



NCFE Level 1/2 Technical Award in Engineering (603/7006/3)

Examined assessment

Paper number: Past paper
Date: Summer 2025

Mark Scheme

v1.0 Post-Standardisation

This Mark Scheme has been written by the assessment writer and refined, alongside the relevant questions, by a panel of subject experts through the external assessment writing process and at standardisation meetings.

The purpose of this Mark Scheme is to give you:

- examples and criteria of the types of response expected from a learner
- information on how individual marks are to be awarded
- the allocated assessment objectives (AOs) and total mark for each question.

Marking guidelines

General guidelines

You must apply the following marking guidelines to all marking undertaken throughout the marking period. This is to ensure fairness to all learners, who must receive the same treatment. You must mark the first learner in exactly the same way as you mark the last.

- The Mark Scheme must be referred to throughout the marking period and applied consistently. Do not change your approach to marking after standardisation.
- Reward learners positively giving credit for what they have shown, rather than what they might have omitted.
- Utilise the whole mark range and always award full marks when the response merits them.
- Be prepared to award zero marks if the learner's response has no creditworthy material.
- Do not credit irrelevant material that does not answer the question, no matter how impressive the response might be.
- If you are in any doubt about the application of the Mark Scheme, you must consult with your team leader or the chief examiner.

Guidelines for using extended-response marking grids

Extended-response marking grids have been designed to award a learner's response holistically and should follow a best-fit approach. The grids are broken down into bands, with each band having an associated descriptor indicating the performance at that band. You should determine the band before determining the mark.

When determining a band, you should use a bottom-up approach. If the response meets all the descriptors in the lowest band, you should move to the next one, and so on, until the response matches the band descriptor. Remember to look at the overall quality of the response and reward learners positively, rather than focusing on small omissions. If the response covers aspects at different bands, you should use a best-fit approach at this stage and use the available marks within the band to credit the response appropriately.

When determining a mark, your decision should be based on the quality of the response in relation to the descriptors. You must also consider the relative weightings of the AOs, so as not to over / under credit a response. Standardisation materials, marked by the chief examiner, will help you with determining a mark. You will be able to compare exemplar learner responses to live responses, to decide if they are the same, better or worse.

You are reminded that the indicative content provided under the marking grid is there as a guide, and therefore you must credit any other suitable responses a learner may produce. It is not a requirement that learners must cover all of the indicative content to be awarded full marks.

Assessment objectives (AOs)

This unit requires learners to:

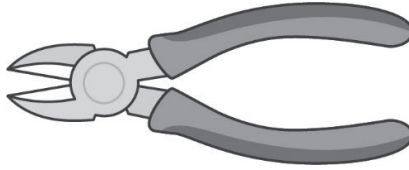
AO1	Recall knowledge and show understanding. The emphasis here is for learners to recall and communicate the fundamental elements of knowledge and understanding.
AO2	Apply knowledge and understanding. The emphasis here is for learners to apply their knowledge and understanding to real-world contexts and novel situations.
AO3	Analyse and evaluate knowledge and understanding. The emphasis here is for learners to develop analytical thinking skills to make reasoned judgements and reach conclusions.

The weightings of each AO can be found in the Qualification Specification.

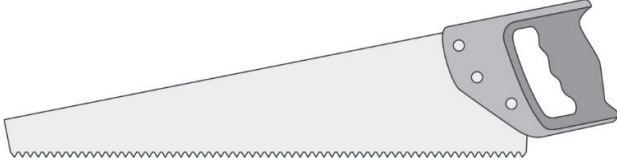
Q	Mark scheme	Total marks
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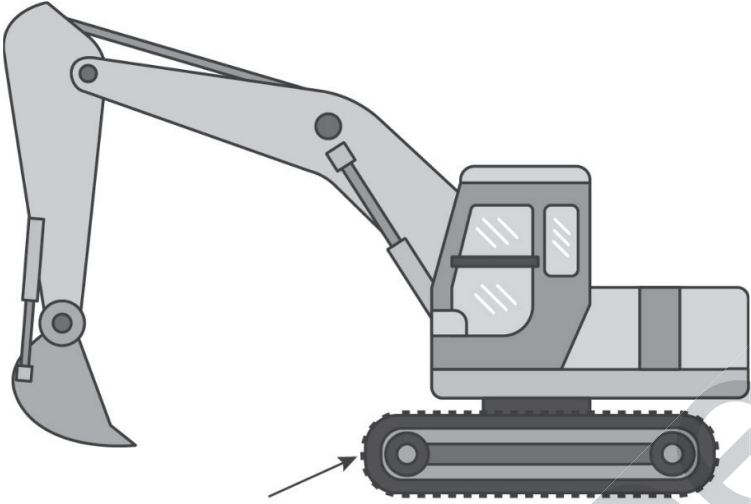
Section A

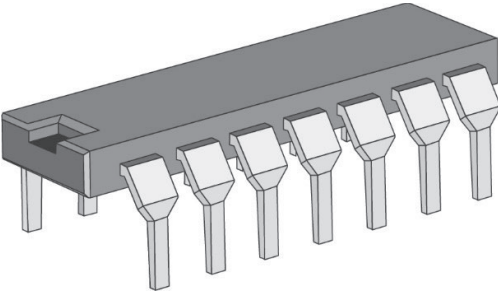
Total for this section: 33 marks

1	 Which one of the following tools is shown in the image above? A Long nose pliers B Open-ended spanner C Ratchet spanner D Side cut pliers Answer: D – Side cut pliers	1 AO1=1
2	Which one of the following relates to the transfer of heat from one surface to another? A Combustion B Conductivity C Flammability D Plasticity Answer: B – Conductivity	1 AO1=1
3	Which one of the following is a thermoplastic? A Acrylic B Neoprene C Silicone D Thermoset Answer: A – Acrylic	1 AO1=1

4	Name three non-ferrous alloys. Award one mark for each correct non-ferrous alloy, up to a maximum of three marks: • brass (1) • bronze/ phosphor bronze (1) • solder (1) • silver solder (1). Accept any other suitable response.	3 AO1=3
5 (a)	MDF is an example of a manufactured board. Identify one other type of manufactured board. Award one mark for correctly identifying a type of manufactured board: • plywood (1) • chipboard (1). Do not accept MDF. Accept any other suitable response.	1 AO1=1
5 (b)	Give two reasons why MDF is suitable for shelving. Award one mark for each correct reason, up to a maximum of two marks: • MDF is suitable for use in mass production (1). • MDF can be painted / varnished to give high quality finishes (1). • MDF is manufactured in large sheets that can easily be cut to size (1). • MDF can be laminated with other materials (1). • MDF does not warp easily (1). Accept any other suitable response.	2 AO2=2

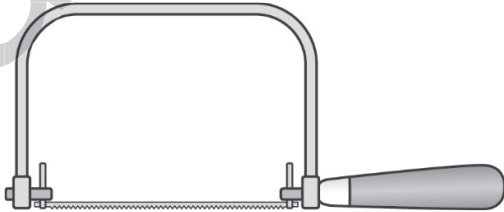
6	 Name the type of saw shown in the image above. Award one mark for correctly naming the saw: • crosscut hand saw (1) • panel saw (1).	1 AO1=1
7 (a)	A hydraulics system is a type of mechanical device. Name two other mechanical devices an engineer might use. Award one mark for each correct mechanical device, up to a maximum of two marks: • gears (1) • pulleys (1). Do not accept hydraulics. Accept any other suitable response.	2 AO1=2
7 (b)	State one use of hydraulics. Award one mark for correctly stating a use of hydraulics: • used to raise / lower bridges (1) • used to lift cars in a garage (1) • used in brakes to stop cars / vehicles (1) • used in diggers to lift / move heavy materials (1). Accept any other suitable response.	1 AO1=1

7 (c)	Rubber is an elastomer used to form part of the outside of the caterpillar track shown in the image below.  Explain why rubber is suitable for a caterpillar track. Award one mark for each explanation point, up to a maximum of two marks: • Rubber's elasticity allows it to conform to different surfaces (1) and provide a better grip on uneven ground (1). • Rubber is resistant to corrosion (1) which makes it a better choice in wet or corrosive environments (1). • Rubber has excellent shock-absorbing properties (1) which helps to protect the machinery / provide a smoother ride / reduces wear on the suspension (1). • The durability of rubber makes it highly resistant to wear / tear (1) reducing the need for frequent replacement (1). Accept any other suitable response.	2 AO2=2
8	Which one of the following would be the most efficient for demolition work? A Band saw B Jigsaw C Mechanical hacksaw D Reciprocating saw Answer: D – Reciprocating saw	1 AO1=1

9	The image below shows an integrated circuit (IC).  Describe the function of an IC within two types of devices. Award one mark for each description point, up to a maximum of four marks: • ICs (such as amplifiers) found in audio / media equipment such as televisions / mobile phones (1) can strengthen weak signals (1). • ICs (such as counters) found in watches / microwaves / cooking appliances (1) can track and count electrical pulses to measure time or cycles (1). • ICs (such as decoders / encoders) used for communications (1) convert data from one form to another (1). • ICs (such as logic gates) found in smartphones / tablets / memory devices (1) perform decision-making tasks based on inputs (1). • ICs (such as memory chips) in laptops / PCs / mobile phones / memory devices (1) are used to store data (1). • ICs (such as microcontrollers / microprocessors) found in robotics / washing machines / drones (1) execute commands for automation (1). • ICs (such as power management chips) that can be found in computers / printers / copiers / televisions / monitors (1) regulate power flow (1). • ICs (such as sensor applications) found in night lights / alarm systems (1) detect motion or changes in temperature / light (1). • ICs (such as timers) in sporting or stadium clocks / bank safes / alarm systems (1) control / measure time intervals for specific tasks (1). Accept any other suitable response.	4 AO2=4
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10 (a)	State two properties of magnets. Award one mark for each correct statement, up to a maximum of two marks: • Magnets attract ferrous metals such as iron / steel / nickel / cobalt (1). • The North and South poles on magnets attract each other (1). • Magnets create a magnetic field (1). • Magnets can pull / push objects (1). Accept any other suitable response.	2 AO1=2
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10 (b)	Magnets can be used on fridges to keep the door securely closed. Explain how magnets are used in the door seals on fridges. Award one mark for each explanation point, up to a maximum of two marks: • Magnets that are built in / joined / attached to the door seal (1) are attracted to the steel of the fridge (1). • Magnets create a magnetic attraction (1) that seals the door and steel frame together (1). • The attraction between the steel fridge and the door magnet (1) creates a strong seal to keep the cold air in (1). Accept any other suitable response.	2 AO2=2
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11 (a)	The image below shows a coping saw.  State one way that a coping saw can be adjusted. Award one mark for the correct adjustment: • twist / turn the saw handle / ferrule / blade / pins (1).	1 AO1=1
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11 (b)	Explain why a coping saw would be used to cut detailed shapes on a cabinet door. Award one mark for each explanation point, up to a maximum of two marks: • The blade can be adjusted for easier movement (1) to cut around more complex curves when adding detail (1). • The blade can be adjusted to change the direction of the cut (1) and allow movement around more complex shapes (1). • The blade can be adjusted so that the user has more space (1) to hold the saw handle firmly and comfortably when working in small areas (1). Accept any other suitable response.	2 AO2=2
12	Discuss why nails are used in some products, but not in others. Give one example to support your answer. Award one mark for each discussion point, up to a maximum of three marks: • Nails can loosen over time (1). They are used in temporary structures like prototypes but avoided in permanent structures like chairs (1). This is because they are quick to install but unsuitable for products where durability is needed (1). • Nails can split some materials (1). They are used in rough structures like fencing because they are cost-effective (1), but splitting weakens the structural integrity so alternatives may be needed (1). • Nails can be difficult to remove (1). They are used in disposable products like crates but avoided in flat-pack furniture like bookshelves (1). This is because they are suitable for one-time use but impractical for products needing disassembly (1). • Nails can leave an untidy finish (1). They are used to build fences but avoided in decorative furniture like cabinetry (1). This is because appearance is not a concern in rough jobs but is critical for a high-quality finish (1). • Nails are cheaper than screws or bolts (1). They are used in low-cost products like pallets but avoided in premium furniture like wardrobes (1). This is because they are cost-effective for temporary structures, but higher-end products prioritise durability and aesthetics (1). • Nails are available in various shapes and grades (1). They are used in roofing but avoided in machinery (1). This is because the variety makes them versatile for wood structures, but they lack the strength and precision needed for metal structures (1). Accept any other suitable response.	3 AO3=3

13	Which one of the following adhesives needs hardener added to it before it can be used? A Contact adhesive B Epoxy resin C Polyvinyl acetate (PVA) D Super glue (cyanoacrylate) Answer: B – Epoxy resin	1 AO1=1
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14	Name two types of screwdrivers. Award one mark for each correct type of screwdriver, up to a maximum of two marks: • Phillips (1) • Torx (1) • Slotted (1) • Pozidriv (1). Accept any other suitable response.	2 AO1=2
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Q	Mark scheme	Total marks
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Section B

Total for this section: 14 marks

15	Which one of the following metal manufacturing processes uses heat? A Bolting B Casting C Drilling D Filing Answer: B – Casting	1 AO1=1
16	Which one of the following is a production planning tool? A BS 8888 B Control measures C Equipment checklist D Flow chart Answer: D – Flow chart	1 AO1=1
17	Give two benefits of using a time plan when working on a project. Award one mark for each correct benefit, up to a maximum of two marks: • Planning of resources can be done (1). • An estimated completion date can be given to the customer (1). • Each part of production can be broken down (1). • It is helpful to work out costs (1). • Waste of time / materials can be minimised (1). • The efficiency of the production can be managed (1). • There will be less interruption to production (1). Accept any other suitable response.	2 AO1=2

18	Suggest one safety check that should be done before using a pillar drill to drill through a piece of metal. Award one mark for a correct safety check: • Check that the correct drill bit is being used for metal (1). • Check that correct clothing / apron is worn (1). • Check that a suitable machine vice for metal is used (1). Accept any other suitable response.	1 AO2=1
19	A high-speed train is travelling between Leeds and London. The distance between these two stations is 195 miles and the journey time is 2 hours. Use the formula: speed (s) = distance (d) ÷ time (t) Calculate the average speed of the train. Award one mark as detailed below, up to a maximum of two marks: • $195 \div 2 (1) = 97.5$ (miles per hour / mph) (1). Award two marks if correct answer seen. Accept answer in any valid unit.	2 AO2=2
20	A minibus has a mass of 3500 kg and travels north at a speed of 25 m/s. Use the formula: momentum (p) = mass (m) × velocity (v) Calculate the momentum of the minibus. Award one mark as detailed below, up to a maximum of two marks: • $3500 \times 25 (1) = 87\,500$ (kg m/s north) (1). Award two marks if correct answer seen.	2 AO2=2

21	State what amperes (amps) are used to measure. Award one mark for a correct statement: • electrical current / current (1). Accept any other suitable response.	1 AO1=1
22	Convert 650 milliamps to amps. AO1 Award one mark for evidence of correct conversion or calculation: • 1000 milliamps = 1 amp (1) OR • 650 ÷ 1000 (1) AO2 Award two marks if correct answer seen: • 0.65 (amps / A) (2). Award a maximum of two marks in total.	2 AO1=1 AO2=1
23	State two activities that need to be completed to prepare materials for processing. Award one mark for each correct activity: • cleaning (1) • marking out (1). Accept any other suitable response.	2 AO1=2

Q	Mark scheme	Total marks
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Section C

Total for this section: 15 marks

24	An engineer is working on the design of an office building. Give two reasons why an engineer might use isometric drawings in the design process. Award one mark for each correct reason, up to a maximum of two marks: • to help visualise how the final building will look (1) • to show customers / clients / others the building design idea (1) • to help work out the materials required for the product (1) • to help work out what fixings / materials may be needed in construction (1) • to help work out any design flaws that could be put right before a prototype building is made (1). Accept any other suitable response.	2 AO2=2
25	An engineer is using computer-aided design (CAD) software to design an aircraft. The design needs to be safe, reliable and able to carry heavy loads. The engineer is considering using finite element modelling (FEM) to help with the design. Discuss two advantages of using FEM for this design. Award one mark for each discussion point, up to a maximum of four marks: • FEM simulates real-world conditions the aircraft will experience, such as air pressure, temperature extremes and turbulence / physical stress, (1) which will ensure that the aircraft is fit for purpose / safe (1). • FEM identifies points of weakness in the aircraft design (1), enabling the engineer to modify and strengthen areas and improve durability (1). • FEM reduces the need for physical prototypes, cutting production time (1) which allows further development of the design (1).	4 AO3=4

	- FEM reduces the need for physical prototypes, reducing costs (1) which is important due to the high cost of materials involved in the manufacture of an aircraft (1). - FEM identifies areas where material can be minimised or reinforced (1), saving material waste while maintaining strength and safety (1). Accept any other suitable response.	
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26 (a)	Orthographic projection drawings should include a range of information.  Identify what is shown by the image above. Award one mark for correctly identifying the image: dimension / dimension line / measurement / length (1).	1 AO1=1
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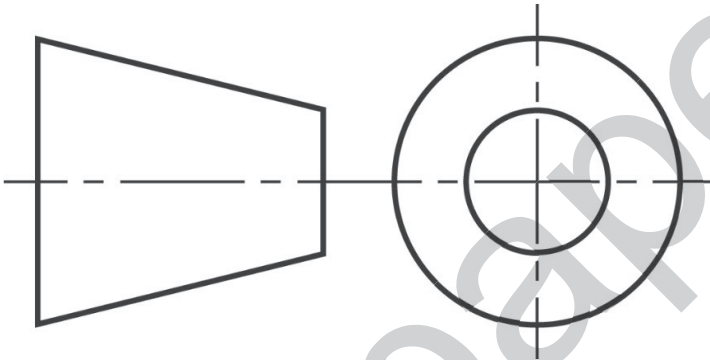
26 (b)	The tolerance for the value of 15 shown in the image is ± 0.1 State the minimum value that will be within tolerance. Award one mark for the correct minimum value: 14.9 (1).	1 AO2=1
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27	Designers often use freehand sketches when generating ideas. These sketches may include additional elements to help designers develop the design. Discuss why designers might include one of the following additional elements: - rendering - annotation.	3 AO3=3
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	Award one mark for each discussion point, up to a maximum of three marks: Rendering: - including details relating to direction of light such as shadow or texture (1) will give drawings more realism / a more realistic 3D finish (1) which will better showcase the idea (1) - including colour (1) to indicate elements such as materials or finish (1) will communicate the design / finished product more effectively (1) increasing the chance that the design will be approved (1). Annotation: - is used to describe features / functions / or to list points of the product specification (1) which will highlight critical information to a third party (1) helping them to better understand the idea (1) - can include materials information (1) specific to each part of the design (1) which will indicate specification points about materials / features / construction (1) - including manufacturing details (1) such as suggested processes to produce components / methods of construction and building prototypes (1) can help to select processes, tools and machines to make the design (1) which will better show how the finished product could look (1). Accept any other suitable response.	
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28	Explain why it is important to use scale in an automotive engineering drawing. Award one mark for each explanation point, up to a maximum of two marks: - Scale helps to reduce large parts (such as doors or panels) into workable size drawings (1) reducing the need for excessive detail while still presenting essential information (1). - Scale helps to enlarge small parts (such as engine components) into workable size drawings (1). This allows the engineer to design and manufacture parts accurately, ensuring they meet safety and performance standards (1). - Scale allows for a whole assembly (like a vehicle) to be represented on a single page (1) making it easier for engineers to visualise the final product (1). - Scale helps engineers to visualise limited space within a vehicle (1). This is crucial in automotive engineering where components like the engine or transmission must fit compactly and precisely (1).	2 AO2=2
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	- Scaled drawings ensure that components (such as the gearbox) will fit and function together (1). This allows the engineer to manufacture parts that align and operate smoothly (1). - Scaled drawings reduce the risk of errors during production (of automotive parts like pistons) by providing exact dimensions (1). This minimises costly mistakes and ensures quality standards (1). Accept any other suitable response.	
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29	The image below shows a projection symbol used in a third angle orthographic drawing of a new car.  Explain why an automotive engineer would use this projection symbol in a third angle orthographic drawing. Award one mark for each explanation point, up to a maximum of two marks: - It shows the method of projection used in the drawing (1) which avoids confusion with first angle projection (1). - It shows that the top view of the car is placed below the front view (1) which ensures the exact shapes / layouts are understood (1). - The symbol shows that the right side view of the car is placed to the right of the front view (1) which ensures the exact shapes / layouts are understood (1). - The symbol represents how the car is presented on the drawing (1) which ensures that all parties can interpret it accurately (1). Accept any other suitable response.	2 AO2=2
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Q	Mark scheme	Total marks
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Section D

Total for this section: 18 marks

30	Manufacturers produce a wide range of household appliances like washing machines and television sets. These appliances may only work for a few years. Analyse: - the importance for manufacturers to switch to more environmentally friendly products and business practices - how manufacturers could make their products more sustainable to reduce their environmental impact. Support your answer with examples of sustainable manufacturing. <table border="1"> <thead> <tr> <th>Band</th><th>Mark</th><th>Descriptor</th></tr> </thead> <tbody> <tr> <td>3</td><td>7 to 9</td><td> AO3 – excellent analysis of the importance for manufacturers to become more sustainable in both processes and products and the consequences of this outcome that is comprehensive and highly relevant. AO2 – excellent application of knowledge and understanding of how more sustainable products will reduce the environmental impact of manufacturing that is comprehensive and highly detailed and highly relevant. AO1 – excellent recall of knowledge and understanding of sustainable materials and processes that is comprehensive. Subject-specific terminology is used consistently throughout. </td></tr> </tbody> </table>	Band	Mark	Descriptor	3	7 to 9	AO3 – excellent analysis of the importance for manufacturers to become more sustainable in both processes and products and the consequences of this outcome that is comprehensive and highly relevant. AO2 – excellent application of knowledge and understanding of how more sustainable products will reduce the environmental impact of manufacturing that is comprehensive and highly detailed and highly relevant. AO1 – excellent recall of knowledge and understanding of sustainable materials and processes that is comprehensive. Subject-specific terminology is used consistently throughout.	9 AO1=3 AO2=3 AO3=3
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Band	Mark	Descriptor
2	4 to 6	AO3 – good analysis of the importance for manufacturers to become more sustainable in both processes and products and the consequences of this outcome that is detailed and mostly relevant. AO2 – good application of knowledge and understanding of how more sustainable products will reduce the environmental impact of manufacturing that is detailed and mostly relevant to the question. AO1 – good recall of knowledge and understanding of sustainable materials and processes that is mostly detailed. Subject-specific terminology is used, but not always consistently.
1	1 to 3	AO3 – limited analysis of the importance for manufacturers to become more sustainable in both processes and products and the consequences of this outcome that has minimal detail and is mostly superficial. AO2 – limited application of knowledge and understanding of how more sustainable products will reduce the environmental impact of manufacturing that has minimal detail and is mostly superficial. AO1 – limited recall of knowledge and understanding of sustainable materials and processes that has minimal detail. Subject-specific terminology is often inappropriate, and a lack of understanding is evident.
	0	No rewardable material

Examiners are reminded that indicative content reflects content-related points that learners may make but is not an exhaustive list, nor is it a model answer. Learners may make all, some or none of the points included in the indicative content. Learners must be credited for any other appropriate response.

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	Indicative content AO1 – learners will recall knowledge and understanding of sustainable materials and processes that may include the following: • Materials chosen are recyclable. • Materials used come from sustainable sources. • Materials are used which can be separated at the end of a product's useful life. • Manufacturing processes limit waste. • The manufacturing processes that are chosen use fewer resources and less energy. AO2 – learners will apply knowledge and understanding of how more sustainable products will reduce the environmental impact of manufacturing that may include the following: • Identifying the environmental impact of manufacturing more sustainable products: ○ Recyclable products will become more common and less expensive. ○ Finite resources will last longer and less will need to be extracted from the earth. ○ Less waste will be created and therefore there will be less environmental damage or pollution. ○ Less energy will be consumed in the production of the more sustainable products, as recycled and recyclable materials could be used. • Suggesting what changes and benefits will come from the production of sustainable products: ○ A reduced amount of material would be sent to landfill. ○ Reduction of manufacturing costs as waste is minimised or can be recycled / reused. ○ An increased opportunity to develop new sustainable manufacturing processes. AO3 – learners will analyse the importance of switching to more sustainable products and business practices that may include the following: • The impact of sustainable products and manufacturing output: ○ Reduced environmental impact as fewer resources need to be extracted. ○ Transportation of resources reduces as materials could be recycled rather than being extracted at source. ○ Less environmental destruction as resources required can come from recycled sources. ○ Matching the global move towards sustainable manufacturing and production. ○ The potential for a greater market share as customers move to sustainable products.	
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	• The potential for the development of a range of sustainable products as customer base increases. • It allows consumers the choice to repair rather than scrap and replace. • Fewer scrapped products means less waste and pollution from the materials used in manufacture. Accept any other suitable response.	
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31	The modern world relies heavily on telecommunications. This helps with almost every aspect of our lives but it can also create problems. Analyse the advantages and disadvantages of telecommunications networks. Support your answer with examples of how telecommunications are used. <table border="1"> <thead> <tr> <th>Band</th><th>Mark</th><th>Descriptor</th></tr> </thead> <tbody> <tr> <td>3</td><td>7 to 9</td><td> AO3 – excellent analysis of the possible advantages and disadvantages of telecommunications that is comprehensive and highly relevant. AO2 – excellent application of knowledge and understanding of the possible advantages and disadvantages of telecommunications that is comprehensive and highly detailed and highly relevant. AO1 – excellent recall of knowledge and understanding of how telecommunications are used that is comprehensive. Subject-specific terminology is used consistently throughout. </td></tr> </tbody> </table>	Band	Mark	Descriptor	3	7 to 9	AO3 – excellent analysis of the possible advantages and disadvantages of telecommunications that is comprehensive and highly relevant. AO2 – excellent application of knowledge and understanding of the possible advantages and disadvantages of telecommunications that is comprehensive and highly detailed and highly relevant. AO1 – excellent recall of knowledge and understanding of how telecommunications are used that is comprehensive. Subject-specific terminology is used consistently throughout.	9 AO1=3 AO2=3 AO3=3
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	Indicative content AO1 – learners will recall knowledge and understanding of how telecommunications are used that may include the following: • Mobile networks: ○ 3G video calls / communication ○ 4G streaming / gaming / high-quality video calls / communication ○ 5G smart products / automation • Satellites – GPS / weather forecasting / broadcasting / military surveillance / communication • Telephone – communication • Radio – communication / broadcasting / entertainment / military operations • Fibre optics – internet. AO2 – learners will apply knowledge and understanding of the possible advantages and disadvantages of telecommunications that may include the following: Mobile networks: • Advantages: ○ faster communication ○ automated technology and smart cities ○ high-quality video calls ○ gaming and streaming from remote locations • Disadvantages: ○ expensive infrastructure to install and maintain ○ limited coverage in rural areas ○ health and environmental concerns (radiation fears and energy use) ○ risk of hacking and privacy concerns. Satellites: • Advantages: ○ provides communication in remote areas where cables are impractical ○ reliable for GPS, weather tracking and global broadcasting ○ used in emergency situations and military operations • Disadvantages: ○ expensive to launch and maintain satellites ○ signal delays in communication ○ risk of satellite debris causing space pollution ○ privacy concerns.	
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Telephone: • Advantages: ○ reliable and widely accessible communication ○ landlines are less prone to hacking compared to mobile networks ○ useful in emergencies when mobile networks fail • Disadvantages: ○ requires fixed location ○ limited mobility ○ expensive to maintain ageing infrastructure. Radio: • Advantages: ○ reliable for emergency communication, public broadcasting and entertainment ○ low-cost and widely available ○ does not rely on the internet or advanced technology • Disadvantages: ○ limited audio communication ○ no data transfer ○ poor quality over long distances without repeaters ○ declining use due to newer technologies. Fibre optics: • Advantages: ○ extremely fast and reliable for internet, TV and phone ○ supports large amount of data ○ energy-efficient and limited infrastructure • Disadvantages: ○ expensive to install and maintain – especially in rural areas ○ fragile cables are difficult to repair ○ limited access in some parts of the world. AO3 – learners will analyse the advantages and disadvantages of telecommunications that may include the following: Mobile networks: • Robust mobile networks enable faster communication, facilitating remote work, education and healthcare, especially in urban areas with reliable coverage. This is beneficial as it helps people stay connected and reduces regional barriers. However, rural areas lack proper infrastructure, leaving many communities unable to access the benefits, which creates inequality. • 5G technology supports smart cities and automated technology, improving healthcare and making daily life more efficient. However, 5G infrastructure is expensive to build and maintain, which limits its availability and raises concerns about environmental impact such as e-waste.
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	Satellites: • Satellites enable GPS, making travel and logistics more efficient by improving navigation. However, signal delays (latency) in satellite communication can make GPS less reliable for real-time operations like emergency rescues or military operations. • Satellites provide accurate weather forecasts, helping communities prepare for natural disasters like hurricanes, saving lives and property. However, the high costs of building and launching satellites means that poorer countries will struggle to access these life-saving technologies. • Satellites provide internet access to remote areas where cables cannot be installed. This helps people in these regions to connect with the world and access education and work opportunities. However, increasing amounts of space debris from old satellites can damage active satellites, risking disruptions. Telephone: • Landlines are reliable in emergencies when mobile networks fail, offering access to emergency services in disaster-prone areas. However, modern landlines often require electricity or internet to function, meaning they may no longer work during power outages. • Landlines offer secure communication, making them ideal for business and older individuals who make be more at risk of being hacked. However, their decline in popularity means maintaining the infrastructure has become more expensive. Radio: • Radio is a cheap and widely available tool for broadcasting information during emergencies, helping large populations stay informed without needing the internet. However, radio signals are limited to audio communication and have poor quality over long distances, making them less versatile. • Radio is useful in remote areas or for military operations where advanced technology is unavailable or unreliable. However, radio signals are susceptible to interference such as weather conditions or overlapping frequencies so in some cases is not a suitable choice.	
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	Fibre optics: • Fibre optic networks provide fast and reliable internet, which supports services like online education and global business operations. This technology allows people to connect instantly, improves productivity and creates opportunities you might not get without the internet. However, it is expensive to install fibre optic networks which means rural and poorer areas are left without access, widening the gap between regions. • They are energy-efficient, reducing environmental damage compared to older technologies. However, manufacturing and installing fibre optic cables requires significant resources, contributing to pollution and harming the environment. Accept any other suitable response.	
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Assessment objective (AO) grid

Section A

Question	AO1	AO2	AO3	Total
1	1			1
2	1			1
3	1			1
4	3			3
5 (a)	1			1
5 (b)		2		2
6	1			1
7 (a)	2			2
7 (b)	1			1
7 (c)		2		2
8	1			1
9		4		4
10 (a)	2			2
10 (b)		2		2
11 (a)	1			1
11 (b)		2		2
12			3	3
13	1			1
14	2			2
Total	18	12	3	33

Section B

Question	AO1	AO2	AO3	Total
15	1			1
16	1			1
17	2			2
18		1		1
19		2		2
20		2		2
21	1			1
22	1	1		2
23	2			2
Total	8	6	0	14

Section C

Question	AO1	AO2	AO3	Total
24		2		2
25			4	4
26 (a)	1			1
26 (b)		1		1
27			3	3
28		2		2
29		2		2
Total	1	7	7	15

Section D

Question	AO1	AO2	AO3	Total
30	3	3	3	9
31	3	3	3	9
Total	6	6	6	18