



GCE AS MARKING SCHEME

SUMMER 2025

**AS
DESIGN & TECHNOLOGY – ENGINEERING DESIGN
2601U10-1**

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

GCE DESIGN & TECHNOLOGY
ENGINEERING DESIGN - UNIT 1
SUMMER 2025 MARK SCHEME

Guidance for examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

Banded mark schemes

For band marked questions mark schemes are in two parts, the indicative content and the assessment grid.

The indicative content suggests the range of issues which may be included in the learner's answers. It can be used to assess the quality of the learner's response. Indicative content is not intended to be exhaustive, and learners **do not** have to include all the indicative content to reach the highest level of the mark scheme.

In order to reach the highest levels of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that it contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

In Design and Technology, each question addresses one assessment objective: either AO3 or AO4. The assessment grid sub-divides the total mark to allocate for a question. These are shown in bands in the mark scheme. For each question, descriptors will indicate the different skills and qualities at the appropriate level.

Examiners should first read and place a tick in the learner's answer/s to indicate the evidence that is being assessed in that question; the mark scheme can then be applied. This is done as a two-stage process.

Stage 1 – Deciding on the band

Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptors for that band. If the descriptors at the lowest band are satisfied, examiners should move up to the next band and repeat this process for each band until the descriptors match the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance, if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark learners down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Question 1

The image shows a handheld modern rechargeable work light.		AO3	AO4	Mark
(a)	Select three design features of the handheld modern rechargeable work light and explain how each feature would be beneficial to the consumer.		✓	3x2
Benefits could include: • The magnetic base would allow the light to be held securely in position on magnetic surfaces such as car body parts. This would allow the user to work hands free. • The 360-degree adjustable head would enable the light to be directed accurately. • The multifunctional switch would facilitate different modes of operation (flashing, variable brightness and different colours). • The USB charging port would enable the product to be conveniently recharged using standardised technology.				
Guidance to markers Incorrect/no answer				0
Basic explanation of the benefit of the identified design feature: <i>(The magnetic base allows the lamp to be held securely)</i>				1
More detailed / developed explanation of the benefit of the identified of design feature with benefit: <i>(The magnetic base allows the lamp to be held securely...and this allows the user to work hands free with light)</i> Credit other correct responses Award no marks for identification of design feature only.				2

		AO3	AO4	Mark
(b)	This image shows a flip top hand-held torch that was designed in the 1980's. Explain a technological difference between this handheld torch and the work light.		✓	2
	The technological differences are LED technology, USB recharging port, and multi-functional operation. • The replacement of disposable batteries with an integrated rechargeable unit. This is better for the environment as the old batteries do not need to be frequently replaced and disposed of. • The use of LED technology which is brighter and more energy efficient than using incandescent lamps. • Multi-functional – this offers enhanced modes / performance and does more than simply illuminate. Award one mark for each technological difference No credit for identifying or explaining design features including magnet / 360-degree angle – these are design features and not technological developments. Guidance to markers – exemplar answer Incorrect/no answer			0
	<i>Disposable batteries have been replaced with a rechargeable unit</i> OR <i>The use of LED technology which is more energy efficient than using incandescent lamps.</i>			1
	<i>Disposable batteries have been replaced with a rechargeable unit via USB port which is a standard feature within electronic products. Recharging stations are readily available.</i> OR <i>The use of LED technology which is brighter and more energy efficient than using incandescent lamps. LED's do not need to be frequently replaced.</i> Credit other correct responses.			2
		Total		8

Question 2

A chain and sprocket mechanism used to transmit the drive from the engine to the rear wheel on a motorcycle is shown below. The small driver sprocket has 13 teeth and the large driven sprocket has 22 teeth.		AO3	AO4	Mark
(a)	Calculate the rotational velocity (RV) of the driven sprocket when the driver sprocket rotates at 1300 rpm. Show your calculation and your answer in the space provided.		✓	2
	RV of Driver x T = RV of driven x T $1300 \times 13 = ? \times 22$ $16,900 = ? \times 22$ $16,900/22 = 768.18\text{rpm}$ Guidance to markers Incorrect answer Correct formula or workings evident Correct answer given in rpm.			0 1 1
(b)	Describe the purpose of the extra sprocket in the diagram shown below.		✓	2
	The extra sprocket keeps the chain in tension so that it will not come off the other sprockets. Incorrect response			0
	Response shows some understanding			1
	Clear understanding / detailed response			2
	Exemplar answers: <i>The extra sprocket increases chain wrap / reduces slack/ maintains tension</i>			1
	<i>The extra sprocket increases chain wrap / reduces slack /maintains tension and prevents the chain from slipping off the sprockets</i>			2

		AO3	AO4	Mark
(c)	Explain the purpose of the elongated slot that has been cut into sprocket shown below.		✓	2
	Guidance to markers: The elongated slot is cut into the sprocket to allow this to fit onto the shaft and prevent slippage. Incorrect response <i>(The slot enables the sprocket to be easily lubricated)</i>			0
	Answer shows some understanding <i>(The slot enables the sprocket to be located onto the shaft)</i>			1
	Answer shows detailed understanding <i>(The slot allows the sprocket to be keyed onto its shaft so that it will not slip as the shaft rotates.)</i>			2
(d)	The sprocket has been made from a steel alloy. Describe why this is a suitable material for the sprocket.			2
	Marks should be awarded for the description of why a steel alloy is a suitable material for the sprocket. Justification includes: • Strength • Durability • Resistance to corrosion • Resistance to wear Guidance to markers Incorrect answer			0
	Basic description – Alloy steel is a strong material which makes it suitable for the motorcycle			1
	Detailed description – Alloy steel is a strong material which can withstand the forces experienced during dynamic movement. It would also resist wear and corrosion that might be anticipated within a motorcycle			2
Total				8

Question 3

		AO3	AO4	Mark
	When selecting materials, design engineers consider a wide range of factors. Evaluate the factors that have influenced the selection of thermoplastic materials to manufacture the casing of the coffee-making appliance shown below. <i>Marks will be awarded for the content of the answer and the quality of written communication.</i>	✓		8
	- Domestic products should be made from durable long-lasting materials which are impact resistant. - The materials used should provide electrical insulation. - The materials should be poor heat conductors, so the users do not get burnt if they touch the casing. - The material used for the casing should be capable of being manufactured as integrated mouldings so that the number of parts requiring assembly is reduced to a minimum. This will reduce the cost of assembly. - The material should have a high-quality surface finish which is inbuilt during manufacture. This will also reduce the cost of labour needed for finishing. - Expensive, labour-intensive manufacturing process should be avoided where possible. - The materials used could be available from sustainable sources. - Manufacturing processes that create pollution should be avoided where possible. - The material used should be reduced to a minimum. - Materials should be suitable for reuse or recycling. - Different scales of production – batch / mass / continuous - Global production and associated issues Guidance to markers Level 1: - Candidate has a simplistic knowledge of the issues associated with the question. - The use of terminology and technical language is basic. - The candidate has limited knowledge in relation to the context. - The candidate will express ideas clearly, if not always fluently. - Answers may deviate from the question or not be relevant. - Grammar, punctuation, and spelling may be weak, impacting on effective communication.			0-2

	Level 2: • The candidate has a basic understanding of the issues associated with the question. • The use of terminology and technical language is variable. • The candidate has some general knowledge of the factors that have influenced the thermoplastic materials and manufacturing methods used in relation to the context. • The candidate will express straightforward ideas clearly, if not always fluently. Answers may deviate from the question or be weakly presented. • There may be some errors of grammar, punctuation and spelling but is still able to communicate the issues.	3-4
	Level 3: • The candidate demonstrates a clear understanding of the issues associated with the question. • The use of terminology and technical language is reasonably accurate. • The candidate has demonstrated knowledge of the factors that have influenced the thermoplastic materials and manufacturing methods used associated to the context. • The candidate will express moderately complex ideas clearly and fluently, through well linked sentences and paragraphs. Answers will be generally relevant and structured. • There may be occasional errors of grammar, punctuation and spelling.	5-6
	Level 4: • The candidate demonstrates a specific ability to analyse the question, takes into account a wide range of factors and has a clear understanding of the associated issues. • Uses correct terminology and technical language. • The candidate has developed a detailed knowledge of the factors that have influenced the thermoplastic materials and manufacturing methods used associated to the context. • The candidate will express complex ideas extremely fluently. Sentences and paragraphs will follow on from each other smoothly and logically. Answers will be consistently relevant and structured. • There will be few, if any, errors of grammar, punctuation and spelling.	7-8
Total		8

Question 4

The logic diagram shows the control system for a domestic central heating boiler.		AO3	AO4	Mark																																			
(a)	Name the type of logic gate labelled A		✓	1																																			
	OR Gate																																						
(b)	Name the type of logic gate labelled B		✓	1																																			
	AND Gate																																						
(c)	Describe the conditions that must be met in order for the gas valve to turn on.		✓	3																																			
	Incorrect answer			0																																			
	Some understanding of the requirements (Inputs need to be on in order the gas to turn on)			1																																			
	Recognition of at least two requirements (In order for the gas valve to turn on the pilot light must be on, and the temperature sensor must be on.)			2																																			
	Detailed description of all requirements (In order for the gas valve to turn on the pilot light must be on and either the manual override or the temperature sensor must be on.)			3																																			
(d)	Complete the truth table for the central heating control system.		✓	3																																			
	<table><tr><th>Temperature Sensor</th><th>Manual Override</th><th>Pilot Light</th><th>Gas Valve</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> Award 1 mark for any two correct responses Less than two answers correct Two or three answers correct Four or five answers correct Six answers correct	Temperature Sensor	Manual Override	Pilot Light	Gas Valve	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	1	1	0	0	0	1	0	1	1	1	1	0	0	1	1	1	1		
Temperature Sensor	Manual Override	Pilot Light	Gas Valve																																				
0	0	0	0																																				
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0	1	0	0																																				
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1	1	1	1																																				
Total				8																																			

Question 5

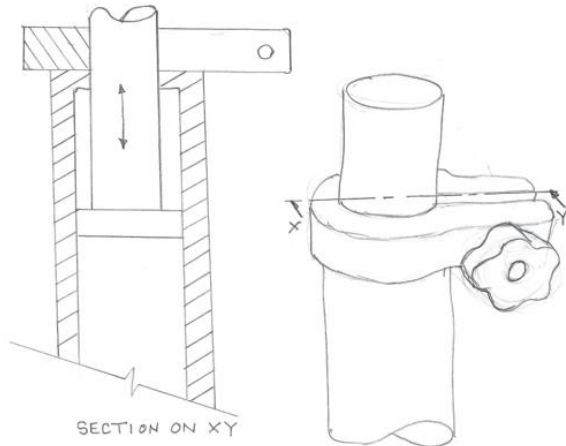
Modern prosthetic limbs are increasingly produced by 3D scanning and additive manufacturing (3D printing).		AO3	AO4	Mark
(a)	Describe two advantages of using 3D printing to manufacture modern prosthetic limbs.		✓	2x3
	Advantages include: • Bespoke parts can be manufactured to meet individual needs and requirements. • 3d-scanning can provide accurate sizes and dimensions so that the parts can be manufactured to accurately fit individuals. • Complex parts can be manufactured far more quickly and easily. • Manufacturing time is much quicker than other methods. • The cost of each product is very much cheaper compared to other methods. • Parts can easily be remade as conditions change. This is particularly beneficial to children as they grow. • 3D printing provides benefits over traditional methods like casting / injection moulding. Guidance to markers: Incorrect response not relevant to the question			0
	Relevant advantage with limited / basic qualification (Parts can be made quickly and easily)			1
	Relevant advantage with some qualification (Bespoke complex parts can be made quickly and easily without having to wait for materials and components to be imported)			2
	Relevant advantage with detailed qualification (Bespoke complex parts can be made quickly and easily without having to wait for materials and components to be imported. Parts can easily be remade as conditions change. This is particularly beneficial to children as they grow.) <i>Award marks for two advantages. DO NOT credit repeat responses.</i>			3

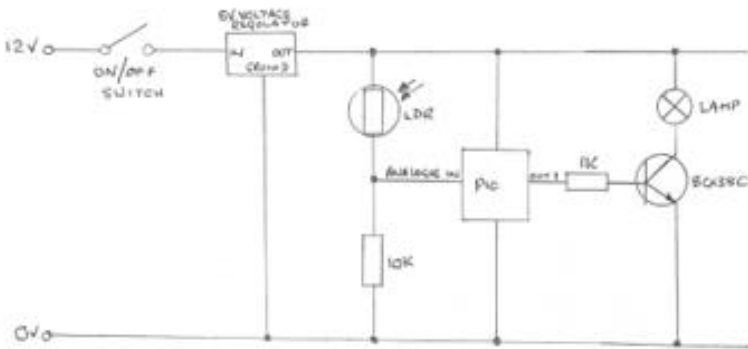
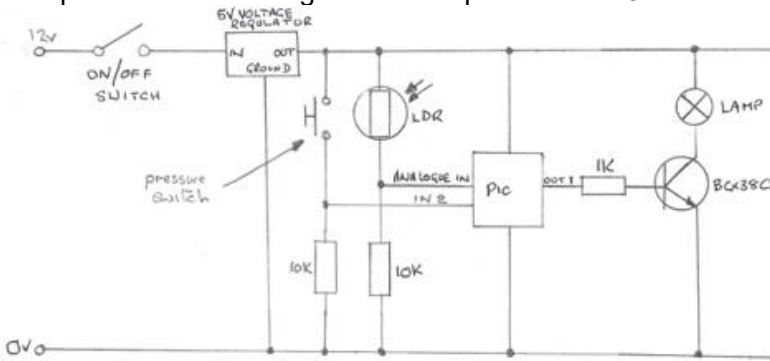
		AO3	AO4	Mark
(b)	Explain why 3D printing is particularly beneficial in less economically developed countries.		✓	2
	• 'In-country' creation. Rather than manufacturing abroad and mailing to a developing country at considerable cost, the parts can be printed in the same country. This means it can be delivered more quickly, and at a greatly reduced cost. • Cost-effective. 3D printing reduces the need for expensive manufacturing equipment, such as injection moulding machines, milling machines and lathes. • Replacement parts. Replacement parts can be created using the 3D printer and plastic filament, rather than importing at considerable expense. (6Rs) • Custom-designed. All prosthetics can be customized to suit the user. This includes aesthetic factors such as skin tone. • Economically developing countries will not have many advanced manufacturing systems in place. • Mobility. 3D printers can be easily relocated, which means more amputees can have access to the technology. • Functionality. 3D printed designs can be easily modified and enhanced to offer a better range of movement for amputees. • Parts made by additive manufacturing have no waste material			
	Little or no understanding of the specific needs of people in less economically developed countries			0
	Some explanation of benefits to the EDC: <i>3D printing is cheaper as printers are lower cost than large industrial machinery which may not be available.</i>			1
	A detailed explanation that highlights the benefits to the EDC: <i>3D printing is beneficial in less economically developed countries as part can be made in the country instead of manufacturing abroad, this reduces the costs of the parts and speeds up the delivery time.</i>			2
	<i>Answers should focus on reduced production and transportation costs.</i>			
			Total	8

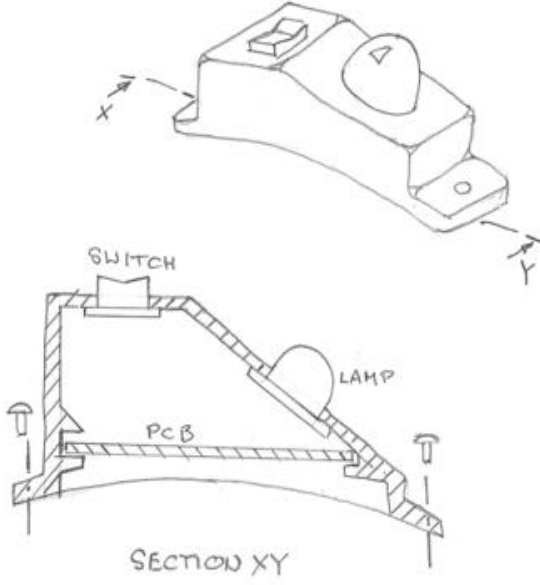
Question 6

E-scooters are available for hire in many cities globally. Modern scooters have a range in excess of 25 miles between charges.		AO3	AO4	Mark
(a)	Describe the technological developments that has been made in recent years that has made e-scooters a viable form of transport.		✓	2
	Developments could include: • Battery technology has progressed so that cells are now lighter, longer lasting and smaller. • DC motors are now more efficient often using brushless technology. • Parts for the scooters can be manufactured from strong, light weight modern composite materials. • Smart Phone Technology – Connected Technology – APP to hire scooter. Guidance to markers Incorrect development which is not relevant to the question			0
	Basic description of technological developments (<i>DC motors are now more efficient and batteries are lighter</i>)			1
	More developed / detailed description of technological developments (<i>Parts for the scooters can be manufactured from strong, light weight modern composite materials and electric motors are now more efficient. This means that the scooters can now run for much longer without being recharged</i>)			2

		AO3	AO4	Mark
(b)	Three design specification points for the e-scooter have been given below. • The e-scooter should have a range in excess of 25 miles so that it can be used during the day without recharging. • The e-scooter should have handlebars that can be easily adjusted in order to accommodate users of different heights. • The e-scooter requires a red flashing light to be fitted to the rear mudguard in order that it can be seen by other road users after dark. Add three other justified specification points that would be needed to guide the design and development of an e-scooter that is intended for public hire.		✓	3x2
	Points could include: • The e-scooter should have an efficient braking system to ensure that it can be safely stopped in a specified distance. • It should be made from strong and durable materials which are weather and corrosion resistant. • The e-scooter should charge from a charging point / docking station. • The e-scooter should have built in front light to illuminate the road ahead, so that it can be used after dark / in poorly lit conditions. • Each e-scooter should be fitted with a tracking device in order that it can be easily located. • The e-scooter should be fitted with a device that limits the speed to comply with regulations. Guidance to markers: An invalid response or no response			0
	A valid response that lacks justification (Each e-scooter should be fitted with a tracking device)			1
	A fully justified response (Each e-scooter should be fitted with a tracking device in order that it can be easily located)			2

		AO3	AO4	Mark
(c)	Using notes and sketches, in the space below design a method that would enable the handlebars to be easily adjusted in order to accommodate users of different heights. Your design must: • be easily adjusted by one person without the use of specialist tools and equipment. • lock securely in position so that it does not move when the scooter is in use. • allow the handlebar to remain attached to the scooter even when adjustment is being made, preventing theft or damage. Your proposed solution should include reference to suitable materials and manufacturing processes.		✓	8
	Exemplar answer  <i>The tubular parts could be made from extruded lightweight aluminium alloy which provides high strength and corrosion resistance. The clamp bracket could be made from cast stainless steel and is fixed / welded to the external tube.</i>			
	• An inappropriate proposal with components unidentified.			0
	• Some attempt to produce an appropriate solution with some components correctly identified.			1-2
	• A solution that would partially solve the problem with further development / detail required. Little reference to materials and processes.			3-4
	• A functional solution with some detail missing. Some reference to materials and processes.			5-6
	• A detailed fully functioning solution with full reference to suitable materials and manufacturing processes.			7-8

		AO3	AO4	Mark
(d)	The e-scooter requires a flashing light to be fitted to the rear mudguard in order that it can be seen by other road users after dark. The light should; • turn on automatically in low-level lighting conditions • turn off automatically when the e-scooter is not being ridden • use a regulated 5 volt power supply that is derived from the 12 volt cell that powers the scooter. In the space below draw a detailed circuit that uses a microcontroller to operate the light. You should include two input devices, an output device, suitable interface devices where required and the microcontroller.	✓		8
Exemplar answer – two requirements met – maximum 5 marks  Exemplar Answer meeting all three requirements – 8 marks  No attempt to answer the question or invalid response. Some attempt to draw a suitable circuit diagram with some components correctly illustrated, which partially fulfils some of the requirements. Circuit diagram with most components included in the correct positions, that would partially fulfil some of the 3 requirements. Detailed circuit diagram fulfilling the 3 requirements with all components included and conventionally correct.				
				0
				1-2
				3-5
				6-8

		AO3	AO4	Mark
(e)	The warning light and electronic circuit is to be fixed inside a housing that can be mounted on the rear mudguard of the e-scooter shown below. Use the space below to draw a suitable housing for the light that will attach to the mudguard. Marks will be awarded for: • a well-drawn design for the proposed casing • an illustration showing how the casing is attached to the mudguard • a suitable mounting for the light • a method of securely mounting the circuit board inside the casing • an annotation that provides justified selection of suitable materials and appropriate manufacturing processes.	✓		8
	Exemplar answer  <i>The casing would be made from injection moulded high impact polypropylene.</i> Responses do not necessarily need the switch. Guidance to markers: Well drawn casing Method of attachment to the mudguard Lamp securely mounted to the case PCB securely mounted Suitable material and manufacturing process selected			3 1 1 1 2

	Suitable materials could include: • HIPS • ABS • Aluminium alloy Manufacturing processes may include: • Vacuum Forming • 3D Printed casing • Injection Moulding • Stamping or pressing			
(f)	Analyse the environmental and safety issues that should be considered before making e-scooters available for rental in large towns and cities.	✓		8
	• Users should wear a safety helmet. • The e-scooters should not be ridden in pedestrianised areas. • Users should hold a full or provisional driving licence. • The handlebars should be height adjustable in order to accommodate people of different heights. • The handles should be made from a material that is comfortable to grip in both hot and cold weather. • Because e-scooters use rechargeable batteries they have zero emissions and can improve the carbon footprint of urban transport.			
	No response or a response that does not relate to the question.			0
	Some attempt to consider a few relevant environmental and safety issues with little analysis.			1-2
	An informed discussion which covers relevant environmental and safety issues, with some analysis.			3-5
	Detailed discussion which analyses a range of environmental and safety issues.			6-8
Total				40