphical representation

Managing production

- prepare and execute simple production plans, time planning, identification of resource needs, and evaluation of manufacturing processes

Unit 2

Unit description

In this unit, students develop knowledge and skills involved with servicing automotive vehicles for purposes of maintenance and repair, in combination with an understanding of automotive engineering principles. Students develop knowledge and skills involved with the different systems and sub-systems in automotive vehicles for purposes of maintenance and repair. They use work health and safety rules and regulations to plan and manage safe working practice. Students develop an understanding of the different influences automotive technologies have on the society and environment.

Unit content

This unit builds on the content covered in Unit 1.

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

Automotive mechanics

Principles

- the scientific principles in their relation to automotive functioning
 - Otto cycle
 - reciprocating and rotary motion
 - hydraulics
 - forces
 - mechanical advantage
 - alignment
 - transmission of electrical and mechanical power
 - conversion of heat energy into mechanical energy

Maintenance and repair

- carry out tune-ups, oil changes and service schedules to maintain optimal performance
- identify and use tools, equipment, parts and materials used in repair and correction of mechanical faults
- maintain work health and safety procedures, working safely in the workshop and safe use of prescribed machinery and technologies
- apply rules associated with the use of vehicles when servicing/maintenance

Systems

- operating functions of 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
- road traffic control and different types of vehicles
- authorities responsible for rules and regulations, and legal implications of vehicle design and road use

Social, economic and environmental implications

- categories of occupations and careers associated with the automotive and affiliated industries
- automotive design, size and capacity
- cost of operating different forms of vehicles
- environmental issues and considerations of materials used and automotive emissions

Materials

- physical and mechanical properties of materials used in automotive technologies
- identification and use of methods of welding materials
- consider workshop-based, computer-assisted fabrication techniques

Design

- apply design skills, including:
 - brainstorming
 - investigating and generating ideas
 - fundamentals of communicating design by graphics
 - graphical representation
- consider Australian Design Rules in relation to vehicle design

Managing production

- prepare and use planning for, and management of manufacturing processes
- compare strategies for automotive design and component design

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 11 syllabus and the weighting for each assessment type.

Assessment table – Year 11

Type of assessment	Weighting
<p>Response 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>	20%
<p>Investigation and diagnostics 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. Teachers assess how students investigate and diagnose automotive projects and issues past and present, and conceptualise planned projects. 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 Extended automotive project/s where students control, evaluate and manage processes and projects as necessary. Teachers must assess the student's understandings and competence when using skills in automotive processes, and when managing production processes and plans. Teachers must also assess the completed task or product, and assembly process in terms of performance, manufacturers' specifications, quality and finish. Types of evidence can include assembled components, made products, journal, observation checklists and evaluation tools (self, peer), and on-balance judgements.</p>	60%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units (or for a single unit where only one is being studied).

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).

In the assessment outline for the pair of units, each assessment type must be included at least once over the year/pair of units. In the assessment outline where a single unit is being studied, each assessment type must be included at least once.

The set of assessment tasks must provide a representative sampling of the content for Unit 1 and Unit 2.

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

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 (or for a unit where only one unit is being studied). 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 11 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 11

A	<p>Response</p> <p>Works independently to prepare detailed and meaningful annotated responses to a task using defined automotive principles and terminology. Using structured evidence, makes 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>Independently conducts investigations or diagnostic tests; findings are clearly communicated in an appropriate form. Develops documentation which provides clear, concise evidence of thorough investigation into the given problem and includes detailed diagnostic steps undertaken. Uses current and appropriate terminology. Includes a detailed evaluation of project processes.</p>
	<p>Production and assembly</p> <p>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; includes 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; communicates findings in an appropriate form. Develops documentation which displays evidence of thorough investigation into the given problem and includes detailed diagnostic steps undertaken. Uses current and appropriate terminology. Includes an evaluation of project processes.</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; includes 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 simple automotive principles and terminology. Makes simple comparisons and comes to 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 assistance, conducts simple investigations or diagnostic tests; adequately communicates findings in a given form. Develops documentation which displays some evidence of investigation into the given problem and includes a list of some diagnostic steps undertaken. Uses some current terminology. With assistance, includes a limited evaluation of project processes.</p>
	<p>Production and assembly</p> <p>With regular guidance, applies some planned operational procedures to construct products to a satisfactory standard. With assistance, rectifies simple faults and assembles components, but typically not to manufacturer or client specifications. Provides occasional reports with some evaluation of ongoing procedures that includes teacher suggested modifications. With occasional guidance, uses appropriate tools and equipment as required to complete tasks. Takes care of tools and equipment on some occasions. Works with some regard for the safety of self and others.</p>
D	<p>Response</p> <p>With guidance and direction, prepares incomplete and sparsely 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.</p>
	<p>Investigation and diagnostics</p> <p>With direction and supervision, conducts simple investigations or diagnostic tests; communicates findings that are partially completed and in a simple, given form. Develops documentation which displays limited evidence of investigation into the given problem and includes an incomplete list of diagnostic steps undertaken. Uses only a small amount of current terminology. Does not submit an evaluation of project processes or evaluation is mostly incomplete.</p>
	<p>Production and assembly</p> <p>With regular guidance, applies some planned operational procedures to construct products, but they are typically of a poor standard. With constant assistance, may rectify simple faults and assemble components, but typically not to manufacturer or client specifications. Provides very poor 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.</p>
E	<p>Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.</p>

