



Oxford Cambridge and RSA

GCE

Design and Technology

H406/01: Principles of Product Design

A Level

Mark Scheme for June 2023

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.

© OCR 2023

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 Assessor 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
	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
	Confused (replaces the question mark)
	Benefit of doubt
	AO1 – Knowledge and understanding
	AO2 – Apply knowledge and understanding
	AO3 - Analyse
	AO4 - Evaluation
	Omission
	Not answered question
	Noted but no credit given
	Too vague
	Own figure rule

REP	Repetition
------------	------------

1. 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.

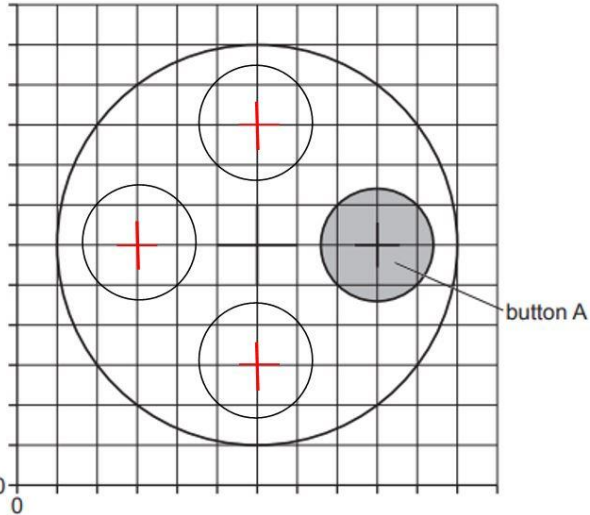
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet Instructions for Examiners. If you are examining for the first time, please read carefully Appendix 5 Introduction to Script Marking: Notes for New Examiners.

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

Question	Answer	Mark	Guidance
1 (a)	<p>Possible ways may include:</p> <ul style="list-style-type: none"> Length of thumbs could be considered for the position of the buttons (1) as the designer would need to consider the 5th percentile/ smallest user to ensure all could reach (1). Spacing of the buttons could be considered for the thickness of the fingers (1) as the largest users/95th percentile would need to be considered to ensure two buttons were not pressed at once. (1). Grip diameter would need to be considered to make the hand rests thick enough (1) as the smallest users/ 5th percentile would have to be accommodated to ensure all users could comfortably hold it (1). Any other suitable response that relates to the size of the controller or refers to reach/proximity of the buttons/toggles in relation to human size. 	4	<p>In each case:</p> <p>Up to two marks for explaining a way in which specific anthropometric data or percentiles could be used to determine the size/design of layout buttons on the controller.</p> <p>Specific reference to the controller/users in the question is needed for marks to be awarded.</p> <p>Do not award marks for ergonomics.</p>
(b)	<p>Positive ways may include:</p> <ul style="list-style-type: none"> Black is a neutral colour (1) so will appeal to a wide range of genders (1). Buttons can be assigned different functions or left hand/right hand use can be set up (1) so users with less mobility/ who are left-handed will be able to use the range that is suitable/ comfortable for them (1) There are no words on the design - symbols are used (1) so it can be used by illiterate/ partially sighted or multiple languages without difficulty (1). Any other suitable response. <p>Reference to user settings to improve inclusivity of the display on screen maybe given credit. Inclusive design relates to barrier free use by all users e.g., children, adults, elderly, those with limited grip/ arthritis, left and right handers, partial or limited sight, colour blind, physical disabilities, language barriers, SEN needs and gender. Users should be specified.</p>	4	<p>In each case:</p> <p>Up to one marks for identifying a way in which the design of the controller is inclusive.</p> <p>Up to one mark for justifying the inclusivity point made and how it relates to users.</p> <p>Specific reference to the context in the question is needed for marks to be awarded.</p> <p>No marks for simple one word responses e.g. 'neutral'.</p>
(c) (i)	<p>Possible methods may include:</p> <ul style="list-style-type: none"> Trend forecasters are employed (1) to examine and analysing past and current influences on fashion/ new technological advances. (1). 	4	<p>In each case:</p>

	<ul style="list-style-type: none"> • Use of research data into consumer trends (1) to look at studies into people and their lifestyle choices. (1). • Inbound marketing such as surveys (1) to include research about patterns and trends of a specific age group/ target market (1). • Discussions/ surveys/ interviews (1) with focus groups/intended consumers/ online forums about what features they would like and what they have been buying (1) • Looking at social media to see what is trending (1) and the type of products that are creating lots of likes or being promoted by influencers (1) • Examining what competitors are offering consumers (1) what is popular from existing products/ various features/ material/ colours (1) • Any other suitable response. 		<p>One mark for identifying a method companies use to predict future trends.</p> <p>One mark for describing this method and relating to the product/ users.</p> <p>Terms such as market pull, and technology push need to be explained.</p>
	<p>(ii) Possible responses may include:</p> <ul style="list-style-type: none"> • The colour of the product can show brand identity, as the colours that it uses can promote an image or core value (1) for example McDonald’s changed their brand colours on packaging to gold and green to make the brand image more environmentally friendly/ coca cola bottles shape and use of white text on red background to portray excitement, energy and passion, Apples use of white on iPod/ iPhones to show simplicity, minimalist and purity (1). • Logos and product shape can also reflect the brand identity, and the images associated with the logo advertising can link to core principles (1) Nikes’ swoosh/ tick suggesting power, speed, and movement (1). • The shape and styling of a product can suggest a brand, for example Apple products are all timeless and minimalist with their styling (1) they were influenced by Dieter Rams who designed for Braun with a less is more approach with a high quality/ desirability and are intuitive and make you want to interact with (1) • Alessi products are influenced by art deco but products are high quality manufacture (1) and often designed by famous designers like Phillippe Starcks lemon juicer and Michael Graves kettle (1) offering functional high quality mass produced products often with an element of fun/humour. (1) • Any other suitable response. 	<p>4</p>	<p>Up to four marks for describing how the designer of products, like the controller, influence brand identity.</p> <p>Question asks for examples – more than one example of a product is needed for full marks</p> <p>Max 2 if only the controller is discussed. Up to 3 marks max if only one example of a product</p>

		<p>(iii) Indicative Content:</p> <p>Discussion about the importance could include:</p> <p>Successful marketing strategies can the make or break of a product when its launched, imaginative successful marketing can capture interest and create longevity in a product and can influence buyers’ decisions.</p> <p>e.g. Coca Cola has remained one of the most popular brands by developing new products and successful marketing campaigns. Apple and Nike advertisements focus on the values of the company, and both regularly update product lines.</p> <ul style="list-style-type: none"> • The marketing mix and the 4Ps. Product, Price, Promotion and Placement – timing is important too, link to Christmas or seasonal sales. Tactics such as price skimming and offers can maintain. • Maintain brand identity, to keep interest in a brand, ensure relevance, reputation, and position in the market. • Keep up with competitors and challenging the competition. Upgrades and updates, new models or limited collections • Reference to marketing lifecycle – launch, demand, maturity and decline and planning marketing for this. <p>Methods used to raise profile when launching new products could include: social media, TikTok, Instagram, twitter etc much of this will be preplanned on a timeline prior to product launch SMM (social media marketing) but then will be shared and reposted. Some companies do not really advertise but rely on social media and influencers/ celebrities to promote products, but they will often target influencers and plan promotions.</p> <ul style="list-style-type: none"> • slogans and advertisements e.g. Nike ‘just do it’ helps consumers relate to how they feel when exercising. Apple have a proactive approach to 	<p>6</p>	<p>Level 3 [5-6 marks] The candidate has a clear understanding of marketing strategies. They produce a thorough discussion in relation to the importance of a strategy when launching new products. The explanation of aspects linked to importance is clear and well-developed and a number of examples are used to exemplify the points being made.</p> <p>Level 2 [3-4 marks] The candidate has a reasonable understanding of marketing strategies. They produce a reasonable discussion in relation the importance of a strategy when launching new products. The explanation of aspects linked to importance is sufficient although one or two opportunities are missed in referring to different examples.</p> <p>Level 1 [1-2 marks] The candidate has a basic knowledge of marketing strategies. Any reference to this issue is descriptive in nature and has little appreciation of the importance of a strategy. The response contains no analysis or evaluation.</p>

		<p>advertising that shows features, but their branding remains instantly recognisable due to its simple, clean uncluttered approach. Influencers or brand ambassadors and collaborations with companies can help to show shared values e.g. Ronaldo and Jordan for Nike or adidas and Stella McCartney/ Parley for the Oceans.</p> <ul style="list-style-type: none"> • Product placement in movies and TV programmes and press releases and articles/ reviews can create interest and buzz. • exclusivity, limited collections and pre-releases, soft launches can all help create and generate interest for first adopters to increase sales and profit by gaining interest before wider sales start. Use of offers and promotions BOGOY, competitions etc <p>Examples of when companies get it wrong may also be used to highlight importance e.g. google glass.</p> <p>Any other suitable response.</p>		<p>0 marks No answer or answer not worthy of credit.</p>
<p>(d)</p>	<p>(i)</p>	 <p>All plotted correctly with accuracy and precision 3 marks. Some accuracy and precision in plotting 2 marks. Limited accuracy 1 mark</p>	<p>3</p>	<p>Up to three marks for plotting buttons B, C and D correctly on the grid using crosses that are accurately placed.</p> <p>Where a candidate has used dots if accurate and precise, they can be awarded marks</p> <p>If no crosses are drawn but the candidate has drawn accurate circles marks can be awarded</p>

		(ii)	<p>Button A Centre point = (9,6) Button B Centre point = (6, 3) Button C Centre point = (3, 6) Button D Centre point = (6, 9)</p>	3	<p>3 marks for stating the co-ordinates for the centre point of all four buttons</p> <p>2 marks for three correct buttons</p> <p>1 mark if the buttons B, C, D have been plotted incorrectly but coordinates match candidates plotting (ECF).</p>
2	(a)		<p>Possible materials may include:</p> <ul style="list-style-type: none"> • ABS (1) • PP (1) <p>Any other suitable response LDPE, acrylic, PVC and PET are unsuitable due to the casing needing to be rigid.</p>	1	<p>One mark for identifying a suitable thermopolymer for the body of the iron.</p> <p>Specific reference to the context in the question is needed for marks to be awarded.</p>
2	(b)		<p>Suitable manufacturing method:</p> <ul style="list-style-type: none"> • Injection moulding (1). <p>Justifications may include:</p> <ul style="list-style-type: none"> • Intricacies and level of detail/ complexity of the moulding (1). • Type of product and quantity to be manufactured/ commercial/ mass/ automated production (1). <p>Two part moulding with reference to the colours in the iron is acceptable. Any other suitable response.</p>	2	<p>One mark for identifying a suitable manufacturing method.</p> <p>One mark for justification of this manufacturing method</p> <p>Specific reference to the context in the question is needed for marks to be awarded.</p> <p>Do not accept 3D printing.</p>
2	(c)		<p>$\cos^{-1}(x) : \text{Adj/Hyp} (1) (1)$</p> <p>$\cos^{-1}(x) = 110/300 = 0.3666666666 \text{ r} (1)$</p> <p>$x = \cos^{-1}(0.3666666666 \text{ r}^*) = 68.48981173^* (1)$</p>	5	<p>Award five marks as follows:</p> <p>One mark for recalling correct trigonometry formula.</p>

		<p>$x = 68^\circ$ (1)</p> <p>4 marks if answer is 69° 4 marks if answer is 68.5°</p>		<p>One mark for manipulating formula for context given i.e. using inverse of Cos because the requirement is to calculate the angle.</p> <p>One mark for inserting correct values into formula.</p> <p>One mark for calculating angle x.</p> <p>One mark for rounding answer to the nearest degree.</p> <p>If correct answer is given without working out shown award full marks.</p> <p>Where an incorrect answer is given working out should be used to credit appropriate marks.</p> <p>*Allow error carried forward (ECF) where correct working out is shown.</p>
	(d) (i)	<p>Total spent on stock = $\text{£}10 \times 240 = \text{£}2400$ [1]</p> <p>90% sold = $240/90\% = 216$ [1]</p> <p>Total value of sales of 90% of iron = $216^* \times \text{£}24.99 = \text{£}5397.84$ [1] or Accept here as total profit of 90% of iron = $216^* \times \text{£}14.99 = 3237.84$ (1)</p> <p>Total profit from sales = $\text{£}5397.84^* - \text{£}2400.00^*/ 3237.84 - 240 = \text{£}2997.84$ [1]</p> <p>If a candidate completes the above calculation and adds the final $\text{£}240$ max 3 marks as question states “profit from sale of the items”</p>	4	<p>Award four marks as follows:</p> <p>One mark for calculating the total value spent on stock.</p> <p>One mark for determining 90% of the initial stock of irons.</p> <p>One mark for calculating the total value of sales for 90% of the irons that have been sold.</p> <p>One mark for calculating the total profit that the shop would make from</p>

					<p>the sale of the electric irons taking into account the initial stock that was purchased.</p> <p>If correct answer is given without working out shown award full marks. Where an incorrect answer is given working out should be used to credit appropriate marks.</p> <p>*Allow error carried forward (ECF) where correct working out is shown.</p>
		(ii)	<p>To calculate the percentage profit it is as follows:</p> <p>Profit percentage = (profit/cost price) x 100</p> <p>Overall profit percentage = (profit/cost price) x 100 = (£2997.84* / £2400*) x 100 = 124.91% [1]</p>	1	<p>One mark for calculating the overall percentage profit that would be made.</p> <p>*Allow error carried forward (ECF) where correct working out is shown or if a candidate has used their answer from d) I but used correct calculation.</p>
		(e)	<p>Fault occurring $3/1500 = 0.002$ or $1/500$ [1]</p>	1	<p>One mark for calculating the probability of an iron having the identified fault.</p>
3	(a)		<p>Possible effects of using depleting raw materials in design could include:</p> <ul style="list-style-type: none"> • The cost of the product increase, as the material is harder to obtain e.g. lithium or oil (1) so this would result in lower profit margins or higher priced products/ services/ energy. (1) • It could put off some consumers (1) as they will be looking for more environmentally/ fare traded conscious brands and will not buy the product due to awareness of environmental, social or ethical issues (1) • It is using up materials that may be vital for products to run (1) e.g. lithium, copper and iron – it's important that we try to source materials from recycling sources and save resources/ supplies (1) 	4	<p>In each case:</p> <p>One mark for identifying an effect</p> <p>One mark for explaining this effect.</p>

		<ul style="list-style-type: none"> Increased carbon footprint and environmental or social/ethical issues when vital materials become harder to source (1) e.g. Lithium mining causes soil contamination/ harmful extraction or CT/ gold mining for electronic products has led to conflicts and violence (1) Any other suitable response. 		
(b)		<p>Indicative Content:</p> <p>Possible discussions of the implications and opportunities of planned obsolescence in products:</p> <p>Implications could include:</p> <ul style="list-style-type: none"> Products when thrown away often end up in landfill, electronic products often end up being received for recycling in low wage economies and the burning of polymers to extract the components or precious metal can result in pollution/ toxins and health hazards. The creation of waste at end of life “throwaway society” which contributes to landfill or ocean waste e.g. coffee cups/ plastic/ polymer bottles etc. Emissions created from the continuous supply of products and use of finite resources. Products can’t be repaired, parts are unavailable and its easier and cheaper to dispose and buy a new one than repair, this can lead to waste. Lack of social awareness of implications of creating waste as it is seen as “normal” and people want the latest technologies and products. Any other suitable response. <p>Opportunities could include:</p> <ul style="list-style-type: none"> Maintain consumer interest in a product as they are looking to the “next model” therefore the life is extended. e.g. games consoles or mobile phones. Designers can plan for the end of life and create the disposable products with more environmentally friendly materials. e.g. Lego made from PLA or bamboo toothbrushes. Companies can take trade old products for new e.g. Ikea’s circular hub or car manufacturers part exchange, recycling schemes for mobile phones so they can be repurposed/ refurbished or recycled. 	8	<p>Level 3 [6-8 marks] The candidate has a clear understanding of planned obsolescence in products. They produce a thorough discussion in relation to the question. The explanation of implications and opportunities is clear and well-developed and a number of examples are used to exemplify the points being made.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated with the use of examples.</i></p> <p>Level 2 [3-5 marks] The candidate has a reasonable understanding of planned obsolescence in products. They produce a reasonable discussion in relation to the question. The explanation of implications and opportunities is sufficient although one or two opportunities are missed in referring to different examples.</p>

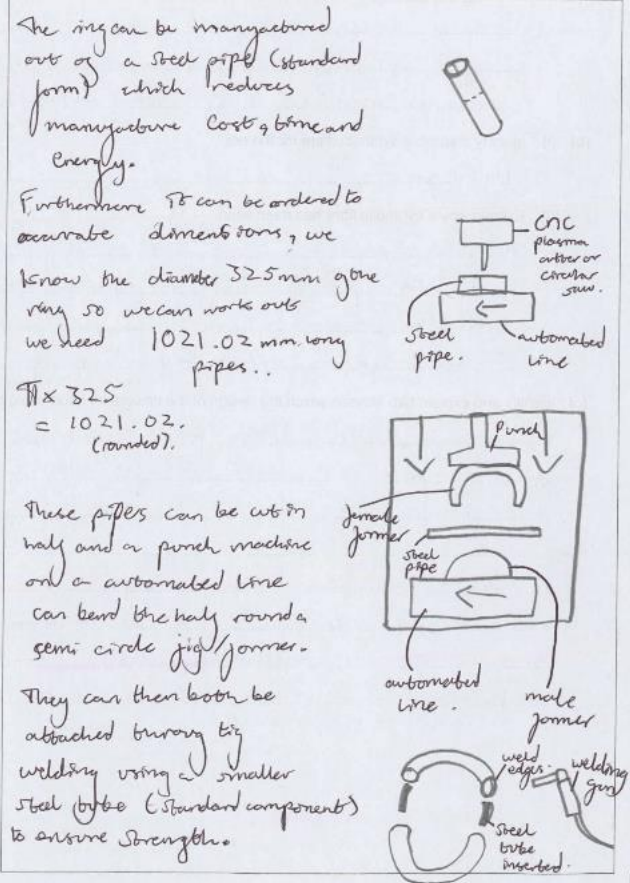
			<ul style="list-style-type: none"> The use of packaging within a product e.g. plant pots that can be used to plant in the ground and decompose. Subscriptions offered for products rather than owning so upgrades are provided and older models returned – circular economy e.g. Gerrard street headphones Popularity of ‘preloved’ clothing and items and platforms such as ‘Vinted’ to sell items to others or ‘reskinned’ to send clothing to be recycled or refurbished. Any other suitable response. 		<p><i>There is a line of reasoning presented with some structure. The information presented is for the most part relevant and supported by some evidence.</i></p> <p>Level 1 [1-2 marks] The candidate has a basic knowledge of planned obsolescence. Any reference to this issue is descriptive in nature and has little appreciation of implications and opportunities. The response contains no analysis or evaluation.</p> <p><i>The information has some relevance and is presented with limited structure or detail. The information is supported by limited evidence.</i></p> <p>0 marks No answer or answer not worthy of credit.</p>
4	(a)	(i)	<p>Possible ferrous metals may include:</p> <ul style="list-style-type: none"> Stainless Steel (1) Mild steel (1) <p>Accept Iron/cast iron. Steel can be accepted; high carbon steel and tool steel are unsuitable.</p>	1	<p>One mark for identifying a suitable ferrous material.</p> <p>Specific reference to the context in the question is needed for marks to be awarded.</p>
		(ii)	<p>Possible responses may include:</p> <ul style="list-style-type: none"> Tough/ toughness (1) so can withstand impact of being hit by bal/ there will constant impact from the ball over time (1). 	2	<p>Up to two marks for explaining why a ferrous metal has been used for the ring.</p>

		<ul style="list-style-type: none"> • Relatively low weight of material/ good strength to weight ratio (1) so can be hung from the wall more easily (1) • Good tensile strength/ durability of material (1) so will not break easily over time/ to last a long time in use/ or not break when hit by the ball (1). • Malleable so it can be shaped or easily moulded (1) so it can be formed into the shape of the ring and brackets (1). • Any other suitable response. Material properties that suit the product and situation such as toughness, durability, tensile strength are acceptable but must be related to use of the product or its context for full marks to be awarded. 		<p>Specific reference to the context in the question is needed for marks to be awarded.</p> <p>This may relate to material properties or low cost/ availability of ferrous metals compared to alternative materials or reference to a surface finish can be applied are acceptable but need to be fully justified.</p>
	(b) (i)	<p>Possible synthetic fibre may include:</p> <ul style="list-style-type: none"> • Nylon (1) • Polyester (1) • Polypropylene (1) • Any other suitable response. 	1	<p>One mark for identifying a suitable synthetic fibre.</p> <p>Specific reference to the context in the question is needed for marks to be awarded.</p>
	(ii)	<p>Possible responses may include:</p> <ul style="list-style-type: none"> • Durable/ hardwearing over time/ long lasting (1) so it will withstand the constant impact of the ball (1). • Will not degrade in UV light/ moisture/ water (1) as the hoop is likely to be used outside (1). • Will be able to withstand rain wind/changes in temperature (1) without corroding/ degrading over time (1). • Can be coloured in the manufacture to different colours (1) so could be coloured for a specific target market or team brand (1). • The colour is in the pigment added to the material in manufacture (1) so will not fade or run if wet over time (1). • Good elasticity (1) so if pulled will return to its original shape without warping (1) • Resists attacks from moths/mildew/mould (1) unlike natural fibres (1). • Any other suitable response. <p>Material properties that suit the product and situation are acceptable but must be related to the use of the net or its context for full marks to be awarded.</p>	2	<p>Up to two marks for explaining why a synthetic fibre has been used for the net. This may relate to material properties or manufacture/ availability etc. Specific reference to the context in the question is needed for marks to be awarded.</p>

	(c)	<p>Possible responses may include:</p> <p>How the design of the basketball hoop could be optimised to keep costs as low as possible may include:</p> <ul style="list-style-type: none"> • Reduction in different parts. The design could be simplified to remove the ring and combine it with bracket A or combine bracket A and B to be one piece. (1) This would reduce the number or stages in production reducing cost and time of manufacture. (1) • Using standardised parts. Off the shelf parts for the ring, clips and net could be used to save parts being manufactured. (1) This would save on tooling costs and reduce the cost of the product as they could be bought in in bulk and low cost. (1) • Explore alternative materials that could reduce cost/quantity of materials without compromising quality, for example the hoop could be made from stainless steel or aluminium alloy (1) to reduce the need for a surface finish. (1) • Product size. The overall product size/ wall thickness of the materials could be reduced to keep costs low. (1) This could include more thoughtful design that incorporates reinforced parts with webbing/ honeycombing etc. (1) • Replaceable/changeable parts for hoop could be sold (1) allowing the consumer to repair broken parts, adapt or customise the design. (1) • Integral fixtures. The parts of the hoop could be designed to snap together when assembled, (1) reducing the need for additional screws which could cost money to purchase and labour to fit. (1) • Using CAD software 'finite' element analysis to see where it is possible to remove material without compromising strength when different parameters are set, (1) this could reduction of sheet material used and reduce costs/ weight. (1) <p>Any other suitable response such as use of topology but this is optimising the design.</p>	4	<p>One mark for suggestions that refer just to Design for Manufacture (DFM) reference to the design is needed for two.</p> <p>One mark for justifying why this feature would have been considered.</p> <p>Specific reference to basketball hop and parts in the question is needed for marks to be awarded.</p>
(d)	(i)	Indicative Content:	5	Level 3 [4-5 marks]

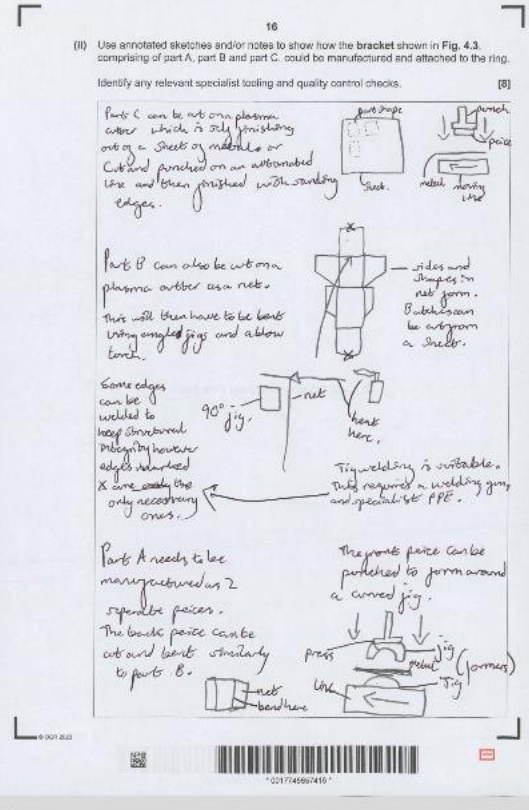
	<p>The candidate is expected to demonstrate their understanding of the process involved through a series of annotated sketches and/or notes. There may be variations to the process as indicated but to get into L3 candidates must demonstrate a clear understanding of the end to end process.</p> <p>The ring is simple and the most suitable methods for manufacture as a batch of 1000 are indicated below involving continuous casting of the bar, use of bending jigs, rollers or forging, if a candidate assumes the bar is solid then sand casting is appropriate. For a batch of 1000 die casting is not an appropriate method – maximum level 1 response.</p> <p>Manufacture of the rod:</p> <ul style="list-style-type: none"> • The steel is melted in a crucible/ heated to 1250 degree celsius • The molten steel is poured into moulds and cast to create the bars, continuous casting • The bars are then heated and rolled through a series of dies to create a circular rod • The circular bar transfers through different rollers to get to the correct diameter and are quenched to cool <p>QC checks at this point may include tensile impact testing, visually inspected, checking of diameter, surface finish</p> <p>Detail of a suitable dies should be given for a top level response</p> <p>Candidates may state a bought in bar/rod is used and the full marks need to be available for them if they state this although the forming of the ring would be expected in more detail, drawing or extruding to form the rod may also be acceptable – tensile forces are used to pull (draw) or push (extrude) metal through a die to form a continuous cross section in the shape of the die – this cross section is then cut to length</p> <p>A bending jig is created (if assumed hollow tube this will be considered-pipe bender)</p> <ul style="list-style-type: none"> • The rod is passed through a heated chamber to make it more malleable • It is then clamped into bending jig • Rotated/ pulled through the bending jig 	<p>The candidate demonstrates a good level of detail of the process needed to manufacture the ring using technical terms and considering any relevant specialist tooling and quality control checks. Sketches, if used will be clear and supported with relevant notes. The process includes all relevant stages.</p> <p>Level 2 [2-3 marks]</p> <p>The candidate will demonstrate a sound level of detail of the process needed to manufacture the ring using some technical terms and there will be some consideration of any relevant specialist tooling and quality control checks. Sketches, if used, will for the most part be clear and supported with notes most of which are relevant. The process includes some relevant stages.</p> <p>Level 1 [1 marks]</p> <p>The candidate will demonstrate a limited level of detail of the process needed to manufacture the ring with a limited use of technical terms and there will be a basic consideration of any relevant specialist tooling and quality control checks. Sketches, if used, will be unclear with only basic notes to accompany them. Few relevant stages are included.</p> <p>0 marks</p>
--	--	---

		<ul style="list-style-type: none"> • The ends of the rod are cleaned and clamped together • Flux is added and then the parts are MIG welded together <p>QC checks at this point may include tensile impact testing tests, visually inspected, testing of hoop diameter, testing of welded joint that might include use of ultra sonic or visual inspection</p> <p>Detail of a suitable bending jig or pipe bender equipment should be given for a top level response</p> <p>Manufacturing the net holders as above on a smaller scale and joined to ring with welding. These net holders could be stamped individually and welded on.</p> <p>Any other suitable response.</p>		<p>No response or no response worthy of credit.</p>
--	--	---	--	---

	<p>The ring can be manufactured out of a steel pipe (standard form) which reduces manufacture cost, time and energy.</p> <p>Furthermore it can be ordered to accurate dimensions, we know the diameter 325mm gone ring so we can work out we need 1021.02mm long pipes..</p> $\pi \times 325 = 1021.02 \text{ (rounded)}$ <p>These pipes can be cut in half and a punch machine and an automated line can bend the half round a semi circle jig/former.</p> <p>They can then both be attached through big welding using a smaller steel tube (standard component) to ensure strength.</p> 	<p>This response achieves a low level 3 more detail of tooling and QC checks needed for a top of level response.</p>		
<p>(ii)</p>	<p>Indicative Content:</p> <p>The candidate is expected to demonstrate their understanding of the process involved through a series of annotated sketches and/or notes. There may be variations to the process as indicated but to get into L3 candidates must demonstrate a clear understanding of the end-to-end process.</p> <p>The parts are simple and the most suitable methods for manufacture as a batch of 1000 sheet metal fabrication, stamping/ blanking, forging, bending or press forming</p>	<p>8</p>	<p>Level 3 [6-8 marks]</p> <p>The candidate demonstrates a good level of detail of the process needed to manufacture the bracket and attach it to the ring using technical terms and considering any relevant specialist tooling and quality control checks. Sketches, if used will be clear and supported with relevant notes. The process includes all relevant stages.</p>	

	<p>then welding to join. For a batch of 1000 die casting is not an appropriate method – maximum level 1 response.</p> <p>Use of automated machinery and clear production of multiple parts. There could be a number of ways this part is formed one of which could involve welding a half ring to flat stamped pieces or press forming of two parts ring and a U shape and welded all of these are acceptable.</p> <p>Part A</p> <ul style="list-style-type: none"> • Shape “stamped” from flat sheet using hydraulic press and die to create a blank • The blank is “pressed formed” into a shape through a series of stages and dies. • Mig welding will involve cleaning and degreasing the metal ready to weld, using MIG welding used to join the fuse the parts together and they are allowed to cool • QC checks at this point may include tensile impact testing tests, visually inspected, checking of stamped parts every 100 produced dimensional accuracy, checking of press forming for dimensional accuracy, testing of welded joint that might include use of ultra sonic or visual inspection <p>Part B</p> <ul style="list-style-type: none"> • Shape stamped from flat sheet. • Pressed and folded into shape using of bending jigs both internal and external. Or press formed in stages • QC checks at this point may include tensile impact testing tests, visually inspected • QC checks at this point may include tensile impact testing tests, visually inspected, checking of stamped parts every 100 produced dimensional accuracy, checking of press forming dimensional accuracy <p>Part C</p> <ul style="list-style-type: none"> • Shape stamped from flat sheet. • QC checks at this point visually inspected, checking of stamped parts every 100 produced dimensional accuracy, <p>Assembly of parts:</p>		<p>Level 2 [3-5 marks] The candidate will demonstrate a sound level of detail of the process needed to manufacture the bracket and attach it to the ring using some technical terms and there will be some consideration of any relevant specialist tooling and quality control checks. Sketches, if used, will for the most part be clear and supported with notes most of which are relevant. The process includes some relevant stages.</p> <p>Level 1 [1-2 marks] The candidate will demonstrate a limited level of detail of the process needed to manufacture the bracket and attach it to the ring with a limited use of technical terms and there will be a basic consideration of any relevant specialist tooling and quality control checks. Sketches, if used, will be unclear with only basic notes to accompany them. Few relevant stages are included.</p> <p>0 marks No response or no response worthy of credit.</p>
--	---	--	--

		<ul style="list-style-type: none">• A jig/ jigs are used to hold parts together• MIG welding used to join the parts together this could be spot welding• Mig welding will involve cleaning and degreasing the metal ready to weld, using MIG welding used to join the fuse the parts together and they are cooled with water• QC checks at this point may include tensile impact testing tests, visually inspected, testing of welded joint might include use of ultra-sonic or visual inspection. <p>Any other suitable response.</p>		
--	--	---	--	--

		<p>16</p> <p>(ii) Use annotated sketches and/or notes to show how the bracket shown in Fig. 4.3, comprising of part A, part B and part C, could be manufactured and attached to the ring. Identify any relevant specialist tooling and quality control checks. [8]</p>  <p>Part C can be cut on a plasma cutter which is only finishing out of a sheet of metal or cut and punched on an automated line and then finished with sanding edges.</p> <p>Part B can also be cut on plasma cutter as a net. This will then have to be bent using angled jigs and allow bench.</p> <p>Some edges can be welded to keep structural integrity however edges marked X are not the only necessary ones.</p> <p>Part A needs to be manufactured as 2 separate pieces. The back piece can be cut and bent similarly to part B.</p> <p>The front piece can be punched to form around a curved jig.</p> <p>Tig welding is suitable. This requires a welding jigs and specialist PPE.</p> <p>A good thing about using punching and cutting is that the punches and formers can be manufactured by a CNC router or milling machine and also be used for a whole batch, ensuring batch accuracy. Similarly jigs used for bending ensure angle accuracy and keep the batch identical.</p> <p>17</p>	<p>This response achieves a low level 3 more detail of tooling in parts and more reference to QC checks needed to achieve the top of level marks.</p>	
	<p>e</p>	<p>Suitable surface finishes include:</p> <ul style="list-style-type: none"> • Spray painted lacquer/ electrostatic application of paint or specific suitable paint such as hammerite (1). This can add colour for decorative purposes/ aesthetics (1) and provide protection against corrosion rusting and effects of weather (1) 	<p>3</p>	<p>One mark for identifying an appropriate surface finish</p> <p>Up to two marks for justifying choice of surface finish</p>

		<ul style="list-style-type: none"> • Galvanising (1) this adds a zinc plating, zinc acts as a sacrificial layer (1) protects against corrosion outdoors (1) • Brushed or sandblasted (1) creates an aesthetically pleasing surface (1) but will need lacquer or maintenance to avoid rusting/corrosion (1) • Dip coating/ powder coated (1) a polymer surface is applied to the steel to improve appearance (1) this will protect against corrosion/ rusting (1) <p>Electroplating with Zinc or blueing are acceptable surface finishing. Do not accept anodising.</p>		<p>Electroplated or chrome plated is unlikely but maybe awarded 1 mark if seen</p> <p>Accept other reasons such as cost/ease of application if justified</p>
--	--	--	--	--

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](https://twitter.com/ocrexams)

 [/ocrexams](https://twitter.com/ocrexams)

 [/company/ocr](https://www.linkedin.com/company/ocr)

 [/ocrexams](https://www.youtube.com/ocrexams)



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

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored. © OCR 2023 Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA.

Registered company number 3484466. OCR is an exempt charity.

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.