OCR
Oxford Cambridge and RSA

GCE

Design and Technology

H406/02: Problem solving in Product Design

A Level

Mark Scheme for June 2022

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: RM A*ssessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space.

   Award Zero '0' if:
   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response:
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
BP	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Tick
	Cross
CON	Confused (replaces the question mark)
BOD	Benefit of doubt
KU	AO1 – Knowledge and understanding
APP	AO2 – Apply knowledge and understanding
AN	AO3 - Analyse
EVAL	AO4 - Evaluation
^	Omission
NAQ	Not answered question
SEEN	Noted but no credit given
TV	Too vague
OFR	Own figure rule
REP	Repetition

12. Subject Specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet Instructions for Examiners. If you are examining for the first time, please read carefully Appendix 5 Introduction to Script Marking: Notes for New Examiners.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Mark	Guidance	
1*			**Indicative content:** **<u>Existing road users:</u>** Examples: Challenges: • An increase in bicycles/scooters on the roads will slow down existing traffic • Hazards presented by inexperienced riders of bicycles/scooters using roads • Signage required to alert existing road users • Separate cycle/scooter lanes will help to address safety concerns and keep scooters and bicycles away from existing road users • The rental bicycles and scooters will need to be illuminated at night so that other road users can see them **<u>Pedestrians:</u>** Examples: Challenges: • App development • Bicycles and scooters are quiet and pedestrians may not be aware of approaching vehicles • Riders of scooters and bicycles may be tempted to ride on the pavements which is hazardous for pedestrians • Pedestrians will need to be made aware of increased existence of bicycles and e-scooters, perhaps with signage. Award credit for any other valid suggestion.	12	All responses should be in relation to the information provided. Challenges should be identified. Candidates may extract information from the Resource Booklet. Any such lifted information can be used in support of the critical examination but no marks should be awarded simply for duplicating text. There is no analysis or evaluation in Level 1.	**Level 4 [10-12 marks**] A **comprehensive** examination of the challenges that will be faced. Comprehensive understanding of the challenges that will be faced when implementing bicycle and electric scooter rental schemes. Information in RB is used effectively to fully exemplify the points being made in relation to existing road users and pedestrians. Well-constructed response in relation to question with a clear and developed narrative. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 3 [7-9 marks]** A **good** examination of the challenges that will be faced. Good level of understanding of the challenges that will be faced when implementing bicycle and electric scooter rental schemes. Information in RB is used for the most part effectively to exemplify points being made in relation to existing road users and pedestrians although one or two opportunities are missed. Well-constructed response in relation to question although one or two opportunities not taken to develop narrative. *There is a line of reasoning presented with some structure. The information presented is in*

						the most part relevant and supported by some evidence. **Level 2 [4-6 marks]** A **sufficient** examination of the challenges that will be faced. Sufficient understanding of the challenges that will be faced when implementing bicycle and electric scooter rental schemes. Information in RB is used to exemplify some points being made in relation to existing road users and/or pedestrians although much more could have been done to exploit the stimulus material available. Reasonable response in relation to the question although narrative at times lacks depth and cohesion. *The information has some relevance and is presented with limited structure. The information is supported by limited evidence.* **Level 1 [1-3 marks**] A **limited** examination of the challenges that will be faced. Limited knowledge and next to no understanding of the challenges that will be faced when implementing bicycle and electric scooter rental schemes. Use of information from the RB is used in a simplistic way and adds limited value to the points being made. Limited response in relation to question. Narrative is basic and unstructured. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the*

						relationship to the evidence may not be clear. 0 marks = No response or no response worthy of credit.

2*			**Indicative content:** **<u>Ergonomics:</u>** • The standing position on a scooter lends itself to a large range of users without any necessary adjustment to handle bar height. This suits very tall users who will still 'fit' the scooter and be able to use it safely, whereas with the bicycle a user with very long legs may not be able to use the bicycle because their legs will hit the fixed handlebars. • The scooter caters for extremes whereas the bicycle is likely to only suit users in the height range to suit the adjustable saddle height – this height is based on inside leg length. Users with very short inside leg lengths, and those with very long inside leg measurements may not be able to use the bicycle. • E-scooters are less strenuous to use than bicycles. Users that have knee or ankle injuries preventing the comfortable use of a bicycle, can use a scooter provided they have sufficient strength for stability. E-scooter handlebars are shorter and require less movement than a bicycle handlebar. • The standing position on an e-scooter is more suited to users with back pain as the spine remains in a stacked vertical position throughout use. • The bicycle has bag storage on it, relieving the user of the strain of carrying a bag while cycling. E-scooter users will need to continue to carry bags. • Carrying a bag on the e-scooter will have an impact on stability. • The e-scooter helmet is a benefit for safety, but the range is unlikely to suit all users. Safety equipment such as helmets tend to be available in sizes e.g. small, medium, large, as well as being adjustable to ensure a good fit. The provision of this piece of safety equipment could present a liability for the operator. • The e-scooter is heavier than the bicycle and it is likely that it cannot be wheeled when it is not being ridden. It may be more awkward to park-up and require more physical effort. **<u>Required maintenance:</u>** • Both products will need to be regularly cleaned to remain attractive to users. In the case of the bicycle cleaning will not only extend the life of the chain and gears, but necessitate the re-lubrication of these moving mechanical parts after cleaning. In contrast, the e-scooter has integrated / sealed moving parts. The motor is enclosed in the rear wheel. • Repair – bicycle wheels are made of multiple components including spokes that can be easily damaged if the bicycle is stored incorrectly, knocked against other bicycles, or bounced hard of a kerb or an obstacle. The e-scooter has smaller	**12**	All responses should be in relation to the existing product information provided on page 3 and 4 of the RB. Candidates may extract information from the Resource Booklet. Any such lifted information can be used in support of the critical evaluation but no marks should be awarded simply for duplicating text. There is no analysis or evaluation in Level 1.	**Level 4 [10-12 marks**] A **comprehensive** examination of the suitability of the listed products for a rental scheme. Comprehensive understanding of the suitability of the existing products for the stated purpose, taking account of three elements specified in question. Information in RB is used effectively to fully exemplify the points being made. Well-constructed response in relation to question with a clear and developed narrative. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 3 [7-9 marks]** A **good** examination of the suitability of the listed products for a rental scheme. Good level of understanding of the suitability of the existing products for the stated purpose, taking into account at least two elements specified in question but one or two opportunities are missed to make connections. Information in RB is used for the most part effectively to exemplify points being made although one or two opportunities are missed. Well-constructed response in relation to question although one or two opportunities not taken to develop narrative. *There is a line of reasoning presented with some structure.*

			wheels with chunky injection moulded spokes that are part of a single component. These wheels are likely to need very little maintenance. • Replacement of broken / worn components – bicycles are simpler machines than e-scooters. The mechanical bicycle components are abundant and cheap to source. E-scooters use electronics and electromechanical systems for the braking and motor. These parts are more likely to cost more than those on the bicycle. • The underside of the e-scooter is likely to be subject to scrapes, dents and damages as it has a small clearance. This could be damaged when riding the e-scooter off high kerbs. The bicycle will nbot suffer similar damage due to the greater clearance of body parts from the ground. • Lubrication of moving parts – the bicycle chain and gear set will need lubrication whereas the e-scooter has sealed moving parts. • Check helmets haven't been dropped / scratched, or show signs of abuse. Helmets are worn close to the body and will require regular disinfection in order for users to be attracted to the use of them. • The e-scooter requires charging. This can be undertaken by charging in a maintenance vehicle overnight, relocation to a charging hub, or swapping the battery. Maintenance technicians will need to visit the e-scooter when it requires charging. Technicians may not need to visit the bicycles as regularly as they do not need charging. • Use of portable fast-chargers to enable the e-scooters to be charged from/in the back of a van. **<u>Planned obsolescence:</u>** • Both products have app controlled locks and positioning systems requiring energy sources – batteries. However, the rest of the bicycle is traditional, parts are readily available, and with good maintenance the bicycle can have a long lifespan. • They are likely to be disposed of if the body becomes damaged, or through wear and tear if the paintwork looks untidy and unsuitable to attract users. • Both products use materials that do not rust for the bodies, however, aluminium is softer than stainless steel and the e-scooter is more likely to suffer dents as a result. • The e-scooter has numerous additional electrical components, including the battery which has a finite life. • Developments in battery technology may not provide backwards compatibility with the e-scooter. Award credit for any other valid suggestion.			*The information presented is in the most part relevant and supported by some evidence.* **Level 2 [4-6 marks]** A **sufficient** examination of the suitability of the listed products for a rental scheme. Sufficient understanding of the suitability of the existing products for the stated purpose, taking into account at least two elements specified in question but there are significant opportunities missed to make connections. Information in RB is used to exemplify some points being made although much more could have been done to exploit the stimulus material available. Reasonable response in relation to the question although narrative at times lacks depth and cohesion. *The information has some relevance and is presented with limited structure. The information is supported by limited evidence.* **Level 1 [1-3 marks**] A **limited** examination of the suitability of the listed products for a rental scheme. Limited knowledge and next to no understanding of the suitability of the listed products for a rental scheme with next to no understanding of the elements specified in question (one at best). Use of information from the RB is used in a simplistic way and adds limited value to the points being made. Limited response in relation to question. Narrative is basic and unstructured.

						The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. 0 marks = No response or no response worthy of credit.

3			**Indicative content:** **<u>Council:</u>** • An initial stock of e-scooters for demonstration. • Demonstration units provided at no cost by the manufacturer for customer demonstration and staff training. • Promotional material for use such as posters/signage, demonstration stands, pop-up stands to raise awareness. • The council will want to have minimal associated cost to promote the scheme. • Sponsorship for adverts placed in newspapers, newsletters, store leaflets, website, social media, advertising pop-ups. • Staff training from the manufacturer at no cost to ensure that staff are familiar with the e-scooters and they can answer customer questions, and be able to advise customers of the USPs, and operation of the scheme. • Access to the manufacturer's internet based digital marketing material for use in council publications e.g. newsletters. • No costs incurred in the event of the scheme selling poorly and being returned to the manufacturer/scheme operator for redistribution elsewhere in the country. • Ongoing manufacturer support. • Guarantee of future support, maintenance, upgrades and updates. • Promote the scheme through highways signage / interactive signs / motorway bill-boards on the approaches to the city. • Clearly defined e-scooter stations. • Council / rental scheme operator representatives to be in attendance at e-scooter stations for the first week to promote the scheme to passers-by. • Active promotion to local businesses, schools, universities etc in person, telephone, leaflet and email. Need customers to be engaged with the product, immediately after an initial launch, for it to be successful. This can be through: • Social media marketing • Email marketing • Search engine marketing • Video marketing – advertising on appropriate low-cost TV channels after local news – to send potential customers to website and awareness of the scheme. Could the manufacturer / e-scooter scheme operator sponsor the news/weather?	**8**	There is no analysis or evaluation in Level 1.	**Level 4 [7-8 marks]** A **comprehensive** critical examination of methods that could be used to create/increase demand. Comprehensive understanding of a wide range (i.e. at least 3) of methods that could be used to create/increase demand. Analysis of method is consistently and appropriately aligned with needs of target group (both). Well-constructed narrative in relation to question with clear and supported evaluative comments. **Level 3 [5-6 marks]** A **good** critical examination of methods that could be used to create/increase demand. Good understanding of a range (i.e. at least 2) of methods that could be used to create/increase demand. Analysis of method is appropriately aligned with needs of target group (both) but one or two opportunities are missed to make connections. Well-constructed narrative in relation to question although one or two opportunities missed to develop response. Evaluative comments are clear but not always supported. **Level 2 [3-4 marks]** A sufficient critical examination of methods that could be used to create/increase demand. Sufficient understanding of method (at least 1) that could be

			• Promotion and maintenance staff interaction with potential customers: staff need to be an extension of the manufacturer and be trained to be able to answer all conceivable questions. • Good placement of stations within the city and surrounding areas to ensure the product can be found easily by potential customers. Need to know which stations are renting-out the most e-scooters. Does this relate to demographic, maintenance, poor signage, poor management? Monitoring of interest can include: • TV advert viewing figures • Web page hit count • App downloads • Feedback from the App, and E-scooter monitoring software. • **<u>Customers:</u>** • Awareness of the e-scooter rental scheme. • USPs of the rental scheme – why should they be interested? Why is it better than alternatives? What are the benefits to commuters, users? • Email marketing. Could be promoted to employers and businesses in the city, then in turn to employees, through emails bringing attention to the rental scheme. Possible opportunity to promote reduction in car park congestion for businesses. • Social media marketing e.g. Facebook Twitter Instagram #E-Scooters • Search engine marketing. Web browser pop-ups from leisure activity and technology interests profiling e.g. Google. • Tailored web-browser search results. • Access to demonstration E-Scooter in the city centre. Can one be seen in use, with a demonstrator, at a pop-up stand in one of the cities busy pedestrian areas? • Advertising through bill boards, interactive boards in the city centre pedestrian areas, and in shops, cafes etc e.g. photographs, informative text, url to scheme operator's website, videos, QR code. • Scheme operator's website to provide detailed information; how to get started, where to download the app, how to book your first e0-scooter, where to collect from. • Awareness of app updates, and offers, such as discounted time of day, for example late at night, or early in the morning. • Health benefits of using E-Scooters over driving to include data about emissions. • Price.			used to create/increase demand. Analysis of method is reasonably aligned with needs of target group (at least 1) but there are significant opportunities missed to make connections. Reasonable narrative in relation to the question although response at times lacks depth and cohesion. Evaluative comments lack clarity and are unsupported **Level 1 [1-2 marks]** A limited examination of methods that could be used to create/increase demand. Limited knowledge and next to no understanding of methods that could be used to create/increase demand. No analysis of method resulting in next to no alignment with needs of target group. Limited narrative in relation to question. Response is basic and unstructured with no evaluative comments. 0 marks = No response or no response worthy of credit.

4			**Indicative content:** Answers **must** include references to the following: **<u>Jigs and templates:</u>** • Repeat alignment of top tube with support bracket rail. • • Parallel alignment of top tube with support bracket rail. • Even separation of support brackets. • Welding jigs to align plate flange with round tube leg perpendicular to the tube end and the main stand frame. • Welding jig to centrally align the square section tube with the round tube. **<u>Visual checks:</u>** • Stock material checked for imperfections before manufacturing commenced • Quality of welds inspected • Checking for differences in material quality. **<u>Accuracy of dimensions checks:</u>** • Accuracy of dimensions tests - parts will be manufactured to dimensional tolerances that should be tested to be within the parameters defined by the technical specification. • A go/no-go gauge could be used. This is an inspection tool used to check a workpiece against its allowed tolerances via a go/no-go test. Its name is derived from two tests: the check involves the workpiece having to pass one test (go) and fail the other (no-go).	**16**	Answers should include methods of ensuring accuracy and quality of manufacture of components and the assembly of the junior school scooter stand for each of the aspects in bullet points in the question. Candidates can draw on practical experience to support responses. Candidates are expected to demonstrate understanding of the processes through annotated sketches and/or notes.	**Level 4 [13-16 marks]** A **comprehensive** demonstration of how to ensure consistent accuracy and quality in the commercial manufacture of the junior school scooter stand. Comprehensive understanding of the four elements specified in question. Information in RB is used effectively to fully exemplify the points being made. Sketches will be clear and supported with relevant notes. The methods will be technically accurate and clear in the way they are explained. **Level 3 [9-12 marks]** A **good** demonstration of how to ensure consistent accuracy and quality in the commercial manufacture of the junior school scooter stand. Good understanding of the three elements specified in question. Information in RB is used for the most part effectively to exemplify points being made although one or two opportunities are missed. Sketches will for the most part be clear and supported with relevant notes. The methods will be technically accurate and for the most part be clear in the way they are explained. **Level 2 [5-8 marks]**

			• Sampling of support brackets to check dimensional accuracy against templates e.g. every 50th bracket checked. • Checks on height, width etc. Go/no-go gauges such as those below could be used to check the height and width of the stand. • Go, no-go checks on components and separation of components e.g. separation of brackets. **<u>Digital manufacturing:</u>** • Symmetrical component design for the support brackets and plate flanges. • CNC laser cutting provides high levels of accuracy with small manufacturing tolerances. • CNC pipe bending will ensure that the round tubes are manufactured to consistent accuracy. Minimising errors through component design: • Where possible use symmetrical components to minimise any inaccuracy caused by mishandling or incorrectly assembling the stand. This can be done with the brackets and base plates. The slots in the brackets could milled or laser cut centrally, for example. • DFMA, common parts, tessellating components Award credit for any other valid suggestion.			A **sufficient** demonstration of how to ensure consistent accuracy and quality in the commercial manufacture of the junior school scooter stand. Sufficient understanding of two elements as specified in question. Information in RB is used to exemplify some points being made although much more could have been done to exploit the stimulus material available. Sketches will be adequate and supported with notes. The methods will not always be technically accurate with some knowledge gaps evident. **Level 1 [1-4 marks]** A **limited** demonstration of how to ensure consistent accuracy and quality in the commercial manufacture of the junior school scooter stand. Limited knowledge and next to no understanding of the elements specified in question. Use of information from the RB is used in a simplistic way and adds limited value to the points being made. Sketches if used will be unclear with only basic notes to accompany them. The methods may lack technical detail and be basic in nature. 0 marks = No response or no response worthy of credit.

5			Weight of tube = volume of tube x density Density of mild steel is 7.85 g/cm^3 Volume = area of cross section x length of tube Length of tube is measured by the central axis of the tube: Length of 90 degree central arc = $\frac{2\pi r}{4}$ Where $r = 225 + \frac{50}{2} = 250mm*$ Substituting value for r gives: Arc length = $\frac{2\pi 250}{4} *= 392.699081699 * mm$ Length = (2 x (1525 – 225)) + (2550 – (2 x 225)) + (2 x 392.699081699 *) = 5485.3981634* mm $Area\ of\ cross\ section = \pi 25^2 - \pi 22^2 = 1963.49540849 * -1520.53084434 *= 442.964564153 *\ mm^2$. Volume = area of cross section x length of tube = 442.964564153* x 5485.3981634* = 2429837.00665* mm^3 = 2429.83700665 cm^{3*} Density of mild steel = 7.85 g/cm^3 Weight = volume x section = 2429.83700665* x 7.85 =19074.2205021 = 19074.22* g 2d.p.	**6**	**Level 2: (4-6 marks)** Candidate applies effective reasoning and logic to solve maths problem. Understanding of process is appropriate and supported with correct calculations. *Allow error carried forward (ECF) where correct working out is shown. **Level 1: (1-3 marks)** Candidate applies reasoning and logic. Understanding of process only with incorrect calculations used. Step 1 - calculate radius Step 2 - calculate arc length Step 3 – calculate length Step 4 - calculate area of cross section Step 5 - calculate volume Step 6 - calculate weight to 2dp (including conversion) **Note:** Where an incorrect answer is given working out should be considered to credit appropriate marks. If correct answer is given without working out shown award full marks.

6			**Indicative content:** **<u>Roof</u>:** **<u>Specific materials;</u>** • Polycarbonate • Acrylic/Perspex • 4mm or greater thickness, 5mm, 6mm… **<u>Manufacturing processes:</u>** • Laser-cut to include holes for self tapping screws and provide a finished edge of qood quality. **<u>Finishes:</u>** • PC/PMMA is self-finished. Available in transparent and translucent forms with colour tint. Tint could be of benefit for shading the e-scooters and reduce the effects of sun-fading, as well as dark surfaces/materials warming up to high temperatures. **<u>Assembly methods:</u>** • Holes drilled in PC sheet using a drilling jig. • Laser cut the holes at the same time as cutting the sheet. • The PC sheet may need to comprise of four pieces due to the size required, all pre-prepared with holes. • Hole diameters 5mm.	**16** Candidates may use sketches and/or notes to outline suitable methods of manufacture and assembly for the features of the concept design. Responses should be appropriate for manufacture of a batch of 50 shelters.	Responses should provide details of processes to make and assemble a batch of 50 shelters. The shelter will be delivered to site in flat pack form and assembled on site. Answers should include details of how the shelter will be made in flat pack form. Candidates can draw on practical experience of iterative designing and product analysis to support response. The question assesses applied knowledge and technical principles to the existing design. Candidates are expected to demonstrate understanding of the manufacturing and assembly processes through annotated sketches and/or notes. There may be variations to	**Level 4 [13-16 marks]** A **comprehensive** demonstration and understanding of how the shelter could be manufactured and assembled. Comprehensive understanding of the four elements specified in question. Information in RB is used effectively to fully exemplify the points being made. Sketches will be clear and supported with relevant notes. The process will be end to end and clear in the way it is explained. **Level 3 [9-12 marks]** A **good** demonstration and understanding of how the shelter could be manufactured and assembled. Good understanding of the three elements specified in question. Information in RB is used for the most part effectively to exemplify points being made although one or two opportunities are missed. Sketches will for the most part be clear and supported with relevant notes. The process will be end to end and for the most part be clear in the way it is explained. **Level 2 [5-8 marks]**

			• No.5 x 25mm self-tapping screws used to attach PC sheet to the timber frame **Timber frame:** **Specific materials:** • Treated kiln dried C16 timber. C24 timber is better quality and more suited to an application where it can be seen; less defects. • 45mm x 95mm, or 50mm x 100mm sections for the main frame sections • Western red cedar (very resistant to decay) • Douglas fir (moderate resistance to decay) • Siberian larch (moderate resistance to decay) • Teak (often used outdoors) • Afrormosia • Oak **Manufacturing processes;** • Drilled and screwed joints; using factory drill presses and drilling jigs, cordless drivers can be used on site to assemble the shelter. • Through screw holes prepared with countersinks for flush screw heads. • Pilot holes drilled for screws as appropriate. • Timber cut to length using a chop saw. Wood joints combined with PVA outdoor wood glue adhesive and screws such as: • Mortice and tenon joints; mortice machine, tenoning machine. • Lap joints; tenoning machine, router. • Halving joint • Curved sections steam formed around moulds/laminated with former. • Tessellated pieces on appropriate sheet timber **Finishes:** • Even a highly resistant wood type will suffer under constant weathering. Left bare, hardwood will turn grey, take on surface cracking and can sometimes warp as they absorb moisture and dry out repeatedly. Sunlight will drain colour and grain features of hardwood if they are not maintained regularly, so a UV blocking finish or topcoat will protect it. • A good finish for an exterior project will have UV protection and water repellents.		the processes as indicated but to get into L3 candidates must show a clear understanding of processes for the roof, frame and brackets.	A **sufficient** demonstration and understanding of how the shelter could be manufactured and assembled. Sufficient understanding of two elements as specified in question. Information in RB is used to exemplify some points being made although much more could have been done to exploit the stimulus material available. Sketches will be adequate and supported with notes. The process may not necessarily be end to end with some knowledge gaps evident. **Level 1 [1-4 marks]** A **limited** understanding of how the shelter could be manufactured and assembled. Limited knowledge and next to no understanding of the elements specified in question. Use of information from the RB is used in a simplistic way and adds limited value to the points being made. Sketches if used will be unclear with only basic notes to accompany them. The end to end process may not exist and if anything is basic in nature. 0 marks = No response or no response worthy of credit.

			• Cuprinol complete wood treatment is a typical product that prevents woodworm, wet and dry rot attack. Other products: Ronseal wood preserver. **Assembly methods:** • The frame can be assembled on site. • Exterior wood adhesive should be used such as PVA, Evo-stik Exterior wood adhesive, Gorilla wood glue. • At least two people will be required to assemble the shelter. One to hold and one to hammer/glue/screw. • Joints may need to be tapped together using a beech mallet. • Screwed joints can be assembled using no.6 x 75mm pozidrive screws driven in with a cordless driver. **Ground brackets:** **Specific materials;** • Mild steel 6mm x 30mm section, **Manufacturing processes;** • Flat bar sourced to section and cut to length using a metal cutting chop saw, or slitting saw with a repeat stop used for repeat work. • Sections stacked and drilled in batches of four using a drill press/ pillar rill and drilling jig. • 8mm diameter or larger holes drilled. • Rectangular pieces and holes could be laser cut from sheet material with a high powered CNC laser cutter. • Bent to a right angle using a bench bending apparatus or similar bending jig. **Finishes;** • Galvanizing • Powder coating **Assembly methods:** • Bolted to legs via through holes drilled in ends of legs.			

			• Stainless steel or zinc plated M8 or larger bolts, M8 penny washers, and locking M8 nuts used. Assembled using cordless drivers, socket sets, combination spanners, ratchet spanners or similar. • Bolted to ground using rawl-bolts. M8 or larger. • Concrete floor, or large flag stones, are suitable to fasten down to. Holes drilled to accept rawl-sleeves or chemical resin bonded threaded rod. Award credit for any other valid suggestion.			

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on

01223 553998

Alternatively, you can email us on

support@ocr.org.uk

For more information visit

ocr.org.uk/qualifications/resource-finder

ocr.org.uk

Twitter/ocrexams

/ocrexams

/company/ocr

/ocrexams

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT

OCR is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

OCR provides resources to help you deliver our qualifications. These resources do not represent any particular teaching method we expect you to use. We update our resources regularly and aim to make sure content is accurate but please check the OCR website so that you have the most up-to-date version. OCR cannot be held responsible for any errors or omissions in these resources.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please contact us.

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our Expression of Interest form.

Please get in touch if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.